



Open Source Used In Cisco Meeting Server (formerly Acano Server) 3.10

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The primary ANTLR guy:

Terence Parr
parrt@cs.usfca.edu
parrt@antlr.org

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<signature of Ty Coon>, 1 April 1990
Ty Coon, President of Vice

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Version 3, 29 June 2007

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GNU LIBICONV - character set conversion library

This library provides an iconv() implementation, for use on systems which don't have one, or whose implementation cannot convert from/to Unicode.

It provides support for the encodings:

European languages

ASCII, ISO-8859-{1,2,3,4,5,7,9,10,13,14,15,16},
KOI8-R, KOI8-U, KOI8-RU,
CP{1250,1251,1252,1253,1254,1257}, CP{850,866,1131},
Mac{Roman,CentralEurope,Iceland,Croatian,Romania},
Mac{Cyrillic,Ukraine,Greek,Turkish},
Macintosh

Semitic languages

ISO-8859-{6,8}, CP{1255,1256}, CP862, Mac{Hebrew,Arabic}

Japanese

EUC-JP, SHIFT_JIS, CP932, ISO-2022-JP, ISO-2022-JP-2, ISO-2022-JP-1

Chinese

EUC-CN, HZ, GBK, CP936, GB18030, EUC-TW, BIG5, CP950, BIG5-HKSCS,
BIG5-HKSCS:2004, BIG5-HKSCS:2001, BIG5-HKSCS:1999, ISO-2022-CN,
ISO-2022-CN-EXT

Korean

EUC-KR, CP949, ISO-2022-KR, JOHAB

Armenian

ARMSCII-8

Georgian

Georgian-Academy, Georgian-PS

Tajik

KOI8-T

Kazakh

PT154, RK1048

Thai

ISO-8859-11, TIS-620, CP874, MacThai

Laotian

MuleLao-1, CP1133

Vietnamese

VISCII, TCVN, CP1258

Platform specifics

HP-ROMAN8, NEXTSTEP

Full Unicode

UTF-8

UCS-2, UCS-2BE, UCS-2LE

UCS-4, UCS-4BE, UCS-4LE

UTF-16, UTF-16BE, UTF-16LE

UTF-32, UTF-32BE, UTF-32LE

UTF-7

C99, JAVA

Full Unicode, in terms of 'uint16_t' or 'uint32_t'

(with machine dependent endianness and alignment)

UCS-2-INTERNAL, UCS-4-INTERNAL

Locale dependent, in terms of 'char' or 'wchar_t'

(with machine dependent endianness and alignment, and with OS and locale dependent semantics)

char, wchar_t

The empty encoding name "" is equivalent to "char": it denotes the locale

dependent character encoding.

When configured with the option --enable-extra-encodings, it also provides support for a few extra encodings:

European languages

CP{437,737,775,852,853,855,857,858,860,861,863,865,869,1125}

Semitic languages

CP864

Japanese

EUC-JISX0213, Shift_JISX0213, ISO-2022-JP-3

Chinese

BIG5-2003 (experimental)

Turkmen

TDS565

Platform specifics

ATARIST, RISCOS-LATIN1

It can convert from any of these encodings to any other, through Unicode conversion.

It has also some limited support for transliteration, i.e. when a character cannot be represented in the target character set, it can be approximated through one or several similarly looking characters. Transliteration is activated when "//TRANSLIT" is appended to the target encoding name.

libiconv is for you if your application needs to support multiple character encodings, but that support

lacks from your system.

Installation

As usual for GNU packages:

```
$ ./configure --prefix=/usr/local
```

```
$ make
```

```
$ make install
```

After installing GNU libiconv for the first time, it is recommended to recompile and reinstall GNU gettext, so that it can take advantage of libiconv.

On systems other than GNU/Linux, the iconv program will be internationalized only if GNU gettext has been built and installed before GNU libiconv. This means that the first time GNU libiconv is installed, we have a circular dependency between the GNU libiconv and GNU gettext packages, which can be resolved by building and installing either

- first libiconv, then gettext, then libiconv again,

or (on systems supporting shared libraries, excluding AIX)

- first gettext, then libiconv, then gettext again.

Recall that before building a package for the second time, you need to erase the traces of the first build by running "make distclean".

This library can be built and installed in two variants:

- The library mode. This works on all systems, and uses a library 'libiconv.so' and a header file '<iconv.h>'. (Both are installed through "make install".)

To use it, simply `#include <iconv.h>` and use the functions.

To use it in an autoconfiguring package:

- If you don't use automake, append `m4/iconv.m4` to your `aclocal.m4` file.
- If you do use automake, add `m4/iconv.m4` to your m4 macro repository.
- Add to the link command line of libraries and executables that use the functions the placeholder `@LIBICONV@` (or, if using libtool for the link, `@LTLIBICONV@`). If you use automake, the right place for these additions are the `*_LDADD` variables.

Note that 'iconv.m4' is also part of the GNU gettext package, which installs it in `/usr/local/share/aclocal/iconv.m4`.

- The libc plug/override mode. This works on GNU/Linux, Solaris and

OSF/1

systems only. It is a way to get good iconv support without having glibc-2.1.

It installs a library 'preloadable_libiconv.so'. This library can be used with LD_PRELOAD, to override the iconv* functions present in the C library.

On GNU/Linux and Solaris:

```
$ export LD_PRELOAD=/usr/local/lib/preloadable_libiconv.so
```

On OSF/1:

```
$ export _RLD_LIST=/usr/local/lib/preloadable_libiconv.so:DEFAULT
```

A program's source need not be modified, the program need not even be recompiled. Just set the LD_PRELOAD environment variable, that's it!

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Download

<http://ftp.gnu.org/gnu/libiconv/libiconv-1.14.tar.gz>

Homepage

<http://www.gnu.org/software/libiconv/>

Bug

reports to

<bug-gnu-libiconv@gnu.org>

Bruno Haible <bruno@clisp.org>

1.4 lua 5.1.5

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1.5 libpcap 1.2.1

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1.7 speex 1.2

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```

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by Yoshioka Tsuneo (tsuneo@rr.iij4u.or.jp)
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```

```
usage: minibz2 [-d] [-{1,2,..9}] [[srcfilename] destfilename]
```

```
*/
```

1.9 lua 5.1.4

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1.11 iptables 1.4.20

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1.13 libpcap 1.7.4

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1.14 libmnl 1.0.3

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30 atime=1337191922.583566431

30 ctime=1338052482.808834269

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Version 2.1, February 1999

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```
<one line to give the
program's name and a brief idea of what it does.>
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```

```
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```
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This is free software, and you are welcome to redistribute it
under certain conditions; type `show c' for details.
```

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<signature of Ty Coon>, 1 April 1989
Ty Coon, President of Vice

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1.16 libxml2 2.9.4

1.16.1 Available under license :

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/*

* hash.c: chained hash tables

*

* Reference: Your favorite introductory book on algorithms

*

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*

```

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*****/
*

```

1.17 glib 2.48.1

1.17.1 Available under license :

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threshold

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<signature of Ty Coon>, 1 April 1990
Ty Coon, President of Vice

That's all there is to it!

/* This is the public header file for the PCRE library, to be #included by applications that call the PCRE functions.

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*

* This file is part of the lwIP TCP/IP stack.

*

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*

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1.19 sqlite 3.13.0

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# All lines in this file are patterns, including the comment lines; this
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# the file name (including the path relative to the current directory,
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#
# Don't put empty lines into this file!
#
.gitignore
#
builds/unix/pkg.m4
#
docs/FTL.TXT
docs/GPLv2.TXT
#
include/freetype/internal/fthash.h
#
src/base/fthash.c
src/base/md5.c
src/base/md5.h
#
src/bdf/bdf.c
src/bdf/bdf.h
src/bdf/bdfdrivr.c
src/bdf/bdfdrivr.h
src/bdf/bdferror.h
src/bdf/bdfplib.c
src/bdf/module.mk
src/bdf/README
src/bdf/rules.mk
#
```

```
src/pcf/module.mk
src/pcf/pcf.c
src/pcf/pcf.h
src/pcf/pcfdrivr.c
src/pcf/pcfdrivr.h
src/pcf/pcferror.h
src/pcf/pcfread.c
src/pcf/pcfread.h
src/pcf/pcfutil.c
src/pcf/pcfutil.h
src/pcf/README
src/pcf/rules.mk
#
src/gzip/adler32.c
src/gzip/infblock.c
src/gzip/infblock.h
src/gzip/infcodes.c
src/gzip/infcodes.h
src/gzip/inffixed.h
src/gzip/inflate.c
src/gzip/inftrees.c
src/gzip/inftrees.h
src/gzip/infutil.c
src/gzip/infutil.h
src/gzip/zconf.h
src/gzip/zlib.h
src/gzip/zutil.c
src/gzip/zutil.h
#
src/tools/apinames.c
src/tools/ftrandom/ftrandom.c
#
#
EOF
```

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```

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```
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--- end of FTL.TXT ---

1.21 logback-core 1.2.3

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1.22 e2fsprogs 1.43.7

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*/

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Index: tdbsa/tdb.c

=====
--- tdbsa.orig/tdb.c

+++ tdbsa/tdb.c

@@ -4,11 +4,11 @@ Rev: 23371

Last Changed Date: 2007-06-06 20:14:06 -0400 (Wed, 06 Jun 2007)

*/

/*

- Unix SMB/CIFS implementation.
+ trivial database library - standalone version

- trivial database library - private includes

-

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If you develop a new program, and you want it to be of the greatest possible use to the public, the best way to achieve this is to make it free software which everyone can redistribute and change under these terms.

To do so, attach the following notices to the program. It is safest to attach them to the start of each source file to most effectively convey the exclusion of warranty; and each file should have at least the "copyright" line and a pointer to where the full notice is found.

```
<one line to give the program's name and a brief idea of what it does.>  
Copyright (C) 19yy <name of author>
```

```
This program is free software; you can redistribute it and/or modify  
it under the terms of the GNU General Public License as published by  
the Free Software Foundation; either version 2 of the License, or  
(at your option) any later version.
```

```
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GNU General Public License for more details.
```

```
You should have received a copy of the GNU General Public License  
along with this program; if not, write to the Free Software  
Foundation, Inc., 675 Mass Ave, Cambridge, MA 02139, USA.
```

Also add information on how to contact you by electronic and paper mail.

If the program is interactive, make it output a short notice like this when it starts in an interactive mode:

```
Gnomovision version 69, Copyright (C) 19yy name of author  
Gnomovision comes with ABSOLUTELY NO WARRANTY;  
for details type `show w'.  
This is free software, and you are welcome to redistribute it  
under certain conditions; type `show c' for details.
```

The hypothetical commands ``show w'` and ``show c'` should show the appropriate parts of the General Public License. Of course, the commands you use may be called something other than ``show w'` and ``show c'`; they could even be mouse-clicks or menu items--whatever suits your program.

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Yoyodyne, Inc., hereby disclaims all copyright interest in the program
`Gnomovision' (which makes passes at compilers) written by James Hacker.

<signature of Ty Coon>, 1 April 1989
Ty Coon, President of Vice

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it more useful to permit linking proprietary applications with the library. If this is what you want to do, use the GNU Library General Public License instead of this License.

This is the Debian GNU/Linux prepackaged version of the EXT2 file system utilities (e2fsck, mke2fs, etc.). The EXT2 utilities were written by Theodore Ts'o <tytso@mit.edu> and Remy Card <card@masi.ibp.fr>.

Sources were obtained from <http://sourceforge.net/projects/e2fsprogs>

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Upstream Author: Theodore Ts'o <tytso@mit.edu>

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2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008 by Theodore Ts'o

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DAMAGE.

This package was added to the e2fsprogs debian source package by Theodore Ts'o <tytso@mit.edu> on Sat Mar 15 15:33:37 EST 2003

It is part of the main e2fsprogs distribution, which can be found at:

<http://sourceforge.net/projects/e2fsprogs>

Upstream Author: Theodore Ts'o <tytso@mit.edu>

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#

This is a Makefile stub which handles the creation of BSD shared
libraries.

#

In order to use this stub, the following makefile variables must be defined.

#

BSDLIB_VERSION = 1.0

BSDLIB_IMAGE = libce

```

# BSDLIB_MYDIR = et
# BSDLIB_INSTALL_DIR = $(SHLIBDIR)
#

all:: image

real-subdirs:: Makefile
@echo " MKDIR pic"
@mkdir -p pic

BSD_LIB = $(BSDLIB_IMAGE).so.$(BSDLIB_VERSION)
BSDLIB_PIC_FLAG = -fpic

image: $(BSD_LIB)

$(BSD_LIB): $(OBJS)
(cd pic; ld -Bshareable -o $(BSD_LIB) $(LD_FLAGS_SHLIB) $(OBJS))
$(MV) pic/$(BSD_LIB) .
$(RM) -f ../$(BSD_LIB)
(cd ..; $(LN) $(LINK_BUILD_FLAGS) \
`echo $(my_dir) | sed -e 's;lib/;;' /$(BSD_LIB) $(BSD_LIB))

install-shlibs install:: $(BSD_LIB)
@echo " INSTALL_PROGRAM $(BSDLIB_INSTALL_DIR)/$(BSD_LIB)"
@$(INSTALL_PROGRAM) $(BSD_LIB) \
$(DESTDIR)$$(BSDLIB_INSTALL_DIR)/$(BSD_LIB)
@-$(LD_CONFIG)

install-strip: install

install-shlibs-strip: install-shlibs

uninstall-shlibs uninstall::
$(RM) -f $(DESTDIR)$$(BSDLIB_INSTALL_DIR)/$(BSD_LIB)

clean::
$(RM)
-rf pic
$(RM) -f $(BSD_LIB)
$(RM) -f ../$(BSD_LIB)

```

This is the Debian GNU/Linux prepackaged version of the `ss` command-line interface parsing library. It is currently distributed together with the EXT2 file system utilities, which are otherwise packaged as "e2fsprogs".

This package was put together by Yann Dirson <dirson@debian.org>, from sources obtained from a mirror of:
tsx-11.mit.edu:/pub/linux/packages/ext2fs/

From the original distribution:

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comprising the libuuid library, and the source file headers of the
libet and libss libraries for more information.

The most recent officially distributed version can be found at
<http://e2fsprogs.sourceforge.net>. If you need to make a distribution,
that's the one you should use. If there is some reason why you'd like
a more recent version that is still in ALPHA testing (i.e., either
using the "WIP" test distributions or one from the hg or git
repository from the development branch, please contact me
(tytso@mit.edu)

before you ship. The release schedules for this
package are flexible, if you give me enough lead time.

Theodore Ts'o
23-June-2007

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Version 2, June 1991

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```

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This is the Debian GNU/Linux prepackaged version of the Common Error Description library. It is currently distributed together with the EXT2 file system utilities, which are otherwise packaged as "e2fsprogs".

This package was put together by Yann Dirson <dirson@debian.org>.

from sources obtained from a mirror of:
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1.23 protobuf 3.5.1

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This file contains a list of people who've made non-trivial
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- * Small patch to handle trailing slashes in --proto_path flag.

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- * Small patch to fix Python CallMethod().

Ulrich Kunitz <kune@deine-taler.de>

- * Small optimizations to Python serialization.

Leandro Lucarella <llucax@gmail.com>

- * VI syntax highlighting tweaks.
- * Fix compiler to not make output executable.

Dilip Joseph <dilip.antony.joseph@gmail.com>

- * Heuristic detection of sub-messages when printing unknown fields in text format.

Brian Atkinson <nairb774@gmail.com>

- * Added @Override annotation to generated Java code where appropriate.

Vincent Choinire <Choiniere.Vincent@hydro.qc.ca>

- * Tru64 support.

Monty Taylor <monty.taylor@gmail.com>

- * Solaris 10 + Sun Studio fixes.

Alek Storm <alek.storm@gmail.com>

- * Slicing support for repeated scalar fields for the Python API.

Oleg Smolsky <oleg.smolsky@gmail.com>

- * MS Visual Studio error format option.
- * Detect unordered_map in stl_hash.m4.

Brian Olson <brianolson@google.com>

- * gzip/zlib I/O support.

Michael Poole <mdpoole@troilus.org>

- * Fixed warnings about generated constructors not explicitly initializing all fields (only present with certain compiler settings).
- * Added generation of field number constants.

Wink Saville <wink@google.com>

- * Fixed initialization ordering problem in logging code.

Will Pierce <willp@nuclei.com>

- * Small patch improving performance of in Python serialization.

Alexandre Vassalotti <alexandre@peadrop.com>
* Emacs mode for Protocol Buffers (editors/protobuf-mode.el).

Scott Stafford <scott.stafford@gmail.com>
* Added Swap(), SwapElements(), and RemoveLast() to Reflection interface.

Alexander Melnikov <alm@sibmail.ru>
* HPUX support.

Oliver Jowett <oliver.jowett@gmail.com>
* Detect whether zlib is new enough in configure script.
* Fixes for Solaris 10 32/64-bit confusion.

Evan Jones <evanj@mit.edu>
* Optimize Java serialization code when writing a small message to a stream.
* Optimize Java serialization of strings so that UTF-8 encoding happens only once per string per serialization call.
* Clean up some Java warnings.
* Fix bug with permanent callbacks that delete themselves when run.

Michael Kucharski <m.kucharski@gmail.com>
* Added CodedInputStream.getTotalBytesRead().

Kacper Kowalik <xarthisius.kk@gmail.com>
* Fixed m4/acx_pthread.m4 problem for some Linux distributions.

William Orr <will@worrbase.com>
* Fixed detection of sched_yield on Solaris.
* Added atomicops for Solaris

Andrew Paprocki <andrew@ishiboo.com>
* Fixed minor IBM xLC compiler build issues
* Added atomicops for AIX (POWER)

This file contains a list of people who've made non-trivial
contribution to the Google C++ Testing Framework project. People
who commit code to the project are encouraged to add their names
here. Please keep the list sorted by first names.

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1.25 curl 7.62.0

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=====

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##

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```
## libssh2
```

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1.26 latencyutils 2.0.3

1.27 freerdp 2.0.0-rc4

1.27.1 Available under license :

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1.28 bzip2 1.0.8

1.29 Idns 1.7.1

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```
#!/bin/sh
```

```
## DO NOT EDIT - This file generated from ./build-aux/ltmain.in
```

```
## by inline-source v2014-01-03.01
```

```
# libtool (GNU libtool) 2.4.6
```

```
# Provide generalized library-building support services.
```

```
# Written by Gordon Matzigkeit <gord@gnu.ai.mit.edu>, 1996
```

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/* From openssh 4.3p2 filename openbsd-compat/fake-rfc2553.h */

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/*

* FILE: sha2.c

* AUTHOR: Aaron D. Gifford - <http://www.aarongifford.com/>

*

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*

* Modified by Jelte Jansen to fit in ldns, and not clash with any

* system-defined SHA code.

* Changes:

- * - Renamed (external) functions and constants to fit Idns style
- * - Removed _End and _Data functions
- * - Added Idns_shaX(data, len, digest) convenience functions
- * - Removed prototypes of _Transform functions and made those static
- *
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- * \$Id:
- sha2.c,v 1.1 2001/11/08 00:01:51 adg Exp adg \$
- */
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/* from openssh 4.3p2 compat/strncpy.c */

/*

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/* From openssh4.3p2 compat/inet_aton.c */

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1.37 json-c 0.12.1

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1.43 libffi 3.2.1

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```
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```
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```

```
<signature of Ty Coon>, 1 April 1989
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1.45 glibc 2.25

1.45.1 Available under license :

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``Source code" for a work means the preferred form of the work for making modifications to it. For a library, complete source code means all the source code for all modules it contains, plus any associated interface definition files, plus the scripts used to control compilation and installation of the library.

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1.48 rsyslog 7.6.7

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```

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```
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```

```
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1.50 opus 1.1.2

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1.51 libvpx 1.4.0

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1.52 python-requests 2.22.0

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1.53 urllib3 1.25.3

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* victor.vde <<http://code.google.com/u/victor.vde/>>

* HTTPS patch (which inspired HTTPSConnectionPool)

* erikcederstrand <<http://code.google.com/u/erikcederstrand/>>

* NTLM-authenticated HTTPSConnectionPool

* Basic-authenticated HTTPSConnectionPool (merged into make_headers)

* niphlod <niphlod@gmail.com>

* Client-verified SSL certificates for HTTPSConnectionPool

* Response gzip and deflate encoding support

* Better unicode support for filepost using StringIO buffers

* btoconnor <brian@btoconnor.net>

* Non-multipart encoding for POST requests

* p.dobrogost <<http://code.google.com/u/@WBRSRIBZDhBFXQB6/>>

* Code review, PEP8 compliance, benchmark fix

* kennethreitz <me@kennethreitz.com>

* Bugfixes, suggestions, Requests integration

* georgemarshall <<https://github.com/georgemarshall>>

* Bugfixes, Improvements and Test coverage

* Thomas Kluyver <thomas@kluyver.me.uk>

* Python 3 support

* brandon-rhodes <<http://rhodesmill.org/brandon>>

* Design review, bugfixes, test coverage.

* studer <theo.studer@gmail.com>

* IPv6 url support and test coverage

* Shivaram Lingamneni <slingamn@cs.stanford.edu>

* Support for explicitly closing pooled connections

* hartator <hartator@gmail.com>

* Corrected multipart behavior for params

* Thomas Weischuh <thomas@t-8ch.de>

* Support for TLS SNI

* API unification of ssl_version/cert_reqs

* SSL fingerprint and alternative hostname verification

* Bugfixes in testsuite

* Sune Kirkeby <mig@ibofobi.dk>

* Optional SNI-support for Python 2 via PyOpenSSL.

* Marc Schlaich <marc.schlaich@gmail.com>

* Various bugfixes and test improvements.

* Bryce Boe <bbzbryce@gmail.com>

* Correct six.moves conflict

* Fixed pickle support of some exceptions

* Boris Figovsky <boris.figovsky@ravellosystems.com>

* Allowed to skip SSL hostname verification

* Cory Benfield

<<https://lukasa.co.uk/about/>>

* Stream method for Response objects.

* Return native strings in header values.

- * Generate 'Host' header when using proxies.

- * Jason Robinson <jaywink@basshero.org>
 - * Add missing WrappedSocket.fileno method in PyOpenSSL

- * Audrius Butkevicius <audrius.butkevicius@elastichosts.com>
 - * Fixed a race condition

- * Stanislav Vitkovskiy <stas.vitkovsky@gmail.com>
 - * Added HTTPS (CONNECT) proxy support

- * Stephen Holsapple <sholsapp@gmail.com>
 - * Added abstraction for granular control of request fields

- * Martin von Gagern <Martin.vGagern@gmx.net>
 - * Support for non-ASCII header parameters

- * Kevin Burke <kev@inburke.com> and Pavel Kirichenko <juanych@yandex-team.ru>
 - * Support for separate connect and request timeouts

- * Peter Waller <p@pwaller.net>
 - * HTTPResponse.tell() for determining amount received over the wire

- * Nipunn Koorapati <nipunn1313@gmail.com>
 - * Ignore default ports when comparing hosts for equality

- * Danilo @dbrgn <https://dbrgn.ch/>
 - * Disabled TLS compression by default on Python 3.2+
 - * Disabled TLS compression in pyopenssl contrib module
 - * Configurable cipher suites in pyopenssl contrib module

- * Roman Bogorodskiy <roman.bogorodskiy@ericsson.com>
 - * Account retries on proxy errors

- * Nicolas Delaby <nicolas.delaby@ezeep.com>
 - * Use the platform-specific CA certificate locations

- * Josh Schneier <https://github.com/jschneier>
 - * HTTPHeaderDict and associated tests and docs
 - * Bugfixes, docs, test coverage

- * Tahia Khan <http://tahia.tk/>
 - * Added Timeout examples in docs

- * Arthur Grunseid <https://grunseid.com>
 - * source_address support and tests (with https://github.com/bui)

- * Ian Cordasco <graffatcolmingov@gmail.com>

- * PEP8 Compliance and Linting
- * Add ability to pass socket options to an HTTP Connection

- * Erik Tollerud <erik.tollerud@gmail.com>
- * Support for standard library io module.

- * Krishna Prasad <kprasad.iitd@gmail.com>
- * Google App Engine documentation

- * Aaron Meurer
<asmeurer@gmail.com>
- * Added Url.url, which unparses a Url

- * Evgeny Kapun <abacabadabacaba@gmail.com>
- * Bugfixes

- * Benjamin Meyer <bm_witness@yahoo.com>
- * Security Warning Documentation update for proper capture

- * Shivan Sornarajah <github@sornars.com>
- * Support for using ConnectionPool and PoolManager as context managers.

- * Alex Gaynor <alex.gaynor@gmail.com>
- * Updates to the default SSL configuration

- * Tomas Tomecek <ttomecek@redhat.com>
- * Implemented generator for getting chunks from chunked responses.

- * tlynn <https://github.com/tlynn>
- * Respect the warning preferences at import.

- * David D. Riddle <ddriddle@illinois.edu>
- * IPv6 bugfixes in testsuite

- * Thea Flowers <magicalgirl@google.com>
- * App Engine environment tests.
- * Documentation re-write.

- * John Krauss <https://github.com/talos>
- * Clues to debugging problems with `cryptography` dependency in docs

- * Disassem <https://github.com/Disassem>
- * Fix pool-default headers not applying for url-encoded requests like GET.

- * James Atherfold <jlatherfold@hotmail.com>
- * Bugfixes relating to cleanup of connections during errors.

- * Christian Pedersen <<https://github.com/chripede>>
- * IPv6 HTTPS proxy bugfix

- * Jordan Moldow <<https://github.com/jmoldow>>
- * Fix low-level exceptions leaking from ``HTTPResponse.stream()``.
- * Bugfix for ``ConnectionPool.urlopen(release_conn=False)``.
- * Creation of ``HTTPConnectionPool.ResponseCls``.

- * Predrag Gruevski <<https://github.com/obi1kenobi>>
- * Made cert digest comparison use a constant-time algorithm.

- * Adam Talsma <<https://github.com/a-tal>>
- * Bugfix to ca_cert file paths.

- * Evan Meagher <<https://evanmeagher.net>>
- * Bugfix related to `memoryview` usage in PyOpenSSL adapter

- * John Vandenberg <jayvdb@gmail.com>
- * Python 2.6 fixes; pyflakes and pep8 compliance

- * Andy Caldwell <andy.m.caldwell@gmail.com>
- * Bugfix related to reusing connections in indeterminate states.

- * Ville Skytt <ville.skytta@iki.fi>
- * Logging efficiency improvements, spelling fixes, Travis config.

- * Shige Takeda <smtakeda@gmail.com>
- * Started Recipes documentation and added a recipe about handling concatenated gzip data in HTTP response

- * Jess Shapiro <jesse@jesseshapiro.net>
- * Various character-encoding fixes/tweaks
- * Disabling IPv6 DNS when IPv6 connections not supported

- * David Foster <<http://dafoster.net/>>
- * Ensure order of request and response headers are preserved.

- * Jeremy Cline <jeremy@jcline.org>
- * Added connection pool keys by scheme

- * Aviv Palivoda <palaviv@gmail.com>
- * History list to Retry object.
- * HTTPResponse contains the last Retry object.

- * Nate Prewitt <nate.prewitt@gmail.com>
- * Ensure timeouts are not booleans and greater than zero.
- * Fixed infinite loop in ``stream`` when amt=None.
- * Added length_remaining to determine remaining data to be read.

- * Added `enforce_content_length` to raise exception when incorrect content-length received.

- * Seth Michael Larson <sethmichaellarson@protonmail.com>
 - * Created selectors backport that supports PEP 475.

- * Alexandre Dias <alex.dias@smarkets.com>
 - * Don't retry on timeout if method not in whitelist

- * Moinuddin Quadri <moin18@gmail.com>
 - * Lazily load idna package

- * Tom White <s6yg1ez3@mail2tor.com>
 - * Made SOCKS handler differentiate socks5h from socks5 and socks4a from socks4.

- * Tim Burke <tim.burke@gmail.com>
 - * Stop buffering entire deflate-encoded responses.

- * Tuukka Mustonen <tuukka.mustonen@gmail.com>
 - * Add counter for `status_forcelist` retries.

- * Erik Rose <erik@mozilla.com>
 - * Bugfix to `pyopenssl` vendoring

- * Wolfgang Richter <wolfgang.richter@gmail.com>
 - * Bugfix related to loading full certificate chains with `PyOpenSSL` backend.

- * Mike Miller <github@mikeage.net>
 - * Logging improvements to include the HTTP(S) port when opening a new connection

- * Ioannis Tziakos <mail@itziakos.gr>
 - * Fix `util.selectors._fileobj_to_fd`` to accept `long``.
 - * Update appveyor tox setup to use the 64bit python.

- * Akamai
(through Jess Shapiro) <jshapiro@akamai.com>
 - * Ongoing maintenance; 2017-2018

- * Dominique Leuenberger <dimstar@opensuse.org>
 - * Minor fixes in the test suite

- * Will Bond <will@wbond.net>
 - * Add Python 2.6 support to `contrib.securetransport``

- * Aleksei Alekseev <alekseev.yeskela@gmail.com>
 - * using auth info for socks proxy

- * Chris Wilcox <git@crwilcox.com>
 - * Improve contribution guide

* Add ``HTTPResponse.geturl`` method to provide ``urllib2.urlopen().geturl()`` behavior

* Bruce Merry <<https://www.brucemerry.org.za>>

* Fix leaking exceptions when system calls are interrupted with zero timeout

* Hugo van Kemenade <<https://github.com/hugovk>>

* Drop support for EOL Python 2.6

* Tim Bell <<https://github.com/timb07>>

* Bugfix for responses with Content-Type: message/* logging warnings

* Justin Bramley <<https://github.com/jbramley>>

* Add ability to handle multiple Content-Encodings

* Katsuhiko YOSHIDA <<https://github.com/kyoshidajp>>

* Remove Authorization header

regardless of case when redirecting to cross-site

* [Your name or handle] <[email or website]>

* [Brief summary of your changes]

1.54 popt 1.16

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1.55 opencv 4.1.1

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The zlib License could have been used instead of the Modified (3-clause) BSD License, and since the IJG License effectively subsumes the distribution conditions of the zlib License, this would have effectively placed libjpeg-turbo binary distributions under the IJG License. However, the IJG License specifically refers to the Independent JPEG Group and does not extend attribution and endorsement protections to other entities. Thus, it was desirable to choose a license that granted us the same protections for new code that were granted to the IJG for code derived from their software.

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License for Berkeley SoftFloat Release 3c

John R. Hauser

2017 February 10

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<!-- tree 1 -->

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    <!-- root node -->
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    <_>
      <!-- root node -->

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            <!-- root node -->
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                    <rects>
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  <!-- root node -->
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  <!-- root node -->
  <feature>
    <rects>
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      49
9 4 6 -1.</_>
      <_>
      49 9 2 3 2.</_>
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    <_>
      10 9 10 7 3.</_></rects>
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4 10 -1.</_>
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  <feature>
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<!-- tree 8 -->
<_>
  <!-- root node -->

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    <_>
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<_>
<!-- root node -->
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    <_>
      1 0 1 1 2.</_></rects>
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<!-- root node -->
<feature>
  <rects>
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    <_>
      14 12 11 3 3.</_></rects>

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  <!-- root node -->
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  <!-- tree 13 -->
  </_>
  <!-- root node -->
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      47 4 1 8 3.</_></rects>
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    <rects>
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      3 2 2 5 3.</_></rects>

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            <_>
                6 1 3 14 2.</_></rects>
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            <_>
                3 6 2 10 -1.</_>
            <_>
                3 11 2 5 2.</_></rects>
        <tilted>0</tilted></feature>
        <threshold>-2.7962020249105990e-004</threshold>
        <left_val>8.2833290100097656e-001</left_val>

        <right_val>-9.8444151878356934e-001</right_val></_></_>
<_>

```

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<!-- tree 4 -->
<_>
  <!-- root node -->
  <feature>
    <rects>
      <_>
        42 0 4 6 -1.</_>
      <_>
        42 0 2 3 2.</_>
      <_>
        44 3 2 3 2.</_></rects>
    <tilted>0</tilted></feature>
  <threshold>-2.7560539820115082e-005</threshold>
  <left_val>1.</left_val>
  <right_val>-9.9543339014053345e-001</right_val></_></_></trees>
<stage_threshold>-9.1314977407455444e-001</stage_threshold>
<parent>14</parent>
<next>-1</next></_></stages></haarcascade_pltzzz64x16_16STG>
</opencv_storage>
```

This package was debianized by Christopher L Cheney <ccheney@debian.org> on
Fri, 22 Aug 2003 01:33:34 -0500.

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It was downloaded from <http://www.ece.uvic.ca/~mdadams/jasper/>

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ring;)Ljava/lang/StringBuffer;(Ljava/lang/String;Ljava/lang/String;)VE([Lorg/apache/ivy/core/module/id/ModuleR  
evisionId;)Ljava/lang/String;->...<init>CircularDependencyHelper.javaCodeLineNumberTableLjava/lang/String;  
SourceFileaddappend
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java/util/Setname-org/apache/ivy/core/module/descriptor/LicensesetToStringurl0%3%#!#3*
+, \$ *#*\$+##* \$#!#!*
\$
!)#]YLYYM*2W+*2W>*1,
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1.59 libcap 2.22

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1.62 tcpdump 4.9.2

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1.63 json-c 0.12

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1.71 Isb 11.1.0

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Here is a list of the main contributors to lm-sensors version 3.

* Frodo Looijaard

Original author of libsensors, sensors-detect, sensors and isadump.

* Merlin Hughes

Original author of sensord.

* Bob Schlaermann

Dynamic chip feature detection (a.k.a. generic chip support) in libsensors and sensors.

* Mark M. Hoffman

Many improvements to the libsensors configuration file scanner.

* Jean Delvare

New libsensors API, and migration of sensors and sensord thereto.

Many optimizations in libsensors and sensors.

Configuration file converter.

Rewrite of sensors-detect.

Support for multiple configuration files in libsensors.

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The reason we have a separate public license for some libraries is that they blur the distinction we usually make between modifying or adding to a program and simply using it. Linking a program with a library, without changing the library, is in some sense simply using the library, and is analogous to running a utility program or application program. However, in a textual and legal sense, the linked executable is a combined work, a derivative of the original library, and the ordinary General Public License treats it as such.

Because of this blurred distinction, using the ordinary General Public License for libraries did not effectively promote software sharing, because most developers did not use the libraries. We concluded that weaker conditions might promote sharing better.

However, unrestricted linking of non-free programs would deprive the users of those programs of all benefit from the free status of the

libraries themselves. This Library General Public License is intended to permit developers of non-free programs to use free libraries, while preserving your freedom as a user of such programs to change the free libraries that are incorporated in them. (We have not seen how to achieve this as regards changes in header files, but we have achieved it as regards changes in the actual functions of the Library.) The hope is that this will lead to faster development of free libraries.

The precise terms and conditions for copying, distribution and modification follow. Pay close attention to the difference between a "work based on the library" and a "work that uses the library". The former contains code derived from the library, while the latter only works together with the library.

Note that it is possible for a library to be covered by the ordinary General Public License rather than by this special one.

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0. This License Agreement applies to any software library which contains a notice placed by the copyright holder or other authorized party saying it may be distributed under the terms of this Library General Public License (also called "this License"). Each licensee is addressed as "you".

A "library" means a collection of software functions and/or data prepared so as to be conveniently linked with application programs (which use some of those functions and data) to form executables.

The "Library", below, refers to any such software library or work which has been distributed under these terms. A "work based on the Library" means either the Library or any derivative work under copyright law: that is to say, a work containing the Library or a portion of it, either verbatim or with modifications and/or translated straightforwardly into another language. (Hereinafter, translation is included without limitation in the term "modification".)

"Source code" for a work means the preferred form of the work for making modifications to it. For a library, complete source code means all the source code for all modules it contains, plus any associated interface definition files, plus the scripts used to control compilation and installation of the library.

Activities other than copying, distribution and modification are not covered by this License; they are outside its scope. The act of

running a program using the Library is not restricted, and output from such a program is covered only if its contents constitute a work based on the Library (independent of the use of the Library in a tool for writing it). Whether that is true depends on what the Library does and what the program that uses the Library does.

1. You may copy and distribute verbatim copies of the Library's complete source code as you receive it, in any medium, provided that you conspicuously and appropriately publish on each copy an appropriate copyright notice and disclaimer of warranty; keep intact all the notices that refer to this License and to the absence of any warranty; and distribute a copy of this License along with the Library.

You may charge a fee for the physical act of transferring a copy, and you may at your option offer warranty protection in exchange for a fee.

2. You may modify your copy or copies of the Library or any portion of it, thus forming a work based on the Library, and copy and distribute such modifications or work under the terms of Section 1 above, provided that you also meet all of these conditions:

- a) The modified work must itself be a software library.
- b) You must cause the files modified to carry prominent notices stating that you changed the files and the date of any change.
- c) You must cause the whole of the work to be licensed at no charge to all third parties under the terms of this License.
- d) If a facility in the modified Library refers to a function or a table of data to be supplied by an application program that uses the facility, other than as an argument passed when the facility is invoked, then you must make a good faith effort to ensure that, in the event an application does not supply such function or table, the facility still operates, and performs whatever part of its purpose remains meaningful.

(For example, a function in a library to compute square roots has a purpose that is entirely well-defined independent of the application. Therefore, Subsection 2d requires that any application-supplied function or table used

by this function must

be optional: if the application does not supply it, the square root function must still compute square roots.)

These requirements apply to the modified work as a whole. If identifiable sections of that work are not derived from the Library, and can be reasonably considered independent and separate works in themselves, then this License, and its terms, do not apply to those sections when you distribute them as separate works. But when you distribute the same sections as part of a whole which is a work based on the Library, the distribution of the whole must be on the terms of this License, whose permissions for other licensees extend to the entire whole, and thus to each and every part regardless of who wrote it.

Thus, it is not the intent of this section to claim rights or contest your rights to work written entirely by you; rather, the intent is to exercise the right to control the distribution of derivative or collective works based on the Library.

In addition, mere aggregation of another work not based on the Library with the Library (or with a work based on the Library) on a volume of a storage or distribution medium does not bring the other work under the scope of this License.

3. You may opt to apply the terms of the ordinary GNU General Public License instead of this License to a given copy of the Library. To do this, you must alter all the notices that refer to this License, so that they refer to the ordinary GNU General Public License, version 2, instead of to this License. (If a newer version than version 2 of the ordinary GNU General Public License has appeared, then you can specify that version instead if you wish.) Do not make any other change in these notices.

Once this change is made in a given copy, it is irreversible for that copy, so the ordinary GNU General Public License applies to all subsequent copies and derivative works made from that copy.

This option is useful when you wish to copy part of the code of the Library into a program that is not a library.

4. You may copy and distribute the Library (or a portion or derivative of it, under Section 2) in object code or executable form under the terms of Sections 1 and 2 above provided that you accompany it with the complete corresponding machine-readable source code, which must be distributed under the terms of Sections 1 and 2 above on a medium customarily used for software interchange.

If distribution of object code is made by offering access to copy

from a designated place, then offering equivalent access to copy the source code from the same place satisfies the requirement to distribute the source code, even though third parties are not compelled to copy the source along with the object code.

5. A program that contains no derivative of any portion of the Library, but is designed to work with the Library by being compiled or linked with it, is called a "work that uses the Library". Such a work, in isolation, is not a derivative work of the Library, and therefore falls outside the scope of this License.

However, linking a "work that uses the Library" with the Library creates an executable that is a derivative of the Library (because it contains portions of the Library), rather than a "work that uses the library". The executable is therefore covered by this License. Section 6 states terms for distribution of such executables.

When a "work that uses the Library" uses material from a header file that is part of the Library, the object code for the work may be a derivative work of the Library even though the source code is not. Whether this is true is especially significant if the work can be linked without the Library, or if the work is itself a library. The threshold for this to be true is not precisely defined by law.

If such an object file uses only numerical parameters, data structure layouts and accessors, and small macros and small inline functions (ten lines or less in length), then the use of the object file is unrestricted, regardless of whether it is legally a derivative work. (Executables containing this object code plus portions of the Library will still fall under Section 6.)

Otherwise, if the work is a derivative of the Library, you may distribute the object code for the work under the terms of Section 6. Any executables containing that work also fall under Section 6, whether or not they are linked directly with the Library itself.

6. As an exception to the Sections above, you may also compile or link a "work that uses the Library" with the Library to produce a work containing portions of the Library, and distribute that work under terms of your choice, provided that the terms permit modification of the work for the customer's own use and reverse engineering for debugging such modifications.

You must give prominent notice with each copy of the work that the Library is used in it and that the Library and its use are covered by this License. You must

supply a copy of this License. If the work during execution displays copyright notices, you must include the copyright notice for the Library among them, as well as a reference directing the user to the copy of this License. Also, you must do one of these things:

a) Accompany the work with the complete corresponding machine-readable source code for the Library including whatever changes were used in the work (which must be distributed under Sections 1 and 2 above); and, if the work is an executable linked with the Library, with the complete machine-readable "work that uses the Library", as object code and/or source code, so that the user can modify the Library and then relink to produce a modified executable containing the modified Library. (It is understood that the user who changes the contents of definitions files in the Library will not necessarily be able to recompile the application to use the modified definitions.)

b) Accompany the work with a written offer, valid for at least three years, to give the same user the materials specified in Subsection 6a, above, for a charge no more than the cost of performing this distribution.

c) If distribution of the work is made by offering access to copy from a designated place, offer equivalent access to copy the above specified materials from the same place.

d) Verify that the user has already received a copy of these materials or that you have already sent this user a copy.

For an executable, the required form of the "work that uses the Library" must include any data and utility programs needed for reproducing the executable from it. However, as a special exception, the source code distributed need not include anything that is normally distributed (in either source or binary form) with the major components (compiler, kernel, and so on) of the operating system on which the executable runs, unless that component itself accompanies the executable.

It may happen that this requirement contradicts the license restrictions of other proprietary libraries that do not normally accompany the operating system. Such a contradiction means you cannot use both them and the Library together in an executable that you distribute.

7. You may place library facilities that are a work based on the

Library side-by-side in a single library together with other library facilities not covered by this License, and distribute such a combined library, provided that the separate distribution of the work based on the Library and of the other library facilities is otherwise permitted, and provided that you do these two things:

a) Accompany the combined library with a copy of the same work based on the Library, uncombined with any other library facilities. This must be distributed under the terms of the Sections above.

b) Give prominent notice with the combined library of the fact that part of it is a work based on the Library, and explaining where to find the accompanying uncombined form of the same work.

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To apply these terms, attach the following notices to the library. It is safest to attach them to the start of each source file to most effectively convey the exclusion of warranty; and each file should have at least the

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<one line to give the library's name and a brief idea of what it does.>

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Also add information on how to contact you by electronic and paper mail.

You should also get your employer (if you work as a programmer) or your school, if any, to sign a "copyright disclaimer" for the library, if necessary.

Here is a sample; alter the names:

Yoyodyne, Inc., hereby disclaims all copyright interest in the library `Frob' (a library for tweaking knobs) written by James Random Hacker.

<signature of Ty Coon>, 1 April 1990

Ty Coon, President of Vice

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Version 3, 29 June 2007

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For the developers' and authors' protection, the GPL clearly explains that there is no warranty for this free software. For both users' and authors' sake, the GPL requires that modified versions be marked as changed, so that their problems will not be attributed erroneously to authors of previous versions.

Some devices are designed to deny users access to install or run modified versions of the software inside them, although the manufacturer can do so. This is fundamentally incompatible with the aim of protecting users' freedom to change the software. The systematic pattern of such abuse occurs in the area of products for individuals to use, which is precisely where it is most unacceptable. Therefore, we have designed this version of the GPL to prohibit the practice for those products. If such problems arise substantially in other domains, we stand

ready to extend this provision to those domains in future versions of the GPL, as needed to protect the freedom of users.

Finally, every program is threatened constantly by software patents. States should not allow patents to restrict development and use of software on general-purpose computers, but in those that do, we wish to avoid the special danger that patents applied to a free program could make it effectively proprietary. To prevent this, the GPL assures that patents cannot be used to render the program non-free.

The precise terms and conditions for copying, distribution and modification follow.

TERMS AND CONDITIONS

0. Definitions.

"This License" refers to version 3 of the GNU General Public License.

"Copyright" also means copyright-like laws that apply to other kinds of works, such as semiconductor masks.

"The Program" refers to any copyrightable work licensed under this License. Each licensee is addressed as "you". "Licensees" and "recipients" may be individuals or organizations.

To "modify" a work means to copy from or adapt all or part of the work in a fashion requiring copyright permission, other than the making of an exact copy. The resulting work is called a "modified version" of the earlier work or a work "based on" the earlier work.

A "covered work" means either the unmodified Program or a work based on the Program.

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To "convey" a work means any kind of propagation that enables other parties to make or receive copies. Mere interaction with a user through a computer network, with no transfer of a copy, is not conveying.

An interactive user interface displays "Appropriate Legal Notices"

to the extent that it includes a convenient and prominently visible feature that (1) displays an appropriate copyright notice, and (2) tells the user that there is no warranty for the work (except to the extent that warranties are provided), that licensees may convey the work under this License, and how to view a copy of this License. If the interface presents a list of user commands or options, such as a menu, a prominent item in the list meets this criterion.

1. Source Code.

The "source code" for a work means the preferred form of the work for making modifications to it. "Object code" means any non-source form of a work.

A "Standard Interface" means an interface that either is an official standard defined by a recognized standards body, or, in the case of interfaces specified for a particular programming language, one that is widely used among developers working in that language.

The

"System Libraries" of an executable work include anything, other than the work as a whole, that (a) is included in the normal form of packaging a Major Component, but which is not part of that Major Component, and (b) serves only to enable use of the work with that Major Component, or to implement a Standard Interface for which an implementation is available to the public in source code form. A "Major Component", in this context, means a major essential component (kernel, window system, and so on) of the specific operating system (if any) on which the executable work runs, or a compiler used to produce the work, or an object code interpreter used to run it.

The "Corresponding Source" for a work in object code form means all the source code needed to generate, install, and (for an executable work) run the object code and to modify the work, including scripts to control those activities. However, it does not include the work's System Libraries, or general-purpose tools or generally available free programs which are used unmodified in performing those activities but which are not part of the work. For example, Corresponding Source includes interface definition files associated with source files for the work, and the source code for shared libraries and dynamically linked subprograms that the work is specifically designed to require, such as by intimate data communication or control flow between those subprograms and other parts of the work.

The Corresponding Source need not include anything that users can regenerate automatically from other parts of the Corresponding Source.

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You may convey a work based on the Program, or the modifications to produce it from the Program, in the form of source code under the terms of section 4, provided that you also meet all of these conditions:

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- b) The work must carry prominent notices stating that it is released under this License and any conditions added under section 7. This requirement modifies the requirement in section 4 to "keep intact all notices".
- c) You must license the entire work, as a whole, under this License to anyone who comes into possession of a copy. This License will therefore apply, along with any applicable section 7 additional terms, to the whole of the work, and all its parts, regardless of how they are packaged. This License gives no permission to license the work in any other way, but it does not invalidate such permission if you have separately received it.
- d) If the work has interactive user interfaces, each must display Appropriate Legal Notices; however, if the Program has interactive interfaces that do not display Appropriate Legal Notices, your work need not make them do so.

A compilation of a covered work with other separate and independent works, which are not by their nature extensions of the covered work, and which are not combined with it such as to form a larger program, in or on a volume of a storage or distribution medium, is called an "aggregate" if the compilation and its resulting copyright are not used to limit the access or legal rights of the compilation's users

beyond what the individual works permit. Inclusion of a covered work in an aggregate does not cause this License to apply to the other parts of the aggregate.

6. Conveying Non-Source Forms.

You may convey a covered work in object code form under the terms of sections 4 and 5, provided that you also convey the machine-readable Corresponding Source under the terms of this License, in one of these ways:

- a) Convey the object code in, or embodied in, a physical product (including a physical distribution medium), accompanied by the Corresponding Source fixed on a durable physical medium customarily used for software interchange.
- b) Convey the object code in, or embodied in, a physical product (including a physical distribution medium), accompanied by a written offer, valid for at least three years and valid for as long as you offer spare parts or customer support for that product model, to give anyone who possesses the object code either (1) a copy of the Corresponding Source for all the software in the product that is covered by this License, on a durable physical medium customarily used for software interchange, for a price no more than your reasonable cost of physically performing this conveying of source, or (2) access to copy the Corresponding Source from a network server at no charge.
- c) Convey individual copies of the object code with a copy of the written offer to provide the Corresponding Source. This alternative is allowed only occasionally and noncommercially, and only if you received the object code with such an offer, in accord with subsection 6b.
- d) Convey the object code by offering access from a designated place (gratis or for a charge), and offer equivalent access to the Corresponding Source in the same way through the same place at no further charge. You need not require recipients to copy the Corresponding Source along with the object code. If the place to copy the object code is a network server, the Corresponding Source may be on a different server (operated by you or a third party) that supports equivalent copying facilities, provided you maintain clear directions next to the object code saying where to find the Corresponding Source. Regardless of what server hosts the Corresponding Source, you remain obligated to ensure that it is available for as long as needed to satisfy these requirements.

e) Convey the object code using peer-to-peer transmission, provided you inform other peers where the object code and Corresponding Source of the work are being offered to the general public at no charge under subsection 6d.

A separable portion of the object code, whose source code is excluded from the Corresponding Source as a System Library, need not be included in conveying the object code work.

A "User Product" is either (1) a "consumer product", which means any tangible personal property which is normally used for personal, family, or household purposes, or (2) anything designed or sold for incorporation into a dwelling. In determining whether a product is a consumer product, doubtful cases shall be resolved in favor of coverage. For a particular product received by a particular user, "normally used" refers to a typical or common use of that class of product, regardless of the status of the particular user or of the way in which the particular user actually uses, or expects or is expected to use, the product. A product is a consumer product regardless of whether the product has substantial commercial, industrial or non-consumer uses, unless such uses represent the only significant mode of use of the product.

"Installation Information" for a User Product means any methods, procedures, authorization keys, or other information required to install and execute modified versions of a covered work in that User Product from a modified version of its Corresponding Source. The information must suffice to ensure that the continued functioning of the modified object code is in no case prevented or interfered with solely because modification has been made.

If you convey an object code work under this section in, or with, or specifically for use in, a User Product, and the conveying occurs as part of a transaction in which the right of possession and use of the User Product is transferred to the recipient in perpetuity or for a fixed term (regardless of how the transaction is characterized), the Corresponding Source conveyed under this section must be accompanied by the Installation Information. But this requirement does not apply if neither you nor any third party retains the ability to install modified object code on the User Product (for example, the work has been installed in ROM).

The requirement to provide Installation Information does not include a requirement to continue to provide support service, warranty, or updates for a work that has been modified or installed by the recipient, or for

the User Product in which it has been modified or installed. Access to a network may be denied when the modification itself materially and adversely affects the operation of the network or violates the rules and protocols for communication across the network.

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1.80 liblogging 1.0.3

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1.81 libva 1.0.15

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1.83 tzdata 2016h

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1.84 slf4j 1.7.30

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1.85 libcap-ng 0.7.9-2.1build1

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1.88 libcap 2.25

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The original code is FirewallControl.pas, released April 16, 2007.

The initial developer of the original code is Rainer Budde (<http://www.speed-soft.de>).

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1.91 dom4j 2.1.3

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Found in path(s):

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* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/ElementHandler.java
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* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-

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* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-
jar/org/dom4j/tree/AbstractDocumentType.java
* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-
jar/org/dom4j/DocumentException.java
* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-
jar/org/dom4j/tree/AbstractText.java
* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-
jar/org/dom4j/dom/DOMNamespace.java
* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-
jar/org/dom4j/tree/DefaultDocumentType.java
*
/opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-
jar/org/dom4j/io/SAXModifyException.java
* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-
jar/org/dom4j/dom/DOMDocument.java
* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-
jar/org/dom4j/tree/AbstractElement.java
* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-
jar/org/dom4j/util/UserDataDocumentFactory.java
* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-
jar/org/dom4j/io/XPPReader.java
* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-
jar/org/dom4j/tree/DefaultAttribute.java
* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-
jar/org/dom4j/io/OutputFormat.java
* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-
jar/org/dom4j/datatype/NamedTypeResolver.java
* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-
jar/org/dom4j/tree/SingleIterator.java
*
/opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-
jar/org/dom4j/dom/DOMAttribute.java

* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/rule/RuleManager.java
* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/tree/DefaultElement.java
* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/datatype/InvalidSchemaException.java
* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/xpath/DefaultNamespaceContext.java
* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/datatype/DatatypeElement.java
* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/io/DocumentSource.java
* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/tree/ElementNameIterator.java
* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/io/DOMSAXContentHandler.java
*
/opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/dom/DOMEElement.java
* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/io/JAXPHelper.java
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* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/Branch.java
* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/Text.java
* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/io/DOMDocumentResult.java
* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/datatype/SchemaParser.java
* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/io/DispatchHandler.java
* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/io/SAXModifyContentHandler.java
*
/opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/tree/AbstractComment.java
* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/util/AttributeHelper.java
* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/tree/DefaultText.java
* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/tree/DefaultNamespace.java
* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/Element.java
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 */

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 jar/org/dom4j/DocumentHelper.java
 * /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-
 jar/org/dom4j/io/SAXReader.java
 * /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-
 jar/org/dom4j/io/SAXHelper.java

1.92 jquery 3.5.1

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1.93 boost 1.72.0

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1.94 commons-fileupload 62

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1.95 libsrtp 2.2.0

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1.96 keyutils 1.6.1-2

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```
<one line to give the program's name and a brief idea of what it does.>  
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```

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```
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This is free software, and you are welcome to redistribute it  
under certain conditions; type `show c' for details.
```

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`Gnomovision' (which makes passes at compilers) written by James Hacker.

<signature of Ty Coon>, 1 April 1989

Ty Coon, President of Vice

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Version 2.1, February 1999

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This option is useful when you wish to copy part of the code of the Library into a program that is not a library.

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Otherwise, if the work is a derivative of the Library, you may distribute the object code for the work under the terms of Section 6.

Any executables containing that work also fall under Section 6, whether or not they are linked directly with the Library itself.

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Ty Coon, President of Vice

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1.97 jandex 2.1.3.Final

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 */
```

Found in path(s):

```
* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-
jar/org/jboss/jandex/ParameterizedType.java
* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-
jar/org/jboss/jandex/Utils.java
*
/opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-
jar/org/jboss/jandex/FieldInfoGenerator.java
* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-
jar/org/jboss/jandex/MethodInfoGenerator.java
* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-
jar/org/jboss/jandex/ThrowsTypeTarget.java
* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-
jar/org/jboss/jandex/TypeParameterBoundTypeTarget.java
```

* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-
 jar/org/jboss/jandex/EmptyTypeTarget.java
 * /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-
 jar/org/jboss/jandex/PositionBasedTypeTarget.java
 * /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-
 jar/org/jboss/jandex/TypeTarget.java
 * /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-
 jar/org/jboss/jandex/AnnotationTargetFilterCollection.java
 *
 /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-
 jar/org/jboss/jandex/IndexWriterImpl.java
 * /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-
 jar/org/jboss/jandex/TypeParameterTypeTarget.java
 * /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-
 jar/org/jboss/jandex/VoidType.java
 * /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-
 jar/org/jboss/jandex/IndexReaderImpl.java
 * /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-
 jar/org/jboss/jandex/ArrayType.java
 * /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-
 jar/org/jboss/jandex/IndexWriterV2.java
 * /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-
 jar/org/jboss/jandex/ClassExtendsTypeTarget.java
 * /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-
 jar/org/jboss/jandex/MethodParameterTypeTarget.java
 *
 /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-
 jar/org/jboss/jandex/MethodInternal.java
 * /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-
 jar/org/jboss/jandex/WildcardType.java
 * /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-
 jar/org/jboss/jandex/GenericSignatureParser.java
 * /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-
 jar/org/jboss/jandex/TypeVariable.java
 * /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-
 jar/org/jboss/jandex/UnresolvedTypeVariable.java
 * /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-
 jar/org/jboss/jandex/IndexReaderV2.java
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Found in path(s):

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* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-jar/org/jboss/jandex/ClassInfo.java
*
/opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-jar/org/jboss/jandex/IndexWriter.java
* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-jar/org/jboss/jandex/DotName.java
* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-jar/org/jboss/jandex/FieldInternal.java
* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-jar/org/jboss/jandex/FieldInfo.java
* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-jar/org/jboss/jandex/NameTable.java
* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-jar/org/jboss/jandex/CompositeIndex.java
* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-jar/org/jboss/jandex/IndexWriterV1.java
* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-jar/org/jboss/jandex/IndexView.java
*
/opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-jar/org/jboss/jandex/StrongInternPool.java
* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-jar/org/jboss/jandex/Indexer.java
* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-jar/org/jboss/jandex/JarIndexer.java
* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-jar/org/jboss/jandex/JandexAntTask.java
* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-jar/org/jboss/jandex/MethodInfo.java
* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-jar/org/jboss/jandex/ClassType.java
* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-jar/org/jboss/jandex/IndexReaderV1.java
* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-

```

jar/org/jboss/jandex/Result.java
* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-
jar/org/jboss/jandex/Index.java
*
/opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-
jar/org/jboss/jandex/MethodParameterInfo.java
* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-
jar/org/jboss/jandex/UnsupportedVersion.java
* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-
jar/org/jboss/jandex/AnnotationValue.java
* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-
jar/org/jboss/jandex/AnnotationTarget.java
* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-
jar/org/jboss/jandex/PrimitiveType.java
* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-
jar/org/jboss/jandex/Main.java
* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-
jar/org/jboss/jandex/PackedDataInputStream.java
* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-
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jar/org/jboss/jandex/IndexReader.java
* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-
jar/org/jboss/jandex/Type.java

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35. [38]Lars H. Mathiesen <thorinn@diku.dk> adaptation of foundation code for Version 3 as specified in RFC-1305
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47. [51]Nick Sayer <mrapple@quack.kfu.com> SunOS streams modules
48. [52]Jack Sasportas <jack@innovativeinternet.com> Saved a Lot of space on the stuff in the html/pic/ subdirectory
49. [53]Ray Schnitzler <schnitz@unipress.com> Unixware1 port
50. [54]Michael Shields <shields@tembel.org> USNO clock driver
51. [55]Jeff Steinman <jss@pebbles.jpl.nasa.gov> Datum PTS clock driver
52. [56]Harlan Stenn <harlan@pfcs.com> GNU automake/autoconfigure makeover, various other bits (see the ChangeLog)
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58. [62]Paul A Vixie <vixie@vix.com> TrueTime GPS driver, generic TrueTime clock driver

59. [63]Ulrich Windl <Ulrich.Windl@rz.uni-regensburg.de> corrected and validated HTML documents according to the HTML DTD

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## Commands to generate dependency files  
GEN_DEPS.c= $(CC) -E -MM $(DEFS) $(CPPFLAGS)  
GEN_DEPS.cc= $(CXX) -E -MM $(DEFS) $(CPPFLAGS)  
  
## Flags for position independent code
```

```

SHAREDLIBCFLAGS = -fPIC
SHAREDLIBCXXFLAGS = -fPIC
SHAREDLIBCPPFLAGS = -DPIC

## Additional flags when building libraries and with threads
THREADSCPPFLAGS = -D_REENTRANT
LIBCPPFLAGS =

## Compiler switch to embed a runtime search path
LD_RPATH=
LD_RPATH_PRE= -Wl,-rpath,

## Compiler switch to embed a library name
LD_SONAME = -Wl,-soname -Wl,$(notdir $(MIDDLE_SO_TARGET))

## Shared library options
LD_SOOPTIONS= -Wl,-Bsymbolic

## Shared object suffix
SO = so
## Non-shared intermediate object suffix
STATIC_O = ao

## Compilation
rules
%.${STATIC_O}: $(srcdir)/%.c
$(COMPILE.c) $(STATICCPPFLAGS) $(STATICCFLAGS) -o $@ $<
%.o: $(srcdir)/%.c
$(COMPILE.c) $(DYNAMICCPPFLAGS) $(DYNAMICCFLAGS) -o $@ $<

%.${STATIC_O}: $(srcdir)/%.cpp
$(COMPILE.cc) $(STATICCPPFLAGS) $(STATICCXXFLAGS) -o $@ $<
%.o: $(srcdir)/%.cpp
$(COMPILE.cc) $(DYNAMICCPPFLAGS) $(DYNAMICCXXFLAGS) -o $@ $<

## Dependency rules
%.d: $(srcdir)/%.c
@echo "generating dependency information for $<"
@$(SHELL) -ec '$(GEN_DEPS.c) $< \
| sed "s^\($*\)\.o[ :]*^1.o $@ : /g\'" > $@; \
[ -s $@ ] || rm -f $@'

%.d: $(srcdir)/%.cpp
@echo "generating dependency information for $<"
@$(SHELL) -ec '$(GEN_DEPS.cc) $< \
| sed "s^\($*\)\.o[ :]*^1.o $@ : /g\'" > $@; \
[ -s $@ ] || rm -f $@'

```

Versioned libraries rules

```
%. $(SO).$(SO_TARGET_VERSION_MAJOR): %. $(SO).$(SO_TARGET_VERSION)
$(RM) $@ && ln -s ${<F} $@
%. $(SO): %. $(SO).$(SO_TARGET_VERSION_MAJOR)
$(RM) $@ && ln -s ${*F}. $(SO).$(SO_TARGET_VERSION) $@
```

Bind internal references

```
# LDflags that pkgdata will use
BIR_LDFLAGS= -Wl,-Bsymbolic
```

```
# Dependencies [i.e. map files] for the final library
BIR_DEPS=
```

```
## Remove shared library 's'
STATIC_PREFIX_WHEN_USED =
STATIC_PREFIX =
```

```
## End BSD-specific setup
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```

```

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1.104 jackson-databind 2.11.2

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1.106 spring-security-web 5.3.4.RELEASE

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```

Found in path(s):

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* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/server/header/ReferrerPolicyServerHttpHeadersWriter.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/http/SecurityHeaders.java
*
/opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/server/authentication/logout/HttpStatusReturningServerLogoutSuccessHandle
r.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/server/authentication/ServerAuthenticationConverter.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
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* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
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jar/org/springframework/security/web/reactive/result/method/annotation/AuthenticationPrincipalArgumentResolver.
java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/server/authorization/ServerWebExchangeDelegatingServerAccessDeniedHan
dler.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
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jar/org/springframework/security/web/server/ServerHttpBasicAuthenticationConverter.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
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jar/org/springframework/security/web/context/request/async/SecurityContextCallableProcessingInterceptor.java
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/opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
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* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
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*
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jar/org/springframework/security/web/server/authentication/ServerX509AuthenticationConverter.java
*
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jar/org/springframework/security/web/server/util/matcher/NegatedServerWebExchangeMatcher.java
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jar/org/springframework/security/web/util/matcher/RequestVariablesExtractor.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/firewall/StrictHttpFirewall.java
*
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* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/access/AccessDeniedHandlerImpl.java

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* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/access/channel/ChannelProcessingFilter.java

* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/access/channel/RetryWithHttpEntryPoint.java

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* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/PortMapperImpl.java

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* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/authentication/RememberMeServices.java

* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/savedrequest/SimpleSavedRequest.java

* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/authentication/switchuser/AuthenticationSwitchUserEvent.java
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* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/authentication/WebAuthenticationDetailsSource.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/authentication/LoginUrlAuthenticationEntryPoint.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/authentication/logout/SecurityContextLogoutHandler.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/access/channel/ChannelDecisionManagerImpl.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/access/intercept/FilterSecurityInterceptor.java
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/opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/access/channel/ChannelEntryPoint.java
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* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/authentication/www/BasicAuthenticationFilter.java
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* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/access/channel/SecureChannelProcessor.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/authentication/NullRememberMeServices.java
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* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/authentication/AnonymousAuthenticationFilter.java
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* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/PortResolverImpl.java
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* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/savedrequest/package-info.java

* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/access/expression/WebExpressionConfigAttribute.java

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 * /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
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 * /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
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* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/server/authentication/AuthenticationWebFilter.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/server/csrf/CsrfWebFilter.java
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* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/session/InvalidSessionAccessDeniedHandler.java
*
/opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/csrf/HttpSessionCsrfTokenRepository.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/csrf/CsrfAuthenticationStrategy.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/util/matcher/AnyRequestMatcher.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/csrf/InvalidCsrfTokenException.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/csrf/DefaultCsrfToken.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/authentication/session/AbstractSessionFixationProtectionStrategy.java

*
/opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/authentication/session/ChangeSessionIdAuthenticationStrategy.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/csrf/CsrfException.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/csrf/MissingCsrfTokenException.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/bind/support/AuthenticationPrincipalArgumentResolver.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/servlet/support/csrf/CsrfRequestDataValueProcessor.java
*
/opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/csrf/CsrfFilter.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/context/AbstractSecurityWebApplicationInitializer.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/authentication/session/SessionFixationProtectionStrategy.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/authentication/session/CompositeSessionAuthenticationStrategy.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/header/writers/XContentTypeOptionsHeaderWriter.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/csrf/CsrfTokenRepository.java
*
/opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/method/annotation/AuthenticationPrincipalArgumentResolver.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/bind/annotation/AuthenticationPrincipal.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/csrf/CsrfToken.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/header/HeaderWriter.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/authentication/session/SessionFixationProtectionEvent.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/method/annotation/CsrfTokenArgumentResolver.java
*
/opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/header/writers/DelegatingRequestMatcherHeaderWriter.java
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* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/authentication/DelegatingAuthenticationFailureHandler.java
*
/opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/access/expression/EvaluationContextPostProcessor.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/access/expression/AbstractVariableEvaluationContextPostProcessor.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/access/DelegatingAccessDeniedHandler.java
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jar/org/springframework/security/core/parameters/AnnotationParameterNameDiscoverer.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/core/annotation/AuthenticationPrincipal.java
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jar/org/springframework/security/core/ComparableVersion.java
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- *
- /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/core/Transient.java
- * /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/core/userdetails/ReactiveUserDetailsPasswordService.java
- * /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/crypto/password/MessageDigestPasswordEncoder.java
- * /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/scheduling/DelegatingSecurityContextTaskScheduler.java
- * /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/authorization/AuthorityReactiveAuthorizationManager.java
- * /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/jackson2/UnmodifiableListDeserializer.java
- *
- /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/provisioning/JdbcUserDetailsManager.java
- * /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/access/expression/method/DefaultMethodSecurityExpressionHandler.java
- * /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/core/token/KeyBasedPersistenceTokenService.java
- * /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/crypto/password/LdapShaPasswordEncoder.java
- * /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/jackson2/UnmodifiableListMixin.java
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- /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/concurrent/DelegatingSecurityContextCallable.java
- * /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/concurrent/DelegatingSecurityContextRunnable.java
- * /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/access/prepost/PrePostAdviceReactiveMethodInterceptor.java
- * /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/authentication/CachingUserDetailsService.java
- * /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/crypto/password/Md4PasswordEncoder.java
- * /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-

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*

/opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-

jar/org/springframework/security/jackson2/BadCredentialsExceptionMixin.java

* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-

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* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-

jar/org/springframework/security/authentication/jaas/AbstractJaasAuthenticationProvider.java

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```
*/
/**
 *
 * @param authentication represents the user in question. Should not be null.
 * @param targetDomainObject the domain object for which permissions should be
 * checked. May be null in which case implementations should return false, as the null
 * condition can be checked explicitly in the expression.
 *
 * @param permission a representation of the permission object as supplied by the
 * expression system. Not null.
 * @return true if the permission is granted, false otherwise
 */
```

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```
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*/
/**
* Base64 encoder which is a reduced version of Robert Harder's public domain
* implementation (version 2.3.7). See <a
* href="http://iharder.sourceforge.net/current/java/base64/">http://iharder.sourceforge.net/current/java/base64/</a>
* for more information.
* <p>
* For internal use only.
*
* @author
* Luke Taylor
* @since 3.0
* @deprecated Use java.util.Base64
*/
```

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* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/crypto/password/Digester.java

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Found in path(s):

* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/core/context/ReactiveSecurityContextHolder.java

* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/authorization/AuthorizationDecision.java

*

/opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/crypto/password/PasswordEncoderUtils.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/authentication/ReactiveAuthenticationManager.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/core/userdetails/ReactiveUserDetailsService.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/authorization/AuthenticatedReactiveAuthorizationManager.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/crypto/password/Md4.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/crypto/factory/PasswordEncoderFactories.java
*

/opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/core/SpringSecurityCoreVersion.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/authorization/ReactiveAuthorizationManager.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/core/AuthenticatedPrincipal.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/core/parameters/P.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/core/userdetails/MapReactiveUserDetailsService.java

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* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/jackson2/UsernamePasswordAuthenticationTokenDeserializer.java

* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/jackson2/UserDeserializer.java

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 * distributed under the License is distributed on an "AS IS" BASIS,
 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
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 * limitations under the License.
 */
/**
 * A token issued by { @link TokenService }.
 *
 * <p>
 * It is important that the keys assigned to tokens are sufficiently randomised and
 * secured that they can serve as identifying a unique user session. Implementations of
 * { @link TokenService } are free to use encryption or encoding strategies of their
 * choice.
 * It is strongly recommended that keys are of sufficient length to balance safety against
 * persistence cost. In relation to persistence cost, it is strongly recommended that
 * returned keys are small enough for encoding in a cookie.
 * </p>
 *
 * @author Ben Alex
 * @since 2.0.1
 */
```

Found in path(s):

```
*/opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/core/token/Token.java
```

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*/
/**
 * Determines if the { @link #getAuthentication() } has permission to access the target
 * given the permission
 * @param target the target domain object to check permission on
 * @param permission the permission to check on the domain object (i.e. "read",
 * "write", etc).
 * @return true if permission
is granted to the { @link #getAuthentication() }, else
 * false
*/
```

Found in path(s):

```
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/expression/SecurityExpressionOperations.java
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```
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/crypto/bcrypt/BCryptPasswordEncoder.java
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jar/org/springframework/security/access/hierarchicalroles/RoleHierarchyUtils.java
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jar/org/springframework/security/crypto/bcrypt/BCrypt.java
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*/
```

```
/**
* Reviews the Object returned from a secure object invocation, being able to
* modify the Object or throw an AccessDeniedException.
*
* 

* Typically used to ensure the principal is permitted to access the domain object
* instance returned by a service layer bean.
* Can also be used to mutate the domain object
* instance so the principal is only able to access authorised bean properties or
* Collection elements.
*
*


```

* Special consideration should be given to using an `AfterInvocationManager`
* on bean methods that modify a database. Typically an
* `AfterInvocationManager` is used with read-only methods, such as
* `public DomainObject getById(id)`. If used with methods that modify a
* database, a transaction manager should be used to ensure any
* `AccessDeniedException` will cause a rollback of the changes made by the
* transaction.
* `</p>`
*
* @author Ben Alex
* /

Found in path(s):

* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/access/intercept/AfterInvocationManager.java

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* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/converter/RsaKeyConverters.java

*

/opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/core/userdetails/UserDetailsPasswordService.java

* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/crypto/argon2/Argon2PasswordEncoder.java

* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/authentication/ReactiveAuthenticationManagerResolver.java

* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/authentication/AbstractUserDetailsReactiveAuthenticationManager.java

* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-

jar/org/springframework/security/crypto/argon2/Argon2EncodingUtils.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/core/token/SecureRandomFactoryBean.java
*
/opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/expression/method/ExpressionBasedPreInvocationAdvice.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/event/LogoutSuccessEvent.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/UserDetailsRepositoryReactiveAuthenticationManager.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/core/annotation/CurrentSecurityContext.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/hierarchicalroles/RoleHierarchyImpl.java
*
/opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/ReactiveAuthenticationManagerAdapter.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/AuthenticationManagerResolver.java
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* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/crypto/keygen/SecureRandomBytesKeyGenerator.java
*
/opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/crypto/util/EncodingUtils.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/crypto/encrypt/HexEncodingTextEncryptor.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-

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jar/org/springframework/security/crypto/encrypt/TextEncryptor.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/crypto/keygen/HexEncodingStringKeyGenerator.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/crypto/password/StandardPasswordEncoder.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/crypto/password/NoOpPasswordEncoder.java
*
/opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/crypto/encrypt/BouncyCastleAesCbcBytesEncryptor.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/crypto/encrypt/CipherUtils.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/crypto/keygen/SharedKeyGenerator.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/crypto/encrypt/BouncyCastleAesBytesEncryptor.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/crypto/keygen/StringKeyGenerator.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/crypto/keygen/KeyGenerators.java
*
/opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/crypto/encrypt/AesBytesEncryptor.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/crypto/encrypt/BytesEncryptor.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/crypto/encrypt/BouncyCastleAesGcmBytesEncryptor.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
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* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/jackson2/UserMixin.java
*
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* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/jackson2/RememberMeAuthenticationTokenMixin.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/jackson2/SimpleGrantedAuthorityMixin.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/jackson2/UsernamePasswordAuthenticationTokenMixin.java
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* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/access/intercept/MethodInvocationPrivilegeEvaluator.java
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/opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/util/FieldUtils.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/core/session/SessionRegistry.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/authentication/AnonymousAuthenticationProvider.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-

jar/org/springframework/security/authentication/event/AuthenticationFailureServiceExceptionEvent.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/annotation/Secured.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/event/AbstractAuthenticationFailureEvent.java
*
/opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/rcp/RemoteAuthenticationManager.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/AuthenticationTrustResolver.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/intercept/AfterInvocationProviderManager.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/jaas/JaasGrantedAuthority.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/event/PublicInvocationEvent.java
*
/opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/event/AbstractAuthorizationEvent.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/AuthenticationServiceException.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/vote/AuthenticatedVoter.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/intercept/aopalliance/MethodSecurityInterceptor.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/LockedException.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/core/userdetails/UserDetailsService.java
*
/opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
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* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
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* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
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* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
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* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
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* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
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* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
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* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-

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* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
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/opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
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* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
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* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
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jar/org/springframework/security/authentication/event/LoggerListener.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
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* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
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* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
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* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
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* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
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* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
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* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
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* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
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 * /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
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 * /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
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 * /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
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 * /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
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 * /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
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 * /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
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 * /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
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 * /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
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jar/org/springframework/security/authentication/InsufficientAuthenticationException.java
 * /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
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 * /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
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 * /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
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 * /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
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* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/access/expression/method/PreInvocationExpressionAttribute.java
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jar/org/springframework/security/access/annotation/AnnotationMetadataExtractor.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/AccountStatusException.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/provisioning/MutableUser.java
*
/opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/core/session/SessionDestroyedEvent.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/concurrent/DelegatingSecurityContextScheduledExecutorService.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/intercept/aspectj/MethodInvocationAdapter.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/jackson2/package-info.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/core/authority/mapping/MappableAttributesRetriever.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/expression/method/MethodSecurityExpressionOperations.java
*
/opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/expression/method/AbstractExpressionBasedMethodConfigAttribute.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/core/authority/mapping/MapBasedAttributes2GrantedAuthoritiesMapper.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/core/context/package-info.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/provisioning/UserDetailsManager.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-

jar/org/springframework/security/access/prepost/PostAuthorize.java
*
/opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/core/authority/GrantedAuthoritiesContainer.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/core/authority/package-info.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/core/authority/mapping/SimpleMappableAttributesRetriever.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/core/authority/mapping/NullAuthoritiesMapper.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/context/DelegatingApplicationListener.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/core/authority/AuthorityUtils.java
*
/opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/core/session/package-info.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/expression/ExpressionUtils.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/vote/RoleHierarchyVoter.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/prepost/PreFilter.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/core/userdetails/UserDetailsByNameServiceWrapper.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/prepost/PrePostInvocationAttributeFactory.java
*
/opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/concurrent/DelegatingSecurityContextExecutor.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/core/authority/mapping/SimpleAttributes2GrantedAuthoritiesMapper.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/core/userdetails/UserDetailsChecker.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/task/DelegatingSecurityContextAsyncTaskExecutor.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/crypto/codecs/Utf8.java
*
/opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/event/package-info.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/core/userdetails/jdbc/package-info.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/prepost/PrePostAnnotationSecurityMetadataSource.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/PermissionCacheOptimizer.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-

jar/org/springframework/security/concurrent/AbstractDelegatingSecurityContextSupport.java
 * /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
 jar/org/springframework/security/access/vote/package-info.java
 *
 /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
 jar/org/springframework/security/core/package-info.java
 * /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
 jar/org/springframework/security/provisioning/package-info.java
 * /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
 jar/org/springframework/security/crypto/password/AbstractPasswordEncoder.java
 * /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
 jar/org/springframework/security/access/prepost/PostInvocationAdviceProvider.java
 * /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
 jar/org/springframework/security/access/prepost/PreInvocationAuthorizationAdvice.java
 * /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
 jar/org/springframework/security/provisioning/GroupManager.java
 *
 /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
 jar/org/springframework/security/util/package-info.java
 * /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
 jar/org/springframework/security/core/userdetails/cache/package-info.java
 * /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
 jar/org/springframework/security/core/userdetails/package-info.java
 * /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
 jar/org/springframework/security/access/expression/SecurityExpressionHandler.java
 * /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
 jar/org/springframework/security/core/userdetails/cache/SpringCacheBasedUserCache.java
 * /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
 jar/org/springframework/security/task/DelegatingSecurityContextTaskExecutor.java
 *
 /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
 jar/org/springframework/security/access/expression/method/package-info.java
 * /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
 jar/org/springframework/security/access/expression/DenyAllPermissionEvaluator.java
 * /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
 jar/org/springframework/security/access/method/DelegatingMethodSecurityMetadataSource.java
 * /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
 jar/org/springframework/security/core/token/Sha512DigestUtils.java
 * /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
 jar/org/springframework/security/core/session/SessionCreationEvent.java
 *
 /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
 jar/org/springframework/security/access/annotation/package-info.java
 * /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
 jar/org/springframework/security/authentication/rcp/package-info.java
 * /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
 jar/org/springframework/security/access/hierarchicalroles/package-info.java
 * /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-

jar/org/springframework/security/provisioning/InMemoryUserDetailsManager.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/core/userdetails/AuthenticationUserDetailsService.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/core/userdetails/memory/package-info.java
*
/opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/hierarchicalroles/RoleHierarchyAuthoritiesMapper.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/core/authority/mapping/Attributes2GrantedAuthoritiesMapper.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/scheduling/DelegatingSecurityContextSchedulingTaskExecutor.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/expression/method/ExpressionBasedAnnotationAttributeFactory.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/crypto/codecs/Hex.java
*
/opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/hierarchicalroles/CycleInRoleHierarchyException.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/core/CredentialsContainer.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/AccountStatusUserDetailsChecker.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/core/token/DefaultToken.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/intercept/aspectj/package-info.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/method/package-info.java
*
/opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/package-info.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/prepost/PreAuthorize.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/jaas/memory/package-info.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/core/parameters/DefaultSecurityParameterNameDiscoverer.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/expression/AbstractSecurityExpressionHandler.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/dao/package-info.java
*
/opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/prepost/PostInvocationAuthorizationAdvice.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/AuthenticationEventPublisher.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-

```

jar/org/springframework/security/crypto/codec/package-info.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/core/authority/mapping/SimpleAuthorityMapper.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/expression/package-info.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/expression/method/PostInvocationExpressionAttribute.java
*
/opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/annotation/Jsr250Voter.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/concurrent/DelegatingSecurityContextExecutorService.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/core/token/package-info.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/provisioning/MutableUserDetails.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/annotation/Jsr250SecurityConfig.java
*
/opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/intercept/aopalliance/package-info.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/hierarchicalroles/RoleHierarchy.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/hierarchicalroles/NullRoleHierarchy.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/core/authority/mapping/package-info.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/expression/method/MethodSecurityExpressionHandler.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/event/package-info.java
*
/opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/prepost/package-info.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/prepost/PreInvocationAttribute.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/expression/method/ExpressionBasedPostInvocationAdvice.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/core/token/TokenService.java

```

1.108 hibernate-validator 6.1.5.Final

1.108.1 Available under license :

No license file was found, but licenses were detected in source scan.

/*


```

* Hibernate Validator, declare and validate application constraints
*
* License: Apache License, Version 2.0
* See the license.txt file in the root directory or <http://www.apache.org/licenses/LICENSE-2.0>.
*/
/**
* Retrieves constraint related meta data for the parameters of the given
* executable.
*
* @param javaBeanExecutable The executable of interest.
*
* @return A list with parameter meta data for the given executable.
*/

```

Found in path(s):

```

* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/hibernate-validator-6-1-5-final-sources-2-
jar/org/hibernate/validator/internal/metadata/provider/AnnotationMetaDataProvider.java

```

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```

Found in path(s):

```

* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/hibernate-validator-6-1-5-final-sources-2-
jar/META-INF/validation-mapping-1.0.xsd
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/hibernate-validator-6-1-5-final-sources-2-
jar/META-INF/maven/org.hibernate.validator/hibernate-validator/pom.xml
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/hibernate-validator-6-1-5-final-sources-2-
jar/META-INF/validation-configuration-1.1.xsd
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/hibernate-validator-6-1-5-final-sources-2-
jar/META-INF/validation-configuration-1.0.xsd
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/hibernate-validator-6-1-5-final-sources-2-
jar/org/hibernate/validator/overview.html
*

```

```

/opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/hibernate-validator-6-1-5-final-sources-2-
jar/META-INF/validation-mapping-1.1.xsd
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/hibernate-validator-6-1-5-final-sources-2-
jar/META-INF/validation-mapping-2.0.xsd
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/hibernate-validator-6-1-5-final-sources-2-
jar/META-INF/validation-configuration-2.0.xsd

```

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```

/*
* Hibernate Validator, declare and validate application constraints
*
* License: Apache License, Version 2.0

```

```

* See the license.txt file in the root directory or <http://www.apache.org/licenses/LICENSE-2.0>.
*/
/**
* <p>
* A method-level constraint, that evaluates a script expression against the
* annotated method or constructor. This constraint can be used to implement
* validation routines that depend on several parameters of the annotated
* executable.
* </p>
* <p>
* Script expressions can be written in any scripting or expression language,
* for which a <a href="http://jcp.org/en/jsr/detail?id=223">JSR 223</a>
* ("Scripting for the Java<sup>TM</sup> Platform") compatible engine can be
* found on the classpath. To refer to a parameter within the scripting
* expression, use its name as obtained by the active
* { @link javax.validation.ParameterNameProvider }. The default provider will
* return the
* actual parameter names, if the -parameters compiler option
* has been enabled, and { @code arg0 }, { @code arg1 } etc. otherwise.
* </p>
* <p>
* The following listing shows an example using the JavaScript engine which
* comes with the JDK:
* </p>
* <pre>
* { @code @ParameterScriptAssert(script = "start.before(end)", lang = "javascript")
* public void createEvent(Date start, Date end) { ... }
* }
* </pre>
* <p>
* Can be specified on any method or constructor.
* </p>
*
* @author Gunnar Morling
*/

```

Found in path(s):

```

* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/hibernate-validator-6-1-5-final-sources-2-
jar/org/hibernate/validator/constraints/ParameterScriptAssert.java
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```

```

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*
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*/
/*

```

* Written by Doug Lea with assistance from members of JCP JSR-166
* Expert Group and released to the public domain, as explained at
* <http://creativecommons.org/licenses/publicdomain>
*/

Found in path(s):

* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/util/ConcurrentReferenceHashMap.java

No license file was found, but licenses were detected in source scan.

/*

* Hibernate Validator, declare and validate application constraints
*
* License: Apache License, Version 2.0
* See the license.txt file in the root directory or <<http://www.apache.org/licenses/LICENSE-2.0>>.
*/

Found in path(s):

* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/constraintvalidators/hv/br/CPFValidator.java

* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/constraintvalidators/bv/time/package-info.java

* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/constraints/URL.java

* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/engine/ConfigurationImpl.java

* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/constraints/Length.java

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* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/cfg/context/ReturnValueTarget.java

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/opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/constraintvalidators/bv/number/sign/PositiveValidatorForBigInteger.java

* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/util/privilegedactions/GetClassLoader.java

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* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/HibernateValidatorContext.java

* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/util/logging/Log.java

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* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/util/privilegedactions/ConstructorInstance.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/cfg/context/ReturnValueConstraintMappingContextImpl.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/path/PropertyNode.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/util/logging/Messages.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/metadata/facets/Validatable.java
*
/opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/constraints/br/TituloEleitoral.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/metadata/descriptor/ReturnValueDescriptorImpl.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/engine/valueextraction/LongArrayValueExtractor.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/properties/PropertyAccessor.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/cfg/context/GroupConversionTargetContextImpl.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-


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jar/org/hibernate/validator/internal/constraintvalidators/hv/pl/PESELValidator.java
*
/opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-
jar/org/hibernate/validator/internal/util/privilegedactions/package-info.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-
jar/org/hibernate/validator/internal/metadata/descriptor/PropertyDescriptorImpl.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-
jar/org/hibernate/validator/constraints/EAN.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-
jar/org/hibernate/validator/internal/constraintvalidators/bv/EmailValidator.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-
jar/org/hibernate/validator/internal/xml/mapping/ConstraintDefinitionStaxBuilder.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-
jar/org/hibernate/validator/internal/xml/mapping/ConstrainedConstructorStaxBuilder.java
*
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jar/org/hibernate/validator/cfg/defs/MinDef.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-
jar/org/hibernate/validator/internal/metadata/descriptor/CrossParameterDescriptorImpl.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-
jar/org/hibernate/validator/constraints/Currency.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-
jar/org/hibernate/validator/internal/constraintvalidators/bv/notempty/NotEmptyValidatorForArraysOfFloat.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-
jar/org/hibernate/validator/internal/engine/validationcontext/PropertyValidationContext.java
*
/opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-
jar/org/hibernate/validator/internal/metadata/BeanMetaDataManagerImpl.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-
jar/org/hibernate/validator/internal/util/annotation/ConstraintAnnotationDescriptor.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-
jar/org/hibernate/validator/internal/constraintvalidators/bv/number/bound/decimal/AbstractDecimalMaxValidator.ja
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* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-
jar/org/hibernate/validator/HibernateValidator.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-
jar/org/hibernate/validator/internal/constraintvalidators/bv/number/sign/PositiveOrZeroValidatorForBigDecimal.jav
a
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-
jar/org/hibernate/validator/internal/constraintvalidators/bv/notempty/NotEmptyValidatorForArraysOfBoolean.java
*
/opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-
jar/org/hibernate/validator/constraints/ISBN.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-
jar/org/hibernate/validator/cfg/defs/PatternDef.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-
jar/org/hibernate/validator/internal/metadata/aggregated/BeanMetaDataBuilder.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-

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jar/org/hibernate/validator/spi/scripting/package-info.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-
jar/org/hibernate/validator/internal/constraintvalidators/bv/number/bound/decimal/DecimalMinValidatorForByte.jav
a
*
/opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-
jar/org/hibernate/validator/internal/constraintvalidators/hv/ScriptAssertContext.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-
jar/org/hibernate/validator/cfg/defs/NotEmptyDef.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-
jar/org/hibernate/validator/internal/engine/messageinterpolation/parser/MessageDescriptorFormatException.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-
jar/org/hibernate/validator/internal/metadata/aggregated/BeanMetaDataImpl.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-
jar/org/hibernate/validator/internal/constraintvalidators/bv/number/bound/MinValidatorForBigInteger.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-
jar/org/hibernate/validator/internal/util/ExecutableHelper.java
*
/opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-
jar/org/hibernate/validator/internal/constraintvalidators/bv/number/sign/NegativeValidatorForFloat.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-
jar/org/hibernate/validator/internal/engine/validationcontext/ValidatorScopedContext.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-
jar/org/hibernate/validator/internal/constraintvalidators/hv/time/DurationMaxValidator.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-
jar/org/hibernate/validator/internal/engine/messageinterpolation/el/SimpleELContext.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-
jar/org/hibernate/validator/internal/engine/resolver/CachingTraversableResolverForSingleValidation.java
*
/opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-
jar/org/hibernate/validator/internal/properties/Constrainable.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-
jar/org/hibernate/validator/internal/engine/groups/GroupWithInheritance.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-
jar/org/hibernate/validator/internal/engine/messageinterpolation/util/InterpolationHelper.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-
jar/org/hibernate/validator/spi/nodenameprovider/Property.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-
jar/org/hibernate/validator/parameternameprovider/ReflectionParameterNameProvider.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-
jar/org/hibernate/validator/internal/constraintvalidators/bv/number/bound/MaxValidatorForNumber.java
*
/opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-
jar/org/hibernate/validator/internal/constraintvalidators/bv/time/futureorpresent/FutureOrPresentValidatorForCalend
ar.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-
jar/org/hibernate/validator/cfg/defs/PastDef.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-

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jar/org/hibernate/validator/internal/xml/mapping/ConstrainedParameterStaxBuilder.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-
jar/org/hibernate/validator/cfg/context/CrossParameterConstraintMappingContext.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-
jar/org/hibernate/validator/internal/constraintvalidators/bv/time/pastorpresent/PastOrPresentValidatorForInstant.java
*
/opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-
jar/org/hibernate/validator/internal/constraintvalidators/bv/number/bound/MinValidatorForShort.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-
jar/org/hibernate/validator/spi/resourceloading/package-info.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-
jar/org/hibernate/validator/internal/constraintvalidators/bv/number/sign/NegativeValidatorForNumber.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-
jar/org/hibernate/validator/internal/constraintvalidators/bv/number/bound/decimal/DecimalMaxValidatorForInteger.
java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-
jar/org/hibernate/validator/cfg/defs/NegativeOrZeroDef.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-
jar/org/hibernate/validator/cfg/context/MethodTarget.java
*
/opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-
jar/org/hibernate/validator/cfg/context/ContainerElementTarget.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-
jar/org/hibernate/validator/constraints/br/CPF.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-
jar/org/hibernate/validator/constraints/ScriptAssert.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-
jar/org/hibernate/validator/internal/constraintvalidators/bv/time/futureorpresent/FutureOrPresentValidatorForHijrah
Date.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-
jar/org/hibernate/validator/internal/constraintvalidators/bv/number/bound/decimal/DecimalMaxValidatorForLong.ja
va
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/opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-
jar/org/hibernate/validator/internal/constraintvalidators/hv/Mod10CheckValidator.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-
jar/org/hibernate/validator/internal/constraintvalidators/bv/time/past/PastValidatorForThaiBuddhistDate.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-
jar/org/hibernate/validator/internal/metadata/aggregated/ConstraintMetaData.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-
jar/org/hibernate/validator/cfg/context/ConstraintDefinitionTarget.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-
jar/org/hibernate/validator/internal/constraintvalidators/bv/time/future/AbstractFutureJavaTimeValidator.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-
jar/org/hibernate/validator/internal/constraintvalidators/bv/time/past/PastValidatorForOffsetTime.java
*
/opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-
jar/org/hibernate/validator/internal/constraintvalidators/bv/number/bound/AbstractMaxValidator.java

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* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/constraintvalidators/bv/time/past/PastValidatorForLocalTime.java
 * /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/constraintvalidators/bv/number/sign/NegativeValidatorForByte.java
 * /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/cfg/context/ParameterTarget.java
 * /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/constraints/ModCheck.java
 *
 /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/constraintvalidators/bv/number/sign/NegativeOrZeroValidatorForFloat.java
 * /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/cfg/ConstraintDef.java
 * /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/metadata/descriptor/ConstraintDescriptorImpl.java
 * /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/cfg/context/AnnotationIgnoreOptions.java
 * /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/engine/constraintvalidation/ConstraintTree.java
 * /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/util/privilegedactions/LoadClass.java
 *
 /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/constraintvalidators/bv/time/past/PastValidatorForZonedDateTime.java
 * /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/constraintvalidators/bv/number/bound/MinValidatorForBigDecimal.java
 * /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/engine/valueextraction/DoubleArrayValueExtractor.java
 * /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/cfg/defs/br/package-info.java
 * /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/constraints/CompositionType.java
 *
 /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/util/privilegedactions/GetMethodFromGetterNameCandidates.java
 * /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/constraintvalidators/hv/ParameterScriptAssertValidator.java
 * /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/spi/properties/ConstrainableExecutable.java
 * /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/spi/nodenameprovider/JavaBeanProperty.java
 * /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/constraints/package-info.java
 * /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/path/package-info.java
 *
 /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/cfg/defs/ISBNDef.java

* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/constraintvalidators/bv/number/bound/MaxValidatorForInteger.java

* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/util/privilegedactions/GetResolvedMemberMethods.java

* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/constraintvalidators/hv/pl/NIPValidator.java

* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/engine/messageinterpolation/DefaultLocaleResolver.java

* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/metadata/location/ParameterConstraintLocation.java

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* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/engine/valueextraction/MapPropertyKeyExtractor.java

* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/metadata/aggregated/rule/OverridingMethodMustNotAlterParameterConstraints.java

* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/xml/mapping/MappingXmlParser.java

* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/constraintvalidators/bv/notempty/NotEmptyValidatorForCharSequence.java

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/opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/constraintvalidators/bv/number/sign/PositiveValidatorForFloat.java

* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/metadata/aggregated/GetterCascadable.java

* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/constraints/NotBlank.java

* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/constraintvalidators/bv/time/pastorpresent/PastOrPresentValidatorForCalendar.java

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- */

Found in path(s):

* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/util/TypeHelper.java

1.109 ical4j 3.0.19

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1.110 oniguruma 6.9.4-1

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1.111 reactor-netty 0.9.11.RELEASE

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1.113 flyway-core 6.4.4

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* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/db2/DB2Table.java

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* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/jdbc/RowMapper.java

* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/license/FlywayEditionUpgradeRequiredException.java

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 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
 jar/org/flywaydb/core/internal/database/snowflake/SnowflakeSchema.java
 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
 jar/org/flywaydb/core/internal/database/snowflake/SnowflakeConnection.java
 *
 /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
 jar/org/flywaydb/core/internal/scanner/classpath/FileSystemClassPathLocationScanner.java
 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
 jar/org/flywaydb/core/internal/scanner/classpath/jboss/JBossVFSv2UrlResolver.java
 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
 jar/org/flywaydb/core/internal/database/h2/H2Database.java
 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
 jar/org/flywaydb/core/internal/parser/Statement.java
 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
 jar/org/flywaydb/core/api/android/ContextHolder.java
 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
 jar/org/flywaydb/core/internal/database/cockroachdb/CockroachDBParser.java
 *
 /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
 jar/org/flywaydb/core/internal/database/base/Schema.java
 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
 jar/org/flywaydb/core/api/configuration/ClassicConfiguration.java
 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
 jar/org/flywaydb/core/internal/resource/ResourceProvider.java
 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
 jar/org/flywaydb/core/api/ErrorCode.java
 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-

jar/org/flywaydb/core/internal/database/oracle/OracleResults.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/info/MigrationInfoContext.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/scanner/LocationScannerCache.java
*
/opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/schemahistory/AppliedMigration.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/database/oracle/OracleSqlScriptExecutor.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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jar/org/flywaydb/core/api/executor/package-info.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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*
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* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/sqlscript/SqlScriptMetadata.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/database/redshift/RedshiftSchema.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/parser/StatementType.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/sqlscript/DefaultSqlScriptExecutor.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/resource/ResourceNameValidator.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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*
/opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/database/oracle/OracleTable.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/database/oracle/OracleConnection.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
 jar/org/flywaydb/core/internal/resource/package-info.java
 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
 jar/org/flywaydb/core/internal/license/Edition.java
 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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 *
 /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
 jar/org/flywaydb/core/internal/database/cockroachdb/CockroachDBRetryingStrategy.java
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 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
 jar/org/flywaydb/core/internal/database/base/package-info.java
 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
 jar/org/flywaydb/core/internal/logging/javautil/JavaUtilLog.java
 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
 jar/org/flywaydb/core/internal/logging/slf4j/package-info.java
 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/package-

info.java

* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/command/DbRepair.java

*

/opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/firebird/FirebirdParser.java

* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/parser/Parser.java

* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/jdbc/PlainExecutionTemplate.java

* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/info/MigrationInfoDumper.java

* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/resource/ResourceName.java

* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/mysql/MySQLDatabase.java

* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/base/Type.java

* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/base/Table.java

*

/opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/api/configuration/FluentConfiguration.java

* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/util/Locations.java

* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/hsqldb/HSQLDBSchema.java

* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/package-info.java

* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/resolver/MigrationInfoHelper.java

* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/informix/InformixSchema.java

* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/api/logging/Log.java

*

/opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/jdbc/DatabaseType.java

* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/postgresql/PostgreSQLType.java

* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/sqlscript/ParsedSqlStatement.java

* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/logging/android/AndroidLog.java

* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/sqlscript/SqlScriptFactory.java

* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/license/FlywayProUpgradeRequiredException.java

* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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 *
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 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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jar/org/flywaydb/core/internal/resolver/sql/SqlMigrationExecutor.java
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* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/callback/package-info.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/resolver/java/ResolvedJavaMigration.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/logging/javautil/JavaUtilLogCreator.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/output/ErrorOutput.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/database/cockroachdb/CockroachDBTable.java
*
/opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/database/saphana/SAPHANAConnection.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/clazz/NoopClassProvider.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/database/redshift/RedshiftType.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/database/sqlserver/SQLServerConnection.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/database/redshift/RedshiftParser.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/database/oracle/OracleSchema.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/database/postgresql/PostgreSQLAdvisoryLockTemplate.java
*
/opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/api/callback/package-info.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/resolver/ResolvedMigrationImpl.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/logging/apachecommons/ApacheCommonsLogCreator.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/database/db2/DB2Type.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/util/UriUtils.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/api/logging/LogCreator.java
*

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/opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/db2/DB2Schema.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/jdbc/DriverDataSource.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/sqlite/SQLiteSchema.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/jdbc/TableLockingExecutionTemplate.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/command/DbInfo.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/resolver/ResolvedMigrationComparator.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/postgresql/PostgreSQLDatabase.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/jdbc/JdbcUtils.java
*
/opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/output/MigrationOutput.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/h2/H2Parser.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/api/logging/package-info.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/api/callback/Callback.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/resource/android/AndroidResource.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/scanner/package-info.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/api/MigrationVersion.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/derby/DerbyTable.java
*
/opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/scanner/classpath/JarUtils.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/resolver/java/ScanningJavaMigrationResolver.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/snowflake/package-info.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/redshift/package-info.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/jdbc/Result.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/sqlite/SQLiteConnection.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/info/MigrationInfoImpl.java

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*
/opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/database/informix/InformixParser.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/command/DbValidate.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/database/mysql/MySQLSchema.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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*
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* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/resolver/sql/package-info.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/database/derby/DerbyParser.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/schemahistory/SchemaHistoryFactory.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/sqlscript/FlywaySqlScriptException.java
*
/opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/resolver/sql/SqlMigrationResolver.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/database/DatabaseFactory.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/database/redshift/RedshiftTable.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/database/DefaultExecutionStrategy.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/resource/NoopResourceProvider.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/parser/TokenType.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/database/db2/DB2Function.java
*

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/opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/h2/H2Connection.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/resource/classpath/ClassPathResource.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/parser/package-info.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/api/resolver/package-info.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/postgresql/PostgreSQLCopyParsedStatement.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/clazz/package-info.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/scanner/classpath/OsgiClassPathLocationScanner.java
*
/opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/firebird/FirebirdTable.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/scanner/classpath/ResourceAndClassScanner.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/sybasease/SybaseASEDatabase.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/parser/Token.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/jdbc/JdbcTemplate.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/postgresql/PostgreSQLTable.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/api/android/package-info.java
*
/opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/info/package-info.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/api/resolver/ChecksumMatcher.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/api/resolver/MigrationResolver.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/configuration/package-info.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/resolver/java/FixedJavaMigrationResolver.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/jdbc/ExecutionTemplateFactory.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/api/executor/MigrationExecutor.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/sqlscript/Delimiter.java
*

/opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/api/Location.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/jdbc/JdbcConnectionFactory.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/resource/ResourceType.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/api/callback/Context.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/api/configuration/package-info.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/sybasease/SybaseASEParser.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/util/package-info.java
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/opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/sqlscript/ParserSqlScript.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/callback/SimpleContext.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/api/resolver/Context.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/resource/classpath/package-info.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/util/AbbreviationUtils.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/exception/FlywayDbUpgradeRequiredException.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/snowflake/SnowflakeParser.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/api/package-info.java
*
/opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/sqlite/SQLiteDatabase.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/scanner/classpath/ClassPathScanner.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/util/IOUtils.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/api/callback/Event.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/sybasease/SybaseASESchema.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/resource/StringResource.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/resource/ResourceNameParser.java
*

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/opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/util/ClassUtils.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/database/hsqldb/HSQldbTable.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/parser/PositionTracker.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/logging/apachecommons/package-info.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/util/Pair.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/resource/filesystem/FileSystemResource.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/exception/FlywaySqlException.java
*
/opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/database/sqlserver/SQLServerApplicationLockTemplate.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/database/sybasease/package-info.java
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1.114 docker-engine 19.03.5

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procfs provides functions to retrieve system, kernel and process metrics from the pseudo-filesystem proc.

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Go support for Protocol Buffers - Google's data interchange format

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```

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amalgamate.py - Amalgamate C source and header files

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1.118 gnulib 2019-09-23

1.118.1 Available under license :

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Please use your full legal name (in ASCII characters) as the subject line of the message.

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[Will this become part of a larger GNU package? If so, what package?]

[Did you copy any files or text written by someone else into the program? Even if that material is free software, we need to know about it.]

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Files:

tests/test-update-copyright.sh

Depends-on:

configure.ac:

```
abs_aux_dir=`cd "$ac_aux_dir"; pwd`
```

```
AC_SUBST([abs_aux_dir])
```

Makefile.am:

```
TESTS += test-update-copyright.sh
```

```
TESTS_ENVIRONMENT += abs_aux_dir='${abs_aux_dir}'
```

```
@c The GNU Lesser General Public License.
```

```
@center Version 2.1, February 1999
```

```
@c This file is intended to be included within another document,
```

```
@c hence no sectioning command or @node.
```

```
@display
```

```
Copyright @copyright{ } 1991, 1999 Free Software Foundation, Inc.
```

```
51 Franklin Street, Fifth Floor, Boston, MA 02110-1301, USA
```

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[This is the first released version of the Lesser GPL. It also counts
as the successor of the GNU Library Public License, version 2, hence the
version number 2.1.]

```
@end display
```

```
@subheading Preamble
```

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@item

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@end enumerate

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@page

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@smallexample

@var{one line to give the library's name and an idea of what it does.}

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smallexample

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```
@smallexample
```

```
Yoyodyne, Inc., hereby disclaims all copyright interest in the library  
'Frob' (a library for tweaking knobs) written by James Random Hacker.
```

```
@var{signature of Ty Coon}, 1 April 1990
```

```
Ty Coon, President of Vice
```

```
@end smallexample
```

That's all there is to it!

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Version 3, 29 June 2007

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Description:

Concatenate two arbitrary file names.

Files:

lib/filenamecat.h
lib/filenamecat-lgpl.c
m4/filenamecat.m4

Depends-on:
dirname-lgpl

configure.ac:
gl_FILE_NAME_CONCAT_LGPL

Makefile.am:
lib_SOURCES += filenamecat-lgpl.c

Include:
"filenamecat.h"

License:
LGPLv2+

Maintainer:
Jim Meyering
\$Id: COPYING,v 1.3 2006-10-26 16:20:28 eggert Exp \$
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@end enumerate

@iftex
@heading END OF TERMS AND CONDITIONS
@end iftex
@ifinfo
@center END OF TERMS AND CONDITIONS

@end ifinfo

@page
@heading Appendix: How to Apply These Terms to Your New Programs

If you develop a new program, and you want it to be of the greatest possible use to the public, the best way to achieve this is to make it

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```
@smallexample
@var{one line to give the program's name
and a brief idea of what it does.}
Copyright (C) @var{yyyy} @var{name of author}
```

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@end smallexample

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If the program is interactive, make it output a short notice like this when it starts in an interactive mode:

```
@smallexample
Gnomovision version
69, Copyright (C) @var{year} @var{name of author}
Gnomovision comes with ABSOLUTELY NO WARRANTY; for details type `show w'.
This is free software, and you are welcome to redistribute it
under certain conditions; type `show c' for details.
@end smallexample
```

The hypothetical commands @samp{show w} and @samp{show c} should show the appropriate parts of the General Public License. Of course, the commands you use may be called something other than @samp{show w} and @samp{show c}; they could even be mouse-clicks or menu items---whatever suits your program.

You should also get your employer (if you work as a programmer) or your school, if any, to sign a ``copyright disclaimer" for the program, if

necessary. Here is a sample; alter the names:

@example

Yoyodyne, Inc., hereby disclaims all copyright interest in the program
'Gnomovision' (which makes passes at compilers) written by James Hacker.

@var{signature of Ty Coon}, 1 April 1989

Ty Coon, President of Vice

@end example

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Version 3, 29 June 2007

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b) Convey the object code in, or embodied in, a physical product (including a physical distribution medium), accompanied by a written offer, valid for at least three years

and valid for as

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```
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```

```
This program comes with ABSOLUTELY NO WARRANTY; for details type `show w'.
```

```
This is free software, and you are welcome to redistribute it  
under certain conditions; type `show c' for details.
```

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Files:

tests/test-canonicalize-lgpl.c
tests/signature.h
tests/null-ptr.h
tests/macros.h

Depends-on:

ignore-value
same-inode
symlink

configure.ac:

Makefile.am:

TESTS += test-canonicalize-lgpl
check_PROGRAMS += test-canonicalize-lgpl

Description:

Provide the GNU Free Documentation License in Texinfo format.

Files:

doc/fdl.texi

Depends-on:

configure.ac:

Makefile.am:

Include:

License:

unmodifiable license text

Maintainer:

all

Legal Issues about Contributing Code to GNU last updated 14 July 2015

Project GNU has to be careful to obey copyright laws, even though these laws are wrong when they stop people from sharing generally useful published information such as software, because we are in the public eye. We also use copyright to defend users' freedom, by means of copyleft (though this does not excuse copyright law for helping to make software proprietary).

This means that if you want to contribute software to GNU, you have to do something to give us legal permission to use it. There are three ways this can be done:

- * Assign the copyright to the Free Software Foundation.

This allows the FSF to act to stop violations of the GPL.

- * Keep the copyright and release the program yourself under the GNU GPL. (This alternative is too impractical for contributions to a preexisting FSF-copyrighted GNU program.)

- * Put the code in the public domain. Then there is nothing to stop hoarding of modified versions, but we can still use the program in GNU.

Most of these alternatives require a signed piece of paper, or in some cases a digital signature, to make it happen.

- * Assigning copyright.

Assigning the copyright means signing a contract that makes the Free Software Foundation the "owner" of the program according to the law. As the copyright holder, the Foundation can sue anyone who tries to distribute the program as a proprietary product. We are willing to keep your name on the program as the author for as long as the program remains recognizably distinct. ("Owner" is in quotes to show that we don't really believe in this kind of ownership.)

The assignment contract commits the foundation to setting distribution terms that permit free redistribution.

Often we don't want to do the work of starting to distribute a program right away. There are many things which we will need in order to have a complete system but which aren't really useful until the rest of the system is done. But signing the assignment does not stop you from distributing the program yourself--as long as you do so under the GNU terms. You don't have to wait for us to start distributing. You can start distributing as soon as you attach our standard copyleft to the files. (Ask for our advice on how to do this.)

The assignment contract we normally use has a clause that permits you to use your code in proprietary programs, on 30 days' notice. (The 30 days' notice is there because, through a legal technicality, it would improve our position in a suit against a hoarder.) Although we believe that proprietary software is wrong, we include this clause because it would serve no purpose to ask you to promise not to do it. You're giving us a gift in the first place.

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* Public domain.

If you put the program in the public domain, we prefer to have a signed piece of paper--a disclaimer of rights--from you confirming this. If the program is not very important, we can do without one; the worst that could happen is that we might some day be forced to stop using it.

The law says that anyone can copyright a modified version of the public domain work. (This doesn't restrict the original, which remains in the public domain; only the changes are copyrighted.) If we make extensive changes,

we will probably do this and add our usual copyleft. If we make small changes, we will leave the version we distribute in the public domain.

* What about your employer?

If you are employed to do programming, or have made an agreement with your employer that says it owns programs you write, we need a signed piece of paper from your employer disclaiming rights to the program. It should be signed by a vice president or general manager of the company. If you can't get at them, it is almost as good to find someone who signs licenses for software that is purchased. Here is a sample wording:

Digital Simulation Corporation hereby disclaims all copyright interest in the program "sample.el" (a program to direct assemblers to make passes at compilers under GNU Emacs) written by Hugh Hacker.

<signature of Mo Ghoul>, 1 April 1987

Mo Ghoul, President of Vice, Digital Simulation Corp.

The description of what the program does is just to make it clearer what the disclaimer covers.

If

what you did was change an existing program, it should say this:

...in the changes and enhancements made by Hugh Hacker to the program "sample.el".

* Did anyone else contribute?

If someone else contributed more than a few lines here or there to the program, then that person too is an author, and that person too needs to sign papers just as you do. So may that person's employer. However, if his contribution is just a fraction of the whole work, it is satisfactory if he disclaims his own rights, even if you are assigning yours. (If just the minor contributors' work goes in the public domain, that doesn't leave much of a loophole for hoarders.)

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Please use your full legal name (in ASCII characters) as the subject line of the message.

REQUEST: SEND FORM FOR PAST AND FUTURE CHANGES

[What is the name of the program or package you're contributing to?]

[Did you copy any files or text written by someone else in these changes?
Even if that material is free software, we need to know about it.]

[Do you have an employer who might have a basis to claim to own
your changes? Do you attend a school which might make such a claim?]

[For the copyright registration, what country are you a citizen of?]

[What year were you born?]

[Please write your email address here.]

[Please write your postal address here.]

[Which files have you changed so far, and which new files have you written
so far?]

Description:

Help make libraries relocatable, that is, to allow them to function
properly when copied to an arbitrary directory.

Files:

doc/relocatable.texi

lib/relocatable.h

lib/relocatable.c

lib/relocatable.valgrind

m4/relocatable-lib.m4

Depends-on:

strdup

configure.ac:

```
gl_RELOCATABLE_LIBRARY
```

```
if test $RELOCATABLE = yes; then
```

```
  AC_LIBOBJ([relocatable])
```

```
fi
```

Makefile.am:

```
DEFS += -DNO_XMALLOC
```

Include:
"relocatable.h"

License:
LGPLv2+

Maintainer:
Ben Pfaff

Description:
Ensure getcwd(NULL, 0) returns a buffer allocated by the malloc() function.

Files:
lib/getcwd-lgpl.c
m4/getcwd.m4

Depends-on:
unistd
strdup [test \$REPLACE_GETCWD = 1]

```
configure.ac:  
gl_FUNC_GETCWD_LGPL  
if test $REPLACE_GETCWD = 1; then  
  AC_LIBOBJ([getcwd-lgpl])  
fi  
gl_UNISTD_MODULE_INDICATOR([getcwd])
```

Makefile.am:

Include:
<unistd.h>

License:
LGPLv2+

Maintainer:
Eric Blake

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Version 2, June 1991

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Version 2.1, February 1999

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Ty Coon, President of Vice

That's all there is to it!

Description:

Locating a program in PATH (LGPLed version).

Files:

lib/findprog.h
lib/findprog.c
lib/findprog-lgpl.c
m4/findprog.m4
m4/eaccess.m4

Depends-on:

stdbool
strdup
concat-filename
access
unistd

configure.ac:

gl_FINDPROG
gl_MODULE_INDICATOR([findprog-lgpl])

Makefile.am:

lib_SOURCES += findprog.h findprog.c

Include:

"findprog.h"

License:

LGPLv2+

Maintainer:

all

The files in this directory describe the gnullib modules.

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[Please write your
postal address here.]

[Which files have you changed so far, and which new files have you written so far?]

Files:

tests/test-getcwd-lgpl.c

tests/signature.h

tests/macros.h

Depends-on:

configure.ac:

Makefile.am:

```
TESTS += test-getcwd-lgpl
```

```
check_PROGRAMS += test-getcwd-lgpl
```

```
test_getcwd_lgpl_LDADD = $(LDADD) $(LIBINTL)
```

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Description:

realpath, canonicalize_file_name: Provide canonical absolute file name

Files:

lib/canonicalize-lgpl.c
m4/canonicalize.m4
m4/double-slash-root.m4

Depends-on:

extensions
stdlib
nocrash
alloca-opt [test \$HAVE_CANONICALIZE_FILE_NAME = 0 || test
\$REPLACE_CANONICALIZE_FILE_NAME = 1]
errno [test \$HAVE_CANONICALIZE_FILE_NAME = 0 || test
\$REPLACE_CANONICALIZE_FILE_NAME = 1]
lstat [test \$HAVE_CANONICALIZE_FILE_NAME = 0 || test \$REPLACE_CANONICALIZE_FILE_NAME
= 1]
alloca [test \$HAVE_CANONICALIZE_FILE_NAME = 0 || test
\$REPLACE_CANONICALIZE_FILE_NAME = 1]
memmove [test \$HAVE_CANONICALIZE_FILE_NAME = 0 || test
\$REPLACE_CANONICALIZE_FILE_NAME = 1]
pathmax [test \$HAVE_CANONICALIZE_FILE_NAME = 0 || test
\$REPLACE_CANONICALIZE_FILE_NAME = 1]
readlink [test \$HAVE_CANONICALIZE_FILE_NAME = 0 || test
\$REPLACE_CANONICALIZE_FILE_NAME = 1]
sys_stat [test \$HAVE_CANONICALIZE_FILE_NAME = 0 || test
\$REPLACE_CANONICALIZE_FILE_NAME = 1]

configure.ac:

```
gl_CANONICALIZE_LGPL
if
  test $HAVE_CANONICALIZE_FILE_NAME = 0 || test $REPLACE_CANONICALIZE_FILE_NAME = 1; then
    AC_LIBOBJ([canonicalize-lgpl])
  fi
gl_MODULE_INDICATOR([canonicalize-lgpl])
gl_STDLIB_MODULE_INDICATOR([canonicalize_file_name])
gl_STDLIB_MODULE_INDICATOR([realpath])
```

Makefile.am:

Include:

<stdlib.h>

License:

GPLv2+

Maintainer:

all

Description:

Extract specific portions of filenames.

Files:

lib/dirname.h
lib/dirname-lgpl.c
lib/basename-lgpl.c
lib/stripslash.c
m4/dirname.m4

Depends-on:

dosname
double-slash-root
malloc-posix
stdbool

configure.ac:

gl_DIRNAME_LGPL

Makefile.am:

lib_SOURCES += dirname-lgpl.c basename-lgpl.c stripslash.c

Include:

"dirname.h"

License:

LGPLv2+

Maintainer:

Jim Meyering, Eric Blake

1.119 hd-parm 9.38

1.119.1 Available under license :

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Version 2, June 1991

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Mark Lord (mlord@pobox.com)

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1.120 Icms 2.7

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1.121 libjpeg 9b

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```
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* jddctmgr.c  
*  
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*  
* This file contains the inverse-DCT management logic.
```

* This code selects a particular IDCT implementation to be used,
* and it performs related housekeeping chores. No code in this file
* is executed per IDCT step, only during output pass setup.
*
* Note that the IDCT routines are responsible for performing coefficient
* dequantization as well as the IDCT proper. This module sets up the
* dequantization multiplier table needed by the IDCT routine.
*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jddctmgr.c
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/*

* jdapistd.c

*

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*

* This file contains application interface code for the decompression half
* of the JPEG library. These are the "standard" API routines that are
* used in the normal full-decompression case. They are not used by a
* transcoding-only application. Note that if an application links in
* jpeg_start_decompress, it will end up linking in the entire decompressor.
* We thus must separate this file from jdapimin.c to avoid linking the
* whole decompression library into a transcoder.

*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jdapistd.c
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/*

* jcmaster.c

*

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*

* This file contains master control logic for the JPEG compressor.

* These routines are concerned with parameter validation, initial setup,
* and inter-pass control (determining the number of passes and the work
* to be done in each pass).
*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jcmaster.c
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/*

* jsimd_i386.c

*

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* Based on the x86 SIMD extension for IJG JPEG library,

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*

* This file contains the interface between the "normal" portions

* of the library and the SIMD implementations when running on a

* 32-bit x86 architecture.

*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jsimd_i386.c
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* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jfss2fst-64.asm

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jimxfst.asm

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jfmmxfst.asm

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jfss2fst.asm

*

/opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jiss2fst.asm

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jiss2fst-64.asm

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```
/*
 * jsimd_none.c
 *
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 *
 * Based on the x86 SIMD extension for IJG JPEG library,
 * Copyright (C) 1999-2006, MIYASAKA Masaru.
 * For conditions of distribution and use, see copyright notice in jsimdext.inc
 *
 * This file contains stubs for when there is no SIMD support available.
 */
```

Found in path(s):

```
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jsimd_none.c
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```
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 * wrtle.c
 *
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 *
 * This file contains routines to write output images in RLE format.
 * The Utah Raster Toolkit library is required (version 3.1 or later).
 *
 * These routines may need modification for non-Unix environments or
 * specialized applications. As they stand, they assume output to
 * an ordinary stdio stream.
 *
 * Based on code contributed by Mike Lijewski,
 * with updates from Robert Hutchinson.
 */
```

Found in path(s):

```
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/wrtle.c
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```

```
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 *
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```

```

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*
* This file contains routines to read input images in GIF format.
*
*****
* NOTE: to avoid entanglements with Unisys' patent on LZW compression, *
* the ability to read GIF files has been removed from the IJG distribution. *
* Sorry about that. *
*****
*
* We are required to state that
* "The Graphics Interchange Format(c) is the Copyright property of
* CompuServe Incorporated. GIF(sm) is a Service Mark property of
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*/

```

Found in path(s):

```

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/rdgif.c
No license file was found, but licenses were detected in source scan.

```

```

/*
* jdtrans.c
*
* Copyright (C) 1995-1997, Thomas G. Lane.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains library routines for transcoding decompression,
* that is, reading raw DCT coefficient arrays from an input JPEG file.
* The routines in jdapimin.c will also be needed by a transcoder.
*/

```

Found in path(s):

```

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jdtrans.c
No license file was found, but licenses were detected in source scan.

```

libjpeg-turbo note: This image was extracted from the 8-bit nightshot_iso_100 image. The original can be downloaded at the link below.

The New Image Compression Test Set - Jan 2008
http://www.imagecompression.info/test_images

The images historically used for compression research (lena, barbra, pepper etc...) have outlived their useful life and its about time they become a part of history only. They are too small, come from data sources too old and are available in only 8-bit precision.

These images have been carefully selected to aid in image compression algorithm research and evaluation. These are photographic images chosen to come from a wide variety of sources and each one picked to stress different aspects of algorithms. Images are available in 8-bit, 16-bit and 16-bit linear variations, RGB and gray.

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Acknowledgments: A lot of people contributed a lot of time and effort in making this test set possible. Thanks to everyone who voiced their opinion in any of the discussions online. Thanks to Axel Becker, Thomas Richter and Niels Frhling for their extensive help in picking images, running all the various tests etc... Thanks to Pete Fraser, Tony

Story, Wayne J. Cosshall, David Coffin, Bruce Lindbloom and raw.fotosite.pl for the images which make up this set.

Sachin Garg [India]
sachingarg@c10n.info

www.sachingarg.com | www.c10n.info | www.imagecompression.info

Found in path(s):

```
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UW7i7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/testimages/nightshot_iso_100.txt
```

No license file was found, but licenses were detected in source scan.

```
/*
```

```
* jmorecfg.h
```

```
*
```

```
* This file was part of the Independent JPEG Group's software:
```

```
* Copyright (C) 1991-1997, Thomas G. Lane.
```

```
* Modifications:
```

```
* Copyright (C) 2009, 2011, D. R. Commander.
```

```
* For conditions of distribution and use, see the accompanying README file.
```

```
*
```

```
* This file contains additional configuration options that customize the
```

```
* JPEG software for special applications or support machine-dependent
```

```
* optimizations. Most users will not need to touch this file.
```

```
*/
```

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jmorecfg.h
No license file was found, but licenses were detected in source scan.

/*

* jdcolor.c

*

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* Modified 2011 by Guido Vollbeding.

* Modifications:

* Copyright 2009 Pierre Ossman <ossman@cendio.se> for Cendio AB

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*

* This file contains output colorspace conversion routines.

*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jdcolor.c
No license file was found, but licenses were detected in source scan.

/*

* wrbmp.c

*

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*

* This file contains routines to write output images in Microsoft "BMP"

* format (MS Windows 3.x and OS/2 1.x flavors).

* Either 8-bit colormapped or 24-bit full-color format can be written.

* No compression is supported.

*

* These routines may need modification for non-Unix environments or

* specialized applications. As they stand, they assume output to

* an ordinary stdio stream.

*

* This code contributed by James Arthur Boucher.

*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/wrbmp.c
No license file was found, but licenses were detected in source scan.

Package: {__PKGNAME}

Version: {__VERSION}-{__BUILD}

Section: misc

Priority: optional

Architecture: {__ARCH}

Essential: no

Maintainer: The libjpeg-turbo Project [<http://www.libjpeg-turbo.org>]

Description: A SIMD-accelerated JPEG codec that provides both the libjpeg and TurboJPEG APIs

libjpeg-turbo is a JPEG image codec that uses SIMD instructions (MMX, SSE2, NEON) to accelerate baseline JPEG compression and decompression on x86, x86-64, and ARM systems. On such systems, libjpeg-turbo is generally 2-4x as fast as libjpeg, all else being equal. On other types of systems, libjpeg-turbo can still outperform libjpeg by a significant amount, by virtue of its highly-optimized Huffman coding routines. In many cases, the performance of libjpeg-turbo rivals that of proprietary high-speed JPEG codecs.

.

libjpeg-turbo implements both the traditional libjpeg API as well as the less powerful but more straightforward TurboJPEG

API. libjpeg-turbo also features

colorspace extensions that allow it to compress from/decompress to 32-bit and big-endian pixel buffers (RGBX, XBGR, etc.), as well as a full-featured Java interface.

.

libjpeg-turbo was originally based on libjpeg/SIMD, an MMX-accelerated derivative of libjpeg v6b developed by Miyasaka Masaru. The TigerVNC and VirtualGL projects made numerous enhancements to the codec in 2009, and in early 2010, libjpeg-turbo spun off into an independent project, with the goal of making high-speed JPEG compression/decompression technology available to a broader range of users and developers.

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/release/deb-control.tmp
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/*

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*

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*

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* and/or other materials provided with the distribution.

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*
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* CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE)
* ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE
* POSSIBILITY OF SUCH DAMAGE.
*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-
1.2.90/java/org/libjpegturbo/turbojpeg/TJLoader.java
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/java/TJUnitTest.java
*
/opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-
1.2.90/java/org/libjpegturbo/turbojpeg/TJCompressor.java
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-
1.2.90/java/org/libjpegturbo/turbojpeg/TJ.java
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/turbojpeg-jni.c
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/java/TJExample.java
*
/opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-
1.2.90/java/org/libjpegturbo/turbojpeg/TJDecompressor.java
No license file was found, but licenses were detected in source scan.

/*

* jdatasrc-tj.c

*

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* Modified 2009-2011 by Guido Vollbeding.

* Modifications:

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 *
 * This file contains decompression data source routines for the case of
 * reading JPEG data from memory or from a file (or any stdio stream).
 * While these routines are sufficient for most applications,
 * some will want to use a different source manager.
 * IMPORTANT: we assume that fread() will correctly transcribe an array of
 * JOCTETs from 8-bit-wide elements on external storage. If char is wider
 * than 8 bits on your machine, you may need to do some tweaking.
 */

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jdatasrc-tj.c
 No license file was found, but licenses were detected in source scan.

```
{\rtf1\ansi\ansicpg1252\cocoartf1038\cocoasubrtf350
{\fonttbl{\f0\fswiss\fcharset0 Helvetica;}
{\colortbl;\red255\green255\blue255;}
{* \listtable{\list\listtemplateid1\listhybrid{\listlevel\levelnfc23\levelnfcn23\leveljcn0\leveljcn0\levelfollow0\levelsta
rtat1\levelspace360\levelindent0{* \levelmarker \{ disc \} }{\leveltext\leveltemplateid1\01\uc0\u8226
;}{\levelnumbers;}{\fi-360\li720\lin720 }{\listname ;}{\listid1 } }
{* \listoverrideable{\listoverride\listid1\listoverridecount0\ls1 } }
\margl1440\margr1440\vieww9820\viewh8480\viewkind0
\defstab720
\pard\pardefstab720
```

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```
\
\pard\tx220\tx720\pardefstab720\li720\fi-720
\ls1\ilvl0\cf0 {\listtext \95 }Redistributions of source code must retain the above copyright notice, this list of
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{\listtext \95 }Neither the name of the libjpeg-turbo Project nor the names of its contributors may be used to endorse
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\pard\pardefstab720\qc
\cf0 \
\pard\pardefstab720
```

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}

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/release/License.rtf
No license file was found, but licenses were detected in source scan.

/*

* jdcoefct.c

*

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*

* This file contains the coefficient buffer controller for decompression.

* This controller is the top level of the JPEG decompressor proper.

* The coefficient buffer lies between entropy decoding and inverse-DCT steps.

*

* In buffered-image mode, this controller is the interface between

* input-oriented processing and output-oriented processing.

* Also, the input side (only) is used when reading a file for transcoding.

*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jdcoefct.c
No license file was found, but licenses were detected in source scan.

/*

* jcinit.c

*

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*

* This file contains initialization logic for the JPEG compressor.

* This routine is in charge of selecting the modules to be executed and

* making an initialization call to each one.

*

* Logically, this code belongs in jcmaster.c. It's split out because

* linking this routine implies linking the entire compression library.

* For a transcoding-only application, we want to be able to use jcmaster.c

* without linking in the whole library.

*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jcinit.c
No license file was found, but licenses were detected in source scan.

** Background

libjpeg-turbo is a JPEG image codec that uses SIMD instructions (MMX, SSE2, NEON) to accelerate baseline JPEG compression and decompression on x86, x86-64, and ARM systems. On such systems, libjpeg-turbo is generally 2-4x as fast as libjpeg, all else being equal. On other types of systems, libjpeg-turbo can still outperform libjpeg by a significant amount, by virtue of its highly-optimized Huffman coding routines. In many cases, the performance of libjpeg-turbo rivals that of proprietary high-speed JPEG codecs.

libjpeg-turbo implements both the traditional libjpeg API as well as the less powerful but more straightforward TurboJPEG API. libjpeg-turbo also features colorspace extensions that allow it to compress from/decompress to 32-bit and big-endian pixel buffers (RGBX, XBGR, etc.), as well as a full-featured Java interface.

libjpeg-turbo was originally based on libjpeg/SIMD, an MMX-accelerated derivative of libjpeg v6b developed by Miyasaka Masaru. The TigerVNC and VirtualGL projects made numerous enhancements to the codec in 2009, and in early 2010, libjpeg-turbo spun off into an independent project, with the goal of making high-speed JPEG compression/decompression technology available to a broader range of users and developers.

** License

Most of libjpeg-turbo inherits the non-restrictive, BSD-style license used by libjpeg (see README.) The TurboJPEG wrapper (both C and Java versions) and associated test programs bear a similar license, which is reproduced below:

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```
*****
** Using libjpeg-turbo
*****
```

libjpeg-turbo includes two APIs that can be used to compress and decompress JPEG images:

TurboJPEG API: This API provides an easy-to-use interface for compressing and decompressing JPEG images in memory. It also provides some functionality that would not be straightforward to achieve using the underlying libjpeg API, such as generating planar YUV images and performing multiple simultaneous lossless transforms on an image. The Java interface for libjpeg-turbo is written on top of the TurboJPEG API.

libjpeg API: This is the de facto industry-standard API for compressing and decompressing JPEG images. It is more difficult to use than the TurboJPEG API but also more powerful. The libjpeg API implementation in libjpeg-turbo is both API/ABI-compatible and mathematically compatible with libjpeg v6b. It can also optionally be configured to be API/ABI-compatible with libjpeg v7 and v8 (see below.)

There is no significant performance advantage to either API when both are used to perform similar operations.

```
=====
Installation Directory
```

=====
This document assumes that libjpeg-turbo will be installed in the default directory (/opt/libjpeg-turbo on Un*x and Mac systems and c:\libjpeg-turbo[-gcc][64] on Windows systems. If your installation of libjpeg-turbo resides in a different directory, then adjust the instructions accordingly.

=====
Replacing libjpeg
at Run Time
=====

Un*x

If a Un*x application is dynamically linked with libjpeg, then you can replace libjpeg with libjpeg-turbo at run time by manipulating LD_LIBRARY_PATH. For instance:

[Using libjpeg]

```
> time cjpeg <vgl_5674_0098.ppm >vgl_5674_0098.jpg
real 0m0.392s
user 0m0.074s
sys 0m0.020s
```

[Using libjpeg-turbo]

```
> export LD_LIBRARY_PATH=/opt/libjpeg-turbo/{lib}:$LD_LIBRARY_PATH
> time cjpeg <vgl_5674_0098.ppm >vgl_5674_0098.jpg
real 0m0.109s
user 0m0.029s
sys 0m0.010s
```

({lib} = lib32 or lib64, depending on whether you wish to use the 32-bit or the 64-bit version of libjpeg-turbo.)

System administrators can also replace the libjpeg symlinks in /usr/lib* with links to the libjpeg-turbo dynamic library located in /opt/libjpeg-turbo/{lib}. This will effectively accelerate every application that uses the libjpeg dynamic library on the system.

Windows

If a Windows application is dynamically linked with libjpeg, then you can replace libjpeg with libjpeg-turbo at run time by backing up the application's copy of jpeg62.dll, jpeg7.dll, or jpeg8.dll (assuming the application has its

own local copy of this library) and copying the corresponding DLL from libjpeg-turbo into the application's install directory. The official libjpeg-turbo binary packages only provide jpeg62.dll. If the application uses jpeg7.dll or jpeg8.dll instead, then it will be necessary to build libjpeg-turbo from source (see "libjpeg v7 and v8 API/ABI Emulation" below.)

The following information is specific to the official libjpeg-turbo binary packages for Visual C++:

-- jpeg62.dll requires the Visual C++ 2008 C run-time DLL (msvcr90.dll). msvcr90.dll ships with more recent versions of Windows, but users of older Windows releases can obtain it from the Visual C++ 2008 Redistributable Package, which is available as a free download from Microsoft's web site.

-- Features of the libjpeg API that require passing a C run-time structure, such as a file handle, from an application to the library will probably not work with jpeg62.dll, unless the application is also built to use the Visual C++ 2008 C run-time DLL. In particular, this affects jpeg_stdio_dest() and jpeg_stdio_src().

Mac

Mac applications typically embed their own copies of the libjpeg dylib inside the (hidden) application bundle, so it is not possible to globally replace libjpeg on OS X systems. Replacing the application's version of the libjpeg dylib would generally involve copying libjpeg.*.dylib from libjpeg-turbo into the appropriate place in the application bundle and using install_name_tool to repoint the libjpeg-turbo dylib to its new directory. This requires an advanced knowledge of OS X and would not survive an upgrade or a re-install of the application. Thus, it is not recommended for most users.

=====
Using libjpeg-turbo in Your Own Programs
=====

For the most part, libjpeg-turbo should work identically to libjpeg, so in most cases, an application can be built against libjpeg and then run against libjpeg-turbo. On Un*x systems and Cygwin, you can build against libjpeg-turbo instead of libjpeg by setting

CPATH=/opt/libjpeg-turbo/include
and
LIBRARY_PATH=/opt/libjpeg-turbo/{lib}

{lib} = lib32 or lib64, depending on whether you are building a 32-bit or a

64-bit application.)

If using MinGW, then set

```
CPATH=/c/libjpeg-turbo-gcc[64]/include
and
LIBRARY_PATH=/c/libjpeg-turbo-gcc[64]/lib
```

Building against libjpeg-turbo is useful, for instance, if you want to build an application that leverages the libjpeg-turbo colorspace extensions (see below.) On Un*x systems, you would still need to manipulate LD_LIBRARY_PATH or create appropriate symlinks to use libjpeg-turbo at run time. On such systems, you can pass `-R /opt/libjpeg-turbo/{lib}` to the linker to force the use of libjpeg-turbo at run time rather than libjpeg (also useful if you want to leverage the colorspace extensions), or you can link against the libjpeg-turbo static library.

To force a Un*x or MinGW application to link against the static version of libjpeg-turbo, you can use the following linker options:

```
-Wl,-Bstatic -ljpeg -Wl,-Bdynamic
```

On OS X, simply add `/opt/libjpeg-turbo/lib/libjpeg.a` to the linker command line.

To build Visual C++ applications using libjpeg-turbo, add `c:\libjpeg-turbo[64]\include` to the system or user INCLUDE environment variable and `c:\libjpeg-turbo[64]\lib` to the system or user LIB environment variable, and then link against either `jpeg.lib` (to use the DLL version of libjpeg-turbo) or `jpeg-static.lib` (to use the static version of libjpeg-turbo.)

```
=====
Colorspace Extensions
=====
```

libjpeg-turbo includes extensions that allow JPEG images to be compressed directly from (and decompressed directly to) buffers that use BGR, BGRX, RGBX, XBGR, and XRGB pixel ordering. This is implemented with ten new colorspace constants:

```
JCS_EXT_RGB /* red/green/blue */
JCS_EXT_RGBX /* red/green/blue/x */
JCS_EXT_BGR /* blue/green/red */
JCS_EXT_BGRX /* blue/green/red/x */
JCS_EXT_XBGR /* x/blue/green/red */
JCS_EXT_XRGB /* x/red/green/blue */
```

```
JCS_EXT_RGBA /* red/green/blue/alpha */
JCS_EXT_BGRA /* blue/green/red/alpha */
JCS_EXT_ABGR /* alpha/blue/green/red */
JCS_EXT_ARGB /* alpha/red/green/blue */
```

Setting `cinfo.in_color_space` (compression) or `cinfo.out_color_space` (decompression) to one of these values will cause libjpeg-turbo to read the red, green, and blue values from (or write them to) the appropriate position in the pixel when compressing from/decompressing to an RGB buffer.

Your application can check for the existence of these extensions at compile time with:

```
#ifdef JCS_EXTENSIONS
```

At run time, attempting to use these extensions with a libjpeg implementation that does not support them will result in a "Bogus input colorspace" error.

Applications

can trap this error in order to test whether run-time support is available for the colorspace extensions.

When using the RGBX, BGRX, XBGR, and XRGB colorspace during decompression, the X byte is undefined, and in order to ensure the best performance, libjpeg-turbo can set that byte to whatever value it wishes. If an application expects the X byte to be used as an alpha channel, then it should specify `JCS_EXT_RGBA`, `JCS_EXT_BGRA`, `JCS_EXT_ABGR`, or `JCS_EXT_ARGB`. When these colorspace constants are used, the X byte is guaranteed to be `0xFF`, which is interpreted as opaque.

Your application can check for the existence of the alpha channel colorspace extensions at compile time with:

```
#ifdef JCS_ALPHA_EXTENSIONS
```

`jcstest.c`, located in the libjpeg-turbo source tree, demonstrates how to check for the existence of the colorspace extensions at compile time and run time.

```
=====
libjpeg v7 and v8 API/ABI Emulation
=====
```

With libjpeg

v7 and v8, new features were added that necessitated extending the compression and decompression structures. Unfortunately, due to the exposed nature of those structures, extending them also necessitated breaking backward ABI compatibility with previous libjpeg releases. Thus, programs that were built to use libjpeg v7 or v8 did not work with libjpeg-turbo, since it is based on the libjpeg v6b code base. Although libjpeg v7 and v8 are still not as widely used as v6b, enough programs (including a few Linux distros) made

the switch that there was a demand to emulate the libjpeg v7 and v8 ABIs in libjpeg-turbo. It should be noted, however, that this feature was added primarily so that applications that had already been compiled to use libjpeg v7+ could take advantage of accelerated baseline JPEG encoding/decoding without recompiling. libjpeg-turbo does not claim to support all of the libjpeg v7+ features, nor to produce identical output to libjpeg v7+ in all cases (see below.)

By

passing an argument of `--with-jpeg7` or `--with-jpeg8` to configure, or an argument of `-DWITH_JPEG7=1` or `-DWITH_JPEG8=1` to cmake, you can build a version of libjpeg-turbo that emulates the libjpeg v7 or v8 ABI, so that programs that are built against libjpeg v7 or v8 can be run with libjpeg-turbo. The following section describes which libjpeg v7+ features are supported and which aren't.

Support for libjpeg v7 and v8 Features:

Fully supported:

- libjpeg: IDCT scaling extensions in decompressor
libjpeg-turbo supports IDCT scaling with scaling factors of 1/8, 1/4, 3/8, 1/2, 5/8, 3/4, 7/8, 9/8, 5/4, 11/8, 3/2, 13/8, 7/4, 15/8, and 2/1 (only 1/4 and 1/2 are SIMD-accelerated.)
- libjpeg: arithmetic coding
- libjpeg: In-memory source and destination managers
See notes below.
- cjpeg: Separate quality settings for luminance and chrominance
Note that the libjpeg v7+ API was extended to accommodate this feature only for convenience purposes. It has always been possible to implement this feature with libjpeg v6b (see `rdswitch.c` for an example.)
- cjpeg: 32-bit BMP support
- cjpeg: `-rgb` option
- jpegtran: lossless cropping
- jpegtran: `-perfect` option
- jpegtran: forcing width/height when performing lossless crop
- rdjpgcom: `-raw` option

-- rdjpgcom: locale awareness

Not supported:

NOTE: As of this writing, extensive research has been conducted into the usefulness of DCT scaling as a means of data reduction and SmartScale as a means of quality improvement. The reader is invited to peruse the research at <http://www.libjpeg-turbo.org/About/SmartScale> and draw his/her own conclusions, but it is the general belief of our project that these features have not demonstrated sufficient usefulness to justify inclusion in libjpeg-turbo.

-- libjpeg: DCT scaling in compressor
cinfo.scale_num and cinfo.scale_denom are silently ignored.
There is no technical reason why DCT scaling could not be supported when emulating the libjpeg v7+ API/ABI, but without the SmartScale extension (see below), only scaling factors of 1/2, 8/15, 4/7, 8/13, 2/3, 8/11, 4/5, and 8/9 would be available, which is of limited usefulness.

-- libjpeg: SmartScale
cinfo.block_size is silently ignored.
SmartScale is an extension to the JPEG format that allows for DCT block sizes other than 8x8. Providing support for this new format would be feasible (particularly without full acceleration.) However, until/unless the format becomes either an official industry standard or, at minimum, an accepted solution in the community, we are hesitant to implement it, as there is no sense of whether or how it might change in the future. It is our belief that SmartScale has not demonstrated sufficient usefulness as a lossless format nor as a means of quality enhancement, and thus, our primary interest in providing this feature would be as a means of supporting additional DCT scaling factors.

-- libjpeg: Fancy downsampling in compressor
cinfo.do_fancy_downsampling is silently ignored.
This requires the DCT scaling feature, which is not supported.

-- jpegtran: Scaling
This requires both the DCT scaling and SmartScale features, which are not supported.

-- Lossless RGB JPEG files
This requires the SmartScale feature, which is not supported.

What About libjpeg v9?

libjpeg v9 introduced yet another field to the JPEG compression structure (color_transform), thus making the ABI backward incompatible with that of libjpeg v8. This new field was introduced solely for the purpose of supporting lossless SmartScale encoding. Further, there was actually no reason to extend the API in this manner, as the color transform could have just as easily been activated by way of a new JPEG colorspace constant, thus preserving backward ABI compatibility.

Our research (see link above) has shown that lossless SmartScale does not generally accomplish anything that can't already be accomplished better with existing, standard lossless formats. Thus, at this time, it is our belief that there is not sufficient technical justification for software to upgrade from libjpeg v8 to libjpeg v9, and therefore, not sufficient technical justification for us to emulate the libjpeg v9 ABI.

=====
In-Memory Source/Destination Managers
=====

By default, libjpeg-turbo 1.3 and later includes the jpeg_mem_src() and jpeg_mem_dest() functions, even when not emulating the libjpeg v8 API/ABI. Previously, it was necessary to build libjpeg-turbo from source with libjpeg v8 API/ABI emulation in order to use the in-memory source/destination managers, but several projects requested that those functions be included when emulating the libjpeg v6b API/ABI as well. This allows the use of those functions by programs that need them without breaking ABI compatibility for programs that don't, and it allows those functions to be provided in the "official" libjpeg-turbo binaries.

Those who are concerned about maintaining strict conformance with the libjpeg v6b or v7 API can pass an argument of --without-mem-srcdst to configure or an argument of -DWITH_MEM_SRCDEST=0 to CMake prior to building libjpeg-turbo. This will restore the pre-1.3 behavior, in which jpeg_mem_src() and jpeg_mem_dest() are only included when emulating the libjpeg v8 API/ABI.

On Un*x systems, including the in-memory source/destination managers changes the dynamic library version from 62.0.0 to 62.1.0 if using libjpeg v6b API/ABI emulation and from 7.0.0 to 7.1.0 if using libjpeg v7 API/ABI emulation.

Note that, on most Un*x systems, the dynamic linker will not look for a function in a library until that function is actually used. Thus, if a program is built against libjpeg-turbo 1.3+ and uses jpeg_mem_src() or jpeg_mem_dest(), that program will not fail if run against an older version of libjpeg-turbo or against

libjpeg v7- until the program actually tries to call jpeg_mem_src() or jpeg_mem_dest(). Such is not the case on Windows. If a program is built against the libjpeg-turbo 1.3+ DLL and uses jpeg_mem_src() or jpeg_mem_dest(), then it must use the libjpeg-turbo 1.3+ DLL at run time.

Both cjpeg and djpeg have been extended to allow testing the in-memory source/destination manager functions. See their respective man pages for more details.

```
*****  
**  Mathematical Compatibility  
*****
```

For the most part, libjpeg-turbo should produce identical output to libjpeg v6b. The one exception to this is when using the floating point DCT/IDCT, in which case the outputs of libjpeg v6b and libjpeg-turbo are not guaranteed to be identical (the accuracy of the floating point DCT/IDCT is constant when using libjpeg-turbo's SIMD extensions, but otherwise, it can depend heavily on the compiler and compiler settings.)

While libjpeg-turbo does emulate the libjpeg v8 API/ABI, under the hood, it is still using the same algorithms as libjpeg v6b, so there are several specific cases in which libjpeg-turbo cannot be expected to produce the same output as libjpeg v8:

- When decompressing using scaling factors of 1/2 and 1/4, because libjpeg v8 implements those scaling algorithms a bit differently than libjpeg v6b does, and libjpeg-turbo's SIMD extensions are based on the libjpeg v6b behavior.
- When using chrominance subsampling, because libjpeg v8 implements this with its DCT/IDCT scaling algorithms rather than with a separate downsampling/upsampling algorithm.
- When using the floating point IDCT, for the reasons stated above and also because the floating point IDCT algorithm was modified in libjpeg v8a to improve accuracy.
- When decompressing using a scaling factor > 1 and merged (AKA "non-fancy" or "non-smooth") chrominance upsampling, because libjpeg v8 does not support merged upsampling with scaling factors > 1.

```
*****  
**  Performance Pitfalls  
*****
```

=====
Restart Markers
=====

The optimized Huffman decoder in libjpeg-turbo does not handle restart markers in a way that makes the rest of the libjpeg infrastructure happy, so it is necessary to use the slow Huffman decoder when decompressing a JPEG image that has restart markers. This can cause the decompression performance to drop by as much as 20%, but the performance will still be much greater than that of libjpeg. Many consumer packages, such as PhotoShop, use restart markers when generating JPEG images, so images generated by those programs will experience this issue.

=====
Fast Integer Forward DCT at High Quality Levels
=====

The algorithm used by the SIMD-accelerated quantization function cannot produce correct results whenever the fast integer forward DCT is used along with a JPEG quality of 98-100. Thus, libjpeg-turbo must use the non-SIMD quantization function in those cases. This causes performance to drop by as much as 40%. It is therefore strongly advised that you use the slow integer forward DCT whenever encoding images with a JPEG quality of 98 or higher.

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/README-turbo.txt
No license file was found, but licenses were detected in source scan.

/*

* jsimddct.h

*

* Copyright 2009 Pierre Ossman <ossman@cendio.se> for Cendio AB

*

* Based on the x86 SIMD extension for IJG JPEG library,

* Copyright (C) 1999-2006, MIYASAKA Masaru.

* For conditions of distribution and use, see copyright notice in jsimdext.inc

*

*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jsimddct.h
No license file was found, but licenses were detected in source scan.

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```

#
# Redistribution and use in source and binary forms, with or without
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#
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# and/or other materials provided with the distribution.
# - Neither the name of the libjpeg-turbo Project nor the names of its
# contributors may be used to endorse or promote products derived from this
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# INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN
# CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE)
# ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE
# POSSIBILITY OF SUCH DAMAGE.

#!/bin/sh

if [ ! "`id -u`" = "0" ]; then
    echo "ERROR: This script must be executed as root"
    exit -1
fi

PACKAGE=@PACKAGE_NAME@
MACPACKAGE=com.$PACKAGE.$PACKAGE
RECEIPT=/Library/Receipts/$PACKAGE.pkg

LSBOM=
if [ -d $RECEIPT ]; then
    LSBOM='lsbom -s -f -l '$RECEIPT'/Contents/Archive.bom'
else
    LSBOM='pkgutil --files '$MACPACKAGE
fi

myslbom()
{
    $LSBOM || (echo "ERROR: Could

```

```

not list package contents"; exit -1)
}

echo Removing package files ...
EXITSTATUS=0
pushd /
myslbom | while read file; do
if [ ! -d "$file" ]; then rm "$file" 2>&1 || EXITSTATUS=-1; fi
done
popd

echo Removing package directories ...
if [ -d /opt/$PACKAGE/bin ]; then
  rmdir /opt/$PACKAGE/bin 2>&1 || EXITSTATUS=-1
fi
if [ -d /opt/$PACKAGE/lib ]; then
  rmdir /opt/$PACKAGE/lib 2>&1 || EXITSTATUS=-1
fi
if [ -d /opt/$PACKAGE/include ]; then
  rmdir /opt/$PACKAGE/include 2>&1 || EXITSTATUS=-1
fi
rm /opt/$PACKAGE/lib32 2>&1 || EXITSTATUS=-1
rm /opt/$PACKAGE/lib64 2>&1 || EXITSTATUS=-1
if [ -d /opt/$PACKAGE/man/man1 ]; then
  rmdir /opt/$PACKAGE/man/man1 2>&1 || EXITSTATUS=-1
fi
if [ -d /opt/$PACKAGE/man ]; then
  rmdir /opt/$PACKAGE/man 2>&1 || EXITSTATUS=-1
fi
if [ -d /opt/$PACKAGE/classes ]; then
  rmdir /opt/$PACKAGE/classes 2>&1 || EXITSTATUS=-1
fi
rmdir /opt/$PACKAGE 2>&1 || EXITSTATUS=-1
rmdir /Library/Documentation/$PACKAGE 2>&1 || EXITSTATUS=-1

if [ -d $RECEIPT ]; then
  echo Removing
  package receipt ...
  rm -r $RECEIPT 2>&1 || EXITSTATUS=-1
else
  echo Forgetting package $MACPACKAGE ...
  pkgutil --forget $MACPACKAGE
fi

exit $EXITSTATUS

```

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-

UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/release/uninstall.in
No license file was found, but licenses were detected in source scan.

```
/*
 * jdapimin.c
 *
 * Copyright (C) 1994-1998, Thomas G. Lane.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file contains application interface code for the decompression half
 * of the JPEG library. These are the "minimum" API routines that may be
 * needed in either the normal full-decompression case or the
 * transcoding-only case.
 *
 * Most of the routines intended to be called directly by an application
 * are in this file or in jdapistd.c. But also see jcomapi.c for routines
 * shared by compression and decompression, and jdtrans.c for the transcoding
 * case.
 */
```

Found in path(s):

```
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jdapimin.c
```

No license file was found, but licenses were detected in source scan.

IJG JPEG LIBRARY: SYSTEM ARCHITECTURE

Copyright (C) 1991-2012, Thomas G. Lane, Guido Vollbeding.

This file was part of the Independent JPEG Group's software.

It was modified by The libjpeg-turbo Project to include only information relevant to libjpeg-turbo.

For conditions of distribution and use, see the accompanying README file.

This file provides an overview of the architecture of the IJG JPEG software; that is, the functions of the various modules in the system and the interfaces between modules. For more precise details about any data structure or calling convention, see the include files and comments in the source code.

We assume that the reader is already somewhat familiar with the JPEG standard.

The README file includes references for learning about JPEG. The file libjpeg.txt describes the library from the viewpoint of an application programmer using the library; it's best to read that file before this one.

Also, the file coderules.txt describes the coding style conventions we use.

In this document, JPEG-specific terminology follows the JPEG standard:

A "component" means a color channel, e.g., Red or Luminance.

A "sample" is a single component value (i.e., one number in the image data).

A "coefficient" is a frequency coefficient (a DCT transform output number).

A "block" is an 8x8 group of samples or coefficients.

An "MCU" (minimum coded unit) is an interleaved set of blocks of size determined by the sampling factors, or a single block in a noninterleaved scan.

We do not use the terms "pixel" and "sample" interchangeably. When we say pixel, we mean an element of the full-size image, while a sample is an element of the downsampled image. Thus the number of samples may vary across components while the number of pixels does not. (This terminology is not used rigorously throughout the code, but it is used in places where confusion would otherwise result.)

*** System features

The IJG distribution contains two parts:

- * A subroutine library for JPEG compression and decompression.

- * cjpeg/djpeg, two sample applications that use the library to transform JFIF JPEG files to and from several other image formats.

cjpeg/djpeg are of no great intellectual complexity: they merely add a simple command-line user interface and I/O routines for several uncompressed image formats. This document concentrates on the library itself.

We desire the library to be capable of supporting all JPEG baseline, extended sequential, and progressive DCT processes. Hierarchical processes are not supported.

The library does not support the lossless (spatial) JPEG process. Lossless JPEG shares little or no code with lossy JPEG, and would normally be used without the extensive pre- and post-processing provided by this library.

We feel that lossless JPEG is better handled by a separate library.

Within these limits, any set of compression parameters allowed by the JPEG spec

should be readable for decompression. (We can be more restrictive about what formats we can generate.) Although the system design allows for all parameter values, some uncommon settings are not yet implemented and may never be; nonintegral sampling ratios are the prime example. Furthermore, we treat 8-bit vs. 12-bit data precision as a compile-time switch, not a run-time option, because most machines can store 8-bit pixels much more compactly than 12-bit.

By itself, the library handles only interchange JPEG datastreams --- in particular the widely used JFIF file format. The library can be used by surrounding code to process interchange or abbreviated JPEG datastreams that

are embedded in more complex file formats. (For example, libtiff uses this library to implement JPEG compression within the TIFF file format.)

The library includes a substantial amount of code that is not covered by the JPEG standard but is necessary for typical applications of JPEG. These functions preprocess

the image before JPEG compression or postprocess it after decompression. They include colorspace conversion, downsampling/upsampling, and color quantization. This code can be omitted if not needed.

A wide range of quality vs. speed tradeoffs are possible in JPEG processing, and even more so in decompression postprocessing. The decompression library provides multiple implementations that cover most of the useful tradeoffs, ranging from very-high-quality down to fast-preview operation. On the compression side we have generally not provided low-quality choices, since compression is normally less time-critical. It should be understood that the low-quality modes may not meet the JPEG standard's accuracy requirements; nonetheless, they are useful for viewers.

*** Portability issues ***

Portability is an essential requirement for the library. The key portability issues that show up at the level of system architecture are:

1. Memory usage. We want the code to be able to run on PC-class machines with limited memory. Images should therefore be processed sequentially (in strips), to avoid holding the whole image in memory at once. Where a full-image buffer is necessary, we should be able to use either virtual memory or temporary files.
2. Near/far pointer distinction. To run efficiently on 80x86 machines, the code should distinguish "small" objects (kept in near data space) from "large" ones (kept in far data space). This is an annoying restriction, but fortunately it does not impact code quality for less brain-damaged machines, and the source code clutter turns out to be minimal with sufficient use of pointer typedefs.
3. Data precision. We assume that "char" is at least 8 bits, "short" and "int" at least 16, "long" at least 32. The code will work fine with larger data sizes, although memory may be used inefficiently in some cases. However, the JPEG compressed datastream must ultimately appear on external storage as a sequence of 8-bit bytes if it is to conform to the standard. This may pose a problem on machines where char is wider than 8 bits. The library represents compressed data as an array of values of typedef JOCTET. If no data type exactly 8 bits wide is available, custom data source and data destination

modules must be written to unpack and pack the chosen JOCTET datatype into 8-bit external representation.

*** System overview ***

The compressor and decompressor are each divided into two main sections: the JPEG compressor or decompressor proper, and the preprocessing or postprocessing functions. The interface between these two sections is the image data that the official JPEG spec regards as its input or output: this data is in the colorspace to be used for compression, and it is downsampled to the sampling factors to be used. The preprocessing and postprocessing steps are responsible for converting a normal image representation to or from this form. (Those few applications that want to deal with YCbCr downsampled data can skip the preprocessing or postprocessing step.)

Looking more closely, the compressor library contains the following main elements:

Preprocessing:

- * Color space conversion (e.g., RGB to YCbCr).
- * Edge expansion and downsampling. Optionally, this step can do simple smoothing --- this is often helpful for low-quality source data.

JPEG proper:

- * MCU assembly, DCT, quantization.
- * Entropy coding (sequential or progressive, Huffman or arithmetic).

In addition to these modules we need overall control, marker generation, and support code (memory management & error handling). There is also a module responsible for physically writing the output data --- typically this is just an interface to `fwrite()`, but some applications may need to do something else with the data.

The decompressor library contains the following main elements:

JPEG proper:

- * Entropy decoding (sequential or progressive, Huffman or arithmetic).
- * Dequantization, inverse DCT,

MCU disassembly.

Postprocessing:

- * Upsampling. Optionally, this step may be able to do more general rescaling of the image.
- * Color space conversion (e.g., YCbCr to RGB). This step may also provide gamma adjustment [currently it does not].
- * Optional color quantization (e.g., reduction to 256 colors).
- * Optional color precision reduction (e.g., 24-bit to 15-bit color).
[This feature is not currently implemented.]

We also need overall control, marker parsing, and a data source module. The support code (memory management & error handling) can be shared with the compression half of the library.

There may be several implementations of each of these elements, particularly in the decompressor, where a wide range of speed/quality tradeoffs is very useful. It must be understood that some of the best speedups involve merging adjacent steps in the pipeline. For example, upsampling, color space conversion, and color quantization might all be done at once when using a low-quality ordered-dither technique. The system architecture is designed to allow such merging where appropriate.

Note: it is convenient to regard edge expansion (padding to block boundaries) as a preprocessing/postprocessing function, even though the JPEG spec includes it in compression/decompression. We do this because downsampling/upsampling can be simplified a little if they work on padded data: it's not necessary to have special cases at the right and bottom edges. Therefore the interface buffer is always an integral number of blocks wide and high, and we expect compression preprocessing to pad the source data properly. Padding will occur only to the next block (8-sample) boundary. In an interleaved-scan situation, additional dummy blocks may be used to fill out MCUs, but the MCU assembly and disassembly logic will create or discard these blocks internally. (This is advantageous for speed reasons, since we avoid DCTing the dummy blocks. It also permits a small reduction in file size, because the compressor can choose dummy block contents so as to minimize their size in compressed form. Finally, it makes the interface buffer specification independent of whether the file is actually interleaved or not.) Applications that wish to deal directly with the downsampled data must provide similar buffering and padding for odd-sized images.

*** Poor man's object-oriented programming ***

It should be clear by now that we have a lot of quasi-independent processing steps, many of which have several possible behaviors. To avoid cluttering the code with lots of switch statements, we use a simple form of object-style programming to separate out the different possibilities.

For example, two different color quantization algorithms could be implemented as two separate modules that present the same external interface; at runtime, the calling code will access the proper module indirectly through an "object".

We can get the limited features we need while

staying within portable C.

The basic tool is a function pointer. An "object" is just a struct containing one or more function pointer fields, each of which corresponds to a method name in real object-oriented languages. During initialization we fill in the function pointers with references to whichever module we have determined we need to use in this run. Then invocation of the module is done by indirecting through a function pointer; on most machines this is no more expensive than a switch statement, which would be the only other way of making the required run-time choice. The really significant benefit, of course, is keeping the source code clean and well structured.

We can also arrange to have private storage that varies between different implementations of the same kind of object. We do this by making all the module-specific object structs be separately allocated entities, which will be accessed via pointers in the master compression or decompression struct.

The "public"

fields or methods for a given kind of object are specified by a commonly known struct. But a module's initialization code can allocate a larger struct that contains the common struct as its first member, plus additional private fields. With appropriate pointer casting, the module's internal functions can access these private fields. (For a simple example, see `jdatadst.c`, which implements the external interface specified by struct `jpeg_destination_mgr`, but adds extra fields.)

(Of course this would all be a lot easier if we were using C++, but we are not yet prepared to assume that everyone has a C++ compiler.)

An important benefit of this scheme is that it is easy to provide multiple versions of any method, each tuned to a particular case. While a lot of precalculation might be done to select an optimal implementation of a method, the cost per invocation is constant. For example, the upsampling step might have a "generic" method, plus one or more "hardwired" methods for the most popular

sampling factors; the hardwired methods would be faster because they'd use straight-line code instead of for-loops. The cost to determine which method to use is paid only once, at startup, and the selection criteria are hidden from the callers of the method.

This plan differs a little bit from usual object-oriented structures, in that only one instance of each object class will exist during execution. The reason for having the class structure is that on different runs we may create different instances (choose to execute different modules). You can think of the term "method" as denoting the common interface presented by a particular set of interchangeable functions, and "object" as denoting a group of related methods, or the total shared interface behavior of a group of modules.

*** Overall control structure ***

We previously mentioned the need for overall control logic in the compression and decompression libraries. In IJG implementations prior to v5, overall control was

mostly provided by "pipeline control" modules, which proved to be large, unwieldy, and hard to understand. To improve the situation, the control logic has been subdivided into multiple modules. The control modules consist of:

1. Master control for module selection and initialization. This has two responsibilities:

1A. Startup initialization at the beginning of image processing.

The individual processing modules to be used in this run are selected and given initialization calls.

1B. Per-pass control. This determines how many passes will be performed and calls each active processing module to configure itself

appropriately at the beginning of each pass. End-of-pass processing, where necessary, is also invoked from the master control module.

Method selection is partially distributed, in that a particular processing module may contain several possible implementations of a particular method, which it will select among when given

its initialization call. The master

control code need only be concerned with decisions that affect more than one module.

2. Data buffering control. A separate control module exists for each inter-processing-step data buffer. This module is responsible for invoking the processing steps that write or read that data buffer.

Each buffer controller sees the world as follows:

```
input data => processing step A => buffer => processing step B => output data
      |           |           |
      ----- controller -----
```

The controller knows the dataflow requirements of steps A and B: how much data they want to accept in one chunk and how much they output in one chunk. Its function is to manage its buffer and call A and B at the proper times.

A data buffer control module may itself be viewed as a processing step by a higher-level control module; thus the control modules form a binary tree with elementary processing steps at the leaves of the tree.

The control modules are objects. A considerable amount of flexibility can

be had by replacing implementations of a control module. For example:

* Merging of adjacent steps in the pipeline is done by replacing a control module and its pair of processing-step modules with a single processing-step module. (Hence the possible merges are determined by the tree of control modules.)

* In some processing modes, a given interstep buffer need only be a "strip" buffer large enough to accommodate the desired data chunk sizes. In other modes, a full-image buffer is needed and several passes are required. The control module determines which kind of buffer is used and manipulates virtual array buffers as needed. One or both processing steps may be unaware of the multi-pass behavior.

In theory, we might be able to make all of the data buffer controllers interchangeable and provide just one set of implementations for all. In practice, each one contains considerable special-case processing for its particular job. The buffer controller concept should be regarded as an overall system structuring principle, not as a complete description of the task performed by any one controller.

*** Compression object structure ***

Here is a sketch of the logical structure of the JPEG compression library:

```

                                |-- Colospace conversion
|-- Preprocessing controller --|
|                                |-- Downsampling
Main controller --|
|                                |-- Forward DCT, quantize
|-- Coefficient controller --|
                                |-- Entropy encoding
```

This sketch also describes the flow of control (subroutine calls) during typical image data processing. Each of the components shown in the diagram is an "object" which may have several different implementations available. One or more source code files contain the actual implementation(s) of each object.

The objects shown above are:

* Main controller: buffer controller for the subsampled-data buffer, which holds the preprocessed input data. This controller invokes preprocessing to fill the subsampled-data buffer, and JPEG compression to empty it. There is usually no need for a full-image buffer here; a strip buffer is adequate.

* Preprocessing controller: buffer controller for the downsampling input data buffer, which lies between colospace conversion and downsampling. Note

that a unified conversion/downsampling module would probably replace this controller entirely.

* Colorspace conversion: converts application image data into the desired JPEG color space; also changes the data from pixel-interleaved layout to separate component planes. Processes one pixel row at a time.

* Downsampling: performs reduction of chroma components as required. Optionally may perform pixel-level smoothing as well. Processes a "row group" at a time, where a row group is defined as V_{max} pixel rows of each component before downsampling, and V_k sample rows afterwards (remember V_k differs across components). Some downsampling or smoothing algorithms may require context rows above and below the current row group; the preprocessing controller is responsible for supplying these rows via proper buffering. The downsampler is responsible for edge expansion at the right edge (i.e., extending each sample row to a multiple of 8 samples); but the preprocessing controller is responsible for vertical edge expansion (i.e., duplicating the bottom sample row as needed to make a multiple of 8 rows).

* Coefficient controller: buffer controller for the DCT-coefficient data. This controller handles MCU assembly, including insertion of dummy DCT blocks when needed at the right or bottom edge. When performing Huffman-code optimization or emitting a multiscan JPEG file, this controller is responsible for buffering the full image. The equivalent of one fully interleaved MCU row of subsampled data is processed per call, even when the JPEG file is noninterleaved.

* Forward DCT and quantization: Perform DCT, quantize, and emit coefficients. Works on one or more DCT blocks at a time. (Note: the coefficients are now emitted in normal array order, which the entropy encoder is expected to convert to zigzag order as necessary. Prior versions of the IJG code did the conversion to zigzag order within the quantization step.)

* Entropy encoding: Perform Huffman or arithmetic entropy coding and emit the coded data to the data destination module. Works on one MCU per call. For progressive JPEG, the same DCT blocks are fed to the entropy coder during each pass, and the coder must emit the appropriate subset of coefficients.

In addition to the above objects, the compression library includes these objects:

* Master control: determines the number of passes required, controls overall and per-pass initialization of the other modules.

* Marker writing: generates JPEG markers (except for RSTn, which is emitted by the entropy encoder when needed).

* Data destination manager: writes the output JPEG datastream to its final destination (e.g., a file). The destination manager supplied with the library knows how to write to a stdio stream or to a memory buffer; for other behaviors, the surrounding application may provide its own destination manager.

* Memory manager: allocates and releases memory, controls virtual arrays (with backing store management, where required).

* Error handler: performs formatting and output of error and trace messages; determines handling of nonfatal errors. The surrounding application may override some or all of this object's methods to change error handling.

* Progress monitor: supports output of "percent-done" progress reports. This object represents an optional callback to the surrounding application: if wanted, it must be supplied by the application.

The error handler, destination manager, and progress monitor objects are defined as separate objects in order to simplify application-specific customization of the JPEG library. A surrounding application may override individual methods or supply its own all-new implementation of one of these objects. The object interfaces for these objects are therefore treated as part of the application interface of the library, whereas the other objects are internal to the library.

The error handler and memory manager are shared by JPEG compression and decompression; the progress monitor, if used, may be shared as well.

*** Decompression object structure ***

Here is a sketch of the logical structure of the JPEG decompression library:

```

                                |-- Entropy decoding
|-- Coefficient controller --|
|                               |-- Dequantize, Inverse DCT
Main controller --|
|                               |-- Upsampling
|-- Postprocessing controller --| |-- Colorspace conversion
                                |-- Color quantization
                                |-- Color precision reduction
```

As before, this diagram also represents typical control flow. The objects shown are:

- * Main controller: buffer controller for the subsampled-data buffer, which holds the output of JPEG decompression proper. This controller's primary task is to feed the postprocessing procedure. Some upsampling algorithms may require context rows above and below the current row group; when this is true, the main controller is responsible for managing its buffer so as to make context rows available. In the current design, the main buffer is always a strip buffer; a full-image buffer is never required.

- * Coefficient controller: buffer controller for the DCT-coefficient data. This controller handles MCU disassembly, including deletion of any dummy DCT blocks at the right or bottom edge. When reading a multiscan JPEG file, this controller is responsible for buffering the full image. (Buffering DCT coefficients, rather than samples, is necessary to support progressive JPEG.) The equivalent of one fully interleaved MCU row of subsampled data is processed per call, even when the source JPEG file is noninterleaved.

- * Entropy decoding: Read coded data from the data source module and perform Huffman or arithmetic entropy decoding. Works on one MCU per call. For progressive JPEG decoding, the coefficient controller supplies the prior coefficients of each MCU (initially all zeroes), which the entropy decoder modifies in each scan.

- * Dequantization and inverse DCT: like it says. Note that the coefficients buffered by the coefficient controller have NOT been dequantized; we merge dequantization and inverse DCT into a single step for speed reasons. When scaled-down output is asked for, simplified DCT algorithms may be used that emit fewer samples per DCT block, not the full 8x8. Works on one DCT block at a time.

- * Postprocessing controller: buffer controller for the color quantization input buffer, when quantization is in use. (Without quantization, this controller just calls the upsampler.) For two-pass quantization, this controller is responsible for buffering the full-image data.

- * Upsampling: restores chroma components to full size. (May support more general output rescaling, too. Note that if undersized DCT outputs have been emitted by the DCT module, this module must adjust so that properly sized outputs are created.) Works on one row group at a time. This module also calls the color conversion module, so its top level is effectively a buffer controller for the upsampling->color conversion buffer. However, in all but the highest-quality operating modes, upsampling and color conversion are likely to be merged into a single step.

- * Colorspace conversion: convert from JPEG color space to output color space, and change data layout from separate component planes to pixel-interleaved. Works on one pixel row at a time.
- * Color quantization: reduce the data to colormapped form, using either an externally specified colormap or an internally generated one. This module is not used for full-color output. Works on one pixel row at a time; may require two passes to generate a color map. Note that the output will always be a single component representing colormap indexes. In the current design, the output values are JSAMPLEs, so an 8-bit compilation cannot quantize to more than 256 colors. This is unlikely to be a problem in practice.
- * Color reduction: this module handles color precision reduction, e.g., generating 15-bit color (5 bits/primary) from JPEG's 24-bit output. Not quite clear yet how this should be handled... should we merge it with colorspace conversion???

Note

that some high-speed operating modes might condense the entire postprocessing sequence to a single module (upsample, color convert, and quantize in one step).

In addition to the above objects, the decompression library includes these objects:

- * Master control: determines the number of passes required, controls overall and per-pass initialization of the other modules. This is subdivided into input and output control: `jdinput.c` controls only input-side processing, while `jdmaster.c` handles overall initialization and output-side control.
- * Marker reading: decodes JPEG markers (except for RSTn).
- * Data source manager: supplies the input JPEG datastream. The source manager supplied with the library knows how to read from a stdio stream or from a memory buffer; for other behaviors, the surrounding application may provide its own source manager.
- * Memory manager: same as for compression library.
- * Error handler: same as for compression library.
- * Progress monitor: same as for compression library.

As with compression, the data source manager, error handler, and progress monitor are candidates for replacement by a surrounding application.

*** Decompression input and output separation ***

To support efficient incremental display of progressive JPEG files, the decompressor is divided into two sections that can run independently:

1. Data input includes marker parsing, entropy decoding, and input into the coefficient controller's DCT coefficient buffer. Note that this processing is relatively cheap and fast.
2. Data output reads from the DCT coefficient buffer and performs the IDCT and all postprocessing steps.

For a progressive JPEG file, the data input processing is allowed to get arbitrarily far ahead of the data output processing. (This occurs only if the application calls `jpeg_consume_input()`; otherwise input and output run in lockstep, since the input section is called only when the output section needs more data.) In

this way the application can avoid making extra display passes when data is arriving faster than the display pass can run. Furthermore, it is possible to abort an output pass without losing anything, since the coefficient buffer is read-only as far as the output section is concerned. See `libjpeg.txt` for more detail.

A full-image coefficient array is only created if the JPEG file has multiple scans (or if the application specifies buffered-image mode anyway). When reading a single-scan file, the coefficient controller normally creates only a one-MCU buffer, so input and output processing must run in lockstep in this case. `jpeg_consume_input()` is effectively a no-op in this situation.

The main impact of dividing the decompressor in this fashion is that we must be very careful with shared variables in the `cinfo` data structure. Each variable that can change during the course of decompression must be classified as belonging to data input or data output, and each section must look only

at its own variables. For example, the data output section may not depend on any of the variables that describe the current scan in the JPEG file, because these may change as the data input section advances into a new scan.

The progress monitor is (somewhat arbitrarily) defined to treat input of the file as one pass when buffered-image mode is not used, and to ignore data input work completely when buffered-image mode is used. Note that the library has no reliable way to predict the number of passes when dealing with a progressive JPEG file, nor can it predict the number of output passes in buffered-image mode. So the work estimate is inherently bogus anyway.

No comparable division is currently made in the compression library, because

there isn't any real need for it.

*** Data formats ***

Arrays of pixel sample values use the following data structure:

```
typedef something JSAMPLE; a pixel component value, 0..MAXJSAMPLE
typedef JSAMPLE *JSAMPROW; ptr to a row of samples
typedef JSAMPROW *JSAMPARRAY; ptr to a list of rows
typedef JSAMPARRAY *JSAMPIMAGE; ptr to a list of color-component arrays
```

The basic element type JSAMPLE will typically be one of unsigned char, (signed) char, or short. Short will be used if samples wider than 8 bits are to be supported (this is a compile-time option). Otherwise, unsigned char is used if possible. If the compiler only supports signed chars, then it is necessary to mask off the value when reading. Thus, all reads of JSAMPLE values must be coded as "GETJSAMPLE(value)", where the macro will be defined as "((value) & 0xFF)" on signed-char machines and "((int) (value))" elsewhere.

With these conventions, JSAMPLE values can be assumed to be ≥ 0 . This helps simplify correct rounding during downsampling, etc. The JPEG standard's specification that sample values run from -128..127 is accommodated by subtracting 128 from the sample value in the DCT step. Similarly, during decompression the output of the IDCT step will be immediately shifted back to 0..255. (NB: different values are required when 12-bit samples are in use. The code is written in terms of MAXJSAMPLE and CENTERJSAMPLE, which will be defined as 255 and 128 respectively in an 8-bit implementation, and as 4095 and 2048 in a 12-bit implementation.)

We use a pointer per row, rather than a two-dimensional JSAMPLE array. This choice costs only a small amount of memory and has several benefits:

- * Code using the data structure doesn't need to know the allocated width of the rows. This simplifies edge expansion/compression, since we can work in an array that's wider than the logical picture width.
- * Indexing doesn't require multiplication; this is a performance win on many machines.
- * Arrays with more than 64K total elements can be supported even on machines where malloc() cannot allocate chunks larger than 64K.
- * The rows forming a component array may be allocated at different times without extra copying. This trick allows some speedups in smoothing steps that need access to the previous and next rows.

Note that each color component is stored in a separate array; we don't use the traditional layout in which the components of a pixel are stored together. This simplifies coding of modules that work on each component independently,

because they don't need to know how many components there are. Furthermore, we can read or write each component to a temporary file independently, which is helpful when dealing with noninterleaved JPEG files.

In general, a specific sample value is accessed by code such as

```
GETJSAMPLE(image[colorcomponent][row][col])
```

where col is measured from the image left edge, but row is measured from the first sample row currently in memory. Either of the first two indexings can be precomputed by copying the relevant pointer.

Since most image-processing applications prefer to work on images in which the components of a pixel are stored together, the data passed to or from the surrounding

application uses the traditional convention: a single pixel is represented by N consecutive JSAMPLE values, and an image row is an array of (# of color components)*(image width) JSAMPLEs. One or more rows of data can be represented by a pointer of type JSAMPARRAY in this scheme. This scheme is converted to component-wise storage inside the JPEG library. (Applications that want to skip JPEG preprocessing or postprocessing will have to contend with component-wise storage.)

Arrays of DCT-coefficient values use the following data structure:

```
typedef short JCOEF; a 16-bit signed integer
typedef JCOEF JBLOCK[DCTSIZE2]; an 8x8 block of coefficients
typedef JBLOCK *JBLOCKROW; ptr to one horizontal row of 8x8 blocks
typedef JBLOCKROW *JBLOCKARRAY; ptr to a list of such rows
typedef JBLOCKARRAY *JBLOCKIMAGE; ptr to a list of color component arrays
```

The underlying type is at least a 16-bit signed integer; while "short" is big enough on all machines of interest, on some machines it is preferable to use "int" for speed reasons, despite the storage cost. Coefficients are grouped into 8x8 blocks (but we always use #defines DCTSIZE and DCTSIZE2 rather than "8" and "64").

The contents of a coefficient block may be in either "natural" or zigzagged order, and may be true values or divided by the quantization coefficients, depending on where the block is in the processing pipeline. In the current library, coefficient blocks are kept in natural order everywhere; the entropy codecs zigzag or dezigzag the data as it is written or read. The blocks contain quantized coefficients everywhere outside the DCT/IDCT subsystems. (This latter decision may need to be revisited to support variable quantization a la JPEG Part 3.)

Notice that the allocation unit is now a row of 8x8 blocks, corresponding to

eight rows of samples. Otherwise the structure is much the same as for samples, and for the same reasons.

On machines where malloc() can't handle a request bigger than 64Kb, this data structure limits us to rows of less than 512 JBLOCKS, or a picture width of 4000+ pixels. This seems an acceptable restriction.

On 80x86 machines, the bottom-level pointer types (JSAMPROW and JBLOCKROW) must be declared as "far" pointers, but the upper levels can be "near" (implying that the pointer lists are allocated in the DS segment). We use a #define symbol FAR, which expands to the "far" keyword when compiling on 80x86 machines and to nothing elsewhere.

*** Suspendable processing ***

In some applications it is desirable to use the JPEG library as an incremental, memory-to-memory filter. In this situation the data source or destination may be a limited-size buffer, and we can't rely on being able to empty or refill the buffer at arbitrary times. Instead the application would like to have control return from the library at buffer overflow/underrun, and then resume compression or decompression at a later time.

This scenario is supported for simple cases. (For anything more complex, we recommend that the application "bite the bullet" and develop real multitasking capability.) The libjpeg.txt file goes into more detail about the usage and limitations of this capability; here we address the implications for library structure.

The essence of the problem is that the entropy codec (coder or decoder) must be prepared to stop at arbitrary times. In turn, the controllers that call the entropy codec must be able to stop before having produced or consumed all the data that they normally would handle in one call. That part is reasonably straightforward: we make the controller call interfaces include "progress counters" which indicate the number of data chunks successfully processed, and we require callers to test the counter rather than just assume all of the data was processed.

Rather than trying to restart at an arbitrary point, the current Huffman codecs are designed to restart at the beginning of the current MCU after a suspension due to buffer overflow/underrun. At the start of each call, the codec's internal state is loaded from permanent storage (in the JPEG object structures) into local variables. On successful completion of the MCU, the permanent state is updated. (This copying is not very expensive, and may even

lead to *improved* performance if the local variables can be registerized.) If a suspension occurs, the codec simply returns without updating the state, thus effectively reverting to the start of the MCU. Note that this implies leaving some data unprocessed in the source/destination buffer (ie, the compressed partial MCU). The data source/destination module interfaces are specified so as to make this possible. This also implies that the data buffer must be large enough to hold a worst-case compressed MCU; a couple thousand bytes should be enough.

In a successive-approximation AC refinement scan, the progressive Huffman decoder has to be able to undo assignments of newly nonzero coefficients if it suspends before the MCU is complete, since decoding requires distinguishing previously-zero and previously-nonzero coefficients. This is a bit tedious but probably won't have much effect on performance. Other variants of Huffman decoding need not worry about this, since they will just store the same values again if forced to repeat the MCU.

This approach would probably not work for an arithmetic codec, since its modifiable state is quite large and couldn't be copied cheaply. Instead it would have to suspend and resume exactly at the point of the buffer end.

The JPEG marker reader is designed to cope with suspension at an arbitrary point. It does so by backing up to the start of the marker parameter segment, so the data buffer must be big enough to hold the largest marker of interest. Again, a couple KB should be adequate. (A special "skip" convention is used to bypass COM and APPn markers, so these can be larger than the buffer size without causing problems; otherwise a 64K buffer would be needed in the worst case.)

The JPEG marker writer currently does *not* cope with suspension. We feel that this is not necessary; it is much easier simply to require the application to ensure there is enough buffer space before starting. (An empty 2K buffer is more than sufficient for the header markers; and ensuring there are a dozen or two bytes available before calling jpeg_finish_compress() will suffice for the trailer.) This would not work for writing multi-scan JPEG files, but we simply do not intend to support that capability with suspension.

*** Memory manager services ***

The JPEG library's memory manager controls allocation and deallocation of memory, and it manages large "virtual" data arrays on machines where the operating system does not provide virtual memory. Note that the same memory manager serves both compression and decompression operations.

In all cases, allocated objects are tied to a particular compression or decompression master record, and they will be released when that master record is destroyed.

The memory manager does not provide explicit deallocation of objects. Instead, objects are created in "pools" of free storage, and a whole pool can be freed at once. This approach helps prevent storage-leak bugs, and it speeds up operations whenever malloc/free are slow (as they often are). The pools can be regarded as lifetime identifiers for objects. Two pools/lifetimes are defined:

- * JPOOL_PERMANENT lasts until master record is destroyed
- * JPOOL_IMAGE lasts until done with image (JPEG datastream)

Permanent lifetime is used for parameters and tables that should be carried across from one datastream to another; this includes all application-visible parameters. Image lifetime is used for everything else. (A third lifetime, JPOOL_PASS = one processing pass, was originally planned. However it was dropped as not being worthwhile. The actual usage patterns are such that the peak memory usage would be about the same anyway; and having per-pass storage substantially complicates the virtual memory allocation rules --- see below.)

The memory manager deals with three kinds of object:

1. "Small" objects. Typically these require no more than 10K-20K total.
2. "Large" objects. These may require tens to hundreds of K depending on image size. Semantically they behave the same as small objects, but we distinguish them for two reasons:
 - * On MS-DOS machines, large objects are referenced by FAR pointers, small objects by NEAR pointers.
 - * Pool allocation heuristics may differ for large and small objects.Note that individual "large" objects cannot exceed the size allowed by type size_t, which may be 64K or less on some machines.
3. "Virtual" objects. These are large 2-D arrays of JSAMPLEs or JBLOCKs (typically large enough for the entire image being processed). The memory manager provides stripwise access to these arrays. On machines without virtual memory, the rest of the array may be swapped out to a temporary file.

(Note: JSAMPARRAY and JBLOCKARRAY data structures are a combination of large objects for the data proper and small objects for the row pointers. For convenience and speed, the memory manager provides single routines to create these structures. Similarly, virtual arrays include a small control block and a JSAMPARRAY or JBLOCKARRAY working buffer, all created with one call.)

In the present implementation, virtual arrays are only permitted to have image lifespan. (Permanent lifespan would not be reasonable, and pass lifespan is not very useful since a virtual array's raison d'etre is to store data for

multiple passes through the image.) We also expect that only "small" objects will be given permanent lifespan, though this restriction is not required by the memory manager.

In a non-virtual-memory machine, some performance benefit can be gained by making the in-memory buffers for virtual arrays be as large as possible.

(For small

images, the buffers might fit entirely in memory, so blind swapping would be very wasteful.) The memory manager will adjust the height of the buffers to fit within a prespecified maximum memory usage. In order to do this in a reasonably optimal fashion, the manager needs to allocate all of the virtual arrays at once. Therefore, there isn't a one-step allocation routine for virtual arrays; instead, there is a "request" routine that simply allocates the control block, and a "realize" routine (called just once) that determines space allocation and creates all of the actual buffers. The realize routine must allow for space occupied by non-virtual large objects. (We don't bother to factor in the space needed for small objects, on the grounds that it isn't worth the trouble.)

To support all this, we establish the following protocol for doing business with the memory manager:

1. Modules must request virtual arrays (which may have only image lifespan) during the initial setup phase, i.e., in their `jinit_XXX` routines.
 2. All "large" objects (including JSAMPARRAYs and JBLOCKARRAYs) must also be allocated during initial setup.
 3. `realize_virt_arrays` will be called at the completion of initial setup.
- The above conventions ensure that sufficient information is available for it to choose a good size for virtual array buffers.

Small objects of any lifespan may be allocated at any time. We expect that the total space used for small objects will be small enough to be negligible in the `realize_virt_arrays` computation.

In a virtual-memory machine, we simply pretend that the available space is infinite, thus causing `realize_virt_arrays` to decide that it can allocate all the virtual arrays as full-size in-memory buffers. The overhead of the virtual-array access protocol is very small when no swapping occurs.

A virtual array can be specified to be "pre-zeroed"; when this flag is set, never-yet-written sections of the array are set to zero before being made available to the caller. If this flag is not set, never-written sections of the array contain garbage. (This feature exists primarily because the equivalent logic would otherwise be needed in `jdcoefct.c` for progressive JPEG mode; we may as well make it available for possible other uses.)

The first write pass on a virtual array is required to occur in top-to-bottom order; read passes, as well as any write passes after the first one, may

access the array in any order. This restriction exists partly to simplify the virtual array control logic, and partly because some file systems may not support seeking beyond the current end-of-file in a temporary file. The main implication of this restriction is that rearrangement of rows (such as converting top-to-bottom data order to bottom-to-top) must be handled while reading data out of the virtual array, not while putting it in.

*** Memory manager internal structure ***

To isolate system dependencies as much as possible, we have broken the memory manager into two parts. There is a reasonably system-independent "front end" (jmemmgr.c) and a "back end" that contains only the code likely to change across systems. All of the memory management methods outlined above are implemented by the front end. The back end provides the following routines for use by the front end (none of these routines are known to the rest of the JPEG code):

jpeg_mem_init, jpeg_mem_term system-dependent initialization/shutdown

jpeg_get_small, jpeg_free_small interface to malloc and free library routines (or their equivalents)

jpeg_get_large, jpeg_free_large interface to FAR malloc/free in MSDOS machines; else usually the same as jpeg_get_small/jpeg_free_small

jpeg_mem_available estimate available memory

jpeg_open_backing_store create a backing-store object

read_backing_store, manipulate a backing-store object
write_backing_store,
close_backing_store

On some systems there will be more than one type of backing-store object (specifically, in MS-DOS a backing store file might be an area of extended memory as well as a disk file). jpeg_open_backing_store is responsible for choosing how to implement a given object. The read/write/close routines are method pointers in the structure that describes a given object; this lets them be different for different object types.

It may be necessary to ensure that backing store objects are explicitly released upon abnormal program termination. For example, MS-DOS won't free extended memory by itself. To support this, we will expect the main program or surrounding application to arrange to call self_destruct (typically via

jpeg_destroy) upon abnormal termination. This may require a SIGINT signal handler or equivalent. We don't want to have the back end module install its own signal handler, because that would pre-empt the surrounding application's ability to control signal handling.

The IJG distribution includes several memory manager back end implementations.

Usually

the same back end should be suitable for all applications on a given system, but it is possible for an application to supply its own back end at need.

*** Implications of DNL marker ***

Some JPEG files may use a DNL marker to postpone definition of the image height (this would be useful for a fax-like scanner's output, for instance). In these files the SOF marker claims the image height is 0, and you only find out the true image height at the end of the first scan.

We could read these files as follows:

1. Upon seeing zero image height, replace it by 65535 (the maximum allowed).
2. When the DNL is found, update the image height in the global image descriptor.

This implies that control modules must avoid making copies of the image height, and must re-test for termination after each MCU row. This would be easy enough to do.

In cases where image-size data structures are allocated, this approach will result in very inefficient use of virtual memory or much-larger-than-necessary temporary files. This seems acceptable for something that probably won't be a mainstream usage. People might have to forgo use of memory-hogging options (such as two-pass color quantization or noninterleaved JPEG files) if they want efficient conversion of such files. (One could improve efficiency by demanding a user-supplied upper bound for the height, less than 65536; in most cases it could be much less.)

The standard also permits the SOF marker to overestimate the image height, with a DNL to give the true, smaller height at the end of the first scan. This would solve the space problems if the overestimate wasn't too great. However, it implies that you don't even know whether DNL will be used.

This leads to a couple of very serious objections:

1. Testing for a DNL marker must occur in the inner loop of the decompressor's Huffman decoder; this implies a speed penalty whether the feature is used or not.
2. There is no way to hide the last-minute change in image height from

an

application using the decoder. Thus *every* application using the IJG library would suffer a complexity penalty whether it cared about DNL or not.

We currently do not support DNL because of these problems.

A different approach is to insist that DNL-using files be preprocessed by a separate program that reads ahead to the DNL, then goes back and fixes the SOF marker. This is a much simpler solution and is probably far more efficient. Even if one wants piped input, buffering the first scan of the JPEG file needs a lot smaller temp file than is implied by the maximum-height method. For this approach we'd simply treat DNL as a no-op in the decompressor (at most, check that it matches the SOF image height).

We will not worry about making the compressor capable of outputting DNL. Something similar to the first scheme above could be applied if anyone ever wants to make that work.

Found in path(s):

```
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/structure.txt
No license file was found, but licenses were detected in source scan.
```

```
/*
```

```
* jmemnobs.c
```

```
*
```

```
* Copyright (C) 1992-1996, Thomas G. Lane.
```

```
* This file is part of the Independent JPEG Group's software.
```

```
* For conditions of distribution and use, see the accompanying README file.
```

```
*
```

```
* This file provides a really simple implementation of the system-
```

```
* dependent portion of the JPEG memory manager. This implementation
```

```
* assumes that no backing-store files are needed: all required space
```

```
* can be obtained from malloc().
```

```
* This is very portable in the sense that it'll compile on almost anything,
```

```
* but you'd better have lots of main memory (or virtual memory) if you want
```

```
* to process big images.
```

```
* Note that the max_memory_to_use option is ignored by this implementation.
```

```
*/
```

Found in path(s):

```
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jmemnobs.c
No license file was found, but licenses were detected in source scan.
```

```
/*
```

```
* rdrle.c
```

```
*
```

- * Copyright (C) 1991-1996, Thomas G. Lane.
- * This file is part of the Independent JPEG Group's software.
- * For conditions of distribution and use, see the accompanying README file.
- *
- * This file contains routines to read input images in Utah RLE format.
- * The Utah Raster Toolkit library is required (version 3.1 or later).
- *
- * These routines may need modification for non-Unix environments or
- * specialized applications. As they stand, they assume input from
- * an ordinary stdio stream. They further assume that reading begins
- * at the start of the file; start_input may need work if the
- * user interface has already read some data (e.g., to determine that
- * the file is indeed RLE format).
- *
- * Based on code contributed by Mike Lijewski,
- * with updates from Robert Hutchinson.
- */

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/rdrle.c
 No license file was found, but licenses were detected in source scan.

libjpeg-turbo note: This file has been modified by The libjpeg-turbo Project to include only information relevant to libjpeg-turbo, to wordsmith certain sections, and to remove impolitic language that existed in the libjpeg v8 README. It is included only for reference. Please see README-turbo.txt for information specific to libjpeg-turbo.

The Independent JPEG Group's JPEG software

=====

This distribution contains a release of the Independent JPEG Group's free JPEG software. You are welcome to redistribute this software and to use it for any purpose, subject to the conditions under LEGAL ISSUES, below.

This software is the work of Tom Lane, Guido Vollbeding, Philip Gladstone, Bill Allombert, Jim Boucher, Lee Crocker, Bob Friesenhahn, Ben Jackson, Julian Minguillon, Luis Ortiz, George Phillips, Davide Rossi, Ge' Weijers, and other members of the Independent JPEG Group.

IJG

is not affiliated with the ISO/IEC JTC1/SC29/WG1 standards committee (also known as JPEG, together with ITU-T SG16).

DOCUMENTATION ROADMAP

=====
This file contains the following sections:

OVERVIEW General description of JPEG and the IJG software.
LEGAL ISSUES Copyright, lack of warranty, terms of distribution.
REFERENCES Where to learn more about JPEG.
ARCHIVE LOCATIONS Where to find newer versions of this software.
FILE FORMAT WARS Software *not* to get.
TO DO Plans for future IJG releases.

Other documentation files in the distribution are:

User documentation:

install.txt How to configure and install the IJG software.
usage.txt Usage instructions for cjpeg, djpeg, jpegtran,
 rdjpgcom, and wrjpgcom.
*.1 Unix-style man pages for programs (same info as usage.txt).
wizard.txt Advanced usage instructions for JPEG wizards only.
change.log Version-to-version
change highlights.

Programmer and internal documentation:

libjpeg.txt How to use the JPEG library in your own programs.
example.c Sample code for calling the JPEG library.
structure.txt Overview of the JPEG library's internal structure.
coderules.txt Coding style rules --- please read if you contribute code.

Please read at least the files install.txt and usage.txt. Some information can also be found in the JPEG FAQ (Frequently Asked Questions) article. See ARCHIVE LOCATIONS below to find out where to obtain the FAQ article.

If you want to understand how the JPEG code works, we suggest reading one or more of the REFERENCES, then looking at the documentation files (in roughly the order listed) before diving into the code.

OVERVIEW

=====
=====

This package contains C software to implement JPEG image encoding, decoding, and transcoding. JPEG (pronounced "jay-peg") is a standardized compression method for full-color and gray-scale images. JPEG's strong suit is compressing photographic images or other types of images that have smooth color and brightness transitions between neighboring pixels. Images with sharp lines or other abrupt features may not compress well with JPEG, and a higher JPEG quality may have to be used to avoid visible compression artifacts with such images.

JPEG is lossy, meaning that the output pixels are not necessarily identical to the input pixels. However, on photographic content and other "smooth" images, very good compression ratios can be obtained with no visible compression artifacts, and extremely high compression ratios are possible if you are willing to sacrifice image quality (by reducing the "quality" setting in the compressor.)

This software implements JPEG baseline, extended-sequential, and progressive compression processes. Provision is made for supporting all variants of these processes, although some uncommon parameter settings aren't implemented yet. We have made no provision for supporting the hierarchical or lossless processes defined in the standard.

We provide a set of library routines for reading and writing JPEG image files, plus two sample applications "cjpeg" and "djpeg", which use the library to perform conversion between JPEG and some other popular image file formats. The library is intended to be reused in other applications.

In order to support file conversion and viewing software, we have included considerable functionality beyond the bare JPEG coding/decoding capability; for example, the color quantization modules are not strictly part of JPEG decoding, but they are essential for output to colormapped file formats or colormapped displays. These extra functions can be compiled out of the library if not required for a particular application.

We have also included "jpegtran", a utility for lossless transcoding between different JPEG processes, and "rdjpgcom" and "wrjpgcom", two simple applications for inserting and extracting textual comments in JFIF files.

The emphasis in designing this software has been on achieving portability and flexibility, while also making it fast enough to be useful. In particular, the software is not intended to be read as a tutorial on JPEG. (See the REFERENCES section for introductory material.) Rather, it is intended to be reliable, portable, industrial-strength code. We do not claim to have achieved that goal in every aspect of the software, but we strive for it.

We welcome the use of this software as a component of commercial products. No royalty is required, but we do ask for an acknowledgement in product documentation, as described under LEGAL ISSUES.

LEGAL ISSUES

=====

In plain English:

1. We don't promise that this software works. (But if you find any bugs, please let us know!)
2. You can use this software for whatever you want. You don't have to pay us.
3. You may not pretend that you wrote this software. If you use it in a program, you must acknowledge somewhere in your documentation that you've used the IJG code.

In legalese:

The authors make NO WARRANTY or representation, either express or implied, with respect to this software, its quality, accuracy, merchantability, or fitness for a particular purpose. This software is provided "AS IS", and you, its user, assume the entire risk as to its quality and accuracy.

This software is copyright (C) 1991-2012, Thomas G. Lane, Guido Vollbeding. All Rights Reserved except as specified below.

Permission is hereby granted to use, copy, modify, and distribute this software (or portions thereof) for any purpose, without fee, subject to these conditions:

- (1) If any part of the source code for this software is distributed, then this README file must be included, with this copyright and no-warranty notice unaltered; and any additions, deletions, or changes to the original files must be clearly indicated in accompanying documentation.
- (2) If only executable code is distributed, then the accompanying documentation must state that "this software is based in part on the work of the Independent JPEG Group".
- (3) Permission for use of this software is granted only if the user accepts full responsibility for any undesirable consequences; the authors accept NO LIABILITY for damages of any kind.

These conditions apply to any software derived from or based on the IJG code, not just to the unmodified library. If you use our work, you ought to acknowledge us.

Permission is NOT granted for the use of any IJG author's name or company name in advertising or publicity relating to this software or products derived from it. This software may be referred to only as "the Independent JPEG Group's software".

We specifically permit and encourage the use of this software as the basis of commercial products, provided that all warranty or liability claims are assumed by the product vendor.

The Unix configuration script "configure" was produced with GNU Autoconf. It is copyright by the Free Software Foundation but is freely distributable. The same holds for its supporting scripts (config.guess, config.sub, ltmain.sh). Another support script, install-sh, is copyright by X Consortium but is also freely distributable.

The IJG distribution formerly included code to read and write GIF files. To avoid entanglement with the Unisys LZW patent, GIF reading support has been removed altogether, and the GIF writer has been simplified to produce "uncompressed GIFs". This technique does not use the LZW algorithm; the resulting GIF files are larger than usual, but are readable by all standard GIF decoders.

We are required to state that

"The Graphics Interchange Format(c) is the Copyright property of CompuServe Incorporated. GIF(sm) is a Service Mark property of CompuServe Incorporated."

REFERENCES

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We recommend reading one or more of these references before trying to understand the innards of the JPEG software.

The best short technical introduction to the JPEG compression algorithm is

Wallace, Gregory K. "The JPEG Still Picture Compression Standard", Communications of the ACM, April 1991 (vol. 34 no. 4), pp. 30-44. (Adjacent articles in that issue discuss MPEG motion picture compression, applications of JPEG, and related topics.) If you don't have the CACM issue handy, a PostScript file containing a revised version of Wallace's article is available at <http://www.ijg.org/files/wallace.ps.gz>. The file (actually a preprint for an article that appeared in IEEE Trans. Consumer Electronics) omits the sample images that appeared in CACM, but it includes corrections and some added material. Note: the Wallace article is copyright ACM and IEEE, and it may not be used for commercial purposes.

A somewhat less technical, more leisurely introduction to JPEG can be found in "The Data Compression Book" by Mark Nelson and Jean-loup Gailly, published by M&T Books (New York), 2nd ed. 1996, ISBN 1-55851-434-1. This book provides good explanations and example C code for a multitude of compression methods including JPEG. It is an excellent source if you are comfortable reading C code but don't know much about data compression in general. The book's JPEG sample code is far from industrial-strength, but when you are ready to look at a full implementation, you've got one here...

The best currently available description of JPEG is the textbook "JPEG Still Image Data Compression Standard" by William B. Pennebaker and Joan L. Mitchell, published by Van Nostrand Reinhold, 1993, ISBN 0-442-01272-1. Price US\$59.95, 638 pp. The book includes the complete text of the ISO JPEG standards (DIS 10918-1 and draft DIS 10918-2).

The original JPEG standard is divided into two parts, Part 1 being the actual specification, while Part 2 covers compliance testing methods. Part 1 is titled "Digital Compression and Coding of Continuous-tone Still Images, Part 1: Requirements and guidelines" and has document numbers ISO/IEC IS 10918-1, ITU-T T.81. Part 2 is titled "Digital Compression and Coding of Continuous-tone Still Images, Part 2: Compliance testing" and has document numbers ISO/IEC IS 10918-2, ITU-T T.83.

The JPEG standard does not specify all details of an interchangeable file format. For the omitted details we follow the "JFIF" conventions, revision 1.02. JFIF 1.02 has been adopted as an Ecma International Technical Report and thus received a formal publication status. It is available as a free download in PDF format from <http://www.ecma-international.org/publications/techreports/E-TR-098.htm>. A PostScript version of the JFIF document is available at <http://www.ijg.org/files/jfif.ps.gz>. There is also a plain text version at <http://www.ijg.org/files/jfif.txt.gz>, but it is missing the figures.

The TIFF 6.0 file format specification can be obtained by FTP from <ftp://ftp.sgi.com/graphics/tiff/TIFF6.ps.gz>. The JPEG incorporation scheme found in the TIFF 6.0 spec of 3-June-92 has a number of serious problems. IJG does not recommend use of the TIFF 6.0 design (TIFF Compression tag 6). Instead, we recommend the JPEG design proposed by TIFF Technical Note #2 (Compression tag 7). Copies of this Note can be obtained from <http://www.ijg.org/files/>. It is expected that the next revision of the TIFF spec will replace the 6.0 JPEG design with the Note's design. Although IJG's own code does not support TIFF/JPEG, the free libtiff library uses our library to implement TIFF/JPEG per the Note.

ARCHIVE LOCATIONS

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The "official" archive site for this software is www.ijg.org. The most recent released version can always be found there in directory "files". This particular version will be archived as <http://www.ijg.org/files/jpegsr.v8d.tar.gz>, and in Windows-compatible "zip" archive format as <http://www.ijg.org/files/jpegsr8d.zip>.

The JPEG FAQ (Frequently Asked Questions) article is a source of some general information about JPEG.

It is available on the World Wide Web at <http://www.faqs.org/faqs/jpeg-faq/> and other

news.answers archive sites, including the official news.answers archive at [rtfm.mit.edu: ftp://rtfm.mit.edu/pub/usenet/news.answers/jpeg-faq/](http://rtfm.mit.edu/ftp://rtfm.mit.edu/pub/usenet/news.answers/jpeg-faq/). If you don't have Web or FTP access, send e-mail to mail-server@rtfm.mit.edu with body

send usenet/news.answers/jpeg-faq/part1

send usenet/news.answers/jpeg-faq/part2

FILE FORMAT WARS

=====

The ISO/IEC JTC1/SC29/WG1 standards committee (also known as JPEG, together with ITU-T SG16) currently promotes different formats containing the name "JPEG" which are incompatible with original DCT-based JPEG. IJG therefore does not support these formats (see REFERENCES). Indeed, one of the original reasons for developing this free software was to help force convergence on common, interoperable format standards for JPEG files.

Don't use an incompatible file format!

(In any case, our decoder will remain capable of reading existing JPEG image files indefinitely.)

TO DO

=====

Please send bug reports, offers of help, etc. to jpeg-info@jpegclub.org.

Found

in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/README
No license file was found, but licenses were detected in source scan.

/*

* jutils.c

*

* Copyright (C) 1991-1996, Thomas G. Lane.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains tables and miscellaneous utility routines needed

* for both compression and decompression.

* Note we prefix all global names with "j" to minimize conflicts with

* a surrounding application.

*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jutils.c
No license file was found, but licenses were detected in source scan.

/*

* jccolext.c

*

* This file was part of the Independent JPEG Group's software:

* Copyright (C) 1991-1996, Thomas G. Lane.

* Modifications:

* Copyright (C) 2009-2012, D. R. Commander.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains input colorspace conversion routines.

*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jccolext.c
No license file was found, but licenses were detected in source scan.

/*

* jdpostct.c

*

* Copyright (C) 1994-1996, Thomas G. Lane.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains the decompression postprocessing controller.

* This controller manages the upsampling, color conversion, and color

* quantization/reduction steps; specifically, it controls the buffering

* between upsample/color conversion and color quantization/reduction.

*

* If no color quantization/reduction is required, then this module has no

* work to do, and it just hands off to the upsample/color conversion code.

* An integrated upsample/convert/quantize process would replace this module

* entirely.

*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jdpostct.c
No license file was found, but licenses were detected in source scan.

/*

* jcapimin.c
*
* Copyright (C) 1994-1998, Thomas G. Lane.
* Modified 2003-2010 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains application interface code for the compression half
* of the JPEG library. These are the "minimum" API routines that may be
* needed in either the normal full-compression case or the transcoding-only
* case.
*
* Most of the routines intended to be called directly by an application
* are in this file or in jcapistd.c. But also see jcparam.c for
* parameter-setup helper routines, jcomapi.c for routines shared by
* compression and decompression, and jctrans.c for the transcoding case.
*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jcapimin.c
No license file was found, but licenses were detected in source scan.

/*

* jidctflt.c
*
* Copyright (C) 1994-1998, Thomas G. Lane.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains a floating-point implementation of the
* inverse DCT (Discrete Cosine Transform). In the IJG code, this routine
* must also perform dequantization of the input coefficients.
*
* This implementation should be more accurate than either of the integer
* IDCT implementations. However, it may not give the same results on all
* machines because of differences in roundoff behavior. Speed will depend
* on the hardware's floating point capacity.
*
* A 2-D IDCT can be done by 1-D IDCT on each column followed by 1-D IDCT
* on each row (or vice versa, but it's more convenient to emit a row at
* a time). Direct algorithms are also available, but they are much more
* complex and seem not to
* be any faster when reduced to code.
*
* This implementation is based on Arai, Agui, and Nakajima's algorithm for
* scaled DCT. Their original paper (Trans. IEICE E-71(11):1095) is in
* Japanese, but the algorithm is described in the Pennebaker & Mitchell

* JPEG textbook (see REFERENCES section in file README). The following code
* is based directly on figure 4-8 in P&M.
* While an 8-point DCT cannot be done in less than 11 multiplies, it is
* possible to arrange the computation so that many of the multiplies are
* simple scalings of the final outputs. These multiplies can then be
* folded into the multiplications or divisions by the JPEG quantization
* table entries. The AA&N method leaves only 5 multiplies and 29 adds
* to be done in the DCT itself.
* The primary disadvantage of this method is that with a fixed-point
* implementation, accuracy is lost due to imprecise representation of the
* scaled quantization values. However, that problem does not arise if
* we
use floating point arithmetic.
*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jidctflt.c
No license file was found, but licenses were detected in source scan.

/*
* simd/jsimd.h
*
* Copyright 2009 Pierre Ossman <ossman@cendio.se> for Cendio AB
* Copyright 2011 D. R. Commander
*
* Based on the x86 SIMD extension for IJG JPEG library,
* Copyright (C) 1999-2006, MIYASAKA Masaru.
* For conditions of distribution and use, see copyright notice in jsimdext.inc
*
*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jsimd.h
No license file was found, but licenses were detected in source scan.

/*
* jfdctint.c
*
* Copyright (C) 1991-1996, Thomas G. Lane.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains a slow-but-accurate integer implementation of the
* forward DCT (Discrete Cosine Transform).
*
* A 2-D DCT can be done by 1-D DCT on each row followed by 1-D DCT

* on each column. Direct algorithms are also available, but they are
* much more complex and seem not to be any faster when reduced to code.
*
* This implementation is based on an algorithm described in
* C. Loeffler, A. Ligtenberg and G. Moschytz, "Practical Fast 1-D DCT
* Algorithms with 11 Multiplications", Proc. Int'l. Conf. on Acoustics,
* Speech, and Signal Processing 1989 (ICASSP '89), pp. 988-991.
* The primary algorithm described there uses 11 multiplies and 29 adds.
* We use their alternate method with 12
multiplies and 32 adds.
* The advantage of this method is that no data path contains more than one
* multiplication; this allows a very simple and accurate implementation in
* scaled fixed-point arithmetic, with a minimal number of shifts.
*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jfdctint.c
No license file was found, but licenses were detected in source scan.

/*

* rdtarga.c

*

* Copyright (C) 1991-1996, Thomas G. Lane.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains routines to read input images in Targa format.

*

* These routines may need modification for non-Unix environments or

* specialized applications. As they stand, they assume input from

* an ordinary stdio stream. They further assume that reading begins

* at the start of the file; start_input may need work if the

* user interface has already read some data (e.g., to determine that

* the file is indeed Targa format).

*

* Based on code contributed by Lee Daniel Crocker.

*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/rdtarga.c
No license file was found, but licenses were detected in source scan.

; For conditions of distribution and use, see copyright notice in jsimdext.inc
; more details.

Found in path(s):

```
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jfss2int-64.asm
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jfss2int.asm
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jiss2int.asm
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jiss2int-64.asm
*
/opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jimxint.asm
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jfmmxint.asm
No license file was found, but licenses were detected in source scan.
```

```
/*
* jdmarker.c
*
* This file was part of the Independent JPEG Group's software:
* Copyright (C) 1991-1998, Thomas G. Lane.
* Modifications:
* Copyright (C) 2012, D. R. Commander.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains routines to decode JPEG datastream markers.
* Most of the complexity arises from our desire to support input
* suspension: if not all of the data for a marker is available,
* we must exit back to the application. On resumption, we reprocess
* the marker.
*/
```

Found in path(s):

```
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jdmarker.c
No license file was found, but licenses were detected in source scan.
```

IJG JPEG LIBRARY: CODING RULES

Copyright (C) 1991-1996, Thomas G. Lane.

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For conditions of distribution and use, see the accompanying README file.

Since numerous people will be contributing code and bug fixes, it's important to establish a common coding style. The goal of using similar coding styles is much more important than the details of just what that style is.

In general we follow the recommendations of "Recommended C Style and Coding

Standards" revision 6.1 (Cannon et al. as modified by Spencer, Keppel and Brader). This document is available in the IJG FTP archive (see jpeg/doc/cstyle.ms.tbl.Z, or cstyle.txt.Z for those without nroff/tbl).

Block comments should be laid out thusly:

```
/*  
* Block comments in this style.  
*/
```

We indent statements in K&R style, e.g.,

```
if (test) {  
    then-part;  
} else {  
    else-part;  
}
```

with two spaces per indentation

level. (This indentation convention is handled automatically by GNU Emacs and many other text editors.)

Multi-word names should be written in lower case with underscores, e.g., multi_word_name (not multiWordName). Preprocessor symbols and enum constants are similar but upper case (MULTI_WORD_NAME). Names should be unique within the first fifteen characters. (On some older systems, global names must be unique within six characters. We accommodate this without cluttering the source code by using macros to substitute shorter names.)

We use function prototypes everywhere; we rely on automatic source code transformation to feed prototype-less C compilers. Transformation is done by the simple and portable tool 'ansi2knr.c' (courtesy of Ghostscript). ansi2knr is not very bright, so it imposes a format requirement on function declarations: the function name MUST BEGIN IN COLUMN 1. Thus all functions should be written in the following style:

```
LOCAL(int *)  
function_name (int a, char  
*b)  
{  
    code...  
}
```

Note that each function definition must begin with GLOBAL(type), LOCAL(type), or METHODDEF(type). These macros expand to "static type" or just "type" as appropriate. They provide a readable indication of the routine's usage and can readily be changed for special needs. (For instance, special linkage keywords can be inserted for use in Windows DLLs.)

ansi2knr does not transform method declarations (function pointers in

structs). We handle these with a macro JMETHOD, defined as

```
#ifdef HAVE_PROTOTYPES
#define JMETHOD(type,methodname,arglist) type (*methodname) arglist
#else
#define JMETHOD(type,methodname,arglist) type (*methodname) ()
#endif
```

which is used like this:

```
struct function_pointers {
    JMETHOD(void, init_entropy_encoder, (int somearg, jparms *jp));
    JMETHOD(void, term_entropy_encoder, (void));
};
```

Note the set of parentheses surrounding the parameter list.

A similar solution is used for forward and external function declarations (see the EXTERN and JPP macros).

If the code is to work on non-ANSI compilers, we cannot rely on a prototype declaration to coerce actual parameters into the right types. Therefore, use explicit casts on actual parameters whenever the actual parameter type is not identical to the formal parameter. Beware of implicit conversions to "int".

It seems there are some non-ANSI compilers in which the sizeof() operator is defined to return int, yet size_t is defined as long. Needless to say, this is brain-damaged. Always use the SIZEOF() macro in place of sizeof(), so that the result is guaranteed to be of type size_t.

The JPEG library is intended to be used within larger programs. Furthermore, we want it to be reentrant so that it can be used by applications that process multiple images concurrently. The following rules support these requirements:

1. Avoid direct use of file I/O, "malloc", error report printouts, etc; pass these through the common routines provided.
2. Minimize global namespace pollution. Functions should be declared static wherever possible. (Note that our method-based calling conventions help this a lot: in many modules only the initialization function will ever need to be called directly, so only that function need be externally visible.) All global function names should begin with "jpeg_", and should have an abbreviated name (unique in the first six characters) substituted by macro when NEED_SHORT_EXTERNAL_NAMES is set.
3. Don't use global variables; anything that must be used in another module should be in the common data structures.
4. Don't use static variables except for read-only constant tables. Variables

that should be private to a module can be placed into private structures (see the system architecture document, structure.txt).

5. Source file names should begin with "j" for files that are part of the library proper; source files that are not part of the library, such as cjpeg.c and djpeg.c, do not begin with "j". Keep source file names to eight characters (plus ".c" or ".h", etc) to make life easy for MS-DOSers. Keep compression and decompression code in separate source files --- some applications may want only one half of the library.

Note: these rules (particularly #4) are not followed religiously in the modules that are used in cjpeg/djpeg but are not part of the JPEG library proper. Those modules are not really intended to be used in other applications.

Found in path(s):

```
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/coderules.txt
No license file was found, but licenses were detected in source scan.
```

```
/*
* wrppm.c
*
* Copyright (C) 1991-1996, Thomas G. Lane.
* Modified 2009 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains routines to write output images in PPM/PGM format.
* The extended 2-byte-per-sample raw PPM/PGM formats are supported.
* The PBMPLUS library is NOT required to compile this software
* (but it is highly useful as a set of PPM image manipulation programs).
*
* These routines may need modification for non-Unix environments or
* specialized applications. As they stand, they assume output to
* an ordinary stdio stream.
*/
```

Found in path(s):

```
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/wrppm.c
No license file was found, but licenses were detected in source scan.
```

```
/*
* jdcolext.c
*
* This file was part of the Independent JPEG Group's software:
```

* Copyright (C) 1991-1997, Thomas G. Lane.
* Modifications:
* Copyright (C) 2009, 2011, D. R. Commander.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains output colorspace conversion routines.
*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jdcolext.c
No license file was found, but licenses were detected in source scan.

/*

* jsimd.h

*

* Copyright 2009 Pierre Ossman <ossman@cendio.se> for Cendio AB

* Copyright 2011 D. R. Commander

*

* Based on the x86 SIMD extension for IJG JPEG library,

* Copyright (C) 1999-2006, MIYASAKA Masaru.

* For conditions of distribution and use, see copyright notice in jsimdext.inc

*

*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jsimd.h
No license file was found, but licenses were detected in source scan.

/*

* jversion.h

*

* This file was part of the Independent JPEG Group's software:

* Copyright (C) 1991-2012, Thomas G. Lane, Guido Vollbeding.

* Modifications:

* Copyright (C) 2010, 2012-2013, D. R. Commander.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains software version identification.

*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jversion.h
No license file was found, but licenses were detected in source scan.

/*

```
* jsimd_x86_64.c
*
* Copyright 2009 Pierre Ossman <ossman@cendio.se> for Cendio AB
* Copyright 2009-2011 D. R. Commander
*
* Based on the x86 SIMD extension for IJG JPEG library,
* Copyright (C) 1999-2006, MIYASAKA Masaru.
* For conditions of distribution and use, see copyright notice in jsimdext.inc
*
* This file contains the interface between the "normal" portions
* of the library and the SIMD implementations when running on a
* x86_64 architecture.
*/
```

Found in path(s):

```
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jsimd_x86_64.c
No license file was found, but licenses were detected in source scan.
```

```
/*
* jfdctflt.c
*
* Copyright (C) 1994-1996, Thomas G. Lane.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains a floating-point implementation of the
* forward DCT (Discrete Cosine Transform).
*
* This implementation should be more accurate than either of the integer
* DCT implementations. However, it may not give the same results on all
* machines because of differences in roundoff behavior. Speed will depend
* on the hardware's floating point capacity.
*
* A 2-D DCT can be done by 1-D DCT on each row followed by 1-D DCT
* on each column. Direct algorithms are also available, but they are
* much more complex and seem not to be any faster when reduced to code.
*
* This implementation is based on Arai, Agui, and Nakajima's algorithm for
* scaled DCT. Their original paper (Trans. IEICE
E-71(11):1095) is in
* Japanese, but the algorithm is described in the Pennebaker & Mitchell
* JPEG textbook (see REFERENCES section in file README). The following code
* is based directly on figure 4-8 in P&M.
* While an 8-point DCT cannot be done in less than 11 multiplies, it is
* possible to arrange the computation so that many of the multiplies are
* simple scalings of the final outputs. These multiplies can then be
* folded into the multiplications or divisions by the JPEG quantization
```

* table entries. The AA&N method leaves only 5 multiplies and 29 adds
* to be done in the DCT itself.
* The primary disadvantage of this method is that with a fixed-point
* implementation, accuracy is lost due to imprecise representation of the
* scaled quantization values. However, that problem does not arise if
* we use floating point arithmetic.
*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jfdctflt.c
No license file was found, but licenses were detected in source scan.

/*

* rdppm.c

*

* Copyright (C) 1991-1997, Thomas G. Lane.

* Modified 2009 by Bill Allombert, Guido Vollbeding.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains routines to read input images in PPM/PGM format.

* The extended 2-byte-per-sample raw PPM/PGM formats are supported.

* The PBMPLUS library is NOT required to compile this software

* (but it is highly useful as a set of PPM image manipulation programs).

*

* These routines may need modification for non-Unix environments or

* specialized applications. As they stand, they assume input from

* an ordinary stdio stream. They further assume that reading begins

* at the start of the file; start_input may need work if the

* user interface has already read some data (e.g., to determine that

* the file is indeed PPM format).

*/

/* Portions of

this code are based on the PBMPLUS library, which is:

**

** Copyright (C) 1988 by Jef Poskanzer.

**

** Permission to use, copy, modify, and distribute this software and its

** documentation for any purpose and without fee is hereby granted, provided

** that the above copyright notice appear in all copies and that both that

** copyright notice and this permission notice appear in supporting

** documentation. This software is provided "as is" without express or

** implied warranty.

*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-

UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/rdppm.c

No license file was found, but licenses were detected in source scan.

/*

* jinclude.h

*

* Copyright (C) 1991-1994, Thomas G. Lane.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file exists to provide a single place to fix any problems with

* including the wrong system include files. (Common problems are taken

* care of by the standard jconfig symbols, but on really weird systems

* you may have to edit this file.)

*

* NOTE: this file is NOT intended to be included by applications using the

* JPEG library. Most applications need only include jpeglib.h.

*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-

UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jinclude.h

No license file was found, but licenses were detected in source scan.

/*

* jcprepect.c

*

* Copyright (C) 1994-1996, Thomas G. Lane.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains the compression preprocessing controller.

* This controller manages the color conversion, downsampling,

* and edge expansion steps.

*

* Most of the complexity here is associated with buffering input rows

* as required by the downsampler. See the comments at the head of

* jcsample.c for the downsampler's needs.

*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-

UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jcprepect.c

No license file was found, but licenses were detected in source scan.

/*

* jpegtran.c

*

- * This file was part of the Independent JPEG Group's software:
- * Copyright (C) 1995-2010, Thomas G. Lane, Guido Vollbeding.
- * Modifications:
- * Copyright (C) 2010, D. R. Commander.
- * For conditions of distribution and use, see the accompanying README file.
- *
- * This file contains a command-line user interface for JPEG transcoding.
- * It is very similar to cjpeg.c, and partly to djpeg.c, but provides
- * lossless transcoding between different JPEG file formats. It also
- * provides some lossless and sort-of-lossless transformations of JPEG data.
- */

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jpegtran.c
No license file was found, but licenses were detected in source scan.

/*

- * rdjpgcom.c
- *
- * Copyright (C) 1994-1997, Thomas G. Lane.
- * Modified 2009 by Bill Allombert, Guido Vollbeding.
- * This file is part of the Independent JPEG Group's software.
- * For conditions of distribution and use, see the accompanying README file.
- *
- * This file contains a very simple stand-alone application that displays
- * the text in COM (comment) markers in a JFIF file.
- * This may be useful as an example of the minimum logic needed to parse
- * JPEG markers.
- */

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/rdjpgcom.c
No license file was found, but licenses were detected in source scan.

/*

- * jccoefct.c
- *
- * Copyright (C) 1994-1997, Thomas G. Lane.
- * This file is part of the Independent JPEG Group's software.
- * For conditions of distribution and use, see the accompanying README file.
- *
- * This file contains the coefficient buffer controller for compression.
- * This controller is the top level of the JPEG compressor proper.
- * The coefficient buffer lies between forward-DCT and entropy encoding steps.
- */

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jccoefct.c
No license file was found, but licenses were detected in source scan.

/*

* cerror.h

*

* Copyright (C) 1994-1997, Thomas G. Lane.

* Modified 2009 by Guido Vollbeding.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file defines the error and message codes for the cjpeg/djpeg

* applications. These strings are not needed as part of the JPEG library

* proper.

* Edit this file to add new codes, or to translate the message strings to

* some other language.

*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/cerror.h
No license file was found, but licenses were detected in source scan.

/*

* jidctint.c

*

* Copyright (C) 1991-1998, Thomas G. Lane.

* Modification developed 2002-2009 by Guido Vollbeding.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains a slow-but-accurate integer implementation of the

* inverse DCT (Discrete Cosine Transform). In the IJG code, this routine

* must also perform dequantization of the input coefficients.

*

* A 2-D IDCT can be done by 1-D IDCT on each column followed by 1-D IDCT

* on each row (or vice versa, but it's more convenient to emit a row at

* a time). Direct algorithms are also available, but they are much more

* complex and seem not to be any faster when reduced to code.

*

* This implementation is based on an algorithm described in

* C. Loeffler, A. Ligtenberg and G. Moschytz, "Practical Fast 1-D DCT

* Algorithms with 11 Multiplications",

Proc. Int'l. Conf. on Acoustics,

* Speech, and Signal Processing 1989 (ICASSP '89), pp. 988-991.

* The primary algorithm described there uses 11 multiplies and 29 adds.

- * We use their alternate method with 12 multiplies and 32 adds.
- * The advantage of this method is that no data path contains more than one
- * multiplication; this allows a very simple and accurate implementation in
- * scaled fixed-point arithmetic, with a minimal number of shifts.
- *
- * We also provide IDCT routines with various output sample block sizes for
- * direct resolution reduction or enlargement without additional resampling:
- * NxN (N=1...16) pixels for one 8x8 input DCT block.
- *
- * For N<8 we simply take the corresponding low-frequency coefficients of
- * the 8x8 input DCT block and apply an NxN point IDCT on the sub-block
- * to yield the downsampled outputs.
- * This can be seen as direct low-pass downsampling from the DCT domain
- * point of view rather than the usual spatial domain point of view,
- * yielding significant computational savings and results at least
- * as good as common bilinear (averaging) spatial downsampling.
- *
- * For N>8 we apply a partial NxN IDCT on the 8 input coefficients as
- * lower frequencies and higher frequencies assumed to be zero.
- * It turns out that the computational effort is similar to the 8x8 IDCT
- * regarding the output size.
- * Furthermore, the scaling and descaling is the same for all IDCT sizes.
- *
- * CAUTION: We rely on the FIX() macro except for the N=1,2,4,8 cases
- * since there would be too many additional constants to pre-calculate.
- */

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jidctint.c
 No license file was found, but licenses were detected in source scan.

/*

* jcmaint.c

*

* Copyright (C) 1994-1996, Thomas G. Lane.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains the main buffer controller for compression.

* The main buffer lies between the pre-processor and the JPEG

* compressor proper; it holds downsampled data in the JPEG colorspace.

*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jcmaint.c

No license file was found, but licenses were detected in source scan.

```
/*
 * jcmarker.c
 *
 * This file was part of the Independent JPEG Group's software:
 * Copyright (C) 1991-1998, Thomas G. Lane.
 * Modifications:
 * Copyright (C) 2010, D. R. Commander.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file contains routines to write JPEG datastream markers.
 */
```

Found in path(s):

```
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jcmarker.c
No license file was found, but licenses were detected in source scan.
```

USING THE IJG JPEG LIBRARY

This file was part of the Independent JPEG Group's software:
Copyright (C) 1994-2011, Thomas G. Lane, Guido Vollbeding.
Modifications:
Copyright (C) 2010, D. R. Commander.
For conditions of distribution and use, see the accompanying README file.

This file describes how to use the IJG JPEG library within an application program. Read it if you want to write a program that uses the library.

The file `example.c` provides heavily commented skeleton code for calling the JPEG library. Also see `jpeglib.h` (the include file to be used by application programs) for full details about data structures and function parameter lists. The library source code, of course, is the ultimate reference.

Note that there have been *major* changes from the application interface presented by IJG version 4 and earlier versions. The old design had several inherent limitations, and it had accumulated a lot of cruft as we added features while trying to minimize application-interface changes. We have sacrificed backward compatibility in the version 5 rewrite, but we think the improvements justify this.

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You should read at least the overview and basic usage sections before trying to program with the library. The sections on advanced features can be read if and when you need them.

OVERVIEW

=====

Functions provided by the library

The IJG JPEG library provides C code to read and write JPEG-compressed image files. The surrounding application program receives or supplies image data a scanline at a time, using a straightforward uncompressed image format. All details of color conversion and other preprocessing/postprocessing can be handled by the library.

The library includes a substantial amount of code that is not covered by the JPEG standard but is necessary for typical applications of JPEG. These

functions preprocess the image before JPEG compression or postprocess it after decompression. They include colorspace conversion, downsampling/upsampling, and color quantization. The application indirectly selects use of this code by specifying the format in which it wishes to supply or receive image data.

For example, if colormapped output is requested, then the decompression library automatically invokes color quantization.

A wide range of quality vs. speed tradeoffs are possible in JPEG processing, and even more so in decompression postprocessing. The decompression library provides multiple implementations that cover most of the useful tradeoffs, ranging from very-high-quality down to fast-preview operation. On the compression side we have generally not provided low-quality choices, since compression is normally less time-critical. It should be understood that the low-quality modes may not meet the JPEG standard's accuracy requirements; nonetheless, they are useful for viewers.

A word about functions *not* provided by the library. We handle a subset of the ISO JPEG standard; most baseline, extended-sequential, and progressive JPEG processes are supported. (Our subset includes all features now in common use.) Unsupported ISO options include:

- * Hierarchical storage
- * Lossless

JPEG

- * DNL marker
- * Nonintegral subsampling ratios

We support both 8- and 12-bit data precision, but this is a compile-time choice rather than a run-time choice; hence it is difficult to use both precisions in a single application.

By itself, the library handles only interchange JPEG datastreams --- in particular the widely used JFIF file format. The library can be used by surrounding code to process interchange or abbreviated JPEG datastreams that are embedded in more complex file formats. (For example, this library is used by the free LIBTIFF library to support JPEG compression in TIFF.)

Outline of typical usage

The rough outline of a JPEG compression operation is:

```
Allocate and initialize a JPEG compression object
Specify the destination for the compressed data (eg, a file)
Set parameters for compression, including image size & colorspace
jpeg_start_compress(...);
while (scan lines remain to be written)
    jpeg_write_scanlines(...);
```

```
jpeg_finish_compress(...);  
Release  
the JPEG compression object
```

A JPEG compression object holds parameters and working state for the JPEG library. We make creation/destruction of the object separate from starting or finishing compression of an image; the same object can be re-used for a series of image compression operations. This makes it easy to re-use the same parameter settings for a sequence of images. Re-use of a JPEG object also has important implications for processing abbreviated JPEG datastreams, as discussed later.

The image data to be compressed is supplied to `jpeg_write_scanlines()` from in-memory buffers. If the application is doing file-to-file compression, reading image data from the source file is the application's responsibility. The library emits compressed data by calling a "data destination manager", which typically will write the data into a file; but the application can provide its own destination manager to do something else.

Similarly, the rough outline of a JPEG decompression operation is:

```
Allocate and initialize a JPEG decompression object  
Specify the source of the compressed data (eg, a file)  
Call jpeg_read_header() to obtain image info  
Set parameters for decompression  
jpeg_start_decompress(...);  
while (scan lines remain to be read)  
    jpeg_read_scanlines(...);  
jpeg_finish_decompress(...);  
Release the JPEG decompression object
```

This is comparable to the compression outline except that reading the datastream header is a separate step. This is helpful because information about the image's size, colorspace, etc is available when the application selects decompression parameters. For example, the application can choose an output scaling ratio that will fit the image into the available screen size.

The decompression library obtains compressed data by calling a data source manager, which typically will read the data from a file; but other behaviors can be obtained with a custom source manager. Decompressed data is delivered into in-memory buffers passed to `jpeg_read_scanlines()`.

It is possible to abort an incomplete compression or decompression operation by calling `jpeg_abort()`; or, if you do not need to retain the JPEG object, simply release it by calling `jpeg_destroy()`.

JPEG compression and decompression objects are two separate struct types. However, they share some common fields, and certain routines such as `jpeg_destroy()` can work on either type of object.

The JPEG library has no static variables: all state is in the compression or decompression object. Therefore it is possible to process multiple compression and decompression operations concurrently, using multiple JPEG objects.

Both compression and decompression can be done in an incremental memory-to-memory fashion, if suitable source/destination managers are used. See the section on "I/O suspension" for more details.

BASIC LIBRARY USAGE

=====

Data formats

Before diving into procedural details, it is helpful to understand the image data format that the JPEG library expects or returns.

The standard input image format is a rectangular array of pixels, with each pixel having the same number of "component" or "sample" values (color channels). You must specify how many components there are and the colorspace interpretation of the components. Most applications will use RGB data (three components per pixel) or grayscale data (one component per pixel). PLEASE NOTE THAT RGB DATA IS THREE SAMPLES PER PIXEL, GRAYSCALE ONLY ONE. A remarkable number of people manage to miss this, only to find that their programs don't work with grayscale JPEG files.

There is no provision for colormapped input. JPEG files are always full-color or full grayscale (or sometimes another colorspace such as CMYK). You can feed in a colormapped image by expanding it to full-color format. However JPEG often doesn't work very well with source data that has been colormapped, because of dithering noise. This is discussed in more detail in the JPEG FAQ and the other references mentioned in the README file.

Pixels are stored by scanlines, with each scanline running from left to right. The component values for each pixel are adjacent in the row; for example, R,G,B,R,G,B,R,G,B,... for 24-bit RGB color. Each scanline is an array of data type JSAMPLE --- which is typically "unsigned char", unless you've changed `jmorecfg.h`. (You can also change the RGB pixel layout, say to B,G,R order, by modifying `jmorecfg.h`. But see the restrictions listed in that file before doing so.)

A 2-D array of pixels is formed by making a list of pointers to the starts of scanlines; so the scanlines need not be physically adjacent in memory. Even if you process just one scanline at a time, you must make a one-element pointer array to conform to this structure. Pointers to JSAMPLE rows are of type JSAMPROW, and the pointer to the pointer array is of type JSAMPARRAY.

The library accepts or supplies one or more complete scanlines per call.

It

is not possible to process part of a row at a time. Scanlines are always processed top-to-bottom. You can process an entire image in one call if you have it all in memory, but usually it's simplest to process one scanline at a time.

For best results, source data values should have the precision specified by BITS_IN_JSAMPLE (normally 8 bits). For instance, if you choose to compress data that's only 6 bits/channel, you should left-justify each value in a byte before passing it to the compressor. If you need to compress data that has more than 8 bits/channel, compile with BITS_IN_JSAMPLE = 12. (See "Library compile-time options", later.)

The data format returned by the decompressor is the same in all details, except that colormapped output is supported. (Again, a JPEG file is never colormapped. But you can ask the decompressor to perform on-the-fly color quantization to deliver colormapped output.) If you request colormapped output then the returned data array contains a single JSAMPLE per pixel; its value is an index into a color map. The color map is represented as a 2-D JSAMPARRAY in which each row holds the values of one color component, that is, colormap[i][j] is the value of the i'th color component for pixel value (map index) j. Note that since the colormap indexes are stored in JSAMPLEs, the maximum number of colors is limited by the size of JSAMPLE (ie, at most 256 colors for an 8-bit JPEG library).

Compression details

Here we revisit the JPEG compression outline given in the overview.

1. Allocate and initialize a JPEG compression object.

A JPEG compression object is a "struct jpeg_compress_struct". (It also has a bunch of subsidiary structures which are allocated via malloc(), but the application doesn't control those directly.) This struct can be just a local variable in the calling routine, if a single routine is going to execute the whole JPEG compression sequence. Otherwise it can be static or allocated

from malloc().

You

will also need a structure representing a JPEG error handler. The part of this that the library cares about is a "struct jpeg_error_mgr". If you are providing your own error handler, you'll typically want to embed the jpeg_error_mgr struct in a larger structure; this is discussed later under "Error handling". For now we'll assume you are just using the default error handler. The default error handler will print JPEG error/warning messages on stderr, and it will call exit() if a fatal error occurs.

You must initialize the error handler structure, store a pointer to it into the JPEG object's "err" field, and then call jpeg_create_compress() to initialize the rest of the JPEG object.

Typical code for this step, if you are using the default error handler, is

```
struct jpeg_compress_struct cinfo;
struct jpeg_error_mgr jerr;
...
cinfo.err = jpeg_std_error(&jerr);
jpeg_create_compress(&cinfo);
```

jpeg_create_compress allocates a small amount of memory, so it could fail if

you are out of memory. In that case it will exit via the error handler; that's why the error handler must be initialized first.

2. Specify the destination for the compressed data (eg, a file).

As previously mentioned, the JPEG library delivers compressed data to a "data destination" module. The library includes one data destination module which knows how to write to a stdio stream. You can use your own destination module if you want to do something else, as discussed later.

If you use the standard destination module, you must open the target stdio stream beforehand. Typical code for this step looks like:

```
FILE * outfile;
...
if ((outfile = fopen(filename, "wb")) == NULL) {
    fprintf(stderr, "can't open %s\n", filename);
    exit(1);
}
jpeg_stdio_dest(&cinfo, outfile);
```

where the last line invokes the standard destination module.

WARNING: it is critical that the binary compressed data be delivered to the output file unchanged. On non-Unix systems the stdio library may perform newline translation or otherwise corrupt binary data. To suppress this behavior, you may need to use a "b" option to fopen (as shown above), or use setmode() or another routine to put the stdio stream in binary mode. See cjpeg.c and djpeg.c for code that has been found to work on many systems.

You can select the data destination after setting other parameters (step 3), if that's more convenient. You may not change the destination between calling jpeg_start_compress() and jpeg_finish_compress().

3. Set parameters for compression, including image size & colorspace.

You must supply information about the source image by setting the following fields in the JPEG object (cinfo structure):

image_width Width of image, in pixels
image_height Height of image, in pixels
input_components Number of color channels (samples per pixel)
in_color_space Color space of source image

The image dimensions are, hopefully, obvious. JPEG supports image dimensions of 1 to 64K pixels in either direction. The input color space is typically RGB or grayscale, and input_components is 3 or 1 accordingly. (See "Special color spaces", later, for more info.) The in_color_space field must be assigned one of the J_COLOR_SPACE enum constants, typically JCS_RGB or JCS_GRAYSCALE.

JPEG has a large number of compression parameters that determine how the image is encoded. Most applications don't need or want to know about all these parameters. You can set all the parameters to reasonable defaults by calling jpeg_set_defaults(); then, if there are particular values you want to change, you can do so after that. The "Compression parameter selection" section tells about all the parameters.

You must set in_color_space correctly before calling jpeg_set_defaults(), because the defaults depend on the source image colorspace. However the other three source image parameters need not be valid until you call jpeg_start_compress(). There's no harm in calling jpeg_set_defaults() more than once, if that happens to be convenient.

Typical code for a 24-bit RGB source image is

```
cinfo.image_width = Width; /* image width and height, in pixels */
cinfo.image_height = Height;
cinfo.input_components = 3; /* # of color components per pixel */
cinfo.in_color_space = JCS_RGB; /* colorspace of input image */

jpeg_set_defaults(&cinfo);
/* Make optional parameter settings here */
```

4. `jpeg_start_compress(...)`;

After you have established the data destination and set all the necessary source image info and other parameters, call `jpeg_start_compress()` to begin a compression cycle. This will initialize internal state, allocate working storage, and emit the first few bytes of the JPEG datastream header.

Typical code:

```
jpeg_start_compress(&cinfo, TRUE);
```

The "TRUE" parameter ensures that a complete JPEG interchange datastream will be written. This is appropriate in most cases. If you think you might want to use an abbreviated datastream, read the section on abbreviated datastreams, below.

Once you have called `jpeg_start_compress()`, you may not alter any JPEG parameters or other fields of the JPEG object until you have completed the compression cycle.

5. while (scan lines remain to be written)
`jpeg_write_scanlines(...)`;

Now write all the required image data by calling `jpeg_write_scanlines()` one or more times. You can pass one or more scanlines in each call, up to the total image height. In most applications it is convenient to pass just one or a few scanlines at a time. The expected format for the passed data is discussed under "Data formats", above.

Image data should be written in top-to-bottom scanline order. The JPEG spec contains some weasel wording about how top and bottom are application-defined terms (a curious interpretation of the English language...) but if you want your files to be compatible with everyone else's, you WILL use top-to-bottom order. If the source data must be read in bottom-to-top order, you can use the JPEG library's

virtual array mechanism to invert the data efficiently.

Examples of this can be found in the sample application `cjpeg`.

The library maintains a count of the number of scanlines written so far in the `next_scanline` field of the JPEG object. Usually you can just use this variable as the loop counter, so that the loop test looks like `"while (cinfo.next_scanline < cinfo.image_height)"`.

Code for this step depends heavily on the way that you store the source data. `example.c` shows the following code for the case of a full-size 2-D source array containing 3-byte RGB pixels:

```
JSAMPROW row_pointer[1]; /* pointer to a single row */
int row_stride; /* physical row width in buffer */

row_stride = image_width * 3; /* JSAMPLEs per row in image_buffer */

while (cinfo.next_scanline < cinfo.image_height) {
    row_pointer[0] = & image_buffer[cinfo.next_scanline * row_stride];
    jpeg_write_scanlines(&cinfo, row_pointer, 1);
}
```

`jpeg_write_scanlines()` returns the number of scanlines actually written.

This will normally be equal to the number passed in, so you can usually ignore the return value. It is different in just two cases:

- * If you try to write more scanlines than the declared image height, the additional scanlines are ignored.
- * If you use a suspending data destination manager, output buffer overrun will cause the compressor to return before accepting all the passed lines. This feature is discussed under "I/O suspension", below. The normal `stdio` destination manager will NOT cause this to happen.

In any case, the return value is the same as the change in the value of `next_scanline`.

6. `jpeg_finish_compress(...)`;

After all the image data has been written, call `jpeg_finish_compress()` to complete the compression cycle. This step is **ESSENTIAL** to ensure that the last bufferload of data is written to the data destination.

`jpeg_finish_compress()` also releases working memory associated with the JPEG object.

Typical code:

```
jpeg_finish_compress(&cinfo);
```

If

using the stdio destination manager, don't forget to close the output stdio stream (if necessary) afterwards.

If you have requested a multi-pass operating mode, such as Huffman code optimization, `jpeg_finish_compress()` will perform the additional passes using data buffered by the first pass. In this case `jpeg_finish_compress()` may take quite a while to complete. With the default compression parameters, this will not happen.

It is an error to call `jpeg_finish_compress()` before writing the necessary total number of scanlines. If you wish to abort compression, call `jpeg_abort()` as discussed below.

After completing a compression cycle, you may dispose of the JPEG object as discussed next, or you may use it to compress another image. In that case return to step 2, 3, or 4 as appropriate. If you do not change the destination manager, the new datastream will be written to the same target. If you do not change any JPEG parameters, the new datastream will be written with the same parameters as before. Note that you can change the input image dimensions freely between cycles, but if you change the input colorspace, you should call `jpeg_set_defaults()` to adjust for the new colorspace; and then you'll need to repeat all of step 3.

7. Release the JPEG compression object.

When you are done with a JPEG compression object, destroy it by calling `jpeg_destroy_compress()`. This will free all subsidiary memory (regardless of the previous state of the object). Or you can call `jpeg_destroy()`, which works for either compression or decompression objects --- this may be more convenient if you are sharing code between compression and decompression cases. (Actually, these routines are equivalent except for the declared type of the passed pointer. To avoid gripes from ANSI C compilers, `jpeg_destroy()` should be passed a `j_common_ptr`.)

If you allocated the `jpeg_compress_struct` structure from `malloc()`, freeing it is your responsibility --- `jpeg_destroy()` won't. Ditto for the error handler structure.

Typical code:

```
jpeg_destroy_compress(&cinfo);
```

8. Aborting.

If you decide to abort a compression cycle before finishing, you can clean up in either of two ways:

* If you don't need the JPEG object any more, just call `jpeg_destroy_compress()` or `jpeg_destroy()` to release memory. This is legitimate at any point after calling `jpeg_create_compress()` --- in fact, it's safe even if `jpeg_create_compress()` fails.

* If you want to re-use the JPEG object, call `jpeg_abort_compress()`, or call `jpeg_abort()` which works on both compression and decompression objects. This will return the object to an idle state, releasing any working memory. `jpeg_abort()` is allowed at any time after successful object creation.

Note that cleaning up the data destination, if required, is your responsibility; neither of these routines will call `term_destination()`. (See "Compressed data handling", below, for more about that.)

`jpeg_destroy()` and `jpeg_abort()` are the only safe calls to make on a JPEG object that has reported an error by calling `error_exit` (see "Error handling" for more info). The internal state of such an object is likely to be out of whack. Either of these two routines will return the object to a known state.

Decompression details

Here we revisit the JPEG decompression outline given in the overview.

1. Allocate and initialize a JPEG decompression object.

This is just like initialization for compression, as discussed above, except that the object is a "struct `jpeg_decompress_struct`" and you call `jpeg_create_decompress()`. Error handling is exactly the same.

Typical code:

```
struct jpeg_decompress_struct cinfo;
struct jpeg_error_mgr jerr;
...
cinfo.err = jpeg_std_error(&jerr);
jpeg_create_decompress(&cinfo);
```

(Both here and in the IJG code, we usually use variable name "cinfo" for both compression and decompression objects.)

2. Specify the source of the compressed data (eg, a file).

As previously mentioned, the JPEG library reads compressed data from a "data source" module. The library includes one data source module which knows how to read from a stdio stream. You can use your own source module if you want to do something else, as discussed later.

If you use the standard source module, you must open the source stdio stream beforehand. Typical code for this step looks like:

```
FILE * infile;
...
if ((infile = fopen(filename, "rb")) == NULL) {
    fprintf(stderr, "can't open %s\n", filename);
    exit(1);
}
jpeg_stdio_src(&cinfo, infile);
```

where the last line invokes the standard source module.

WARNING: it is critical that the binary compressed data be read unchanged. On non-Unix systems the stdio library may perform newline translation or otherwise corrupt binary data. To suppress this behavior, you may need to use a "b" option to fopen (as shown above), or use setmode() or another routine to put the stdio stream in binary mode. See cjpeg.c and djpeg.c for code that has been found to work on many systems.

You may not change the data source between calling jpeg_read_header() and jpeg_finish_decompress(). If you wish to read a series of JPEG images from a single source file, you should repeat the jpeg_read_header() to jpeg_finish_decompress() sequence without reinitializing either the JPEG object or the data source module; this prevents buffered input data from being discarded.

3. Call jpeg_read_header() to obtain image info.

Typical code for this step is just

```
jpeg_read_header(&cinfo, TRUE);
```

This will read the source datastream header markers, up to the beginning of the compressed data proper. On return, the image dimensions and other info have been stored in the JPEG object. The application may wish to consult this information before selecting decompression parameters.

More complex code is necessary if

- * A suspending data source is used --- in that case `jpeg_read_header()` may return before it has read all the header data. See "I/O suspension", below. The normal stdio source manager will NOT cause this to happen.
- * Abbreviated JPEG files are to be processed --- see the section on abbreviated datastreams. Standard applications that deal only in interchange JPEG files need not be concerned with this case either.

It is permissible to stop at this point if you just wanted to find out the image dimensions and other header info for a JPEG file. In that case, call `jpeg_destroy()` when you are done with the JPEG object, or call `jpeg_abort()` to return it to an idle state before selecting a new data source and reading another header.

4. Set parameters for decompression.

`jpeg_read_header()` sets appropriate default decompression parameters based on the properties of the image (in particular, its colorspace). However, you may well want to alter these defaults before beginning the decompression. For example, the default is to produce full color output from a color file. If you want colormapped output you must ask for it. Other options allow the returned image to be scaled and allow various speed/quality tradeoffs to be selected. "Decompression parameter selection", below, gives details.

If the defaults are appropriate, nothing need be done at this step.

Note that all default values are set by each call to `jpeg_read_header()`. If you reuse a decompression object, you cannot expect your parameter settings to be preserved across cycles, as you can for compression. You must set desired parameter values each time.

5. `jpeg_start_decompress(...)`;

Once the parameter values are satisfactory, call `jpeg_start_decompress()` to begin decompression. This will initialize internal state, allocate working memory, and prepare for returning data.

Typical code is just

```
jpeg_start_decompress(&cinfo);
```

If you have requested a multi-pass operating mode, such as 2-pass color quantization, `jpeg_start_decompress()` will do everything needed before data output can begin. In this case `jpeg_start_decompress()` may take quite a while to complete. With a single-scan (non progressive) JPEG file and default

decompression parameters, this will not happen; `jpeg_start_decompress()` will return quickly.

After this call, the final output image dimensions, including any requested scaling, are available in the JPEG object; so is the selected colormap, if colormapped output has been requested. Useful fields include

`output_width` image width and height, as scaled
`output_height`
`out_color_components` # of color components in `out_color_space`
`output_components` # of color components returned per pixel
`colormap` the selected colormap, if any
`actual_number_of_colors` number of entries in colormap

`output_components` is 1 (a colormap index) when quantizing colors; otherwise it equals `out_color_components`. It is the number of JSAMPLE values that will be emitted per pixel in the output arrays.

Typically you will need to allocate data buffers to hold the incoming image. You will need `output_width * output_components` JSAMPLEs per scanline in your output buffer, and a total of `output_height` scanlines will be returned.

Note: if you are using the JPEG library's internal memory manager to allocate data buffers (as `djpeg` does), then the manager's protocol requires that you request large buffers *before* calling `jpeg_start_decompress()`. This is a little tricky since the `output_XXX` fields are not normally valid then. You can make them valid by calling `jpeg_calc_output_dimensions()` after setting the relevant parameters (scaling, output color space, and quantization flag).

```
6. while (scan lines remain to be read)
   jpeg_read_scanlines(...);
```

Now you can read the decompressed image data by calling `jpeg_read_scanlines()` one or more times. At each call, you pass in the maximum number of scanlines to be read (ie, the height of your working buffer); `jpeg_read_scanlines()` will return up to that many lines. The return value is the number of lines actually read. The format of the returned data is discussed under "Data formats", above. Don't forget that grayscale and color JPEGs will return different data formats!

Image data is returned in top-to-bottom scanline order. If you must write out the image in bottom-to-top order, you can use the JPEG library's virtual array mechanism to invert the data efficiently. Examples of this can be found in the sample application `djpeg`.

The library maintains a count of the number of scanlines returned so far in the `output_scanline` field of the JPEG object. Usually you can just use this variable as the loop counter, so that the loop test looks like "while (`cinfo.output_scanline < cinfo.output_height`)". (Note that the test should NOT be against `image_height`, unless you never use scaling. The `image_height` field is the height of the original unscaled image.) The return value always equals the change in the value of `output_scanline`.

If you don't use a suspending data source, it is safe to assume that `jpeg_read_scanlines()` reads at least one scanline per call, until the bottom of the image has been reached.

If you use a buffer larger than one scanline, it is NOT safe to assume that `jpeg_read_scanlines()` fills it. (The current implementation returns only a few scanlines per call, no matter how large a buffer you pass.) So you must always provide a loop that calls `jpeg_read_scanlines()` repeatedly until the whole image has been read.

7. `jpeg_finish_decompress(...)`;

After all the image data has been read, call `jpeg_finish_decompress()` to complete the decompression cycle. This causes working memory associated with the JPEG object to be released.

Typical code:

```
jpeg_finish_decompress(&cinfo);
```

If using the `stdio` source manager, don't forget to close the source `stdio` stream if necessary.

It is an error to call `jpeg_finish_decompress()` before reading the correct total number of scanlines. If you wish to abort decompression, call `jpeg_abort()` as discussed below.

After completing a decompression cycle, you may dispose of the JPEG object as discussed next, or you may use it to decompress another image. In that case return to step 2 or 3 as appropriate. If you do not change the source manager, the next image will be read from the same source.

8. Release the JPEG decompression object.

When you are done with a JPEG decompression object, destroy it by calling `jpeg_destroy_decompress()` or `jpeg_destroy()`. The previous discussion of

destroying compression objects applies here too.

Typical code:

```
jpeg_destroy_decompress(&cinfo);
```

9. Aborting.

You can abort a decompression cycle by calling `jpeg_destroy_decompress()` or `jpeg_destroy()` if you don't need the JPEG object any more, or `jpeg_abort_decompress()` or `jpeg_abort()` if you want to reuse the object. The previous discussion of aborting compression cycles applies here too.

Mechanics of usage: include files, linking, etc

Applications using the JPEG library should include the header file `jpeglib.h` to obtain

declarations of data types and routines. Before including `jpeglib.h`, include system headers that define at least the typedefs `FILE` and `size_t`. On ANSI-conforming systems, including `<stdio.h>` is sufficient; on older Unix systems, you may need `<sys/types.h>` to define `size_t`.

If the application needs to refer to individual JPEG library error codes, also include `jerror.h` to define those symbols.

`jpeglib.h` indirectly includes the files `jconfig.h` and `jmorecfg.h`. If you are installing the JPEG header files in a system directory, you will want to install all four files: `jpeglib.h`, `jerror.h`, `jconfig.h`, `jmorecfg.h`.

The most convenient way to include the JPEG code into your executable program is to prepare a library file ("`libjpeg.a`", or a corresponding name on non-Unix machines) and reference it at your link step. If you use only half of the library (only compression or only decompression), only that much code will be included from the library, unless your linker is hopelessly brain-damaged.

The supplied makefiles build `libjpeg.a` automatically (see `install.txt`).

While you can build the JPEG library as a shared library if the whim strikes you, we don't really recommend it. The trouble with shared libraries is that at some point you'll probably try to substitute a new version of the library without recompiling the calling applications. That generally doesn't work because the parameter struct declarations usually change with each new version. In other words, the library's API is **not** guaranteed binary compatible across versions; we only try to ensure source-code compatibility. (In hindsight, it might have been smarter to hide the parameter structs from

applications and introduce a ton of access functions instead. Too late now, however.)

On some systems your application may need to set up a signal handler to ensure that temporary files are deleted if the program is interrupted. This is most critical if you are on MS-DOS and use the `jmemdos.c` memory manager back end; it

will try to grab extended memory for temp files, and that space will NOT be freed automatically. See `cjpeg.c` or `djpeg.c` for an example signal handler.

It may be worth pointing out that the core JPEG library does not actually require the stdio library: only the default source/destination managers and error handler need it. You can use the library in a stdio-less environment if you replace those modules and use `jmemnobs.c` (or another memory manager of your own devising). More info about the minimum system library requirements may be found in `jinclude.h`.

ADVANCED FEATURES

=====

Compression parameter selection

This section describes all the optional parameters you can set for JPEG compression, as well as the "helper" routines provided to assist in this task. Proper setting of some parameters requires detailed understanding of the JPEG standard; if you don't know what a parameter is for, it's best not to mess with it! See REFERENCES in the README file for pointers to more info about JPEG.

It's a good idea to call `jpeg_set_defaults()` first, even if you plan to set all the parameters; that way your code is more likely to work with future JPEG libraries that have additional parameters. For the same reason, we recommend you use a helper routine where one is provided, in preference to twiddling `cinfo` fields directly.

The helper routines are:

`jpeg_set_defaults(j_compress_ptr cinfo)`

This routine sets all JPEG parameters to reasonable defaults, using only the input image's color space (field `in_color_space`, which must already be set in `cinfo`). Many applications will only need to use this routine and perhaps `jpeg_set_quality()`.

`jpeg_set_colorspace(j_compress_ptr cinfo, J_COLOR_SPACE colorspace)`

Sets the JPEG file's colorspace (field `jpeg_color_space`) as specified,

and sets other color-space-dependent parameters appropriately. See "Special color spaces", below, before using this. A large number of parameters, including all per-component parameters, are set by this routine; if you want to twiddle individual parameters you should call `jpeg_set_colorspace()` before rather than after.

`jpeg_default_colorspace (j_compress_ptr cinfo)`

Selects an appropriate JPEG colorspace based on `cinfo->in_color_space`, and calls `jpeg_set_colorspace()`. This is actually a subroutine of `jpeg_set_defaults()`. It's broken out in case you want to change just the colorspace-dependent JPEG parameters.

`jpeg_set_quality (j_compress_ptr cinfo, int quality, boolean force_baseline)`

Constructs JPEG quantization tables appropriate for the indicated quality setting. The quality value is expressed on the 0..100 scale recommended by IJG (cjpeg's "-quality" switch uses this routine). Note that the exact mapping from quality values to tables may change in future IJG releases as more is learned about DCT quantization. If the `force_baseline` parameter is TRUE, then the quantization table entries are constrained to the range 1..255 for full JPEG baseline compatibility. In the current implementation, this only makes a difference for quality settings below 25, and it effectively prevents very small/low quality files from being generated. The IJG decoder is capable of reading the non-baseline files generated at low quality settings when `force_baseline` is FALSE, but other decoders may not be.

`jpeg_set_linear_quality (j_compress_ptr cinfo, int scale_factor, boolean force_baseline)`

Same as `jpeg_set_quality()` except that the generated tables are the sample tables given in the JPEG spec section K.1, multiplied by the specified scale factor (which is expressed as a percentage; thus `scale_factor = 100` reproduces the spec's tables). Note that larger scale factors give lower quality. This entry point is useful for conforming to the Adobe PostScript DCT conventions, but we do not recommend linear scaling as a user-visible quality scale otherwise. `force_baseline` again constrains the computed table entries to 1..255.

`int jpeg_quality_scaling (int quality)`

Converts a value on the IJG-recommended quality scale to a linear scaling percentage. Note that this routine may change or go away in future releases --- IJG may choose to adopt a scaling method that can't be expressed as a simple scalar multiplier, in which case the premise of this routine collapses. Caveat user.

`jpeg_default_qtables (j_compress_ptr cinfo, boolean force_baseline)`

[libjpeg v7+ API/ABI emulation only]

Set default quantization tables with linear `q_scale_factor[]` values (see below).

```
jpeg_add_quant_table (j_compress_ptr cinfo, int which_tbl,  
    const unsigned int *basic_table,  
    int scale_factor, boolean force_baseline)
```

Allows an arbitrary quantization table to be created. `which_tbl` indicates which table slot to fill. `basic_table` points to an array of 64 unsigned ints given in normal array order. These values are multiplied by `scale_factor/100` and then clamped to the range 1..65535

(or to 1..255 if `force_baseline` is TRUE).

CAUTION: prior to library version 6a, `jpeg_add_quant_table` expected the basic table to be given in JPEG zigzag order. If you need to write code that works with either older or newer versions of this routine, you must check the library version number. Something like `"#if JPEG_LIB_VERSION >= 61"` is the right test.

```
jpeg_simple_progression (j_compress_ptr cinfo)
```

Generates a default scan script for writing a progressive-JPEG file.

This is the recommended method of creating a progressive file, unless you want to make a custom scan sequence. You must ensure that the JPEG color space is set correctly before calling this routine.

Compression parameters (cinfo fields) include:

```
J_DCT_METHOD dct_method
```

Selects the algorithm used for the DCT step. Choices are:

JDCT_ISLOW: slow but accurate integer algorithm

JDCT_IFAST: faster, less accurate integer method

JDCT_FLOAT: floating-point method

JDCT_DEFAULT: default method (normally

JDCT_ISLOW)

JDCT_FASTEST: fastest method (normally JDCT_IFAST)

The FLOAT method is very slightly more accurate than the ISLOW method, but may give different results on different machines due to varying roundoff behavior. The integer methods should give the same results on all machines. On machines with sufficiently fast FP hardware, the floating-point method may also be the fastest. The IFAST method is considerably less accurate than the other two; its use is not recommended if high quality is a concern. JDCT_DEFAULT and JDCT_FASTEST are macros configurable by each installation.

```
J_COLOR_SPACE jpeg_color_space
```

```
int num_components
```

The JPEG color space and corresponding number of components; see

"Special color spaces", below, for more info. We recommend using `jpeg_set_color_space()` if you want to change these.

boolean `optimize_coding`

TRUE causes the compressor to compute optimal Huffman coding tables for the image. This requires an extra pass over the data and therefore costs a good deal of space and time. The default is FALSE, which tells the compressor to use the supplied or default Huffman tables. In most cases optimal tables save only a few percent of file size compared to the default tables. Note that when this is TRUE, you need not supply Huffman tables at all, and any you do supply will be overwritten.

unsigned int `restart_interval`

int `restart_in_rows`

To emit restart markers in the JPEG file, set one of these nonzero. Set `restart_interval` to specify the exact interval in MCU blocks. Set `restart_in_rows` to specify the interval in MCU rows. (If `restart_in_rows` is not 0, then `restart_interval` is set after the image width in MCUs is computed.) Defaults are zero (no restarts). One restart marker per MCU row is often a good choice. NOTE: the overhead of restart markers is higher in grayscale JPEG files than in color files, and MUCH higher in progressive JPEGs. If you use restarts, you may want to use larger intervals in those cases.

const `jpeg_scan_info` * `scan_info`

int `num_scans`

By default, `scan_info` is NULL; this causes the compressor to write a single-scan sequential JPEG file. If not NULL, `scan_info` points to an array of scan definition records of length `num_scans`. The compressor will then write a JPEG file having one scan for each scan definition record. This is used to generate noninterleaved or progressive JPEG files. The library checks that the scan array defines a valid JPEG scan sequence. (`jpeg_simple_progression` creates a suitable scan definition array for progressive JPEG.) This is discussed further under "Progressive JPEG support".

int `smoothing_factor`

If non-zero, the input image is smoothed; the value should be 1 for minimal smoothing to 100 for maximum smoothing. Consult `jcsample.c` for details of the smoothing algorithm. The default is zero.

boolean `write_JFIF_header`

If TRUE, a JFIF APP0 marker is emitted. `jpeg_set_defaults()` and `jpeg_set_colorspace()` set this

TRUE if a JFIF-legal JPEG color space
(ie, YCbCr or grayscale) is selected, otherwise FALSE.

UINT8 JFIF_major_version

UINT8 JFIF_minor_version

The version number to be written into the JFIF marker.

jpeg_set_defaults() initializes the version to 1.01 (major=minor=1).

You should set it to 1.02 (major=1, minor=2) if you plan to write
any JFIF 1.02 extension markers.

UINT8 density_unit

UINT16 X_density

UINT16 Y_density

The resolution information to be written into the JFIF marker;

not used otherwise. density_unit may be 0 for unknown,

1 for dots/inch, or 2 for dots/cm. The default values are 0,1,1
indicating square pixels of unknown size.

boolean write_Adobe_marker

If TRUE, an Adobe APP14 marker is emitted. jpeg_set_defaults() and
jpeg_set_colorspace() set this TRUE if JPEG color space RGB, CMYK,
or YCCK is selected, otherwise FALSE. It is generally a bad idea
to set both write_JFIF_header and write_Adobe_marker. In fact,
you probably shouldn't change the default settings

at all --- the

default behavior ensures that the JPEG file's color space can be
recognized by the decoder.

JQUANT_TBL * quant_tbl_ptrs[NUM_QUANT_TBLS]

Pointers to coefficient quantization tables, one per table slot,

or NULL if no table is defined for a slot. Usually these should

be set via one of the above helper routines; jpeg_add_quant_table()

is general enough to define any quantization table. The other

routines will set up table slot 0 for luminance quality and table

slot 1 for chrominance.

int q_scale_factor[NUM_QUANT_TBLS]

[libjpeg v7+ API/ABI emulation only]

Linear quantization scaling factors (0-100, default 100)

for use with jpeg_default_qtables().

See rdswitch.c and cjpeg.c for an example of usage.

Note that the q_scale_factor[] values use "linear" scales, so JPEG

quality levels chosen by the user must be converted to these scales

using jpeg_quality_scaling(). Here is an example that corresponds to

cjpeg -quality 90,70:

```
jpeg_set_defaults(cinfo);
```

```

/*
Set luminance quality 90. */
cinfo->q_scale_factor[0] = jpeg_quality_scaling(90);
/* Set chrominance quality 70. */
cinfo->q_scale_factor[1] = jpeg_quality_scaling(70);

jpeg_default_qtables(cinfo, force_baseline);

```

CAUTION: Setting separate quality levels for chrominance and luminance is mainly only useful if chrominance subsampling is disabled. 2x2 chrominance subsampling (AKA "4:2:0") is the default, but you can explicitly disable subsampling as follows:

```

cinfo->comp_info[0].v_samp_factor = 1;
cinfo->comp_info[0].h_samp_factor = 1;

```

```

JHUFF_TBL * dc_huff_tbl_ptrs[NUM_HUFF_TBLS]
JHUFF_TBL * ac_huff_tbl_ptrs[NUM_HUFF_TBLS]

```

Pointers to Huffman coding tables, one per table slot, or NULL if no table is defined for a slot. Slots 0 and 1 are filled with the JPEG sample tables by `jpeg_set_defaults()`. If you need to allocate more table structures, `jpeg_alloc_huff_table()` may be used. Note that optimal Huffman tables can be computed for an image by setting `optimize_coding`, as discussed above; there's seldom any need to mess with providing your own Huffman tables.

[libjpeg v7+ API/ABI emulation only]

The actual dimensions of the JPEG image that will be written to the file are given by the following fields. These are computed from the input image dimensions and the compression parameters by `jpeg_start_compress()`. You can also call `jpeg_calc_jpeg_dimensions()` to obtain the values that will result from the current parameter settings. This can be useful if you are trying to pick a scaling ratio that will get close to a desired target size.

```

JDIMENSION jpeg_width Actual dimensions of output image.
JDIMENSION jpeg_height

```

Per-component parameters are stored in the struct `cinfo.comp_info[i]` for component number `i`. Note that components here refer to components of the JPEG color space, *not* the source image color space. A suitably large `comp_info[]` array is allocated by `jpeg_set_defaults()`; if you choose not to use that routine, it's up to you to allocate the array.

```

int component_id

```


The one-byte identifier code to be recorded in the JPEG file for this component. For the standard color spaces, we recommend you leave the default values alone.

int h_samp_factor

int v_samp_factor

Horizontal and vertical sampling factors for the component; must be 1..4 according to the JPEG standard. Note that larger sampling factors indicate a higher-resolution component; many people find this behavior quite unintuitive. The default values are 2,2 for luminance components and 1,1 for chrominance components, except for grayscale where 1,1 is used.

int quant_tbl_no

Quantization table number for component. The default value is 0 for luminance components and 1 for chrominance components.

int dc_tbl_no

int ac_tbl_no

DC and AC entropy coding table numbers. The default values are 0 for luminance components and 1 for chrominance components.

int component_index

Must equal the component's index in comp_info[]. (Beginning in release v6, the compressor library will fill this in automatically; you don't have to.)

Decompression parameter selection

Decompression parameter selection is somewhat simpler than compression parameter selection, since all of the JPEG internal parameters are recorded in the source file and need not be supplied by the application. (Unless you are working with abbreviated files, in which case see "Abbreviated datastreams", below.) Decompression parameters control the postprocessing done on the image to deliver it in a format suitable for the application's use. Many of the parameters control speed/quality tradeoffs, in which faster decompression may be obtained at the price of a poorer-quality image. The defaults select the highest quality (slowest) processing.

The following fields in the JPEG object are set by jpeg_read_header() and may be useful to the application in choosing decompression parameters:

JDIMENSION image_width Width and height of

image
JDIMENSION image_height
int num_components Number of color components
J_COLOR_SPACE jpeg_color_space Colorspace of image
boolean saw_JFIF_marker TRUE if a JFIF APP0 marker was seen
UINT8 JFIF_major_version Version information from JFIF marker
UINT8 JFIF_minor_version
UINT8 density_unit Resolution data from JFIF marker
UINT16 X_density
UINT16 Y_density
boolean saw_Adobe_marker TRUE if an Adobe APP14 marker was seen
UINT8 Adobe_transform Color transform code from Adobe marker

The JPEG color space, unfortunately, is something of a guess since the JPEG standard proper does not provide a way to record it. In practice most files adhere to the JFIF or Adobe conventions, and the decoder will recognize these correctly. See "Special color spaces", below, for more info.

The decompression parameters that determine the basic properties of the returned image are:

J_COLOR_SPACE out_color_space
Output color space. jpeg_read_header() sets an appropriate default based on jpeg_color_space; typically it will be RGB or grayscale. The application can change this field to request output in a different colorspace. For example, set it to JCS_GRAYSCALE to get grayscale output from a color file. (This is useful for previewing: grayscale output is faster than full color since the color components need not be processed.) Note that not all possible color space transforms are currently implemented; you may need to extend jdcolor.c if you want an unusual conversion.

unsigned int scale_num, scale_denom
Scale the image by the fraction scale_num/scale_denom. Default is 1/1, or no scaling. Currently, the only supported scaling ratios are M/8 with all M from 1 to 16, or any reduced fraction thereof (such as 1/2, 3/4, etc.) (The library design allows for arbitrary scaling ratios but this is not likely to be implemented any time soon.) Smaller scaling ratios permit significantly faster decoding since fewer pixels need be processed and a simpler IDCT method can be used.

boolean quantize_colors
If set TRUE, colormapped output will be delivered. Default is FALSE, meaning that full-color output will be delivered.

The next three parameters are relevant only if `quantize_colors` is `TRUE`.

`int desired_number_of_colors`

Maximum number of colors to use in generating a library-supplied color map (the actual number of colors is returned in a different field).

Default 256. Ignored when the application supplies its own color map.

`boolean two_pass_quantize`

If `TRUE`, an extra pass over the image is made to select a custom color map for the image. This usually looks a lot better than the one-size-fits-all colormap that is used otherwise. Default is `TRUE`. Ignored when the application supplies its own color map.

`J_DITHER_MODE dither_mode`

Selects color dithering method. Supported values are:

`JDITHER_NONE` no dithering: fast, very low quality

`JDITHER_ORDERED` ordered dither: moderate speed and quality

`JDITHER_FS` Floyd-Steinberg

dither: slow, high quality

Default is `JDITHER_FS`. (At present, ordered dither is implemented only in the single-pass, standard-colormap case. If you ask for ordered dither when `two_pass_quantize` is `TRUE` or when you supply an external color map, you'll get F-S dithering.)

When `quantize_colors` is `TRUE`, the target color map is described by the next two fields. `colormap` is set to `NULL` by `jpeg_read_header()`. The application can supply a color map by setting `colormap` non-`NULL` and setting `actual_number_of_colors` to the map size. Otherwise, `jpeg_start_decompress()` selects a suitable color map and sets these two fields itself.

[Implementation restriction: at present, an externally supplied colormap is only accepted for 3-component output color spaces.]

`JSAMPARRAY colormap`

The color map, represented as a 2-D pixel array of `out_color_components` rows and `actual_number_of_colors` columns. Ignored if not quantizing.

CAUTION: if the JPEG library creates its own colormap, the storage pointed

to by this field is released by `jpeg_finish_decompress()`.

Copy the colormap somewhere else first, if you want to save it.

`int actual_number_of_colors`

The number of colors in the color map.

Additional decompression parameters that the application may set include:

`J_DCT_METHOD dct_method`

Selects the algorithm used for the DCT step. Choices are the same as described above for compression.

boolean do_fancy_upsampling

If TRUE, do careful upsampling of chroma components. If FALSE, a faster but sloppier method is used. Default is TRUE. The visual impact of the sloppier method is often very small.

boolean do_block_smoothing

If TRUE, interblock smoothing is applied in early stages of decoding progressive JPEG files; if FALSE, not. Default is TRUE. Early progression stages look "fuzzy" with smoothing, "blocky" without. In any case, block smoothing ceases to be applied after the first few AC coefficients are known to full accuracy, so it is relevant only when using buffered-image mode for progressive images.

boolean enable_1pass_quant

boolean enable_external_quant

boolean enable_2pass_quant

These are significant only in buffered-image mode, which is described in its own section below.

The output image dimensions are given by the following fields. These are computed from the source image dimensions and the decompression parameters by `jpeg_start_decompress()`. You can also call `jpeg_calc_output_dimensions()` to obtain the values that will result from the current parameter settings. This can be useful if you are trying to pick a scaling ratio that will get close to a desired target size. It's also important if you are using the JPEG library's memory manager to allocate output buffer space, because you are supposed to request such buffers **before** `jpeg_start_decompress()`.

JDIMENSION output_width Actual dimensions of output image.

JDIMENSION output_height

int out_color_components Number of color components in out_color_space.

int output_components Number of color components returned.

int rec_outbuf_height Recommended height of scanline buffer.

When quantizing colors, `output_components` is 1, indicating a single color map index per pixel. Otherwise it equals `out_color_components`. The output arrays are required to be `output_width * output_components` JSAMPLEs wide.

`rec_outbuf_height` is the recommended minimum height (in scanlines) of the buffer passed to `jpeg_read_scanlines()`. If the buffer is smaller, the library will still work, but time will be wasted due to unnecessary data copying. In high-quality modes, `rec_outbuf_height` is always 1, but some faster, lower-quality modes set it to larger values (typically 2 to 4).

If you are going to ask for a high-speed processing mode, you may as well

go to the trouble of honoring `rec_outbuf_height` so as to avoid data copying. (An output buffer larger than `rec_outbuf_height` lines is OK, but won't provide any material speed improvement over that height.)

Special color spaces

The

JPEG standard itself is "color blind" and doesn't specify any particular color space. It is customary to convert color data to a luminance/chrominance color space before compressing, since this permits greater compression. The existing de-facto JPEG file format standards specify YCbCr or grayscale data (JFIF), or grayscale, RGB, YCbCr, CMYK, or YCCK (Adobe). For special applications such as multispectral images, other color spaces can be used, but it must be understood that such files will be unportable.

The JPEG library can handle the most common colorspace conversions (namely RGB \Leftrightarrow YCbCr and CMYK \Leftrightarrow YCCK). It can also deal with data of an unknown color space, passing it through without conversion. If you deal extensively with an unusual color space, you can easily extend the library to understand additional color spaces and perform appropriate conversions.

For compression, the source data's color space is specified by field `in_color_space`. This is

transformed to the JPEG file's color space given

by `jpeg_color_space`. `jpeg_set_defaults()` chooses a reasonable JPEG color space depending on `in_color_space`, but you can override this by calling `jpeg_set_colorspace()`. Of course you must select a supported transformation. `jpegcolor.c` currently supports the following transformations:

RGB \Rightarrow YCbCr

RGB \Rightarrow GRAYSCALE

YCbCr \Rightarrow GRAYSCALE

CMYK \Rightarrow YCCK

plus the null transforms: GRAYSCALE \Rightarrow GRAYSCALE, RGB \Rightarrow RGB, YCbCr \Rightarrow YCbCr, CMYK \Rightarrow CMYK, YCCK \Rightarrow YCCK, and UNKNOWN \Rightarrow UNKNOWN.

The de-facto file format standards (JFIF and Adobe) specify APPn markers that indicate the color space of the JPEG file. It is important to ensure that these are written correctly, or omitted if the JPEG file's color space is not one of the ones supported by the de-facto standards. `jpeg_set_colorspace()` will set the compression parameters to include or omit the APPn markers properly, so long as it is told the truth about the JPEG color space.

For example, if you are

writing some random 3-component color space without

conversion, don't try to fake out the library by setting `in_color_space` and

`jpeg_color_space` to `JCS_YCbCr`; use `JCS_UNKNOWN`. You may want to write an

APPn marker of your own devising to identify the colorspace --- see "Special

markers", below.

When told that the color space is UNKNOWN, the library will default to using luminance-quality compression parameters for all color components. You may well want to change these parameters. See the source code for `jpeg_set_colorspace()`, in `jcparam.c`, for details.

For decompression, the JPEG file's color space is given in `jpeg_color_space`, and this is transformed to the output color space `out_color_space`.

`jpeg_read_header`'s setting of `jpeg_color_space` can be relied on if the file conforms to JFIF or Adobe conventions, but otherwise it is no better than a guess. If you know the JPEG file's color space for certain, you can override `jpeg_read_header`'s guess by setting `jpeg_color_space`. `jpeg_read_header` also

selects a default output color space based on (its guess of) `jpeg_color_space`; set `out_color_space` to override this. Again, you must select a supported transformation. `jdcolor.c` currently supports

YCbCr => RGB

YCbCr => GRAYSCALE

RGB => GRAYSCALE

GRAYSCALE => RGB

YCK => CMYK

as well as the null transforms. (Since GRAYSCALE=>RGB is provided, an application can force grayscale JPEGs to look like color JPEGs if it only wants to handle one case.)

The two-pass color quantizer, `jquant2.c`, is specialized to handle RGB data (it weights distances appropriately for RGB colors). You'll need to modify the code if you want to use it for non-RGB output color spaces. Note that `jquant2.c` is used to map to an application-supplied colormap as well as for the normal two-pass colormap selection process.

CAUTION: it appears that Adobe Photoshop writes inverted data in CMYK JPEG files: 0 represents 100% ink coverage, rather than 0% ink as you'd expect.

This is arguably a bug in

Photoshop, but if you need to work with Photoshop

CMYK files, you will have to deal with it in your application. We cannot "fix" this in the library by inverting the data during the CMYK<=>YCK transform, because that would break other applications, notably Ghostscript.

Photoshop versions prior to 3.0 write EPS files containing JPEG-encoded CMYK data in the same inverted-YCK representation used in bare JPEG files, but the surrounding PostScript code performs an inversion using the PS image operator. I am told that Photoshop 3.0 will write uninverted YCK in EPS/JPEG files, and will omit the PS-level inversion. (But the data polarity used in bare JPEG files will not change in 3.0.) In either case, the JPEG library must not invert the data itself, or else Ghostscript would read these EPS files incorrectly.

Error handling

When the default error handler is used, any error detected inside the JPEG routines will cause a message to be printed on `stderr`, followed by `exit()`.

You

can supply your own error handling routines to override this behavior and to control the treatment of nonfatal warnings and trace/debug messages. The file `example.c` illustrates the most common case, which is to have the application regain control after an error rather than exiting.

The JPEG library never writes any message directly; it always goes through the error handling routines. Three classes of messages are recognized:

- * Fatal errors: the library cannot continue.
- * Warnings: the library can continue, but the data is corrupt, and a damaged output image is likely to result.
- * Trace/informational messages. These come with a trace level indicating the importance of the message; you can control the verbosity of the program by adjusting the maximum trace level that will be displayed.

You may, if you wish, simply replace the entire JPEG error handling module (`jerror.c`) with your own code. However, you can avoid code duplication by only replacing some of the routines depending on the behavior you need.

This is accomplished by calling `jpeg_std_error()` as usual, but then overriding some of the method pointers in the `jpeg_error_mgr` struct, as illustrated by `example.c`.

All of the error handling routines will receive a pointer to the JPEG object (a `j_common_ptr` which points to either a `jpeg_compress_struct` or a `jpeg_decompress_struct`; if you need to tell which, test the `is_decompressor` field). This struct includes a pointer to the error manager struct in its "err" field. Frequently, custom error handler routines will need to access additional data which is not known to the JPEG library or the standard error handler. The most convenient way to do this is to embed either the JPEG object or the `jpeg_error_mgr` struct in a larger structure that contains additional fields; then casting the passed pointer provides access to the additional fields. Again, see `example.c` for one way to do it. (Beginning with IJG version 6b, there is also a void pointer

"client_data" in each

JPEG object, which the application can also use to find related data.

The library does not touch `client_data` at all.)

The individual methods that you might wish to override are:

`error_exit(j_common_ptr cinfo)`

Receives control for a fatal error. Information sufficient to

generate the error message has been stored in `cinfo->err`; call `output_message` to display it. Control must NOT return to the caller; generally this routine will `exit()` or `longjmp()` somewhere. Typically you would override this routine to get rid of the `exit()` default behavior. Note that if you continue processing, you should clean up the JPEG object with `jpeg_abort()` or `jpeg_destroy()`.

`output_message (j_common_ptr cinfo)`

Actual output of any JPEG message. Override this to send messages somewhere other than `stderr`. Note that this method does not know how to generate a message, only where to send it.

`format_message (j_common_ptr cinfo, char * buffer)`

Constructs a readable error message string based on the error info stored in `cinfo->err`. This method is called by `output_message`. Few applications should need to override this method. One possible reason for doing so is to implement dynamic switching of error message language.

`emit_message (j_common_ptr cinfo, int msg_level)`

Decide whether or not to emit a warning or trace message; if so, calls `output_message`. The main reason for overriding this method would be to abort on warnings. `msg_level` is -1 for warnings, 0 and up for trace messages.

Only `error_exit()` and `emit_message()` are called from the rest of the JPEG library; the other two are internal to the error handler.

The actual message texts are stored in an array of strings which is pointed to by the field `err->jpeg_message_table`. The messages are numbered from 0 to `err->last_jpeg_message`, and it is these code numbers that are used in the JPEG library code. You could replace the message texts (for instance, with messages in French or German)

by changing the message table pointer. See `jerror.h` for the default texts. CAUTION: this table will almost certainly change or grow from one library version to the next.

It may be useful for an application to add its own message texts that are handled by the same mechanism. The error handler supports a second "add-on" message table for this purpose. To define an addon table, set the pointer `err->addon_message_table` and the message numbers `err->first_addon_message` and `err->last_addon_message`. If you number the addon messages beginning at 1000 or so, you won't have to worry about conflicts with the library's built-in messages. See the sample applications `cjpeg/djpeg` for an example of using addon messages (the addon messages are defined in `cderror.h`).

Actual invocation of the error handler is done via macros defined in `jerror.h`:

ERREXITn(...) for fatal errors
WARNMSn(...) for corrupt-data warnings
TRACEMSn(...) for trace and informational messages.

These macros store the message code and any additional parameters into the error handler struct, then invoke the error_exit() or emit_message() method. The variants of each macro are for varying numbers of additional parameters. The additional parameters are inserted into the generated message using standard printf() format codes.

See jerror.h and jerror.c for further details.

Compressed data handling (source and destination managers)

The JPEG compression library sends its compressed data to a "destination manager" module. The default destination manager just writes the data to a memory buffer or to a stdio stream, but you can provide your own manager to do something else. Similarly, the decompression library calls a "source manager" to obtain the compressed data; you can provide your own source manager if you want the data to come from somewhere other than a memory buffer or a stdio stream.

In both cases, compressed data is processed a bufferload at a time: the destination or source manager provides a work buffer, and the library invokes the manager only when the buffer is filled or emptied. (You could define a one-character buffer to force the manager to be invoked for each byte, but that would be rather inefficient.) The buffer's size and location are controlled by the manager, not by the library. For example, the memory source manager just makes the buffer pointer and length point to the original data in memory. In this case the buffer-reload procedure will be invoked only if the decompressor ran off the end of the datastream, which would indicate an erroneous datastream.

The work buffer is defined as an array of datatype JOCTET, which is generally "char" or "unsigned char". On a machine where char is not exactly 8 bits wide, you must define JOCTET as a wider data type and then modify the data source and destination modules to transcribe the work arrays into 8-bit units on external storage.

A data destination manager struct contains a pointer and count defining the next byte to write in the work buffer and the remaining free space:

```
JOCTET * next_output_byte; /* => next byte to write in buffer */  
size_t free_in_buffer;    /* # of byte spaces remaining in buffer */
```

The library increments the pointer and decrements the count until the buffer is filled. The manager's `empty_output_buffer` method must reset the pointer and count. The manager is expected to remember the buffer's starting address and total size in private fields not visible to the library.

A data destination manager provides three methods:

`init_destination (j_compress_ptr cinfo)`

Initialize destination. This is called by `jpeg_start_compress()` before any data is actually written. It must initialize `next_output_byte` and `free_in_buffer`. `free_in_buffer` must be initialized to a positive value.

`empty_output_buffer (j_compress_ptr cinfo)`

This is called whenever the buffer has filled (`free_in_buffer` reaches zero). In typical applications, it should write out the *entire* buffer (use the saved start address and buffer length; ignore the current state of `next_output_byte` and `free_in_buffer`). Then reset the pointer & count to the start of the buffer, and return `TRUE` indicating that the buffer has been dumped. `free_in_buffer` must be set to a positive value when `TRUE` is returned. A `FALSE` return should only be used when I/O suspension is desired (this operating mode is discussed in the next section).

`term_destination (j_compress_ptr cinfo)`

Terminate destination --- called by `jpeg_finish_compress()` after all data has been written. In most applications, this must flush any data remaining in the buffer. Use either `next_output_byte` or `free_in_buffer` to determine how much data is in the buffer.

`term_destination()` is NOT called by `jpeg_abort()` or `jpeg_destroy()`. If you want the destination manager to be cleaned up during an abort, you must do it yourself.

You will also need code to create a `jpeg_destination_mgr` struct, fill in its method pointers, and insert a pointer to the struct into the "dest" field of the JPEG compression object. This can be done in-line in your setup code if you like, but it's probably cleaner to provide a separate routine similar to the `jpeg_stdio_dest()` or `jpeg_mem_dest()` routines of the supplied destination managers.

Decompression source managers follow a parallel design, but with some additional frammishes. The source manager struct contains a pointer and count defining the next byte to read from the work buffer and the number of bytes remaining:

```
const JOCTET * next_input_byte; /* => next byte to read from buffer */
size_t bytes_in_buffer;      /* # of bytes remaining in buffer */
```

The library increments the pointer and decrements the count until the buffer is emptied. The manager's `fill_input_buffer` method must reset the pointer and count. In most applications, the manager must remember the buffer's starting address and total size in private fields not visible to the library.

A data source manager provides five methods:

`init_source (j_decompress_ptr cinfo)`

Initialize source. This is called by `jpeg_read_header()` before any data is actually read. Unlike `init_destination()`, it may leave `bytes_in_buffer` set to 0 (in which case a `fill_input_buffer()` call will occur immediately).

`fill_input_buffer (j_decompress_ptr cinfo)`

This is called whenever `bytes_in_buffer` has reached zero and more data is wanted. In typical applications, it should read fresh data into the buffer (ignoring the current state of `next_input_byte` and `bytes_in_buffer`), reset the pointer & count to the start of the buffer, and return `TRUE` indicating that the buffer has been reloaded. It is not necessary to fill the buffer entirely, only to obtain at least one more byte. `bytes_in_buffer` **MUST** be set to a positive value if `TRUE` is returned. A `FALSE` return should only be used when I/O suspension is desired (this mode is discussed in the next section).

`skip_input_data`

`(j_decompress_ptr cinfo, long num_bytes)`

Skip `num_bytes` worth of data. The buffer pointer and count should be advanced over `num_bytes` input bytes, refilling the buffer as needed. This is used to skip over a potentially large amount of uninteresting data (such as an APPn marker). In some applications it may be possible to optimize away the reading of the skipped data, but it's not clear that being smart is worth much trouble; large skips are uncommon. `bytes_in_buffer` may be zero on return.

A zero or negative skip count should be treated as a no-op.

`resync_to_restart (j_decompress_ptr cinfo, int desired)`

This routine is called only when the decompressor has failed to find a restart (RSTn) marker where one is expected. Its mission is to find a suitable point for resuming decompression. For most applications, we recommend that you just use the default resync procedure, `jpeg_resync_to_restart()`. However, if you are able to back up in the input

data stream, or if you have a-priori knowledge about the likely location of restart markers, you may be able to do better. Read the `read_restart_marker()` and `jpeg_resync_to_restart()` routines in `jdmarker.c` if you think you'd like to implement your own resync procedure.

`term_source (j_decompress_ptr cinfo)`

Terminate source --- called by `jpeg_finish_decompress()` after all data has been read. Often a no-op.

For both `fill_input_buffer()` and `skip_input_data()`, there is no such thing as an EOF return. If the end of the file has been reached, the routine has a choice of exiting via `ERREXIT()` or inserting fake data into the buffer. In most cases, generating a warning message and inserting a fake EOI marker is the best course of action --- this will allow the decompressor to output however much of the image is there. In pathological cases, the decompressor may swallow the EOI and again demand data ... just keep feeding it fake EOIs. `jdatsrc.c` illustrates the recommended error recovery behavior.

`term_source()` is NOT called by `jpeg_abort()` or `jpeg_destroy()`. If you want the source manager to be cleaned up during an abort, you must do it yourself.

You will also need code to create a `jpeg_source_mgr` struct, fill in its method pointers, and insert a pointer to the struct into the "src" field of the JPEG decompression object. This can be done in-line in your setup code if you like, but it's probably cleaner to provide a separate routine similar to the `jpeg_stdio_src()` or `jpeg_mem_src()` routines of the supplied source managers.

For more information, consult the memory and stdio source and destination managers in `jdatsrc.c` and `jdatadst.c`.

I/O suspension

Some applications need to use the JPEG library as an incremental memory-to-memory filter: when the compressed data buffer is filled or emptied, they want control to return to the outer loop, rather than expecting that the buffer can be emptied or reloaded within the data source/destination manager subroutine.

The library supports this need by providing an "I/O suspension" mode, which we describe in this section.

The I/O suspension mode is not a panacea: nothing is guaranteed about the maximum amount of time spent in any one call to the library, so it will not eliminate response-time problems in single-threaded applications. If you need guaranteed response time, we suggest you "bite the bullet" and implement

a real multi-tasking capability.

To use I/O suspension, cooperation is needed between the calling application and the data source or destination manager; you will always need a custom source/destination manager. (Please read the previous section if you haven't already.) The basic idea is that the `empty_output_buffer()` or `fill_input_buffer()` routine is a no-op, merely returning `FALSE` to indicate that it has done nothing. Upon seeing this, the JPEG library suspends operation and returns to its caller. The surrounding application is responsible for emptying or refilling the work buffer before calling the JPEG library again.

Compression suspension:

For compression suspension, use an `empty_output_buffer()` routine that returns `FALSE`; typically it will not do anything else. This will cause the compressor to return to the caller of `jpeg_write_scanlines()`, with the return value indicating that not all the supplied scanlines have been accepted. The application must make more room in the output buffer, adjust the output buffer pointer/count appropriately, and then call `jpeg_write_scanlines()` again, pointing to the first unconsumed scanline.

When forced to suspend, the compressor will backtrack to a convenient stopping point (usually the start of the current MCU); it will regenerate some output data when restarted. Therefore, although `empty_output_buffer()` is only called when the buffer is filled, you should NOT write out the entire buffer after a suspension. Write only the data up to the current position of `next_output_byte/free_in_buffer`. The data beyond that point will be regenerated after resumption.

Because of the backtracking behavior, a good-size output buffer is essential for efficiency; you don't want the compressor to suspend often. (In fact, an overly small buffer could lead to infinite looping, if a single MCU required more data than would fit in the buffer.) We recommend a buffer of at least several Kbytes. You may want to insert explicit code to ensure that you don't call `jpeg_write_scanlines()` unless there is a reasonable amount of space in the output buffer; in other words, flush the buffer before trying to compress more data.

The compressor does not allow suspension while it is trying to write JPEG markers at the beginning and end of the file. This means that:

- * At the beginning of a compression operation, there must be enough free space in the output buffer to hold the header markers (typically 600 or so bytes). The recommended buffer size is bigger than this anyway, so this is not a problem as

long as you start with an empty buffer. However, this restriction might catch you if you insert large special markers, such as a JFIF thumbnail image, without flushing the buffer afterwards.

- * When you call `jpeg_finish_compress()`, there must be enough space in the output buffer to emit any buffered data and the final EOI marker. In the current implementation, half a dozen bytes should suffice for this, but for safety's sake we recommend ensuring that at least 100 bytes are free before calling `jpeg_finish_compress()`.

A more significant restriction is that `jpeg_finish_compress()` cannot suspend. This means you cannot use suspension with multi-pass operating modes, namely Huffman code optimization and multiple-scan output. Those modes write the whole file during `jpeg_finish_compress()`, which will certainly result in buffer overrun. (Note that this restriction applies only to compression, not decompression. The decompressor supports input suspension in all of its operating modes.)

Decompression suspension:

For decompression suspension, use a `fill_input_buffer()` routine that simply returns `FALSE` (except perhaps during error recovery, as discussed below). This will cause the decompressor to return to its caller with an indication that suspension has occurred. This can happen at four places:

- * `jpeg_read_header()`: will return `JPEG_SUSPENDED`.
- * `jpeg_start_decompress()`: will return `FALSE`, rather than its usual `TRUE`.
- * `jpeg_read_scanlines()`: will return the number of scanlines already completed (possibly 0).
- * `jpeg_finish_decompress()`: will return `FALSE`, rather than its usual `TRUE`.

The surrounding application must recognize these cases, load more data into the input buffer, and repeat the call. In the case of `jpeg_read_scanlines()`, increment the passed pointers past any scanlines successfully read.

Just as with compression, the decompressor will typically backtrack to a convenient restart point before suspending. When `fill_input_buffer()` is called, `next_input_byte/bytes_in_buffer` point to the current restart point, which is where the decompressor will backtrack to if `FALSE` is returned. The data beyond that position must NOT be discarded if you suspend; it needs to be re-read upon resumption. In most implementations, you'll need to shift this data down to the start of your work buffer and then load more data after it. Again, this behavior means that a several-Kbyte work buffer is essential for decent performance; furthermore, you should load a reasonable amount of new data before resuming decompression. (If you loaded, say, only one new byte each time around, you could waste a LOT of cycles.)

The `skip_input_data()` source manager routine requires special care in a suspension scenario. This routine is NOT granted the ability to suspend the

decompressor; it can decrement `bytes_in_buffer` to zero, but no more. If the requested skip distance exceeds the amount of data currently in the input buffer, then `skip_input_data()` must set `bytes_in_buffer` to zero and record the additional skip distance somewhere else. The decompressor will immediately call `fill_input_buffer()`, which should return `FALSE`, which will cause a suspension return. The surrounding application must then arrange to discard the recorded number of bytes before it resumes loading the input buffer. (Yes, this design is rather baroque, but it avoids complexity in the far more common case where a non-suspending source manager is used.)

If the input data has been exhausted, we recommend that you emit a warning and insert dummy EOI markers just as a non-suspending data source manager would do. This can be handled either in the surrounding application logic or within `fill_input_buffer()`; the latter is probably more efficient. If `fill_input_buffer()` knows that no more data is available, it can set the pointer/count to point to a dummy EOI marker and then return `TRUE` just as though it had read more data in a non-suspending situation.

The decompressor does not attempt to suspend within standard JPEG markers; instead it will backtrack to the start of the marker and reprocess the whole marker next time. Hence the input buffer must be large enough to hold the longest standard marker in the file. Standard JPEG markers should normally not exceed a few hundred bytes each (DHT tables are typically the longest). We recommend at least a 2K buffer for performance reasons, which is much larger than any correct marker is likely to be. For robustness against damaged marker length counts, you may wish to insert a test in your application for the case that the input buffer is completely full and yet the decoder has suspended without consuming any data --- otherwise, if this situation did occur, it would lead to an endless loop. (The library can't provide this test since it has no idea whether "the buffer is full", or even whether there is a fixed-size input buffer.)

The input buffer would need to be 64K to allow for arbitrary COM or APPn markers, but these are handled specially: they are either saved into allocated memory, or skipped over by calling `skip_input_data()`. In the former case, suspension is handled correctly, and in the latter case, the problem of buffer overrun is placed on `skip_input_data`'s shoulders, as explained above. Note that if you provide your own marker handling routine for large markers, you should consider how to deal with buffer overflow.

Multiple-buffer management:

In some applications it is desirable to store the compressed data in a linked list of buffer areas, so as to avoid data copying. This can be handled by having `empty_output_buffer()` or `fill_input_buffer()` set the pointer and count

to reference the next available buffer; FALSE is returned only if no more buffers are available. Although seemingly straightforward, there is a pitfall in this approach: the backtrack that occurs when FALSE is returned could back up into an earlier buffer. For example, when fill_input_buffer() is

called, the current pointer & count indicate the backtrack restart point. Since fill_input_buffer() will set the pointer and count to refer to a new buffer, the restart position must be saved somewhere else. Suppose a second call to fill_input_buffer() occurs in the same library call, and no additional input data is available, so fill_input_buffer must return FALSE. If the JPEG library has not moved the pointer/count forward in the current buffer, then *the correct restart point is the saved position in the prior buffer*. Prior buffers may be discarded only after the library establishes a restart point within a later buffer. Similar remarks apply for output into a chain of buffers.

The library will never attempt to backtrack over a skip_input_data() call, so any skipped data can be permanently discarded. You still have to deal with the case of skipping not-yet-received data, however.

It's much simpler to use only a single buffer; when fill_input_buffer() is called, move any unconsumed data (beyond the current pointer/count) down to the beginning of this buffer and then load new data into the remaining buffer space. This approach requires a little more data copying but is far easier to get right.

Progressive JPEG support

Progressive JPEG rearranges the stored data into a series of scans of increasing quality. In situations where a JPEG file is transmitted across a slow communications link, a decoder can generate a low-quality image very quickly from the first scan, then gradually improve the displayed quality as more scans are received. The final image after all scans are complete is identical to that of a regular (sequential) JPEG file of the same quality setting. Progressive JPEG files are often slightly smaller than equivalent sequential JPEG files, but the possibility of incremental display is the main reason for using progressive JPEG.

The IJG encoder library generates progressive JPEG files when given a suitable "scan

script" defining how to divide the data into scans.

Creation of progressive JPEG files is otherwise transparent to the encoder.

Progressive JPEG files can also be read transparently by the decoder library.

If the decoding application simply uses the library as defined above, it

will receive a final decoded image without any indication that the file was

progressive. Of course, this approach does not allow incremental display. To perform incremental display, an application needs to use the decoder library's "buffered-image" mode, in which it receives a decoded image multiple times.

Each displayed scan requires about as much work to decode as a full JPEG image of the same size, so the decoder must be fairly fast in relation to the data transmission rate in order to make incremental display useful. However, it is possible to skip displaying the image and simply add the incoming bits to the decoder's coefficient buffer. This is fast because only Huffman decoding need be done, not IDCT,

upsampling, colorspace conversion, etc.

The IJG decoder library allows the application to switch dynamically between displaying the image and simply absorbing the incoming bits. A properly coded application can automatically adapt the number of display passes to suit the time available as the image is received. Also, a final higher-quality display cycle can be performed from the buffered data after the end of the file is reached.

Progressive compression:

To create a progressive JPEG file (or a multiple-scan sequential JPEG file), set the scan_info cinfo field to point to an array of scan descriptors, and perform compression as usual. Instead of constructing your own scan list, you can call the jpeg_simple_progression() helper routine to create a recommended progression sequence; this method should be used by all applications that don't want to get involved in the nitty-gritty of progressive scan sequence design. (If you want to provide user control of scan sequences, you may

wish to borrow the scan script reading code found in rdswitch.c, so that you can read scan script files just like cjpeg's.)

When scan_info is not NULL, the compression library will store DCT'd data into a buffer array as jpeg_write_scanlines() is called, and will emit all the requested scans during jpeg_finish_compress(). This implies that multiple-scan output cannot be created with a suspending data destination manager, since jpeg_finish_compress() does not support suspension. We should also note that the compressor currently forces Huffman optimization mode when creating a progressive JPEG file, because the default Huffman tables are unsuitable for progressive files.

Progressive decompression:

When buffered-image mode is not used, the decoder library will read all of a multi-scan file during jpeg_start_decompress(), so that it can provide a final decoded image. (Here "multi-scan" means either progressive or multi-scan sequential.) This makes multi-scan files transparent to the decoding

application. However, existing applications that used suspending input with version 5 of the IJG library will need to be modified to check for a suspension return from `jpeg_start_decompress()`.

To perform incremental display, an application must use the library's buffered-image mode. This is described in the next section.

Buffered-image mode

In buffered-image mode, the library stores the partially decoded image in a coefficient buffer, from which it can be read out as many times as desired. This mode is typically used for incremental display of progressive JPEG files, but it can be used with any JPEG file. Each scan of a progressive JPEG file adds more data (more detail) to the buffered image. The application can display in lockstep with the source file (one display pass per input scan), or it can allow input processing to outrun display processing. By making input and display processing run independently, it is possible for the application to adapt progressive display to a wide range of data transmission rates.

The basic control flow for buffered-image decoding is

```
jpeg_create_decompress()
set data source
jpeg_read_header()
set overall decompression parameters
cinfo.buffered_image = TRUE; /* select buffered-image mode */
jpeg_start_decompress()
for (each output pass) {
    adjust output decompression parameters if required
    jpeg_start_output() /* start a new output pass */
    for (all scanlines in image) {
        jpeg_read_scanlines()
        display scanlines
    }
    jpeg_finish_output() /* terminate output pass */
}
jpeg_finish_decompress()
jpeg_destroy_decompress()
```

This differs from ordinary unbuffered decoding in that there is an additional level of looping. The application can choose how many output passes to make and how to display each pass.

The simplest approach to displaying progressive images is to do one display

pass for each scan appearing in the input file. In this case the outer loop condition

is typically

```
while (! jpeg_input_complete(&cinfo))
```

and the start-output call should read

```
jpeg_start_output(&cinfo, cinfo.input_scan_number);
```

The second parameter to `jpeg_start_output()` indicates which scan of the input file is to be displayed; the scans are numbered starting at 1 for this

purpose. (You can use a loop counter starting at 1 if you like, but using the library's input scan counter is easier.) The library automatically reads

data as necessary to complete each requested scan, and `jpeg_finish_output()` advances to the next scan or end-of-image marker (hence `input_scan_number` will be incremented by the time control arrives back at `jpeg_start_output()`).

With this technique, data is read from the input file only as needed, and input and output processing run in lockstep.

After reading the final scan and reaching the end of the input file, the buffered image remains available; it can be read additional times by repeating the `jpeg_start_output()/jpeg_read_scanlines()/jpeg_finish_output()` sequence.

For example, a useful technique is to use fast one-pass color quantization for display passes made while the image is arriving, followed by a final display pass using two-pass quantization for highest quality. This is done by changing the library parameters before the final output pass. Changing parameters between passes is discussed in detail below.

In general the last scan of a progressive file cannot be recognized as such until after it is read, so a post-input display pass is the best approach if you want special processing in the final pass.

When done with the image, be sure to call `jpeg_finish_decompress()` to release the buffered image (or just use `jpeg_destroy_decompress()`).

If input data arrives faster than it can be displayed, the application can cause the library to decode input data in advance of what's needed to produce output. This is done by calling the routine `jpeg_consume_input()`.

The return value is one of the following:

JPEG_REACHED_SOS:

reached an SOS marker (the start of a new scan)

JPEG_REACHED_EOI: reached the EOI marker (end of image)

JPEG_ROW_COMPLETED: completed reading one MCU row of compressed data

JPEG_SCAN_COMPLETED: completed reading last MCU row of current scan

JPEG_SUSPENDED: suspended before completing any of the above

(**JPEG_SUSPENDED** can occur only if a suspending data source is used.) This

routine can be called at any time after initializing the JPEG object. It

reads some additional data and returns when one of the indicated significant

events occurs. (If called after the EOI marker is reached, it will

immediately return **JPEG_REACHED_EOI** without attempting to read more data.)

The library's output processing will automatically call `jpeg_consume_input()` whenever the output processing overtakes the input; thus, simple lockstep display requires no direct calls to `jpeg_consume_input()`. But by adding calls to `jpeg_consume_input()`, you can absorb data in advance of what is being displayed.

This has two benefits:

- * You can limit buildup of unprocessed data in your input buffer.
- * You can eliminate extra display passes by paying attention to the state of the library's input processing.

The first of these benefits only requires interspersing calls to `jpeg_consume_input()` with your display operations and any other processing you may be doing. To avoid wasting cycles due to backtracking, it's best to call `jpeg_consume_input()` only after a hundred or so new bytes have arrived. This is discussed further under "I/O suspension", above. (Note: the JPEG library currently is not thread-safe. You must not call `jpeg_consume_input()` from one thread of control if a different library routine is working on the same JPEG object in another thread.)

When input arrives fast enough that more than one new scan is available before you start a new output pass, you may as well skip the output pass corresponding to the completed scan. This occurs for free if you pass `cinfo.input_scan_number` as the target scan number to `jpeg_start_output()`.

The `input_scan_number` field is simply the index of the scan currently being consumed by the input processor. You can ensure that this is up-to-date by emptying the input buffer just before calling `jpeg_start_output()`: call `jpeg_consume_input()` repeatedly until it returns `JPEG_SUSPENDED` or `JPEG_REACHED_EOI`.

The target scan number passed to `jpeg_start_output()` is saved in the `cinfo.output_scan_number` field. The library's output processing calls `jpeg_consume_input()` whenever the current input scan number and row within that scan is less than or equal to the current output scan number and row. Thus, input processing can "get ahead" of the output processing but is not allowed to "fall behind". You can achieve several different effects by manipulating this interlock rule. For example, if you pass a target scan number greater than the current input scan number, the output processor will wait until that scan starts to arrive before producing any output. (To avoid an infinite loop, the target scan number is automatically reset to the last scan number when the end of image is reached. Thus, if you specify a large target scan number, the library will just absorb the entire input file and then perform an output pass. This is effectively the same as what `jpeg_start_decompress()` does when you don't select buffered-image mode.) When you pass a target scan number equal to the current input scan number, the image is displayed no faster than the current input scan arrives. The

final possibility is to pass a target scan number less than the current input scan number; this disables the input/output interlock and causes the output processor to simply display whatever it finds in the image buffer, without waiting for input. (However, the library will not accept a target scan number less than one, so you can't avoid waiting for the first scan.)

When data is arriving faster than the output display processing can advance

through the image, `jpeg_consume_input()` will store data into the buffered image beyond the point at which the output processing is reading data out again. If the input arrives fast enough, it may "wrap around" the buffer to the point where the input is more than one whole scan ahead of the output. If the output processing simply proceeds through its display pass without paying attention to the input, the effect seen on-screen is that the lower part of the image is one or more scans better in quality than the upper part. Then, when the next output scan is started, you have a choice of what target scan number to use. The recommended choice is to use the current input scan number at that time, which implies that you've skipped the output scans corresponding to the input scans that were completed while you processed the previous output scan. In this way, the decoder automatically adapts its speed to the arriving data, by skipping output scans as necessary to keep up with the arriving data.

When using this strategy, you'll want to be sure that you perform a final output pass after receiving all the data; otherwise your last display may not be full quality across the whole screen. So the right outer loop logic is something like this:

```
do {
    absorb any waiting input by calling jpeg_consume_input()
    final_pass = jpeg_input_complete(&cinfo);
    adjust output decompression parameters if required
    jpeg_start_output(&cinfo, cinfo.input_scan_number);
    ...
    jpeg_finish_output()
} while (! final_pass);
```

rather than quitting as soon as `jpeg_input_complete()` returns TRUE. This arrangement makes it simple to use higher-quality decoding parameters for the final pass. But if you don't want to use special parameters for the final pass, the right loop logic is like this:

```
for (;;) {
    absorb any waiting input by calling jpeg_consume_input()
    jpeg_start_output(&cinfo, cinfo.input_scan_number);
    ...
    jpeg_finish_output()
    if (jpeg_input_complete(&cinfo)
    &&
        cinfo.input_scan_number == cinfo.output_scan_number)
```

```
break;
}
```

In this case you don't need to know in advance whether an output pass is to be the last one, so it's not necessary to have reached EOF before starting the final output pass; rather, what you want to test is whether the output pass was performed in sync with the final input scan. This form of the loop will avoid an extra output pass whenever the decoder is able (or nearly able) to keep up with the incoming data.

When the data transmission speed is high, you might begin a display pass, then find that much or all of the file has arrived before you can complete the pass. (You can detect this by noting the JPEG_REACHED_EOI return code from `jpeg_consume_input()`, or equivalently by testing `jpeg_input_complete()`.) In this situation you may wish to abort the current display pass and start a new one using the newly arrived information. To do so, just call `jpeg_finish_output()` and then start a new pass with `jpeg_start_output()`.

A variant strategy is to abort and restart display if more than one complete scan arrives during an output pass; this can be detected by noting JPEG_REACHED_SOS returns and/or examining `cinfo.input_scan_number`. This idea should be employed with caution, however, since the display process might never get to the bottom of the image before being aborted, resulting in the lower part of the screen being several passes worse than the upper. In most cases it's probably best to abort an output pass only if the whole file has arrived and you want to begin the final output pass immediately.

When receiving data across a communication link, we recommend always using the current input scan number for the output target scan number; if a higher-quality final pass is to be done, it should be started (aborting any incomplete output pass) as soon as the end of file is received. However, many other strategies are possible. For example, the application can examine the parameters of the current input scan and decide whether to display it or not. If the scan contains only chroma data, one might choose not to use it as the target scan, expecting that the scan will be small and will arrive quickly. To skip to the next scan, call `jpeg_consume_input()` until it returns JPEG_REACHED_SOS or JPEG_REACHED_EOI. Or just use the next higher number as the target scan for `jpeg_start_output()`; but that method doesn't let you inspect the next scan's parameters before deciding to display it.

In buffered-image mode, `jpeg_start_decompress()` never performs input and thus never suspends. An application that uses input suspension with buffered-image mode must be prepared for suspension returns from these routines:

* `jpeg_start_output()` performs input only if you request 2-pass quantization and the target scan isn't fully read yet. (This is discussed below.)

* `jpeg_read_scanlines()`, as always, returns the number of scanlines that it was able to produce before suspending.

* `jpeg_finish_output()` will read any markers following the target scan, up to the end of the file or the SOS marker that begins another scan. (But it reads no input if `jpeg_consume_input()` has already reached the end of the file or a SOS marker beyond the target output scan.)

* `jpeg_finish_decompress()` will read until the end of file, and thus can suspend if the end hasn't already been reached (as can be tested by calling `jpeg_input_complete()`).

`jpeg_start_output()`, `jpeg_finish_output()`, and `jpeg_finish_decompress()` all return TRUE if they completed their tasks, FALSE if they had to suspend. In the event of a FALSE return, the application must load more input data and repeat the call. Applications that use non-suspending data sources need not check the return values of these three routines.

It is possible to change decoding parameters between output passes in the buffered-image mode. The decoder library currently supports only very limited changes of parameters.

ONLY THE FOLLOWING parameter changes are allowed after `jpeg_start_decompress()` is called:

- * `dct_method` can be changed before each call to `jpeg_start_output()`. For example, one could use a fast DCT method for early scans, changing to a higher quality method for the final scan.
- * `dither_mode` can be changed before each call to `jpeg_start_output()`; of course this has no impact if not using color quantization. Typically one would use ordered dither for initial passes, then switch to Floyd-Steinberg dither for the final pass. Caution: changing dither mode can cause more memory to be allocated by the library. Although the amount of memory involved is not large (a scanline or so), it may cause the initial `max_memory_to_use` specification to be exceeded, which in the worst case would result in an out-of-memory failure.
- * `do_block_smoothing` can be changed before each call to `jpeg_start_output()`. This setting is relevant only when decoding a progressive JPEG image.

During the first DC-only scan, block smoothing provides a very "fuzzy" look instead of the very "blocky" look seen without it; which is better seems a matter of personal taste. But block smoothing is nearly always a win during later stages, especially when decoding a successive-approximation image: smoothing helps to hide the slight blockiness that otherwise shows up on smooth gradients until the lowest coefficient bits are sent.

- * Color quantization mode can be changed under the rules described below. You *cannot* change between full-color and quantized output (because that would alter the required I/O buffer sizes), but you can change which quantization method is used.

When generating color-quantized output, changing quantization method is a

very useful way of switching between high-speed and high-quality display.

The library allows you to change among its three quantization methods:

1. Single-pass quantization to a fixed color cube.

Selected by `cinfo.two_pass_quantize = FALSE` and `cinfo.colormap = NULL`.

2. Single-pass quantization to an application-supplied colormap.

Selected by setting `cinfo.colormap` to point to the colormap (the value of `two_pass_quantize` is ignored); also set `cinfo.actual_number_of_colors`.

3. Two-pass quantization to a colormap chosen specifically for the image.

Selected by `cinfo.two_pass_quantize = TRUE` and `cinfo.colormap = NULL`. (This is the default setting selected by `jpeg_read_header`, but it is probably NOT what you want for the first pass of progressive display!)

These methods offer successively better quality and lesser speed. However, only the first method is available for quantizing in non-RGB color spaces.

IMPORTANT: because the different quantizer methods have very different working-storage requirements, the library requires you to indicate which one(s) you intend to use before you call `jpeg_start_decompress()`. (If we did not require this, the `max_memory_to_use` setting would be a complete fiction.)

You

do this by setting one or more of these three `cinfo` fields to `TRUE`:

`enable_1pass_quant` Fixed color cube colormap

`enable_external_quant` Externally-supplied colormap

`enable_2pass_quant` Two-pass custom colormap

All three are initialized `FALSE` by `jpeg_read_header()`. But

`jpeg_start_decompress()` automatically sets `TRUE` the one selected by the current `two_pass_quantize` and `colormap` settings, so you only need to set the enable flags for any other quantization methods you plan to change to later.

After setting the enable flags correctly at `jpeg_start_decompress()` time, you can change to any enabled quantization method by setting `two_pass_quantize` and `colormap` properly just before calling `jpeg_start_output()`. The following special rules apply:

1. You must explicitly set `cinfo.colormap` to `NULL` when switching to 1-pass or 2-pass mode from a different mode, or when you want the 2-pass quantizer to be re-run to generate a new colormap.

2. To switch to an external colormap, or to change to a different external colormap than was used on the prior pass, you must call `jpeg_new_colormap()` after setting `cinfo.colormap`.

NOTE: if you want to use the same colormap as was used in the prior pass, you should not do either of these things. This will save some nontrivial switchover costs.

(These requirements exist because `cinfo.colormap` will always be non-`NULL` after completing a prior output pass, since both the 1-pass and 2-pass quantizers set it to point to their output colormaps. Thus you have to do one of these two things to notify the library that something has changed.

Yup, it's a bit klugy, but it's necessary to do it this way for backwards

compatibility.)

Note that in buffered-image mode, the library generates any requested colormap during `jpeg_start_output()`, not during `jpeg_start_decompress()`.

When using two-pass quantization, `jpeg_start_output()` makes a pass over the buffered image to determine the optimum color map; it therefore may take a significant amount of time, whereas ordinarily it does little work. The progress monitor hook is called during this pass, if defined. It is also important to realize that if the specified target scan number is greater than or equal to the current input scan number, `jpeg_start_output()` will attempt to consume input as it makes this pass. If you use a suspending data source, you need to check for a `FALSE` return from `jpeg_start_output()` under these conditions. The combination of 2-pass quantization and a not-yet-fully-read target scan is the only case in which `jpeg_start_output()` will consume input.

Application authors who support buffered-image mode may be tempted to use it for all JPEG images, even single-scan ones. This will work, but it is inefficient: there is no need to create an image-sized coefficient buffer for single-scan images. Requesting buffered-image mode for such an image wastes memory. Worse, it can cost time on large images, since the buffered data has to be swapped out or written to a temporary file. If you are concerned about maximum performance on baseline JPEG files, you should use buffered-image mode only when the incoming file actually has multiple scans. This can be tested by calling `jpeg_has_multiple_scans()`, which will return a correct result at any time after `jpeg_read_header()` completes.

It is also worth noting that when you use `jpeg_consume_input()` to let input processing get ahead of output processing, the resulting pattern of access to the coefficient buffer is quite nonsequential. It's best to use the memory manager `jmemnobs.c` if you can (ie, if you have enough real or virtual main memory). If not, at least make sure that `max_memory_to_use` is set as high as possible. If the JPEG memory manager has to use a temporary file, you will probably see a lot of disk traffic and poor performance. (This could be improved with additional work on the memory manager, but we haven't gotten around to it yet.)

In some applications it may be convenient to use `jpeg_consume_input()` for all input processing, including reading the initial markers; that is, you may wish to call `jpeg_consume_input()` instead of `jpeg_read_header()` during startup. This works, but note that you must check for `JPEG_REACHED_SOS` and `JPEG_REACHED_EOI` return codes as the equivalent of `jpeg_read_header()`'s codes. Once the first SOS marker has been reached, you must call `jpeg_start_decompress()` before `jpeg_consume_input()` will consume more input;

it'll just keep returning JPEG_REACHED_SOS until you do. If you read a tables-only file this way, jpeg_consume_input() will return JPEG_REACHED_EOI without ever returning JPEG_REACHED_SOS; be sure to check for this case. If this happens, the decompressor will not read any more input until you call jpeg_abort() to reset it. It is OK to call jpeg_consume_input() even when not using buffered-image mode, but in that case it's basically a no-op after the initial markers have been read: it will just return JPEG_SUSPENDED.

Abbreviated

datastreams and multiple images

A JPEG compression or decompression object can be reused to process multiple images. This saves a small amount of time per image by eliminating the "create" and "destroy" operations, but that isn't the real purpose of the feature. Rather, reuse of an object provides support for abbreviated JPEG datastreams. Object reuse can also simplify processing a series of images in a single input or output file. This section explains these features.

A JPEG file normally contains several hundred bytes worth of quantization and Huffman tables. In a situation where many images will be stored or transmitted with identical tables, this may represent an annoying overhead. The JPEG standard therefore permits tables to be omitted. The standard defines three classes of JPEG datastreams:

- * "Interchange" datastreams contain an image and all tables needed to decode the image. These are the usual kind of JPEG file.
- * "Abbreviated image" datastreams contain an image, but are missing some or all of the tables needed to decode that image.
- * "Abbreviated table specification" (henceforth "tables-only") datastreams contain only table specifications.

To decode an abbreviated image, it is necessary to load the missing table(s) into the decoder beforehand. This can be accomplished by reading a separate tables-only file. A variant scheme uses a series of images in which the first image is an interchange (complete) datastream, while subsequent ones are abbreviated and rely on the tables loaded by the first image. It is assumed that once the decoder has read a table, it will remember that table until a new definition for the same table number is encountered.

It is the application designer's responsibility to figure out how to associate the correct tables with an abbreviated image. While abbreviated datastreams can be useful in a closed environment, their use is strongly discouraged in any situation where data exchange with other applications might be needed. Caveat designer.

The JPEG library provides support for reading and writing any combination of

tables-only datastreams and abbreviated images. In both compression and decompression objects, a quantization or Huffman table will be retained for the lifetime of the object, unless it is overwritten by a new table definition.

To create abbreviated image datastreams, it is only necessary to tell the compressor not to emit some or all of the tables it is using. Each quantization and Huffman table struct contains a boolean field "sent_table", which normally is initialized to FALSE. For each table used by the image, the header-writing process emits the table and sets sent_table = TRUE unless it is already TRUE. (In normal usage, this prevents outputting the same table definition multiple times, as would otherwise occur because the chroma components typically share tables.) Thus, setting this field to TRUE before calling jpeg_start_compress() will prevent the table from being written at all.

If you want to create a "pure" abbreviated image file containing no tables, just call "jpeg_suppress_tables(&cinfo, TRUE)" after constructing all the tables. If you want to emit some but not all tables, you'll need to set the individual sent_table fields directly.

To create an abbreviated image, you must also call jpeg_start_compress() with a second parameter of FALSE, not TRUE. Otherwise jpeg_start_compress() will force all the sent_table fields to FALSE. (This is a safety feature to prevent abbreviated images from being created accidentally.)

To create a tables-only file, perform the same parameter setup that you normally would, but instead of calling jpeg_start_compress() and so on, call jpeg_write_tables(&cinfo). This will write an abbreviated datastream containing only SOI, DQT and/or DHT markers, and EOI. All the quantization and Huffman tables that are currently defined in the compression object will be emitted unless their sent_tables flag is already TRUE, and then all the sent_tables flags will be set TRUE.

A sure-fire way to create matching tables-only and abbreviated image files is to proceed as follows:

```
create JPEG compression object
set JPEG parameters
set destination to tables-only file
jpeg_write_tables(&cinfo);
set destination to image file
jpeg_start_compress(&cinfo, FALSE);
write data...
jpeg_finish_compress(&cinfo);
```

Since the JPEG parameters are not altered between writing the table file and the abbreviated image file, the same tables are sure to be used. Of course, you can repeat the `jpeg_start_compress()` ... `jpeg_finish_compress()` sequence many times to produce many abbreviated image files matching the table file.

You cannot suppress output of the computed Huffman tables when Huffman optimization is selected. (If you could, there'd be no way to decode the image...) Generally, you don't want to set `optimize_coding = TRUE` when you are trying to produce abbreviated files.

In some cases you might want to compress an image using tables which are not stored in the application, but are defined in an interchange or tables-only file readable by the application. This can be done by setting up a JPEG decompression object to read the specification file, then copying the tables into your compression object. See `jpeg_copy_critical_parameters()` for an example of copying quantization tables.

To read abbreviated image files, you simply need to load the proper tables into the decompression object before trying to read the abbreviated image. If the proper tables are stored in the application program, you can just allocate the table structs and fill in their contents directly. For example, to load a fixed quantization table into table slot "n":

```
if (cinfo.quant_tbl_ptrs[n] == NULL)
    cinfo.quant_tbl_ptrs[n] = jpeg_alloc_quant_table((j_common_ptr) &cinfo);
quant_ptr = cinfo.quant_tbl_ptrs[n]; /* quant_ptr is JQUANT_TBL* */

for (i = 0; i < 64; i++) {
    /* Qtable[] is desired quantization table, in natural array order */
    quant_ptr->quantval[i] = Qtable[i];
}
```

Code to load a fixed Huffman table is typically (for AC table "n"):

```
if (cinfo.ac_huff_tbl_ptrs[n] == NULL)
    cinfo.ac_huff_tbl_ptrs[n] = jpeg_alloc_huff_table((j_common_ptr) &cinfo);
huff_ptr = cinfo.ac_huff_tbl_ptrs[n]; /* huff_ptr is JHUFF_TBL* */
for (i = 1; i <= 16; i++) {
    /* counts[i] is number of Huffman codes of length i bits, i=1..16 */
    huff_ptr->bits[i] = counts[i];
}
for (i = 0; i < 256; i++) {
    /* symbols[] is the list of Huffman symbols, in code-length order */
    huff_ptr->huffval[i] = symbols[i];
}
```

(Note that trying to set `cinfo.quant_tbl_ptrs[n]` to point directly at a constant `JQUANT_TBL` object is not safe. If the incoming file happened to contain a quantization table definition, your master table would get overwritten! Instead allocate a working table copy and copy the master table into it, as illustrated above. Ditto for Huffman tables, of course.)

You might want to read the tables from a tables-only file, rather than hard-wiring them into your application. The `jpeg_read_header()` call is sufficient to read a tables-only file. You must pass a second parameter of `FALSE` to indicate that you do not require an image to be present. Thus, the typical scenario is

```
create JPEG decompression object
set source to tables-only file
jpeg_read_header(&cinfo, FALSE);
set source to abbreviated image file
jpeg_read_header(&cinfo, TRUE);
set decompression parameters
jpeg_start_decompress(&cinfo);
read data...
jpeg_finish_decompress(&cinfo);
```

In some cases, you may want to read a file without knowing whether it contains an image or just tables. In that case, pass `FALSE` and check the return value from `jpeg_read_header()`: it will be `JPEG_HEADER_OK` if an image was found, `JPEG_HEADER_TABLES_ONLY` if only tables were found. (A third return value, `JPEG_SUSPENDED`, is possible when using a suspending data source manager.)

Note that `jpeg_read_header()` will not complain if you read an abbreviated image for which you haven't loaded the missing tables; the missing-table check occurs later, in `jpeg_start_decompress()`.

It is possible to read a series of images from a single source file by repeating the `jpeg_read_header() ... jpeg_finish_decompress()` sequence, without releasing/recreating the JPEG object or the data source module. (If you did reinitialize, any partial bufferload left in the data source buffer at the end of one image would be discarded, causing you to lose the start of the next image.) When you use this method, stored tables are automatically carried forward, so some of the images can be abbreviated images that depend on tables from earlier images.

If you intend to write a series of images into a single destination file, you might want to make a specialized data destination module that doesn't flush the output buffer at `term_destination()` time. This would speed things up by some trifling amount. Of course, you'd need to remember to flush the

buffer after the last image. You can make the later images be abbreviated ones by passing FALSE to jpeg_start_compress().

Special markers

Some applications may need to insert or extract special data in the JPEG datastream. The JPEG standard provides marker types "COM" (comment) and "APP0" through "APP15" (application) to hold application-specific data. Unfortunately, the use of these markers is not specified by the standard. COM markers are fairly widely used to hold user-supplied text. The JFIF file format spec uses APP0 markers with specified initial strings to hold certain data. Adobe applications use APP14 markers beginning with the string "Adobe" for miscellaneous data. Other APPn markers are rarely seen, but might contain almost anything.

If you wish to store user-supplied text, we recommend you use COM markers and place readable 7-bit ASCII text in them. Newline conventions are not standardized --- expect to find LF (Unix style), CR/LF (DOS style), or CR (Mac style). A robust COM reader should be able to cope with random binary garbage, including nulls, since some applications generate COM markers containing non-ASCII junk. (But yours should not be one of them.)

For program-supplied data, use an APPn marker, and be sure to begin it with an identifying string so that you can tell whether the marker is actually yours. It's probably best to avoid using APP0 or APP14 for any private markers. (NOTE: the upcoming SPIFF standard will use APP8 markers; we recommend you not use APP8 markers for any private purposes, either.)

Keep in mind that at most 65533 bytes can be put into one marker, but you can have as many markers as you like.

By default, the IJG compression library will write a JFIF APP0 marker if the selected JPEG colorspace is grayscale or YCbCr, or an Adobe APP14 marker if the selected colorspace is RGB, CMYK, or YCCK. You can disable this, but we don't recommend it. The decompression library will recognize JFIF and Adobe markers and will set the JPEG colorspace properly when one is found.

You can write special markers immediately following the datastream header by calling jpeg_write_marker() after jpeg_start_compress() and before the first call to jpeg_write_scanlines(). When you do this, the markers appear after the SOI and the JFIF APP0 and Adobe APP14 markers (if written), but before all else. Specify the marker type parameter as "JPEG_COM" for COM or "JPEG_APP0 + n" for APPn. (Actually, jpeg_write_marker will let you write

any marker type, but we don't recommend writing any other kinds of marker.)
For example, to write a user comment string pointed to by `comment_text`:
`jpeg_write_marker(cinfo, JPEG_COM, comment_text, strlen(comment_text));`

If it's not convenient to store all the marker data in memory at once, you can instead call `jpeg_write_m_header()` followed by multiple calls to `jpeg_write_m_byte()`. If you do it this way, it's your responsibility to call `jpeg_write_m_byte()` exactly the number of times given in the `length` parameter to `jpeg_write_m_header()`. (This method lets you empty the output buffer partway through a marker, which might be important when using a suspending data destination module. In any case, if you are using a suspending destination, you should flush its buffer after inserting any special markers. See "I/O suspension".)

Or, if you prefer to synthesize the marker byte sequence yourself, you can just cram it straight into the data destination module.

If you are writing JFIF 1.02 extension markers (thumbnail images), don't forget to set `cinfo.JFIF_minor_version = 2` so that the encoder will write the correct JFIF version number in the JFIF header marker. The library's default is to write version 1.01, but that's wrong if you insert any 1.02 extension markers. (We could probably get away with just defaulting to 1.02, but there used to be broken decoders that would complain about unknown minor version numbers. To reduce compatibility risks it's safest not to write 1.02 unless you are actually using 1.02 extensions.)

When reading, two methods of handling special markers are available:

1. You can ask the library to save the contents of COM and/or APPn markers into memory, and then examine them at your leisure afterwards.
2. You can supply your own routine to process COM and/or APPn markers on-the-fly as they are read.

The first method is simpler to use, especially if you are using a suspending data source; writing a marker processor that copes with input suspension is not easy (consider what happens if the marker is longer than your available input buffer). However, the second method conserves memory since the marker data need not be kept around after it's been processed.

For either method, you'd normally set up marker handling after creating a decompression object and before calling `jpeg_read_header()`, because the markers of interest will typically be near the head of the file and so will be scanned by `jpeg_read_header`. Once you've established a marker handling method, it will be used for the life of that decompression object (potentially many datastreams), unless you change it. Marker handling is determined separately for COM markers and for each APPn marker code.

To save the contents of special markers in memory, call `jpeg_save_markers(cinfo, marker_code, length_limit)` where `marker_code` is the marker type to save, `JPEG_COM` or `JPEG_APP0+n`. (To arrange to save all the special marker types, you need to call this routine 17 times, for `COM` and `APP0-APP15`.) If the incoming marker is longer than `length_limit` data bytes, only `length_limit` bytes will be saved; this parameter allows you to avoid chewing up memory when you only need to see the first few bytes of a potentially large marker. If you want to save all the data, set `length_limit` to `0xFFFF`; that is enough since marker lengths are only 16 bits. As a special case, setting `length_limit` to 0 prevents that marker type from being saved at all. (That is the default behavior, in fact.)

After `jpeg_read_header()` completes, you can examine the special markers by following the `cinfo->marker_list` pointer chain. All the special markers in the file appear in this list, in order of their occurrence in the file (but omitting any markers of types you didn't ask for). Both the original data length and the saved data length are recorded for each list entry; the latter will not exceed `length_limit` for the particular marker type. Note that these lengths exclude the marker length word, whereas the stored representation within the JPEG file includes it. (Hence the maximum data length is really only 65533.)

It is possible that additional special markers appear in the file beyond the SOS marker at which `jpeg_read_header` stops; if so, the marker list will be extended during reading of the rest of the file. This is not expected to be common, however. If you are short on memory you may want to reset the length limit to zero for all marker types after finishing `jpeg_read_header`, to ensure that the `max_memory_to_use` setting cannot be exceeded due to addition of later markers.

The marker list remains stored until you call `jpeg_finish_decompress` or `jpeg_abort`, at which point the memory is freed and the list is set to empty. (`jpeg_destroy` also releases the storage, of course.)

Note that the library is internally interested in `APP0` and `APP14` markers; if you try to set a small nonzero length limit on these types, the library will silently force the length up to the minimum it wants. (But you can set a zero length limit to prevent them from being saved at all.) Also, in a 16-bit environment, the maximum length limit may be constrained to less than 65533 by `malloc()` limitations. It is therefore best not to assume that the effective length limit is exactly what you set it to be.

If you want to supply your own marker-reading

routine, you do it by calling `jpeg_set_marker_processor()`. A marker processor routine must have the signature

```
boolean jpeg_marker_parser_method (j_decompress_ptr cinfo)
```

Although the marker code is not explicitly passed, the routine can find it in `cinfo->unread_marker`. At the time of call, the marker proper has been read from the data source module. The processor routine is responsible for reading the marker length word and the remaining parameter bytes, if any. Return `TRUE` to indicate success. (`FALSE` should be returned only if you are using a suspending data source and it tells you to suspend. See the standard marker processors in `jdmarker.c` for appropriate coding methods if you need to use a suspending data source.)

If you override the default APP0 or APP14 processors, it is up to you to recognize JFIF and Adobe markers if you want colorspace recognition to occur properly. We recommend copying and extending the default processors if you want to do that. (A better idea is to save these marker types for later examination by calling `jpeg_save_markers()`; that method doesn't interfere with the library's own processing of these markers.)

`jpeg_set_marker_processor()` and `jpeg_save_markers()` are mutually exclusive --- if you call one it overrides any previous call to the other, for the particular marker type specified.

A simple example of an external COM processor can be found in `djpeg.c`. Also, see `jpegtran.c` for an example of using `jpeg_save_markers`.

Raw (downsampled) image data

Some applications need to supply already-downsampled image data to the JPEG compressor, or to receive raw downsampled data from the decompressor. The library supports this requirement by allowing the application to write or read raw data, bypassing the normal preprocessing or postprocessing steps. The interface is different from the standard one and is somewhat harder to use. If your interest is merely in bypassing color conversion, we recommend that

you use the standard interface and simply set `jpeg_color_space = in_color_space` (or `jpeg_color_space = out_color_space` for decompression). The mechanism described in this section is necessary only to supply or receive downsampled image data, in which not all components have the same dimensions.

To compress raw data, you must supply the data in the colorspace to be used in the JPEG file (please read the earlier section on Special color spaces)

and downsampled to the sampling factors specified in the JPEG parameters. You must supply the data in the format used internally by the JPEG library, namely a JSAMPIMAGE array. This is an array of pointers to two-dimensional arrays, each of type JSAMPARRAY. Each 2-D array holds the values for one color component. This structure is necessary since the components are of different sizes. If the image dimensions are not a multiple of the MCU size, you must also pad the data correctly (usually, this is done by replicating the last column and/or row). The data must be padded to a multiple of a DCT block in each component: that is, each downsampled row must contain a multiple of 8 valid samples, and there must be a multiple of 8 sample rows for each component. (For applications such as conversion of digital TV images, the standard image size is usually a multiple of the DCT block size, so that no padding need actually be done.)

The procedure for compression of raw data is basically the same as normal compression, except that you call `jpeg_write_raw_data()` in place of `jpeg_write_scanlines()`. Before calling `jpeg_start_compress()`, you must do the following:

- * Set `cinfo->raw_data_in` to TRUE. (It is set FALSE by `jpeg_set_defaults()`.) This notifies the library that you will be supplying raw data.
- * Ensure `jpeg_color_space` is correct --- an explicit `jpeg_set_colorspace()` call is a good idea. Note that since color conversion is bypassed, `in_color_space` is ignored, except that `jpeg_set_defaults()` uses it to choose the default `jpeg_color_space` setting.
- * Ensure the sampling factors, `cinfo->comp_info[i].h_samp_factor` and `cinfo->comp_info[i].v_samp_factor`, are correct. Since these indicate the dimensions of the data you are supplying, it's wise to set them explicitly, rather than assuming the library's defaults are what you want.

To pass raw data to the library, call `jpeg_write_raw_data()` in place of `jpeg_write_scanlines()`. The two routines work similarly except that `jpeg_write_raw_data` takes a JSAMPIMAGE data array rather than JSAMPARRAY. The scanlines count passed to and returned from `jpeg_write_raw_data` is measured in terms of the component with the largest `v_samp_factor`.

`jpeg_write_raw_data()` processes one MCU row per call, which is to say `v_samp_factor*DCTSIZE` sample rows of each component. The passed `num_lines` value must be at least `max_v_samp_factor*DCTSIZE`, and the return value will be exactly that amount (or possibly some multiple of that amount, in future library versions). This is true even on the last call at the bottom of the image; don't forget to pad your data as necessary.

The required dimensions of the supplied data can be computed for each component as

`cinfo->comp_info[i].width_in_blocks*DCTSIZE` samples per row
`cinfo->comp_info[i].height_in_blocks*DCTSIZE` rows in image

after `jpeg_start_compress()` has initialized those fields. If the valid data is smaller than this, it must be padded appropriately. For some sampling factors and image sizes, additional dummy DCT blocks are inserted to make the image a multiple of the MCU dimensions. The library creates such dummy blocks itself; it does not read them from your supplied data. Therefore you need never pad by more than `DCTSIZE` samples. An example may help here.

Assume 2h2v downsampling of YCbCr data, that is

```
cinfo->comp_info[0].h_samp_factor = 2 for Y
cinfo->comp_info[0].v_samp_factor = 2
cinfo->comp_info[1].h_samp_factor = 1 for Cb
cinfo->comp_info[1].v_samp_factor = 1
cinfo->comp_info[2].h_samp_factor
= 1 for Cr
cinfo->comp_info[2].v_samp_factor = 1
```

and suppose that the nominal image dimensions (`cinfo->image_width` and `cinfo->image_height`) are 101x101 pixels. Then `jpeg_start_compress()` will compute `downsampled_width = 101` and `width_in_blocks = 13` for Y, `downsampled_width = 51` and `width_in_blocks = 7` for Cb and Cr (and the same for the height fields). You must pad the Y data to at least $13*8 = 104$ columns and rows, the Cb/Cr data to at least $7*8 = 56$ columns and rows. The MCU height is `max_v_samp_factor = 2` DCT rows so you must pass at least 16 scanlines on each call to `jpeg_write_raw_data()`, which is to say 16 actual sample rows of Y and 8 each of Cb and Cr. A total of 7 MCU rows are needed, so you must pass a total of $7*16 = 112$ "scanlines". The last DCT block row of Y data is dummy, so it doesn't matter what you pass for it in the data arrays, but the scanlines count must total up to 112 so that all of the Cb and Cr data gets passed.

Output

suspension is supported with raw-data compression: if the data destination module suspends, `jpeg_write_raw_data()` will return 0. In this case the same data rows must be passed again on the next call.

Decompression with raw data output implies bypassing all postprocessing: you cannot ask for rescaling or color quantization, for instance. More seriously, you must deal with the color space and sampling factors present in the incoming file. If your application only handles, say, 2h1v YCbCr data, you must check for and fail on other color spaces or other sampling factors. The library will not convert to a different color space for you.

To obtain raw data output, set `cinfo->raw_data_out = TRUE` before `jpeg_start_decompress()` (it is set `FALSE` by `jpeg_read_header()`). Be sure to verify that the color space and sampling factors are ones you can handle. Then call `jpeg_read_raw_data()` in place of `jpeg_read_scanlines()`. The decompression process is otherwise the same as usual.

```
jpeg_read_raw_data()
```

returns one MCU row per call, and thus you must pass a buffer of at least `max_v_samp_factor*DCTSIZE` scanlines (scanline counting is the same as for raw-data compression). The buffer you pass must be large enough to hold the actual data plus padding to DCT-block boundaries. As with compression, any entirely dummy DCT blocks are not processed so you need not allocate space for them, but the total scanline count includes them. The above example of computing buffer dimensions for raw-data compression is equally valid for decompression.

Input suspension is supported with raw-data decompression: if the data source module suspends, `jpeg_read_raw_data()` will return 0. You can also use buffered-image mode to read raw data in multiple passes.

Really raw data: DCT coefficients

It is possible to read or write the contents of a JPEG file as raw DCT coefficients. This facility is mainly intended for use in lossless transcoding between different JPEG file formats. Other possible applications include lossless cropping of a JPEG image, lossless reassembly of a multi-strip or multi-tile TIFF/JPEG file into a single JPEG datastream, etc.

To read the contents of a JPEG file as DCT coefficients, open the file and do `jpeg_read_header()` as usual. But instead of calling `jpeg_start_decompress()` and `jpeg_read_scanlines()`, call `jpeg_read_coefficients()`. This will read the entire image into a set of virtual coefficient-block arrays, one array per component. The return value is a pointer to an array of virtual-array descriptors. Each virtual array can be accessed directly using the JPEG memory manager's `access_virt_barray` method (see Memory management, below, and also read `structure.txt`'s discussion of virtual array handling). Or, for simple transcoding to a different JPEG file format, the array list can just be handed directly to `jpeg_write_coefficients()`.

Each block in the block arrays contains quantized coefficient values in normal array order (not JPEG zigzag order). The block arrays contain only DCT blocks containing real data; any entirely-dummy blocks added to fill out interleaved MCUs at the right or bottom edges of the image are discarded during reading and are not stored in the block arrays. (The size of each block array can be determined from the `width_in_blocks` and `height_in_blocks` fields of the component's `comp_info` entry.) This is also the data format expected by `jpeg_write_coefficients()`.

When you are done using the virtual arrays, call `jpeg_finish_decompress()` to release the array storage and return the decompression object to an idle state; or just call `jpeg_destroy()` if you don't need to reuse the object.

If you use a suspending data source, `jpeg_read_coefficients()` will return NULL if it is forced to suspend; a non-NULL return value indicates successful completion. You need not test for a NULL return value when using a non-suspending data source.

It is also possible to call `jpeg_read_coefficients()` to obtain access to the decoder's coefficient arrays during a normal decode cycle in buffered-image mode. This frammish might be useful for progressively displaying an incoming image and then re-encoding it without loss. To do this, decode in buffered-image mode as discussed previously, then call `jpeg_read_coefficients()` after the last `jpeg_finish_output()` call. The arrays will be available for your use until you call `jpeg_finish_decompress()`.

To write the contents of a JPEG file as DCT coefficients, you must provide the DCT coefficients stored in virtual block arrays. You can either pass block arrays read from an input JPEG file by `jpeg_read_coefficients()`, or allocate virtual arrays from the JPEG compression object and fill them yourself. In either case, `jpeg_write_coefficients()` is substituted for `jpeg_start_compress()` and `jpeg_write_scanlines()`. Thus the sequence is

- * Create compression object
- * Set all compression parameters as necessary
- * Request virtual arrays if needed
- * `jpeg_write_coefficients()`
- * `jpeg_finish_compress()`
- * Destroy or re-use compression object

`jpeg_write_coefficients()` is passed a pointer to an array of virtual block array descriptors; the number of arrays is equal to `cinfo.num_components`.

The virtual arrays need only have been requested, not realized, before `jpeg_write_coefficients()` is called. A side-effect of `jpeg_write_coefficients()` is to realize any virtual arrays that have been requested from the compression object's memory manager. Thus, when obtaining the virtual arrays from the compression object, you should fill the arrays after calling `jpeg_write_coefficients()`. The data is actually written out when you call `jpeg_finish_compress()`; `jpeg_write_coefficients()` only writes the file header.

When writing raw DCT coefficients, it is crucial that the JPEG quantization tables and sampling factors match the way the data was encoded, or the resulting file will be invalid. For transcoding from an existing JPEG file, we recommend using `jpeg_copy_critical_parameters()`. This routine initializes all the compression parameters to default values (like `jpeg_set_defaults()`), then copies the critical information from a source decompression object.

The decompression object should have just been used to read the entire JPEG input file --- that is, it should be awaiting `jpeg_finish_decompress()`.

`jpeg_write_coefficients()` marks all tables stored in the compression object as needing to be written to the output file (thus, it acts like `jpeg_start_compress(cinfo, TRUE)`). This is for safety's sake, to avoid emitting abbreviated JPEG files by accident. If you really want to emit an abbreviated JPEG file, call `jpeg_suppress_tables()`, or set the tables' individual `sent_table` flags, between calling `jpeg_write_coefficients()` and `jpeg_finish_compress()`.

Progress monitoring

Some applications may need to regain control from the JPEG library every so often. The typical use of this feature is to produce a percent-done bar or other progress display. (For a simple example, see `cjpeg.c` or `djpeg.c`.) Although you do get control back frequently during the data-transferring pass (the `jpeg_read_scanlines` or `jpeg_write_scanlines` loop), any additional passes will occur inside `jpeg_finish_compress` or `jpeg_start_decompress`; those routines may take a long time to execute, and you don't get control back until they are done.

You can define a progress-monitor routine which will be called periodically by the library. No guarantees are made about how often this call will occur, so we don't recommend you use it for mouse tracking or anything like that. At present, a call will occur once per MCU row, scanline, or sample row group, whichever unit is convenient for the current processing mode; so the wider the image, the longer the time between calls. During the data transferring pass, only one call occurs per call of `jpeg_read_scanlines` or `jpeg_write_scanlines`, so don't pass a large number of scanlines at once if you want fine resolution in the progress count. (If you really need to use the callback mechanism for time-critical tasks like mouse tracking, you could insert additional calls inside some of the library's inner loops.)

To establish a progress-monitor callback, create a struct `jpeg_progress_mgr`, fill in its `progress_monitor` field with a pointer to your callback routine, and set `cinfo->progress` to point to the struct. The callback will be called whenever `cinfo->progress` is non-NULL. (This pointer is set to NULL by `jpeg_create_compress` or `jpeg_create_decompress`; the library will not change it thereafter. So if you allocate dynamic storage for the progress struct, make sure it will live as long as the JPEG object does. Allocating from the JPEG memory manager with lifetime `JPOOL_PERMANENT` will work nicely.) You can use the same callback routine for both compression and decompression.

The jpeg_progress_mgr struct contains four fields which are set by the library:

```
long pass_counter; /* work units completed in this pass */
long pass_limit; /* total number of work units in this pass */
int completed_passes; /* passes completed so far */
int total_passes; /* total number of passes expected */
```

During any one pass, pass_counter increases from 0 up to (not including) pass_limit; the step size is usually but not necessarily 1. The pass_limit value may change from one pass to another. The expected total number of passes is in total_passes, and the number of passes already completed is in completed_passes. Thus the fraction of work completed may be estimated as

```
-----
    completed_passes + (pass_counter/pass_limit)
```

ignoring the fact that the passes may not be equal amounts of work.

When decompressing, pass_limit can even change within a pass, because it depends on the number of scans in the JPEG file, which isn't always known in advance. The computed fraction-of-work-done may jump suddenly (if the library discovers it has overestimated the number of scans) or even decrease (in the opposite case). It is not wise to put great faith in the work estimate.

When using the decompressor's buffered-image mode, the progress monitor work estimate is likely to be completely unhelpful, because the library has no way to know how many output passes will be demanded of it. Currently, the library sets total_passes based on the assumption that there will be one more output pass if the input file end hasn't yet been read (jpeg_input_complete() isn't TRUE), but no more output passes if the file end has been reached when the output pass is started. This means that total_passes will rise as additional output passes are requested. If you have a way of determining the input file size, estimating progress based on the fraction of the file that's been read will probably be more useful than using the library's value.

Memory management

This section covers some key facts about the JPEG library's built-in memory manager. For more info, please read structure.txt's section about the memory manager, and consult the source code if necessary.

All memory and temporary file allocation within the library is done via the memory manager. If necessary, you can replace the "back end" of the memory manager to control allocation yourself (for example, if you don't want the library to use malloc() and free() for some reason).

Some data is allocated "permanently" and will not be freed until the JPEG object is destroyed. Most data is allocated "per image" and is freed by `jpeg_finish_compress`, `jpeg_finish_decompress`, or `jpeg_abort`. You can call the memory manager yourself to allocate structures that will automatically be freed at these times. Typical code for this is

```
ptr = (*cinfo->mem->alloc_small) ((j_common_ptr) cinfo, JPOOL_IMAGE, size);
```

Use `JPOOL_PERMANENT` to get storage that lasts as long as the JPEG object. Use `alloc_large` instead of `alloc_small` for anything bigger than a few Kbytes. There are also `alloc_sarray` and `alloc_barray` routines that automatically build 2-D sample or block arrays.

The library's minimum space requirements to process an image depend on the image's width, but not on its height, because the library ordinarily works with "strip" buffers that are as wide as the image but just a few rows high. Some operating modes (eg, two-pass color quantization) require full-image buffers. Such buffers are treated as "virtual arrays": only the current strip need be in memory, and the rest can be swapped out to a temporary file.

If you use the simplest memory manager back end (`jmemnobs.c`), then no temporary files are used; virtual arrays are simply `malloc()`'d. Images bigger than memory can be processed only if your system supports virtual memory. The other memory manager back ends support temporary files of various flavors and thus work in machines without virtual memory. They may also be useful on Unix machines if you need to process images that exceed available swap space.

When using temporary files, the library will make the in-memory buffers for its virtual arrays just big enough to stay within a "maximum memory" setting. Your application can set this limit by setting `cinfo->mem->max_memory_to_use` after creating the JPEG object. (Of course, there is still a minimum size for the buffers, so the max-memory setting is effective only if it is bigger than the minimum space needed.) If you allocate any large structures yourself, you must allocate them before `jpeg_start_compress()` or `jpeg_start_decompress()` in order to have them counted against the max memory limit. Also keep in mind that space allocated with `alloc_small()` is ignored, on the assumption that it's too small to be worth worrying about; so a reasonable safety margin should be left when setting `max_memory_to_use`.

If you use the `jmemname.c` or `jmemdos.c` memory manager back end, it is important to clean up the JPEG object properly to ensure that the temporary files get deleted. (This is especially crucial with `jmemdos.c`, where the "temporary files" may be extended-memory segments; if they are not freed, DOS will require a reboot to recover the memory.) Thus, with these memory managers, it's a good idea to provide a signal handler that will trap any early exit from your program. The handler should call either `jpeg_abort()` or `jpeg_destroy()` for any active JPEG objects. A handler is not needed with

jmemnobs.c, and shouldn't be necessary with jmemansi.c or jmemmac.c either, since the C library is supposed to take care of deleting files made with tmpfile().

Memory usage

Working memory requirements while performing compression or decompression depend on image dimensions, image characteristics (such as colorspace and JPEG process), and operating mode (application-selected options).

As of v6b, the decompressor requires:

1. About 24K in more-or-less-fixed-size data. This varies a bit depending on operating mode and image characteristics (particularly color vs. grayscale), but it doesn't depend on image dimensions.
 2. Strip buffers (of size proportional to the image width) for IDCT and upsampling results. The worst case for commonly used sampling factors is about 34 bytes * width in pixels for a color image. A grayscale image only needs about 8 bytes per pixel column.
 3. A full-image DCT coefficient buffer is needed to decode a multi-scan JPEG file (including progressive JPEGs), or whenever you select buffered-image mode. This takes 2 bytes/coefficient. At typical 2x2 sampling, that's 3 bytes per pixel for a color image. Worst case (1x1 sampling) requires 6 bytes/pixel. For grayscale, figure 2 bytes/pixel.
 4. To perform 2-pass color quantization, the decompressor also needs a 128K color lookup table and a full-image pixel buffer (3 bytes/pixel).
- This does not count any memory allocated by the application, such as a buffer to hold the final output image.

The above figures are valid for 8-bit JPEG data precision and a machine with 32-bit ints. For 12-bit JPEG data, double the size of the strip buffers and quantization pixel buffer. The "fixed-size" data will be somewhat smaller with 16-bit ints, larger with 64-bit ints. Also, CMYK or other unusual color spaces will require different amounts of space.

The full-image coefficient and pixel buffers, if needed at all, do not have to be fully RAM resident; you can have the library use temporary files instead when the total memory usage would exceed a limit you set. (But if your OS supports virtual memory, it's probably better to just use jmemnobs and let the OS do the swapping.)

The compressor's memory requirements are similar, except that it has no need for color quantization. Also, it needs a full-image DCT coefficient buffer if Huffman-table optimization is asked for, even if progressive mode is not requested.

If you need more detailed information about memory usage in a particular situation, you can enable the MEM_STATS code in jmemmgr.c.

Library compile-time options

A number of compile-time options are available by modifying jmorecfg.h.

The JPEG standard provides for both the baseline 8-bit DCT process and a 12-bit DCT process. The IJG code supports 12-bit lossy JPEG if you define BITS_IN_JSAMPLE as 12 rather than 8. Note that this causes JSAMPLE to be larger than a char, so it affects the surrounding application's image data.

The sample applications cjpeg and djpeg can support 12-bit mode only for PPM and GIF file formats; you must disable the other file formats to compile a 12-bit cjpeg or djpeg. (install.txt has more information about that.)

At present, a 12-bit library can handle *only* 12-bit images, not both precisions. (If you need to include both 8- and 12-bit libraries in a single application, you could probably do it by defining NEED_SHORT_EXTERNAL_NAMES for just one of the copies. You'd have to access the 8-bit and 12-bit copies from separate application source files. This is untested ... if you try it, we'd like to hear whether it works!)

Note that a 12-bit library always compresses in Huffman optimization mode, in order to generate valid Huffman tables. This is necessary because our default Huffman tables only cover 8-bit data. If you need to output 12-bit files in one pass, you'll have to supply suitable default Huffman tables. You may also want to supply your own DCT quantization tables; the existing quality-scaling code has been developed for 8-bit use, and probably doesn't generate especially good tables for 12-bit.

The maximum number of components (color channels) in the image is determined by MAX_COMPONENTS. The JPEG standard allows up to 255 components, but we expect that few applications will need more than four or so.

On machines with unusual data type sizes, you may be able to improve performance or reduce memory space by tweaking the various typedefs in jmorecfg.h.

In particular, on some RISC CPUs, access to arrays of "short"s is quite slow; consider trading memory for speed by making JCOEF, INT16, and UINT16 be "int" or "unsigned int". UINT8 is also a candidate to become int. You probably don't want to make JSAMPLE be int unless you have lots of memory to burn.

You can reduce the size of the library by compiling out various optional

functions. To do this, undefine `xxx_SUPPORTED` symbols as necessary.

You can also save a few K by not having text error messages in the library; the standard error message table occupies about 5Kb. This is particularly reasonable for embedded applications where there's no good way to display a message anyway. To do this, remove the creation of the message table (`jpeg_std_message_table[]`) from `jerror.c`, and alter `format_message` to do something reasonable without it. You could output the numeric value of the message code number, for example. If you do this, you can also save a couple more K by modifying the `TRACEMSn()` macros in `jerror.h` to expand to nothing; you don't need trace capability anyway, right?

Portability considerations

The JPEG library has been written to be extremely portable; the sample applications `cjpeg` and `djpeg` are slightly less so. This section summarizes the design goals in this area. (If you encounter any bugs that cause the library to be less portable than is claimed here, we'd appreciate hearing about them.)

The code works fine on ANSI C, C++, and pre-ANSI C compilers, using any of the popular system include file setups, and some not-so-popular ones too. See `install.txt` for configuration procedures.

The code is not dependent on the exact sizes of the C data types. As distributed, we make the assumptions that

- char is at least 8 bits wide
- short is at least 16 bits wide
- int is at least 16 bits wide
- long is at least 32 bits wide

(These are the minimum requirements of the ANSI C standard.) Wider types will work fine, although

- memory may be used inefficiently if char is much larger than 8 bits or short is much bigger than 16 bits.

The code should work equally well with 16- or 32-bit ints.

In a system where these assumptions are not met, you may be able to make the code work by modifying the typedefs in `jmorecfg.h`. However, you will probably have difficulty if int is less than 16 bits wide, since references to plain int abound in the code.

char can be either signed or unsigned, although the code runs faster if an unsigned char type is available. If char is wider than 8 bits, you will need to redefine `JOCTET` and/or provide custom data source/destination managers so that `JOCTET` represents exactly 8 bits of data on external storage.

The JPEG library proper does not assume ASCII representation of characters. But some of the image file I/O modules in cjpeg/djpeg do have ASCII dependencies in file-header manipulation; so does cjpeg's select_file_type() routine.

The JPEG library does not rely heavily on the C library. In particular, C stdio is used only by the data source/destination modules and the error handler, all of which are application-replaceable. (cjpeg/djpeg are more heavily dependent on stdio.) malloc and free are called only from the memory manager "back end" module, so you can use a different memory allocator by replacing that one file.

The code generally assumes that C names must be unique in the first 15 characters. However, global function names can be made unique in the first 6 characters by defining NEED_SHORT_EXTERNAL_NAMES.

More info about porting the code may be gleaned by reading jconfig.txt, jmorecfg.h, and jinclude.h.

Notes for MS-DOS implementors

The IJG code is designed to work efficiently in 80x86 "small" or "medium" memory models (i.e., data pointers are 16 bits unless explicitly declared "far"; code pointers can be either size). You may be able to use small model to compile cjpeg or djpeg by itself, but you will probably have to use medium model for any larger application. This won't make much difference in performance. You *will* take a noticeable performance hit if you use a large-data memory model (perhaps 10%-25%), and you should avoid "huge" model if at all possible.

The JPEG library typically needs 2Kb-3Kb of stack space. It will also malloc about 20K-30K of near heap space while executing (and lots of far heap, but that doesn't count in this calculation). This figure will vary depending on selected operating mode, and to a lesser extent on image size. There is also about 5Kb-6Kb of constant data which will be allocated in the near data segment (about 4Kb of this is the error message table). Thus you have perhaps 20K available for other modules' static data and near heap space before you need to go to a larger memory model. The C library's static data will account for several K of this, but that still leaves a good deal for your needs. (If you are tight on space, you could reduce the sizes of the I/O buffers allocated by jdatasrc.c and jdatadst.c, say from 4K to 1K. Another possibility is to move the error message table to far memory;

this should be doable with only localized hacking on jerror.c.)

About 2K of the near heap space is "permanent" memory that will not be released until you destroy the JPEG object. This is only an issue if you save a JPEG object between compression or decompression operations.

Far data space may also be a tight resource when you are dealing with large images. The most memory-intensive case is decompression with two-pass color quantization, or single-pass quantization to an externally supplied color map. This requires a 128Kb color lookup table plus strip buffers amounting to about 40 bytes per column for typical sampling ratios (eg, about 25600 bytes for a 640-pixel-wide image). You may not be able to process wide images if you have large data structures of your own.

Of course, all of these concerns vanish if you use a 32-bit flat-memory-model compiler, such as DJGPP or Watcom C. We highly recommend flat model if you can use it; the JPEG library is significantly faster in flat model.

Found in path(s):

```
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/libjpeg.txt
No license file was found, but licenses were detected in source scan.
```

```
/*
* transupp.h
*
* Copyright (C) 1997-2011, Thomas G. Lane, Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains declarations for image transformation routines and
* other utility code used by the jpegtran sample application. These are
* NOT part of the core JPEG library. But we keep these routines separate
* from jpegtran.c to ease the task of maintaining jpegtran-like programs
* that have other user interfaces.
*
* NOTE: all the routines declared here have very specific requirements
* about when they are to be executed during the reading and writing of the
* source and destination files. See the comments in transupp.c, or see
* jpegtran.c for an example of correct usage.
*/
```

Found in path(s):

```
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/transupp.h
No license file was found, but licenses were detected in source scan.
```

; For conditions of distribution and use, see copyright notice in jsimdex.inc

Found in path(s):

```
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jimmxred.asm
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jdclrss2-64.asm
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jcqntmmx.asm
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jdmermmx.asm
*
/opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jiss2flt-64.asm
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jcsamss2.asm
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jcqntsse.asm
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jiss2red-64.asm
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jf3dnflt.asm
*
/opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jcgryss2.asm
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jcsamss2-64.asm
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jdmrgss2.asm
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jdclrss2.asm
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jccolss2.asm
*
/opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jdsamss2.asm
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jcqnts2i.asm
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jcgryss2-64.asm
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jisseflt.asm
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jdsamss2-64.asm
*
/opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jcclrss2.asm
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
```



```
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jcclrmx.asm
*
/opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jdclrmx.asm
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/ji3dnflt.asm
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jdcolss2-64.asm
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jcgrass2-64.asm
*
/opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jdcolmmx.asm
No license file was found, but licenses were detected in source scan.
```

```
/*
* jmehmsys.h
*
* Copyright (C) 1992-1997, Thomas G. Lane.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This include file defines the interface between the system-independent
* and system-dependent portions of the JPEG memory manager. No other
* modules need include it. (The system-independent portion is jmehmgr.c;
* there are several different versions of the system-dependent portion.)
*
* This file works as-is for the system-dependent memory managers supplied
* in the IJG distribution. You may need to modify it if you write a
* custom memory manager. If system-dependent changes are needed in
* this file, the best method is to #ifdef them based on a configuration
* symbol supplied in jconfig.h, as we have done with USE_MSDOS_MEMMGR
* and USE_MAC_MEMMGR.
*/
```

Found in path(s):

```
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jmehmsys.h
No license file was found, but licenses were detected in source scan.
```

```
/*
* jdarith.c
*
* Developed 1997-2009 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains portable arithmetic entropy decoding routines for JPEG
```



```

* (implementing the ISO/IEC IS 10918-1 and CCITT Recommendation ITU-T T.81).
*
* Both sequential and progressive modes are supported in this single module.
*
* Suspension is not currently supported in this module.
*/

```

Found in path(s):

```

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jdarith.c
No license file was found, but licenses were detected in source scan.

```

```

;
; jdct.inc - private declarations for forward & reverse DCT subsystems
;
; Copyright 2009 Pierre Ossman <ossman@cendio.se> for Cendio AB
;
; Based on
; x86 SIMD extension for IJG JPEG library
; Copyright (C) 1999-2006, MIYASAKA Masaru.
; For conditions of distribution and use, see copyright notice in jsimext.inc
;
; [TAB8]

; Each IDCT routine is responsible for range-limiting its results and
; converting them to unsigned form (0..MAXJSAMPLE). The raw outputs could
; be quite far out of range if the input data is corrupt, so a bulletproof
; range-limiting step is required. We use a mask-and-table-lookup method
; to do the combined operations quickly.
;
#define RANGE_MASK (MAXJSAMPLE * 4 + 3) ; 2 bits wider than legal samples

#define ROW(n,b,s) ((b)+(n)*(s))
#define COL(n,b,s) ((b)+(n)*(s)*DCTSIZE)

#define DWBLOCK(m,n,b,s) ((b)+(m)*DCTSIZE*(s)+(n)*sizeof_dword)
#define MMBLOCK(m,n,b,s) ((b)+(m)*DCTSIZE*(s)+(n)*sizeof_mword)
#define
XMMBLOCK(m,n,b,s) ((b)+(m)*DCTSIZE*(s)+(n)*sizeof_xmword)

; -----

```

Found in path(s):

```

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jdct.inc
No license file was found, but licenses were detected in source scan.

```

```

/*

```

* Copyright (C)2011 D. R. Commander. All Rights Reserved.
 *
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 * modification, are permitted provided that the following conditions are met:
 *
 * - Redistributions of source code must retain the above copyright notice,
 * this list of conditions and the following disclaimer.
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 * this list of conditions and the following disclaimer in the documentation
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 * - Neither the name of the libjpeg-turbo Project nor the names of its
 * contributors may be used to endorse or promote products derived from this
 * software without specific prior written permission.
 *
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 * CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF
 * SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS
 * INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN
 * CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE)
 * ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE
 * POSSIBILITY OF SUCH DAMAGE.
 */

package org.libjpegturbo.turbojpeg;

```
final class TJLoader {
    static void load() {
        System.loadLibrary("@TURBOJPEG_DLL_NAME@");
    }
};
```

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UW7i7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/java/org/libjpegturbo/turbojpeg/TJLoader.java.in

No license file was found, but licenses were detected in source scan.

```
/*
 * cdjpeg.c
 *
 * Copyright (C) 1991-1997, Thomas G. Lane.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
```

*
* This file contains common support routines used by the IJG application
* programs (cjpeg, djpeg, jpegtran).
*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/cdjpeg.c
No license file was found, but licenses were detected in source scan.

/*

* jdmgext.c

*

* This file was part of the Independent JPEG Group's software:
* Copyright (C) 1994-1996, Thomas G. Lane.
* Modifications:
* Copyright (C) 2011, D. R. Commander.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains code for merged upsampling/color conversion.
*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jdmgext.c
No license file was found, but licenses were detected in source scan.

/*

* transupp.c

*

* This file was part of the Independent JPEG Group's software:
* Copyright (C) 1997-2011, Thomas G. Lane, Guido Vollbeding.
* Modifications:
* Copyright (C) 2010, D. R. Commander.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains image transformation routines and other utility code
* used by the jpegtran sample application. These are NOT part of the core
* JPEG library. But we keep these routines separate from jpegtran.c to
* ease the task of maintaining jpegtran-like programs that have other user
* interfaces.
*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/transupp.c
No license file was found, but licenses were detected in source scan.

```
/*
 * jerror.h
 *
 * Copyright (C) 1994-1997, Thomas G. Lane.
 * Modified 1997-2009 by Guido Vollbeding.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file defines the error and message codes for the JPEG library.
 * Edit this file to add new codes, or to translate the message strings to
 * some other language.
 * A set of error-reporting macros are defined too. Some applications using
 * the JPEG library may wish to include this file to get the error codes
 * and/or the macros.
 */
```

Found in path(s):

```
*/opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jerror.h
No license file was found, but licenses were detected in source scan.
```

```
/*
 * jfdctfst.c
 *
 * Copyright (C) 1994-1996, Thomas G. Lane.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file contains a fast, not so accurate integer implementation of the
 * forward DCT (Discrete Cosine Transform).
 *
 * A 2-D DCT can be done by 1-D DCT on each row followed by 1-D DCT
 * on each column. Direct algorithms are also available, but they are
 * much more complex and seem not to be any faster when reduced to code.
 *
 * This implementation is based on Arai, Agui, and Nakajima's algorithm for
 * scaled DCT. Their original paper (Trans. IEICE E-71(11):1095) is in
 * Japanese, but the algorithm is described in the Pennebaker & Mitchell
 * JPEG textbook (see REFERENCES section in file README). The following code
 * is based directly on figure 4-8 in P&M.
 * While an 8-point DCT cannot be done in less
 * than 11 multiplies, it is
 * possible to arrange the computation so that many of the multiplies are
 * simple scalings of the final outputs. These multiplies can then be
 * folded into the multiplications or divisions by the JPEG quantization
 * table entries. The AA&N method leaves only 5 multiplies and 29 adds
 * to be done in the DCT itself.
 * The primary disadvantage of this method is that with fixed-point math,
```

- * accuracy is lost due to imprecise representation of the scaled
- * quantization values. The smaller the quantization table entry, the less
- * precise the scaled value, so this implementation does worse with high-
- * quality-setting files than with low-quality ones.

*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jfdctfst.c
No license file was found, but licenses were detected in source scan.

/*

* jcapistd.c

*

* Copyright (C) 1994-1996, Thomas G. Lane.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains application interface code for the compression half

* of the JPEG library. These are the "standard" API routines that are

* used in the normal full-compression case. They are not used by a

* transcoding-only application. Note that if an application links in

* jpeg_start_compress, it will end up linking in the entire compressor.

* We thus must separate this file from jcapimin.c to avoid linking the

* whole compression library into a transcoder.

*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jcapistd.c
No license file was found, but licenses were detected in source scan.

/*

* rdswitch.c

*

* This file was part of the Independent JPEG Group's software:

* Copyright (C) 1991-1996, Thomas G. Lane.

* Modifications:

* Copyright (C) 2010, D. R. Commander.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains routines to process some of cjpeg's more complicated

* command-line switches. Switches processed here are:

* -qtables file Read quantization tables from text file

* -scans file Read scan script from text file

* -quality N[,N,...] Set quality ratings

* -qslots N[,N,...] Set component quantization table selectors

* -sample HxV[,HxV,...] Set component sampling factors

*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/rdswitch.c
No license file was found, but licenses were detected in source scan.

/*

* djpeg.c

*

* This file was part of the Independent JPEG Group's software:

* Copyright (C) 1991-1997, Thomas G. Lane.

* Modifications:

* Copyright (C) 2010-2011, 2013, D. R. Commander.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains a command-line user interface for the JPEG decompressor.

* It should work on any system with Unix- or MS-DOS-style command lines.

*

* Two different command line styles are permitted, depending on the

* compile-time switch TWO_FILE_COMMANDLINE:

* djpeg [options] inputfile outputfile

* djpeg [options] [inputfile]

* In the second style, output is always to standard output, which you'd

* normally redirect to a file or pipe to some other program. Input is

* either from a named file or from standard input (typically redirected).

* The second style is convenient on Unix but is unhelpful on systems that

* don't support pipes.

Also, you MUST use the first style if your system

* doesn't do binary I/O to stdin/stdout.

* To simplify script writing, the "-outfile" switch is provided. The syntax

* djpeg [options] -outfile outputfile inputfile

* works regardless of which command line style is used.

*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/djpeg.c
No license file was found, but licenses were detected in source scan.

/*

* jdmainct.c

*

* This file was part of the Independent JPEG Group's software:

* Copyright (C) 1994-1996, Thomas G. Lane.

* Modifications:

* Copyright (C) 2010, D. R. Commander.

* For conditions of distribution and use, see the accompanying README file.

*
* This file contains the main buffer controller for decompression.
* The main buffer lies between the JPEG decompressor proper and the
* post-processor; it holds downsampled data in the JPEG colorspace.
*
* Note that this code is bypassed in raw-data mode, since the application
* supplies the equivalent of the main buffer in that case.
*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jdmainct.c
No license file was found, but licenses were detected in source scan.

/*

* jchuff.h
*
* Copyright (C) 1991-1997, Thomas G. Lane.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains declarations for Huffman entropy encoding routines
* that are shared between the sequential encoder (jchuff.c) and the
* progressive encoder (jcphuff.c). No other modules need to see these.
*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jchuff.h
No license file was found, but licenses were detected in source scan.

/*

* jctrans.c
*
* Copyright (C) 1995-1998, Thomas G. Lane.
* Modified 2000-2009 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains library routines for transcoding compression,
* that is, writing raw DCT coefficient arrays to an output JPEG file.
* The routines in jcapimin.c will also be needed by a transcoder.
*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jctrans.c

No license file was found, but licenses were detected in source scan.

```
;  
; jcolsamp.inc - private declarations for color conversion & up/downsampling  
;  
; Copyright 2009 Pierre Ossman <ossman@cendio.se> for Cendio AB  
;  
; Based on  
; x86 SIMD extension for IJG JPEG library  
; Copyright (C) 1999-2006, MIYASAKA Masaru.  
; For conditions of distribution and use, see copyright notice in jsimdext.inc  
;  
; [TAB8]
```

```
; -----
```

```
; pseudo-registers to make ordering of RGB configurable
```

```
;  
%if RGB_RED == 0  
%define mmA mm0  
%define mmB mm1  
%define xmmA xmm0  
%define xmmB xmm1  
%elif RGB_GREEN == 0  
%define mmA mm2  
%define mmB mm3  
%define xmmA xmm2  
%define xmmB xmm3  
%elif RGB_BLUE == 0  
%define mmA mm4  
%define mmB mm5  
%define xmmA xmm4  
%define xmmB xmm5  
%else  
%define mmA mm6  
%define mmB mm7  
%define xmmA xmm6  
%define xmmB xmm7  
%endif
```

```
%if RGB_RED == 1  
%define mmC mm0  
%define mmD mm1  
%define xmmC xmm0  
%define xmmD xmm1  
%elif RGB_GREEN  
== 1  
%define mmC mm2
```



```
%define mmD mm3
%define xmmC xmm2
%define xmmD xmm3
%elif RGB_BLUE == 1
%define mmC mm4
%define mmD mm5
%define xmmC xmm4
%define xmmD xmm5
%else
%define mmC mm6
%define mmD mm7
%define xmmC xmm6
%define xmmD xmm7
%endif
```

```
%if RGB_RED == 2
%define mmE mm0
%define mmF mm1
%define xmmE xmm0
%define xmmF xmm1
%elif RGB_GREEN == 2
%define mmE mm2
%define mmF mm3
%define xmmE xmm2
%define xmmF xmm3
%elif RGB_BLUE == 2
%define mmE mm4
%define mmF mm5
%define xmmE xmm4
%define xmmF xmm5
%else
%define mmE mm6
%define mmF mm7
%define xmmE xmm6
%define xmmF xmm7
%endif
```

```
%if RGB_RED == 3
%define mmG mm0
%define mmH mm1
%define xmmG xmm0
%define xmmH xmm1
%elif RGB_GREEN == 3
%define mmG mm2
%define mmH mm3
%define xmmG xmm2
%define xmmH xmm3
%elif RGB_BLUE == 3
```

```
%define mmG mm4
%define mmH mm5
%define xmmG xmm4
%define xmmH xmm5
%else
%define mmG mm6
%define mmH mm7
%define xmmG xmm6
%define xmmH xmm7
%endif
```

```
;-----
```

Found

in path(s):

```
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jcolsamp.inc
No license file was found, but licenses were detected in source scan.
```

```
/*
```

```
* jcpam.c
```

```
*
```

```
* This file was part of the Independent JPEG Group's software:
```

```
* Copyright (C) 1991-1998, Thomas G. Lane.
```

```
* Modified 2003-2008 by Guido Vollbeding.
```

```
* Modifications:
```

```
* Copyright (C) 2009-2011, D. R. Commander.
```

```
* For conditions of distribution and use, see the accompanying README file.
```

```
*
```

```
* This file contains optional default-setting code for the JPEG compressor.
```

```
* Applications do not have to use this file, but those that don't use it
```

```
* must know a lot more about the innards of the JPEG code.
```

```
*/
```

Found in path(s):

```
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jcpam.c
No license file was found, but licenses were detected in source scan.
```

```
/*
```

```
* jdmaster.c
```

```
*
```

```
* This file was part of the Independent JPEG Group's software:
```

```
* Copyright (C) 1991-1997, Thomas G. Lane.
```

```
* Modified 2002-2009 by Guido Vollbeding.
```

```
* Modifications:
```

```
* Copyright (C) 2009-2011, D. R. Commander.
```

```
* For conditions of distribution and use, see the accompanying README file.
```

*
* This file contains master control logic for the JPEG decompressor.
* These routines are concerned with selecting the modules to be executed
* and with determining the number of passes and the work to be done in each
* pass.
*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jdmaster.c

No license file was found, but licenses were detected in source scan.

/*

* jdatasrc.c

*

* This file was part of the Independent JPEG Group's software:

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* Modified 2009-2011 by Guido Vollbeding.

* Modifications:

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*

* This file contains decompression data source routines for the case of

* reading JPEG data from memory or from a file (or any stdio stream).

* While these routines are sufficient for most applications,

* some will want to use a different source manager.

* IMPORTANT: we assume that fread() will correctly transcribe an array of

* JOCTETs from 8-bit-wide elements on external storage. If char is wider

* than 8 bits on your machine, you may need to do some tweaking.

*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jdatasrc.c

No license file was found, but licenses were detected in source scan.

/*

* jQuery JavaScript Library v1.3.2

* <http://jquery.com/>

*

* Copyright (c) 2009 John Resig

* Dual licensed under the MIT and GPL licenses.

* <http://docs.jquery.com/License>

*

* Date: 2009-02-19 17:34:21 -0500 (Thu, 19 Feb 2009)

* Revision: 6246

*/

/*

```

* Sizzle CSS Selector Engine - v0.9.3
* Copyright 2009, The Dojo Foundation
* Released under the MIT, BSD, and GPL Licenses.
* More information: http://sizzlejs.com/
*/
/*
* jQuery UI 1.7.2
*
* Copyright (c) 2009 AUTHORS.txt (http://jqueryui.com/about)
* Dual licensed under the MIT (MIT-LICENSE.txt)
* and GPL (GPL-LICENSE.txt) licenses.
*
* http://docs.jquery.com/UI
*/
/**
* jQuery.ScrollTo - Easy element scrolling using jQuery.
* Copyright (c) 2008 Ariel Flesler - aflesler(at)gmail(dot)com
* Licensed under GPL license (http://www.opensource.org/licenses/gpl-license.php).
* Date: 2/8/2008
* @author Ariel Flesler
* @version 1.3.2
*/

```

Found

in path(s):

```

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UW7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/doc/html/jquery.js
No license file was found, but licenses were detected in source scan.

```

```

/*
* jdatadst-tj.c
*
* This file was part of the Independent JPEG Group's software:
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* Modified 2009-2012 by Guido Vollbeding.
* Modifications:
* Copyright (C) 2011, D. R. Commander.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains compression data destination routines for the case of
* emitting JPEG data to memory or to a file (or any stdio stream).
* While these routines are sufficient for most applications,
* some will want to use a different destination manager.
* IMPORTANT: we assume that fwrite() will correctly transcribe an array of
* JOCTETs into 8-bit-wide elements on external storage. If char is wider
* than 8 bits on your machine, you may need to do some tweaking.
*/

```

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jdatadst-tj.c
No license file was found, but licenses were detected in source scan.

/*

* cdjpeg.h

*

* Copyright (C) 1994-1997, Thomas G. Lane.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains common declarations for the sample applications

* cjpeg and djpeg. It is NOT used by the core JPEG library.

*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/cdjpeg.h
No license file was found, but licenses were detected in source scan.

/*

* jd Huff.h

*

* This file was part of the Independent JPEG Group's software:

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* Modifications:

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* For conditions of distribution and use, see the accompanying README file.

*

* This file contains declarations for Huffman entropy decoding routines

* that are shared between the sequential decoder (jd Huff.c) and the

* progressive decoder (jdp Huff.c). No other modules need to see these.

*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jd Huff.h
No license file was found, but licenses were detected in source scan.

/*

* jdsample.c

*

* This file was part of the Independent JPEG Group's software:

* Copyright (C) 1991-1996, Thomas G. Lane.

* Modifications:

* Copyright 2009 Pierre Ossman <ossman@cendio.se> for Cendio AB

* Copyright (C) 2010, D. R. Commander.

```
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains upsampling routines.
*
* Upsampling input data is counted in "row groups". A row group
* is defined to be (v_samp_factor * DCT_scaled_size / min_DCT_scaled_size)
* sample rows of each component. Upsampling will normally produce
* max_v_samp_factor pixel rows from each row group (but this could vary
* if the upsampler is applying a scale factor of its own).
*
* An excellent reference for image resampling is
* Digital Image Warping, George Wolberg, 1990.
* Pub. by IEEE Computer Society Press, Los Alamitos, CA. ISBN 0-8186-8944-7.
*/
```

Found in path(s):

```
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jdsample.c
No license file was found, but licenses were detected in source scan.
```

```
/*
* rdcolmap.c
*
* Copyright (C) 1994-1996, Thomas G. Lane.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file implements djpeg's "-map file" switch. It reads a source image
* and constructs a colormap to be supplied to the JPEG decompressor.
*
* Currently, these file formats are supported for the map file:
* GIF: the contents of the GIF's global colormap are used.
* PPM (either text or raw flavor): the entire file is read and
* each unique pixel value is entered in the map.
* Note that reading a large PPM file will be horrendously slow.
* Typically, a PPM-format map file should contain just one pixel
* of each desired color. Such a file can be extracted from an
* ordinary image PPM file with ppmtomap(1).
*
* Rescaling a PPM that has a maxval unequal to MAXJSAMPLE is not
* currently implemented.
*/
/* Portions of this code are based on the PBMPLUS library, which is:
**
** Copyright (C) 1988 by Jef Poskanzer.
**
** Permission to use, copy, modify, and distribute this software and its
** documentation for any purpose and without fee is hereby granted, provided
```

** that the above copyright notice appear in all copies and that both that
** copyright notice and this permission notice appear in supporting
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** implied warranty.
*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/rdcolmap.c
No license file was found, but licenses were detected in source scan.

/*

* jsimd_arm.c

*

* Copyright 2009 Pierre Ossman <ossman@cendio.se> for Cendio AB

* Copyright 2009-2011 D. R. Commander

*

* Based on the x86 SIMD extension for IJG JPEG library,

* Copyright (C) 1999-2006, MIYASAKA Masaru.

* For conditions of distribution and use, see copyright notice in jsimdext.inc

*

* This file contains the interface between the "normal" portions

* of the library and the SIMD implementations when running on

* ARM architecture.

*

* Based on the stubs from 'jsimd_none.c'

*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jsimd_arm.c
No license file was found, but licenses were detected in source scan.

/*

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*

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*

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*

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* INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN
* CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE)
* ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE
* POSSIBILITY OF SUCH DAMAGE.
*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/bmp.h
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/java/org/libjpegturbo/turbojpeg/TJScalingFactor.java
*
/opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jcstest.c
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/tjutil.h
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/bmp.c
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/java/org/libjpegturbo/turbojpeg/TJCustomFilter.java
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/java/org/libjpegturbo/turbojpeg/TJTransform.java
*
/opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/java/org/libjpegturbo/turbojpeg/TJTransformer.java
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/tjutil.c
No license file was found, but licenses were detected in source scan.

/*

* jpegint.h

*

* Copyright (C) 1991-1997, Thomas G. Lane.

* Modified 1997-2009 by Guido Vollbeding.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*
* This file provides common declarations for the various JPEG modules.
* These declarations are considered internal to the JPEG library; most
* applications using the library shouldn't need to include this file.
*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jpegint.h
No license file was found, but licenses were detected in source scan.

/*

* jquant1.c

*

* This file was part of the Independent JPEG Group's software:

* Copyright (C) 1991-1996, Thomas G. Lane.

* Modifications:

* Copyright (C) 2009, D. R. Commander

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains 1-pass color quantization (color mapping) routines.

* These routines provide mapping to a fixed color map using equally spaced

* color values. Optional Floyd-Steinberg or ordered dithering is available.

*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jquant1.c
No license file was found, but licenses were detected in source scan.

1.2.90 (1.3 beta1)

=====

[1] Added support for additional scaling factors (3/8, 5/8, 3/4, 7/8, 9/8, 5/4, 11/8, 3/2, 13/8, 7/4, 15/8, and 2) when decompressing. Note that the IDCT will not be SIMD-accelerated when using any of these new scaling factors.

[2] The TurboJPEG dynamic library is now versioned. It was not strictly necessary to do so, because TurboJPEG uses versioned symbols, and if a function changes in an ABI-incompatible way, that function is renamed and a legacy function is provided to maintain backward compatibility. However, certain Linux distro maintainers will blindly reject any library that is not versioned, so this was an attempt to make them happy.

[3] Extended the TurboJPEG Java API so that it can be used to compress a JPEG image from and decompress a JPEG image to an arbitrary position in a large image buffer.

[4] The `tjDecompressToYUV()` function now supports the `TJFLAG_FASTDCT` flag.

[5] The 32-bit supplementary package for amd64 Debian systems now provides symlinks in `/usr/lib/i386-linux-gnu` for the TurboJPEG libraries in `/usr/lib32`. This allows those libraries to be used on MultiArch-compatible systems (such as Ubuntu 11 and later) without setting the linker path.

[6] The TurboJPEG Java wrapper should now find the JNI library on Mac systems without having to pass `-Djava.library.path=/usr/lib` to java.

[7] `TJBench` has been ported to Java to provide a convenient way of validating the performance of the TurboJPEG Java API. It can be run with `'java -cp turbojpeg.jar TJBench'`.

[8] `cjpeg` can now be used to generate JPEG files with the RGB colorspace (feature ported from `jpeg-8d`.)

[9] The width and height in the `-crop` argument passed to `jpegtran` can now be suffixed with "f" to indicate that, when the upper left corner of the cropping region is automatically moved to the nearest iMCU boundary, the bottom right corner should be moved by the same amount. In other words, this feature causes `jpegtran` to strictly honor the specified width/height rather than the specified bottom right corner (feature ported from `jpeg-8d`.)

[10] JPEG files using the RGB colorspace can now be decompressed into grayscale images (feature ported from `jpeg-8d`.)

[11] Fixed a regression caused by 1.2.1[7] whereby the build would fail with multiple "Mismatch in operand sizes" errors when attempting to build the x86 SIMD code with NASM 0.98.

[12] The in-memory source/destination managers (`jpeg_mem_src()` and `jpeg_mem_dest()`) are now included by default when building `libjpeg-turbo` with `libjpeg v6b` or `v7` emulation, so that programs can take advantage of these functions without requiring the use of the backward-incompatible `libjpeg v8` ABI. The "age number" of the `libjpeg-turbo` library on `Un*x` systems has been incremented by 1 to reflect this. You can disable this feature with a `configure/CMake` switch in order to retain strict API/ABI compatibility with the `libjpeg v6b` or `v7` API/ABI (or with previous versions of `libjpeg-turbo`.) See `README-turbo.txt` for more details.

[13] Added ARM v7s architecture to `libjpeg.a` and `libturbojpeg.a` in the official `libjpeg-turbo` binary package for OS X, so that those libraries can be used to build applications that leverage the faster CPUs in the iPhone 5 and iPad 4.

1.2.1

=====

- [1] Creating or decoding a JPEG file that uses the RGB colorspace should now properly work when the input or output colorspace is one of the libjpeg-turbo colorspace extensions.
- [2] When libjpeg-turbo was built without SIMD support and merged (non-fancy) upsampling was used along with an alpha-enabled colorspace during decompression, the unused byte of the decompressed pixels was not being set to 0xFF. This has been fixed. TJUnitTest has also been extended to test for the correct behavior of the colorspace extensions when merged upsampling is used.
- [3] Fixed a bug whereby the libjpeg-turbo SSE2 SIMD code would not preserve the upper 64 bits of xmm6 and xmm7 on Win64 platforms, which violated the Win64 calling conventions.
- [4] Fixed a regression caused by 1.2.0[6] whereby decompressing corrupt JPEG images (specifically, images in which the component count was erroneously set to a large value) would cause libjpeg-turbo to segfault.
- [5] Worked around a severe performance issue with "Bobcat" (AMD Embedded APU) processors. The MASKMOVDQU instruction, which was used by the libjpeg-turbo SSE2 SIMD code, is apparently implemented in microcode on AMD processors, and it is painfully slow on Bobcat processors in particular. Eliminating the use of this instruction improved performance by an order of magnitude on Bobcat processors and by a small amount (typically 5%) on AMD desktop processors.
- [6] Added SIMD acceleration for performing 4:2:2 upsampling on NEON-capable ARM platforms. This speeds up the decompression of 4:2:2 JPEGs by 20-25% on such platforms.
- [7] Fixed a regression caused by 1.2.0[2] whereby, on Linux/x86 platforms running the 32-bit SSE2 SIMD code in libjpeg-turbo, decompressing a 4:2:0 or 4:2:2 JPEG image into a 32-bit (RGBX, BGRX, etc.) buffer without using fancy upsampling would produce several incorrect columns of pixels at the right-hand side of the output image if each row in the output image was not evenly divisible by 16 bytes.
- [8] Fixed an issue whereby attempting to build the SIMD extensions with Xcode 4.3 on OS X platforms would cause NASM to return numerous errors of the form "'%define' expects a macro identifier".
- [9] Added flags to the TurboJPEG API that allow the caller to force the use of either the fast or the accurate DCT/IDCT algorithms in the underlying codec.

1.2.0

=====

[1] Fixed build issue with YASM on Unix systems (the libjpeg-turbo build system was not adding the current directory to the assembler include path, so YASM was not able to find jsimdcfg.inc.)

[2] Fixed out-of-bounds read in SSE2 SIMD code that occurred when decompressing a JPEG image to a bitmap

buffer whose size was not a multiple of 16 bytes.

This was more of an annoyance than an actual bug, since it did not cause any actual run-time problems, but the issue showed up when running libjpeg-turbo in valgrind. See <http://crbug.com/72399> for more information.

[3] Added a compile-time macro (LIBJPEG_TURBO_VERSION) that can be used to check the version of libjpeg-turbo against which an application was compiled.

[4] Added new RGBA/BGRA/ABGR/ARGB colorspace extension constants (libjpeg API) and pixel formats (TurboJPEG API), which allow applications to specify that, when decompressing to a 4-component RGB buffer, the unused byte should be set to 0xFF so that it can be interpreted as an opaque alpha channel.

[5] Fixed regression issue whereby DevIL failed to build against libjpeg-turbo because libjpeg-turbo's distributed version of jconfig.h contained an INLINE macro, which conflicted with a similar macro in DevIL. This macro is used only internally when building libjpeg-turbo, so it was moved into config.h.

[6] libjpeg-turbo will now correctly decompress erroneous CMYK/YCCK JPEGs whose K component is assigned a component ID of 1 instead of 4. Although these files are in violation of the spec, other JPEG implementations handle them correctly.

[7] Added ARM v6 and ARM v7 architectures to libjpeg.a and libturbojpeg.a in the official libjpeg-turbo binary package for OS X, so that those libraries can be used to build both OS X and iOS applications.

1.1.90 (1.2 beta1)

=====

[1] Added a Java wrapper for the TurboJPEG API. See [java/README](#) for more details.

[2] The TurboJPEG API can now be used to scale down images during decompression.

[3] Added SIMD routines for RGB-to-grayscale color conversion, which significantly improves the performance of grayscale JPEG compression from an RGB source image.

[4] Improved the performance of the C color conversion routines, which are used on platforms for which SIMD acceleration is not available.

[5] Added a function to the TurboJPEG API that performs lossless transforms. This function is implemented using the same back end as jpegtran, but it performs transcoding entirely in memory and allows multiple transforms and/or crop operations to be batched together, so the source coefficients only need to be read once. This is useful when generating image tiles from a single source JPEG.

[6] Added tests for the new TurboJPEG scaled decompression and lossless transform features to tjbench (the TurboJPEG benchmark, formerly called "jpgtest".)

[7] Added support for 4:4:0 (transposed 4:2:2) subsampling in TurboJPEG, which was necessary in order for it to read 4:2:2 JPEG files that had been losslessly transposed or rotated 90 degrees.

[8] All legacy VirtualGL code has been re-factored, and this has allowed libjpeg-turbo, in its entirety, to be re-licensed under a BSD-style license.

[9] libjpeg-turbo can now be built with YASM.

[10] Added SIMD acceleration for ARM Linux and iOS platforms that support NEON instructions.

[11] Refactored the TurboJPEG C API and documented it using Doxygen. The TurboJPEG 1.2 API uses pixel formats to define the size and component order of the uncompressed source/destination images, and it includes a more efficient version of TJBUFFSIZE() that computes a worst-case JPEG size based on the level of chrominance subsampling. The refactored implementation of the TurboJPEG API now uses the libjpeg memory source and destination managers, which allows the TurboJPEG compressor to grow the JPEG buffer as necessary.

[12] Eliminated errors in the output of jpegtran on Windows that occurred when the application was invoked using I/O redirection (jpegtran <input.jpg >output.jpg).

[13] The inclusion of libjpeg v7 and v8 emulation as well as arithmetic coding support in libjpeg-turbo v1.1.0 introduced several new error constants in jerror.h, and these were mistakenly enabled for all emulation modes, causing

the error enum in libjpeg-turbo to sometimes have different values than the same enum in libjpeg. This represents an ABI incompatibility, and it caused problems with rare applications that took specific action based on a particular error value. The fix was to include the new error constants conditionally based on whether libjpeg v7 or v8 emulation was enabled.

[14] Fixed an issue whereby Windows applications that used libjpeg-turbo would fail to compile if the Windows system headers were included before jpeglib.h. This issue was caused by a conflict in the definition of the INT32 type.

[15] Fixed 32-bit supplementary package for amd64 Debian systems, which was broken by enhancements to the packaging system in 1.1.

[16] When decompressing a JPEG image using an output colorspace of JCS_EXT_RGBX, JCS_EXT_BGRX, JCS_EXT_XBGR, or JCS_EXT_XRGB, libjpeg-turbo will now set the unused byte to 0xFF, which allows applications to interpret that byte as an alpha channel (0xFF = opaque).

1.1.1

=====

[1] Fixed a 1-pixel error in row 0, column 21 of the luminance plane generated by tjEncodeYUV().

[2] libjpeg-turbo's accelerated Huffman decoder previously ignored unexpected markers found in the middle of the JPEG data stream during decompression. It will now hand off decoding of a particular block to the unaccelerated Huffman decoder if an unexpected marker is found, so that the unaccelerated Huffman decoder can generate an appropriate warning.

[3] Older versions of MinGW64 prefixed symbol names with underscores by default, which differed from the behavior of 64-bit Visual C++. MinGW64 1.0 has adopted the behavior of 64-bit Visual C++ as the default, so to accommodate this, the libjpeg-turbo SIMD function names are no longer prefixed with an underscore when building with MinGW64. This means that, when building libjpeg-turbo with older versions of MinGW64, you will now have to add -fno-leading-underscore to the CFLAGS.

[4] Fixed a regression bug in the NSIS script that caused the Windows installer build to fail when using the Visual Studio IDE.

[5] Fixed a bug in jpeg_read_coefficients() whereby it would not initialize cinfo->image_width and cinfo->image_height if libjpeg v7 or v8 emulation was enabled. This specifically caused the jpegoptim program to fail if it was

linked against a version of libjpeg-turbo that was built with libjpeg v7 or v8 emulation.

[6] Eliminated excessive I/O overhead that occurred when reading BMP files in cjpeg.

[7] Eliminated errors in the output of cjpeg on Windows that occurred when the application was invoked using I/O redirection (cjpeg <inputfile >output.jpg).

1.1.0

=====

[1] The algorithm used by the SIMD quantization function cannot produce correct results when the JPEG quality is ≥ 98 and the fast integer forward DCT is used. Thus, the non-SIMD quantization function is now used for those cases, and libjpeg-turbo should now produce identical output to libjpeg v6b in all cases.

[2] Despite the above, the fast integer forward DCT still degrades somewhat for JPEG

qualities greater than 95, so the TurboJPEG wrapper will now automatically use the slow integer forward DCT when generating JPEG images of quality 96 or greater. This reduces compression performance by as much as 15% for these high-quality images but is necessary to ensure that the images are perceptually lossless. It also ensures that the library can avoid the performance pitfall created by [1].

[3] Ported jpgtest.cxx to pure C to avoid the need for a C++ compiler.

[4] Fixed visual artifacts in grayscale JPEG compression caused by a typo in the RGB-to-luminance lookup tables.

[5] The Windows distribution packages now include the libjpeg run-time programs (cjpeg, etc.)

[6] All packages now include jpgtest.

[7] The TurboJPEG dynamic library now uses versioned symbols.

[8] Added two new TurboJPEG API functions, tjEncodeYUV() and tjDecompressToYUV(), to replace the somewhat hackish TJ_YUV flag.

1.0.90 (1.1 beta1)

=====

[1] Added emulation of the libjpeg v7 and

v8 APIs and ABIs. See

README-turbo.txt for more details. This feature was sponsored by CamTrace SAS.

[2] Created a new CMake-based build system for the Visual C++ and MinGW builds.

[3] Grayscale bitmaps can now be compressed from/decompressed to using the TurboJPEG API.

[4] jpgtest can now be used to test decompression performance with existing JPEG images.

[5] If the default install prefix (/opt/libjpeg-turbo) is used, then 'make install' now creates /opt/libjpeg-turbo/lib32 and /opt/libjpeg-turbo/lib64 sym links to duplicate the behavior of the binary packages.

[6] All symbols in the libjpeg-turbo dynamic library are now versioned, even when the library is built with libjpeg v6b emulation.

[7] Added arithmetic encoding and decoding support (can be disabled with configure or CMake options)

[8] Added a TJ_YUV flag to the TurboJPEG API, which causes both the compressor and decompressor to output planar YUV images.

[9] Added an extended version of tjDecompressHeader() to the TurboJPEG API, which allows the caller to determine the type of subsampling used in a JPEG image.

[10] Added further protections against invalid Huffman codes.

1.0.1

=====

[1] The Huffman decoder will now handle erroneous Huffman codes (for instance, from a corrupt JPEG image.) Previously, these would cause libjpeg-turbo to crash under certain circumstances.

[2] Fixed typo in SIMD dispatch routines that was causing 4:2:2 upsampling to be used instead of 4:2:0 when decompressing JPEG images using SSE2 code.

[3] configure script will now automatically determine whether the INCOMPLETE_TYPES_BROKEN macro should be defined.

1.0.0

=====

[1] 2983700: Further FreeBSD build tweaks (no longer necessary to specify --host when configuring on a 64-bit system)

[2] Created symlinks in the Unix/Linux packages so that the TurboJPEG include file can always be found in /opt/libjpeg-turbo/include, the 32-bit static libraries can always be found in /opt/libjpeg-turbo/lib32, and the 64-bit static libraries can always be found in /opt/libjpeg-turbo/lib64.

[3] The Unix/Linux distribution packages now include the libjpeg run-time programs (cjpeg, etc.) and man pages.

[4] Created a 32-bit supplementary package for amd64 Debian systems, which contains just the 32-bit libjpeg-turbo libraries.

[5] Moved the libraries from */lib32 to */lib in the i386 Debian package.

[6] Include distribution package for Cygwin

[7] No longer necessary to specify --without-simd on non-x86 architectures, and unit tests now work on those architectures.

0.0.93

=====

[1] 2982659, Fixed x86-64 build on FreeBSD systems

[2] 2988188: Added support for Windows 64-bit systems

0.0.91

=====

[1] Added documentation to .deb packages

[2] 2968313: Fixed data corruption issues when decompressing large JPEG images and/or using buffered I/O with the libjpeg-turbo decompressor

0.0.90

=====

Initial release

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/ChangeLog.txt
No license file was found, but licenses were detected in source scan.

/*

* jconfig.txt

*

* Copyright (C) 1991-1994, Thomas G. Lane.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file documents the configuration options that are required to
* customize the JPEG software for a particular system.

*

* The actual configuration options for a particular installation are stored
* in jconfig.h. On many machines, jconfig.h can be generated automatically
* or copied from one of the "canned" jconfig files that we supply. But if
* you need to generate a jconfig.h file by hand, this file tells you how.

*

* DO NOT EDIT THIS FILE --- IT WON'T ACCOMPLISH ANYTHING.

* EDIT A COPY NAMED JCONFIG.H.

*/

/*

* These symbols indicate the properties of your machine or compiler.

* #define the symbol if yes, #undef it if no.

*/

/* Does your compiler support function prototypes?

* (If not,

you also need to use ansi2knr, see install.txt)

*/

#define HAVE_PROTOTYPES

/* Does your compiler support the declaration "unsigned char" ?

* How about "unsigned short" ?

*/

#define HAVE_UNSIGNED_CHAR

#define HAVE_UNSIGNED_SHORT

/* Define "void" as "char" if your compiler doesn't know about type void.

* NOTE: be sure to define void such that "void *" represents the most general

* pointer type, e.g., that returned by malloc().

*/

/* #define void char */

/* Define "const" as empty if your compiler doesn't know the "const" keyword.

```

*/
/* #define const */

/* Define this if an ordinary "char" type is unsigned.
* If you're not sure, leaving it undefined will work at some cost in speed.
* If you defined HAVE_UNSIGNED_CHAR then the speed difference is minimal.
*/
#undef CHAR_IS_UNSIGNED

/* Define this if your system has an ANSI-conforming <stddef.h> file.
*/
#define HAVE_STDDEF_H

/* Define this if your system has an ANSI-conforming <stdlib.h> file.
*/
#define HAVE_STDLIB_H

/*
Define this if your system does not have an ANSI/SysV <string.h>,
* but does have a BSD-style <strings.h>.
*/
#undef NEED_BSD_STRINGS

/* Define this if your system does not provide typedef size_t in any of the
* ANSI-standard places (stddef.h, stdlib.h, or stdio.h), but places it in
* <sys/types.h> instead.
*/
#undef NEED_SYS_TYPES_H

/* For 80x86 machines, you need to define NEED_FAR_POINTERS,
* unless you are using a large-data memory model or 80386 flat-memory mode.
* On less brain-damaged CPUs this symbol must not be defined.
* (Defining this symbol causes large data structures to be referenced through
* "far" pointers and to be allocated with a special version of malloc.)
*/
#undef NEED_FAR_POINTERS

/* Define this if your linker needs global names to be unique in less
* than the first 15 characters.
*/
#undef NEED_SHORT_EXTERNAL_NAMES

/* Although a real ANSI C compiler can deal perfectly well with pointers to
* unspecified structures (see "incomplete types" in the
spec), a few pre-ANSI
* and pseudo-ANSI compilers get confused. To keep one of these bozos happy,
* define INCOMPLETE_TYPES_BROKEN. This is not recommended unless you
* actually get "missing structure definition" warnings or errors while

```

```

* compiling the JPEG code.
*/
#undef INCOMPLETE_TYPES_BROKEN

/* Define "boolean" as unsigned char, not int, on Windows systems.
*/
#ifdef _WIN32
#ifndef __RPCNDR_H__ /* don't conflict if rpcndr.h already read */
typedef unsigned char boolean;
#endif
#define HAVE_BOOLEAN /* prevent jmorecfg.h from redefining it */
#endif

/*
* The following options affect code selection within the JPEG library,
* but they don't need to be visible to applications using the library.
* To minimize application namespace pollution, the symbols won't be
* defined unless JPEG_INTERNALS has been defined.
*/

#ifdef JPEG_INTERNALS

/* Define this if your compiler implements ">>" on signed values as a logical
* (unsigned) shift; leave it undefined if ">>" is a
* signed (arithmetic) shift,
* which is the normal and rational definition.
*/
#undef RIGHT_SHIFT_IS_UNSIGNED

#endif /* JPEG_INTERNALS */

/*
* The remaining options do not affect the JPEG library proper,
* but only the sample applications cjpeg/djpeg (see cjpeg.c, djpeg.c).
* Other applications can ignore these.
*/

#ifdef JPEG_CJPEG_DJPEG

/* These defines indicate which image (non-JPEG) file formats are allowed. */

#define BMP_SUPPORTED /* BMP image file format */
#define GIF_SUPPORTED /* GIF image file format */
#define PPM_SUPPORTED /* PBMPLUS PPM/PGM image file format */
#undef RLE_SUPPORTED /* Utah RLE image file format */

```

```

#define TARGA_SUPPORTED /* Targa image file format */

/* Define this if you want to name both input and output files on the command
 * line, rather than using stdout and optionally stdin. You MUST do this if
 * your system can't cope with binary I/O to stdin/stdout. See comments at
 * head of cjpeg.c or djpeg.c.
 */
#undef TWO_FILE_COMMANDLINE

/*
 * Define this if your system needs explicit cleanup of temporary files.
 * This is crucial under MS-DOS, where the temporary "files" may be areas
 * of extended memory; on most other systems it's not as important.
 */
#undef NEED_SIGNAL_CATCHER

/* By default, we open image files with fopen(...,"rb") or fopen(...,"wb").
 * This is necessary on systems that distinguish text files from binary files,
 * and is harmless on most systems that don't. If you have one of the rare
 * systems that complains about the "b" spec, define this symbol.
 */
#undef DONT_USE_B_MODE

/* Define this if you want percent-done progress reports from cjpeg/djpeg.
 */
#undef PROGRESS_REPORT

#endif /* JPEG_CJPEG_DJPEG */

```

Found in path(s):

```

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jconfig.txt

```

No license file was found, but licenses were detected in source scan.

```

/*
 * jerror.c
 *
 * Copyright (C) 1991-1998, Thomas G. Lane.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file contains simple error-reporting and trace-message routines.
 * These are suitable for Unix-like systems and others where writing to
 * stderr is the right thing to do. Many applications will want to replace
 * some or all of these routines.
 *
 * If you define USE_WINDOWS_MESSAGEBOX in jconfig.h or in the makefile,

```

- * you get a Windows-specific hack to display error messages in a dialog box.
- * It ain't much, but it beats dropping error messages into the bit bucket,
- * which is what happens to output to stderr under most Windows C compilers.
- *
- * These routines are used by both the compression and decompression code.
- */

Found in path(s):

- * /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jerror.c

No license file was found, but licenses were detected in source scan.

License: IJG

Found in path(s):

- * /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo.spec

No license file was found, but licenses were detected in source scan.

/*

- * jcsample.c

*

- * Copyright (C) 1991-1996, Thomas G. Lane.

- * Copyright 2009 Pierre Ossman <ossman@cendio.se> for Cendio AB

- * This file is part of the Independent JPEG Group's software.

- * For conditions of distribution and use, see the accompanying README file.

*

- * This file contains downsampling routines.

*

- * Downsampling input data is counted in "row groups". A row group

- * is defined to be max_v_samp_factor pixel rows of each component,

- * from which the downsampler produces v_samp_factor sample rows.

- * A single row group is processed in each call to the downsampler module.

*

- * The downsampler is responsible for edge-expansion of its output data

- * to fill an integral number of DCT blocks horizontally. The source buffer

- * may be modified if it is helpful for this purpose (the source buffer is

- * allocated wide enough to correspond to the desired output width).

- * The caller (the prep controller) is

- * responsible for vertical padding.

*

- * The downsampler may request "context rows" by setting need_context_rows

- * during startup. In this case, the input arrays will contain at least

- * one row group's worth of pixels above and below the passed-in data;

- * the caller will create dummy rows at image top and bottom by replicating

- * the first or last real pixel row.

*

- * An excellent reference for image resampling is

* Digital Image Warping, George Wolberg, 1990.
* Pub. by IEEE Computer Society Press, Los Alamitos, CA. ISBN 0-8186-8944-7.
*
* The downsampling algorithm used here is a simple average of the source
* pixels covered by the output pixel. The hi-falutin sampling literature
* refers to this as a "box filter". In general the characteristics of a box
* filter are not very good, but for the specific cases we normally use (1:1
* and 2:1 ratios) the box is equivalent to a "triangle filter" which is not
* nearly so bad. If you intend to use other sampling ratios,
* you'd be well
* advised to improve this code.
*
* A simple input-smoothing capability is provided. This is mainly intended
* for cleaning up color-dithered GIF input files (if you find it inadequate,
* we suggest using an external filtering program such as pnmconvol). When
* enabled, each input pixel P is replaced by a weighted sum of itself and its
* eight neighbors. P's weight is 1-8*SF and each neighbor's weight is SF,
* where SF = (smoothing_factor / 1024).
* Currently, smoothing is only supported for 2h2v sampling factors.
*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jcsample.c

No license file was found, but licenses were detected in source scan.

// Natural Docs is licensed under the GPL.

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/doc/html/search/search.js

No license file was found, but licenses were detected in source scan.

/*

* jinput.c

*

* This file was part of the Independent JPEG Group's software:

* Copyright (C) 1991-1997, Thomas G. Lane.

* Modifications:

* Copyright (C) 2010, D. R. Commander.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains input control logic for the JPEG decompressor.

* These routines are concerned with controlling the decompressor's input

* processing (marker reading and coefficient decoding). The actual input

* reading is done in jdmarker.c, jdhuft.c, and jdphuff.c.

*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jdinput.c
No license file was found, but licenses were detected in source scan.

/*

* wrgif.c

*

* Copyright (C) 1991-1997, Thomas G. Lane.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains routines to write output images in GIF format.

*

* NOTE: to avoid entanglements with Unisys' patent on LZW compression, *

* this code has been modified to output "uncompressed GIF" files. *

* There is no trace of the LZW algorithm in this file. *

*

* These routines may need modification for non-Unix environments or

* specialized applications. As they stand, they assume output to

* an ordinary stdio stream.

*/

/*

* This code is loosely based on ppmtogif from the PBMPLUS distribution

* of Feb. 1991. That file

contains the following copyright notice:

* Based on GIFENCODER by David Rowley <mgardi@watdscu.waterloo.edu>.

* Lempel-Ziv compression based on "compress" by Spencer W. Thomas et al.

* Copyright (C) 1989 by Jef Poskanzer.

* Permission to use, copy, modify, and distribute this software and its

* documentation for any purpose and without fee is hereby granted, provided

* that the above copyright notice appear in all copies and that both that

* copyright notice and this permission notice appear in supporting

* documentation. This software is provided "as is" without express or

* implied warranty.

*

* We are also required to state that

* "The Graphics Interchange Format(c) is the Copyright property of

* CompuServe Incorporated. GIF(sm) is a Service Mark property of

* CompuServe Incorporated."

*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/wrgif.c

No license file was found, but licenses were detected in source scan.

```
/*
 * jmemmgr.c
 *
 * Copyright (C) 1991-1997, Thomas G. Lane.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file contains the JPEG system-independent memory management
 * routines. This code is usable across a wide variety of machines; most
 * of the system dependencies have been isolated in a separate file.
 * The major functions provided here are:
 * * pool-based allocation and freeing of memory;
 * * policy decisions about how to divide available memory among the
 *   virtual arrays;
 * * control logic for swapping virtual arrays between main memory and
 *   backing storage.
 * The separate system-dependent file provides the actual backing-storage
 * access code, and it contains the policy decision about how much total
 * main memory to use.
 * This file is system-dependent in the sense that some of
 * its functions
 * are unnecessary in some systems. For example, if there is enough virtual
 * memory so that backing storage will never be used, much of the virtual
 * array control logic could be removed. (Of course, if you have that much
 * memory then you shouldn't care about a little bit of unused code...)
 */
```

Found in path(s):

```
*/opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jmemmgr.c
No license file was found, but licenses were detected in source scan.
```

```
/*
 * jchuff.c
 *
 * This file was part of the Independent JPEG Group's software:
 * Copyright (C) 1991-1997, Thomas G. Lane.
 * Modifications:
 * Copyright (C) 2009-2011, D. R. Commander.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file contains Huffman entropy encoding routines.
 *
 * Much of the complexity here has to do with supporting output suspension.
 * If the data destination module demands suspension, we want to be able to
 * back up to the start of the current MCU. To do this, we copy state
```

- * variables into local working storage, and update them back to the
- * permanent JPEG objects only upon successful completion of an MCU.
- */

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jchuff.c
No license file was found, but licenses were detected in source scan.

/*

* jquant2.c

*

* This file was part of the Independent JPEG Group's software:

* Copyright (C) 1991-1996, Thomas G. Lane.

* Modifications:

* Copyright (C) 2009, D. R. Commander.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains 2-pass color quantization (color mapping) routines.

* These routines provide selection of a custom color map for an image,

* followed by mapping of the image to that color map, with optional

* Floyd-Steinberg dithering.

* It is also possible to use just the second pass to map to an arbitrary

* externally-given color map.

*

* Note: ordered dithering is not supported, since there isn't any fast

* way to compute intercolor distances; it's unclear that ordered dither's

* fundamental assumptions even hold with an irregularly spaced color map.

*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jquant2.c
No license file was found, but licenses were detected in source scan.

/*

* jdct.h

*

* Copyright (C) 1994-1996, Thomas G. Lane.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This include file contains common declarations for the forward and

* inverse DCT modules. These declarations are private to the DCT managers

* (jcdctmgr.c, jddctmgr.c) and the individual DCT algorithms.

* The individual DCT algorithms are kept in separate files to ease

* machine-dependent tuning (e.g., assembly coding).

*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jdct.h
No license file was found, but licenses were detected in source scan.

/*

* jpegcomp.h

*

* Copyright (C) 2010, D. R. Commander

* For conditions of distribution and use, see the accompanying README file.

*

* JPEG compatibility macros

* These declarations are considered internal to the JPEG library; most

* applications using the library shouldn't need to include this file.

*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jpegcomp.h
No license file was found, but licenses were detected in source scan.

/*

* wrjpgcom.c

*

* Copyright (C) 1994-1997, Thomas G. Lane.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains a very simple stand-alone application that inserts

* user-supplied text as a COM (comment) marker in a JFIF file.

* This may be useful as an example of the minimum logic needed to parse

* JPEG markers.

*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/wrjpgcom.c
No license file was found, but licenses were detected in source scan.

TurboJPEG Java Wrapper

=====

The TurboJPEG shared library can optionally be built with a Java Native Interface wrapper, which allows the library to be loaded and used directly from Java applications. The Java front end for this is defined in several classes located under org/libjpegturbo/turbojpeg. The source code for these Java classes is licensed under a BSD-style license, so the files can be incorporated

directly into both open source and proprietary projects without restriction. A Java archive (JAR) file containing these classes is also shipped with the "official" distribution packages of libjpeg-turbo.

TJExample.java, which should also be located in the same directory as this README file, demonstrates how to use the TurboJPEG Java API to compress and decompress JPEG images in memory.

Performance Pitfalls

The TurboJPEG Java API defines several convenience methods that can allocate image buffers or instantiate classes to hold the result of compress, decompress, or transform operations. However, if you use these methods, then be mindful of the amount of new data you are creating on the heap. It may be necessary to manually invoke the garbage collector to prevent heap exhaustion or to prevent performance degradation. Background garbage collection can kill performance, particularly in a multi-threaded environment (Java pauses all threads when the GC runs.)

The TurboJPEG Java API always gives you the option of pre-allocating your own source and destination buffers, which allows you to re-use those buffers for compressing/decompressing multiple images. If the image sequence you are compressing or decompressing consists of images of the same size, then pre-allocating the buffers is recommended.

Installation Directory

If the TurboJPEG JNI library (libturbojpeg.so, libturbojpeg.jnilib, or turbojpeg.dll) is not installed under a system library directory or under a directory specified in LD_LIBRARY_PATH (Unix) or PATH (Windows), then you will need to pass an argument of `-Djava.library.path={path_to_JNI_library}` to java.

Found in path(s):

```
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/java/README
No license file was found, but licenses were detected in source scan.
```

```
/*
```

```
* jidctred.c
```

```
*
```

```
* Copyright (C) 1994-1998, Thomas G. Lane.
```

```
* This file is part of the Independent JPEG Group's software.
```

* For conditions of distribution and use, see the accompanying README file.
*
* This file contains inverse-DCT routines that produce reduced-size output:
* either 4x4, 2x2, or 1x1 pixels from an 8x8 DCT block.
*
* The implementation is based on the Loeffler, Ligtenberg and Moschytz (LL&M)
* algorithm used in jidctint.c. We simply replace each 8-to-8 1-D IDCT step
* with an 8-to-4 step that produces the four averages of two adjacent outputs
* (or an 8-to-2 step producing two averages of four outputs, for 2x2 output).
* These steps were derived by computing the corresponding values at the end
* of the normal LL&M code, then simplifying as much as possible.
*
* 1x1 is trivial: just take the DC coefficient divided by 8.
*
* See jidctint.c for additional comments.
*/

Found in path(s):

*
/opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jidctred.c
No license file was found, but licenses were detected in source scan.

/*
* jcdctmgr.c
*
* This file was part of the Independent JPEG Group's software:
* Copyright (C) 1994-1996, Thomas G. Lane.
* Modifications:
* Copyright (C) 1999-2006, MIYASAKA Masaru.
* Copyright 2009 Pierre Ossman <ossman@cendio.se> for Cendio AB
* Copyright (C) 2011 D. R. Commander
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains the forward-DCT management logic.
* This code selects a particular DCT implementation to be used,
* and it performs related housekeeping chores including coefficient
* quantization.
*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jcdctmgr.c
No license file was found, but licenses were detected in source scan.

/*
* jccolor.c
*
*/

* This file was part of the Independent JPEG Group's software:
* Copyright (C) 1991-1996, Thomas G. Lane.
* Modifications:
* Copyright 2009 Pierre Ossman <ossman@cendio.se> for Cendio AB
* Copyright (C) 2009-2012, D. R. Commander.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains input colorspace conversion routines.
*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jccolor.c
No license file was found, but licenses were detected in source scan.

```
{\rtf1\ansi\ansicpg1252\cocoartf1038\cocoasubrtf360
{\fonttbl{\f0\fswiss\fcharset0 Helvetica;}
{\colortbl;\red255\green255\blue255;}
\margl1440\margr1440\vieww26380\viewh15840\viewkind0
\defstab720
\pard\pardefstab720\ql\qnatural
```

\f0\fs24 \cf0 libjpeg-turbo is a JPEG image codec that uses SIMD instructions (MMX, SSE2, NEON) to accelerate baseline JPEG compression and decompression on x86, x86-64, and ARM systems. On such systems, libjpeg-turbo is generally 2-4x as fast as libjpeg, all else being equal. On other types of systems, libjpeg-turbo can still outperform libjpeg by a significant amount, by virtue of its highly-optimized Huffman coding routines. In many cases, the performance of libjpeg-turbo rivals that of proprietary high-speed JPEG codecs.\

\libjpeg-turbo implements both the traditional libjpeg API as well as the less powerful but more straightforward TurboJPEG API. libjpeg-turbo also features colorspace extensions that allow it to compress from/decompress to 32-bit and big-endian pixel buffers (RGBX, XBGR, etc.), as well as a full-featured Java interface.\

\libjpeg-turbo was originally based on libjpeg/SIMD, an MMX-accelerated derivative of libjpeg v6b developed by Miyasaka Masaru. The TigerVNC and VirtualGL projects made numerous enhancements to the codec in 2009, and in early 2010, libjpeg-turbo spun off into an independent project, with the goal of making high-speed JPEG compression/decompression technology available to a broader range of users and developers.\

}

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/release/ReadMe.rtf
No license file was found, but licenses were detected in source scan.

```
/*
* jdphuff.c
*
* Copyright (C) 1995-1997, Thomas G. Lane.
```

* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains Huffman entropy decoding routines for progressive JPEG.
*
* Much of the complexity here has to do with supporting input suspension.
* If the data source module demands suspension, we want to be able to back
* up to the start of the current MCU. To do this, we copy state variables
* into local working storage, and update them back to the permanent
* storage only upon successful completion of an MCU.
*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jdphuff.c
No license file was found, but licenses were detected in source scan.

/*

* jcarith.c
*
* Developed 1997-2009 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains portable arithmetic entropy encoding routines for JPEG
* (implementing the ISO/IEC IS 10918-1 and CCITT Recommendation ITU-T T.81).
*
* Both sequential and progressive modes are supported in this single module.
*
* Suspension is not currently supported in this module.
*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jcarith.c
No license file was found, but licenses were detected in source scan.

/*

* jdatadst.c
*
* This file was part of the Independent JPEG Group's software:
* Copyright (C) 1994-1996, Thomas G. Lane.
* Modified 2009-2012 by Guido Vollbeding.
* Modifications:
* Copyright (C) 2013, D. R. Commander.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains compression data destination routines for the case of

* emitting JPEG data to memory or to a file (or any stdio stream).
* While these routines are sufficient for most applications,
* some will want to use a different destination manager.
* IMPORTANT: we assume that fwrite() will correctly transcribe an array of
* JOCTETs into 8-bit-wide elements on external storage. If char is wider
* than 8 bits on your machine, you may need to do some tweaking.
*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jdatadst.c
No license file was found, but licenses were detected in source scan.

/*

* cjpeg.c

*

* This file was part of the Independent JPEG Group's software:
* Copyright (C) 1991-1998, Thomas G. Lane.
* Modified 2003-2011 by Guido Vollbeding.
* Modifications:
* Copyright (C) 2010, 2013, D. R. Commander.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains a command-line user interface for the JPEG compressor.
* It should work on any system with Unix- or MS-DOS-style command lines.
*
* Two different command line styles are permitted, depending on the
* compile-time switch TWO_FILE_COMMANDLINE:
* cjpeg [options] inputfile outputfile
* cjpeg [options] [inputfile]
* In the second style, output is always to standard output, which you'd
* normally redirect to a file or pipe to some other program. Input is
* either from a named file or from standard input (typically redirected).
* The second style is convenient on Unix but is unhelpful
on systems that
* don't support pipes. Also, you MUST use the first style if your system
* doesn't do binary I/O to stdin/stdout.
* To simplify script writing, the "-outfile" switch is provided. The syntax
* cjpeg [options] -outfile outputfile inputfile
* works regardless of which command line style is used.
*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/cjpeg.c
No license file was found, but licenses were detected in source scan.

/*


```

* wrtarga.c
*
* Copyright (C) 1991-1996, Thomas G. Lane.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains routines to write output images in Targa format.
*
* These routines may need modification for non-Unix environments or
* specialized applications. As they stand, they assume output to
* an ordinary stdio stream.
*
* Based on code contributed by Lee Daniel Crocker.
*/

```

Found in path(s):

```

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/wrtarga.c
No license file was found, but licenses were detected in source scan.

```

```

/*
* jdmerge.c
*
* This file was part of the Independent JPEG Group's software:
* Copyright (C) 1994-1996, Thomas G. Lane.
* Copyright 2009 Pierre Ossman <ossman@cendio.se> for Cendio AB
* Modifications:
* Copyright (C) 2009, 2011, D. R. Commander.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains code for merged upsampling/color conversion.
*
* This file combines functions from jdsample.c and jdcolor.c;
* read those files first to understand what's going on.
*
* When the chroma components are to be upsampled by simple replication
* (ie, box filtering), we can save some work in color conversion by
* calculating all the output pixels corresponding to a pair of chroma
* samples at one time. In the conversion equations
*  $R = Y + K1 * Cr$ 
*  $G = Y + K2 * Cb + K3 * Cr$ 
*  $B = Y + K4 * Cb$ 
* only the Y term varies among the group of pixels corresponding
* to a pair
* of chroma samples, so the rest of the terms can be calculated just once.
* At typical sampling ratios, this eliminates half or three-quarters of the
* multiplications needed for color conversion.
*
*/

```

- * This file currently provides implementations for the following cases:
- * YCbCr => RGB color conversion only.
- * Sampling ratios of 2h1v or 2h2v.
- * No scaling needed at upsample time.
- * Corner-aligned (non-CCIR601) sampling alignment.
- * Other special cases could be added, but in most applications these are
- * the only common cases. (For uncommon cases we fall back on the more
- * general code in jdsample.c and jdcolor.c.)
- */

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jdmerge.c
 No license file was found, but licenses were detected in source scan.

```

;
;jsimdext.inc - common declarations
;
; Copyright 2009 Pierre Ossman <ossman@cendio.se> for Cendio AB
; Copyright 2010 D. R. Commander
;
; Based on
; x86 SIMD extension for IJG JPEG library - version 1.02
;
; Copyright (C) 1999-2006, MIYASAKA Masaru.
;
; This software is provided 'as-is', without any express or implied
; warranty. In no event will the authors be held liable for any damages
; arising from the use of this software.
;
; Permission is granted to anyone to use this software for any purpose,
; including commercial applications, and to alter it and redistribute it
; freely, subject to the following restrictions:
;
; 1. The origin of this software must not be misrepresented; you must not
; claim that you wrote the original software. If you use this software
; in a product, an acknowledgment in the product documentation would be
; appreciated but is not required.
; 2. Altered source versions must
; be plainly marked as such, and must not be
; misrepresented as being the original software.
; 3. This notice may not be removed or altered from any source distribution.
;
; [TAB8]
;
; =====
; System-dependent configurations

```

```

%ifdef WIN32 ; ----(nasm -fwin32 -DWIN32 ...)-----
; * Microsoft Visual C++
; * MinGW (Minimalist GNU for Windows)
; * CygWin
; * LCC-Win32

; -- segment definition --
;
%ifdef __YASM_VER__
%define SEG_TEXT .text align=16
%define SEG_CONST .rdata align=16
%else
%define SEG_TEXT .text align=16 public use32 class=CODE
%define SEG_CONST .rdata align=16 public use32 class=CONST
%endif

%elifdef WIN64 ; ----(nasm -fwin64 -DWIN64 ...)-----
; * Microsoft Visual C++

; -- segment definition --
;
%ifdef __YASM_VER__
%define SEG_TEXT .text align=16
%define SEG_CONST .rdata align=16
%else
%define SEG_TEXT .text align=16 public use64 class=CODE
%define SEG_CONST .rdata align=16
public use64 class=CONST
%endif
%define EXTN(name) name ; foo() -> foo

%elifdef OBJ32 ; ----(nasm -fobj -DOBJ32 ...)-----
; * Borland C++ (Win32)

; -- segment definition --
;
%define SEG_TEXT .text align=16 public use32 class=CODE
%define SEG_CONST .data align=16 public use32 class=DATA

%elifdef ELF ; ----(nasm -felf[64] -DELFB ...)-----
; * Linux
; * *BSD family Unix using elf format
; * Unix System V, including Solaris x86, UnixWare and SCO Unix

; mark stack as non-executable
section .note.GNU-stack noalloc noexec nowrite progbits

; -- segment definition --

```

```

;
%ifdef __x86_64__
%define SEG_TEXT .text progbits align=16
%define SEG_CONST .rodata progbits align=16
%else
%define SEG_TEXT .text progbits alloc exec nowrite align=16
%define SEG_CONST .rodata progbits alloc noexec nowrite align=16
%endif

; To make the code position-independent, append -DPIC to the commandline
;
%define GOT_SYMBOL __GLOBAL_OFFSET_TABLE_ ; ELF supports PIC
%define EXTN(name)
name ; foo() -> foo

%elifdef AOUT ; ----(nasm -faoutb/aout -DAOUT ...)----
; * Older Linux using a.out format (nasm -f aout -DAOUT ...)
; * *BSD family Unix using a.out format (nasm -f aoutb -DAOUT ...)

; -- segment definition --
;
%define SEG_TEXT .text
%define SEG_CONST .data

; To make the code position-independent, append -DPIC to the commandline
;
%define GOT_SYMBOL __GLOBAL_OFFSET_TABLE_ ; BSD-style a.out supports PIC

%elifdef MACHO ; ----(nasm -fmacho -DMACHO ...)-----
; * NeXTstep/OpenStep/Rhapsody/Darwin/MacOS X (Mach-O format)

; -- segment definition --
;
%define SEG_TEXT .text ;align=16 ; nasm doesn't accept align=16. why?
%define SEG_CONST .rodata align=16

; The generation of position-independent code (PIC) is the default on Darwin.
;
%define PIC
%define GOT_SYMBOL __MACHO_PIC_ ; Mach-O style code-relative addressing

%else ; ----(Other case)-----

; -- segment definition --
;
%define SEG_TEXT .text
%define SEG_CONST

```

```

.data

%endif ; -----

; =====

; -----
; Common types
;
#ifdef __x86_64__
#define POINTER          qword          ; general pointer type
#define SIZEOF_POINTER   SIZEOF_QWORD   ; sizeof(POINTER)
#define POINTER_BIT      QWORD_BIT      ; sizeof(POINTER)*BYTE_BIT
#else
#define POINTER          dword          ; general pointer type
#define SIZEOF_POINTER   SIZEOF_DWORD   ; sizeof(POINTER)
#define POINTER_BIT      DWORD_BIT      ; sizeof(POINTER)*BYTE_BIT
#endif

#define INT              dword          ; signed integer type
#define SIZEOF_INT       SIZEOF_DWORD   ; sizeof(INT)
#define INT_BIT          DWORD_BIT      ; sizeof(INT)*BYTE_BIT

#define FP32             dword          ; IEEE754 single
#define SIZEOF_FP32      SIZEOF_DWORD   ; sizeof(FP32)
#define FP32_BIT         DWORD_BIT      ; sizeof(FP32)*BYTE_BIT

#define MMWORD           qword          ; int64 (MMX register)
#define SIZEOF_MMWORD    SIZEOF_QWORD   ; sizeof(MMWORD)
#define MMWORD_BIT       QWORD_BIT      ; sizeof(MMWORD)*BYTE_BIT

; NASM is buggy and doesn't properly handle operand sizes for SSE
; instructions, so for now we have to define XMMWORD as blank.
#define XMMWORD           ; int128 (SSE register)
#define SIZEOF_XMMWORD   SIZEOF_OWORD   ; sizeof(XMMWORD)
#define XMMWORD_BIT      OWORD_BIT      ; sizeof(XMMWORD)*BYTE_BIT

; Similar hacks for when we load a dword or MMWORD into an xmm# register
#define XMM_DWORD
#define XMM_MMWORD

#define SIZEOF_BYTE      1              ; sizeof(BYTE)
#define SIZEOF_WORD      2              ; sizeof(WORD)
#define SIZEOF_DWORD     4              ; sizeof(DWORD)
#define SIZEOF_QWORD     8              ; sizeof(QWORD)
#define SIZEOF_OWORD     16             ; sizeof(OWORD)

```

```

#define BYTE_BIT      8      ; CHAR_BIT in C
#define WORD_BIT      16     ; sizeof(WORD)*BYTE_BIT
#define DWORD_BIT    32     ; sizeof(DWORD)*BYTE_BIT
#define QWORD_BIT    64     ; sizeof(QWORD)*BYTE_BIT
#define OWORD_BIT    128    ; sizeof(OWORD)*BYTE_BIT

```

```

;-----
; External Symbol Name
;
%ifndef EXTN
#define EXTN(name) _ %+ name ; foo() -> _foo
%endif

```

```

;-----
; Macros for position-independent code (PIC) support
;
%ifndef GOT_SYMBOL
%undef PIC
%endif

```

```

%ifdef PIC ;-----

```

```

%ifidn GOT_SYMBOL,_MACHO_PIC_ ;-----

```

```

; At present, nasm doesn't seem to support PIC generation for Mach-O.
; The PIC support code below is a
little tricky.

```

```

SECTION SEG_CONST

```

```

const_base:

```

```

#define GOTOFF(got,sym) (got) + (sym) - const_base

```

```

%imacro get_GOT 1

```

```

; NOTE: this macro destroys ecx register.

```

```

call %%geteip

```

```

add ecx, byte (%%ref - $)

```

```

jmp short %%adjust

```

```

%%geteip:

```

```

mov ecx, POINTER [esp]

```

```

ret

```

```

%%adjust:

```

```

push ebp

```

```

xor ebp,ebp ; ebp = 0

```

```

%ifidni %1,ebx ; (%1 == ebx)

```

```

; db 0x8D,0x9C + jmp near const_base =

```

```

; lea ebx, [ecx+ebp*8+(const_base-%%ref)] ; 8D,9C,E9,(offset32)

```

```

db 0x8D,0x9C ; 8D,9C
jmp near const_base ; E9,(const_base-%%ref)
%%ref:
%else ; (%1 != ebx)
; db 0x8D,0x8C + jmp near const_base =
; lea ecx, [ecx+ebp*8+(const_base-%%ref)] ; 8D,8C,E9,(offset32)
db 0x8D,0x8C ; 8D,8C
jmp near const_base ; E9,(const_base-%%ref)
%%ref: mov %1, ecx
%endif ; (%1 == ebx)
pop ebp
%endmacro

```

```
%else ; GOT_SYMBOL != _MACHO_PIC_ -----
```

```
%define GOTOFF(got,sym) (got) + (sym) wrt ..gotoff
```

```

%imacro get_GOT 1
extern GOT_SYMBOL
call %%geteip
add %1, GOT_SYMBOL + $$ - $ wrt ..gotpc
jmp short %%done
%%geteip:
mov %1,
POINTER [esp]
ret
%%done:
%endmacro

```

```
%endif ; GOT_SYMBOL == _MACHO_PIC_ -----
```

```
%imacro pushpic 1.nolist
```

```
push %1
```

```
%endmacro
```

```
%imacro poppic 1.nolist
```

```
pop %1
```

```
%endmacro
```

```
%imacro movpic 2.nolist
```

```
mov %1,%2
```

```
%endmacro
```

```
%else ; !PIC -----
```

```
%define GOTOFF(got,sym) (sym)
```

```
%imacro get_GOT 1.nolist
```

```
%endmacro
```

```
%imacro pushpic 1.nolist
```

```

%endmacro
%imacro poppic 1.nolist
%endmacro
%imacro movpic 2.nolist
%endmacro

%endif ; PIC -----

; -----
; Align the next instruction on {2,4,8,16,..}-byte boundary.
; ".balign n,,m" in GNU as
;
%define MSKLE(x,y) (~(((y) & 0xFFFF) - ((x) & 0xFFFF)) >> 16)
%define FILLB(b,n) (($(b) & ((n)-1))

%imacro alignx 1-2.nolist 0xFFFF
%%bs: times MSKLE(FILLB(%%bs,%1),%2) & MSKLE(16,FILLB($,%1)) & FILLB($,%1) \
    db 0x90                ; nop
times MSKLE(FILLB(%%bs,%1),%2) & FILLB($,%1)/9 \

    db 0x8D,0x9C,0x23,0x00,0x00,0x00,0x00 ; lea ebx,[ebx+0x00000000]
times MSKLE(FILLB(%%bs,%1),%2) & FILLB($,%1)/7 \
    db 0x8D,0xAC,0x25,0x00,0x00,0x00,0x00 ; lea ebp,[ebp+0x00000000]
times MSKLE(FILLB(%%bs,%1),%2) & FILLB($,%1)/6 \
    db 0x8D,0xAD,0x00,0x00,0x00,0x00    ; lea ebp,[ebp+0x00000000]
times MSKLE(FILLB(%%bs,%1),%2) & FILLB($,%1)/4 \
    db 0x8D,0x6C,0x25,0x00                ; lea ebp,[ebp+0x00]
times MSKLE(FILLB(%%bs,%1),%2) & FILLB($,%1)/3 \
    db 0x8D,0x6D,0x00                ; lea ebp,[ebp+0x00]
times MSKLE(FILLB(%%bs,%1),%2) & FILLB($,%1)/2 \
    db 0x8B,0xED                ; mov ebp,ebp
times MSKLE(FILLB(%%bs,%1),%2) & FILLB($,%1)/1 \
    db 0x90                ; nop
%endmacro

; Align the next data on {2,4,8,16,..}-byte boundary.
;
%imacro alignz 1.nolist
align %1, db 0 ; filling zeros
%endmacro

%ifdef __x86_64__

%ifdef WIN64

%imacro collect_args 0
push r12
push r13

```



```
push r14
push r15
mov
r10, rcx
mov r11, rdx
mov r12, r8
mov r13, r9
mov r14, [rax+48]
mov r15, [rax+56]
push rsi
push rdi
sub  rsp, SIZEOF_XMMWORD
movaps XMMWORD [rsp], xmm6
sub  rsp, SIZEOF_XMMWORD
movaps XMMWORD [rsp], xmm7
%endmacro
```

```
%imacro uncollect_args 0
movaps xmm7, XMMWORD [rsp]
add  rsp, SIZEOF_XMMWORD
movaps xmm6, XMMWORD [rsp]
add  rsp, SIZEOF_XMMWORD
pop rdi
pop rsi
pop r15
pop r14
pop r13
pop r12
%endmacro
```

```
%else
```

```
%imacro collect_args 0
push r10
push r11
push r12
push r13
push r14
push r15
mov r10, rdi
mov r11, rsi
mov r12, rdx
mov r13, rcx
mov r14, r8
mov r15, r9
%endmacro
```

```
%imacro uncollect_args 0
```

```
pop r15
pop r14
pop r13
pop r12
pop r11
pop r10
%endmacro
```

```
%endif
```

```
%endif
```

```
;-----
; Defines picked up from the C headers
;
#include "jsimdcfg.inc"

;-----
```

Found in path(s):

```
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jsimdext.inc
No license file was found, but licenses were detected in source scan.
```

```
/*
* jcphuff.c
*
* Copyright (C) 1995-1997, Thomas G. Lane.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains Huffman entropy encoding routines for progressive JPEG.
*
* We do not support output suspension in this module, since the library
* currently does not allow multiple-scan files to be written with output
* suspension.
*/
```

Found in path(s):

```
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jcphuff.c
No license file was found, but licenses were detected in source scan.
```

```
/*
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*
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```

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*
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* ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE
* POSSIBILITY OF SUCH DAMAGE.
*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/turbojpeg.h
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/turbojpeg.c
*
/opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/java/TJBench.java
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/tjunittest.c
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/tjbench.c

No license file was found, but licenses were detected in source scan.

/*
* jcomapi.c
*
* Copyright (C) 1994-1997, Thomas G. Lane.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains application interface routines that are used for both
* compression and decompression.
*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jcomapi.c
No license file was found, but licenses were detected in source scan.

```
%ifarch x86_64
%define __lib lib64
%else
%define __lib lib
%endif
```

Summary: A SIMD-accelerated JPEG codec that provides both the libjpeg and TurboJPEG APIs

Name: @PACKAGE_NAME@

Version: @VERSION@

Vendor: The libjpeg-turbo Project

URL: <http://www.libjpeg-turbo.org>

Group: System Environment/Libraries

#-->Source0: <http://prdownloads.sourceforge.net/libjpeg-turbo/libjpeg-turbo-%{version}.tar.gz>

Release: @BUILD@

License: BSD-style

BuildRoot: % {_blddir}/% {name}-buildroot-% {version}-% {release}

Prereq: /sbin/ldconfig

```
%ifarch x86_64
```

Provides: % {name} = % {version}-% {release}, turbojpeg = 2.00, libturbojpeg.so()(64bit)

```
%else
```

Provides: % {name} = % {version}-% {release}, turbojpeg = 2.00, libturbojpeg.so

```
%endif
```

Obsoletes: turbojpeg

```
%description
```

libjpeg-turbo is a JPEG image codec that uses SIMD instructions (MMX, SSE2, NEON) to accelerate baseline JPEG compression and decompression on x86, x86-64, and ARM systems. On such systems, libjpeg-turbo is generally 2-4x as fast as libjpeg, all else being equal. On other types of systems, libjpeg-turbo can still outperform libjpeg by a significant amount, by virtue of its highly-optimized Huffman coding routines. In many cases, the performance of libjpeg-turbo rivals that of proprietary high-speed JPEG codecs.

libjpeg-turbo implements both the traditional libjpeg API as well as the less powerful but more straightforward TurboJPEG API. libjpeg-turbo also features colorspace extensions that allow it to compress from/decompress to 32-bit and big-endian pixel buffers (RGBX, XBGR, etc.), as well as a full-featured Java interface.

libjpeg-turbo was originally based on libjpeg/SIMD, an MMX-accelerated derivative of libjpeg v6b developed by Miyasaka Masaru. The TigerVNC and

VirtualGL projects made numerous enhancements to the codec in 2009, and in early 2010, libjpeg-turbo spun off into an independent project, with the goal of making high-speed JPEG compression/decompression technology available to a broader range of users and developers.

```
#-->%prep
#-->%setup -q

#-->%build
#-->./configure libdir=/opt/% {name} /% {__lib} mandir=/opt/% {name} /man
JPEG_LIB_VERSION=@JPEG_LIB_VERSION@ SO_MAJOR_VERSION=@SO_MAJOR_VERSION@
SO_MINOR_VERSION=@SO_MINOR_VERSION@ --with-pic @RPM_CONFIG_ARGS@
#-->make DESTDIR=$RPM_BUILD_ROOT libdir=/opt/% {name} /% {__lib} mandir=/opt/% {name} /man

%install

rm -rf $RPM_BUILD_ROOT
make install DESTDIR=$RPM_BUILD_ROOT libdir=/opt/% {name} /% {__lib} mandir=/opt/% {name} /man
docdir=/opt/% {name} /doc exampledir=/opt/% {name} /doc
rm -f $RPM_BUILD_ROOT/opt/% {name} /% {__lib} /*.la
mkdir -p $RPM_BUILD_ROOT/usr/% {__lib}
mv $RPM_BUILD_ROOT/opt/% {name} /% {__lib} /libturbojpeg.* $RPM_BUILD_ROOT/usr/% {__lib}
/sbin/ldconfig -n $RPM_BUILD_ROOT/opt/% {name} /% {__lib}
/sbin/ldconfig -n $RPM_BUILD_ROOT/usr/% {__lib}
mkdir -p $RPM_BUILD_ROOT/usr/include
mv $RPM_BUILD_ROOT/opt/% {name} /include/turbojpeg.h $RPM_BUILD_ROOT/usr/include
ln -fs /usr/include/turbojpeg.h $RPM_BUILD_ROOT/opt/% {name} /include/
ln
-fs /usr/% {__lib} /libturbojpeg.a $RPM_BUILD_ROOT/opt/% {name} /% {__lib} /
mkdir -p $RPM_BUILD_ROOT% {_defaultdocdir}
mv $RPM_BUILD_ROOT/opt/% {name} /doc $RPM_BUILD_ROOT% {_defaultdocdir} /% {name} -% {version}

%post -p /sbin/ldconfig

%postun -p /sbin/ldconfig

%clean
rm -rf $RPM_BUILD_ROOT

%files
%defattr(-,root,root)
%dir % {_defaultdocdir} /% {name} -% {version}
%doc % {_defaultdocdir} /% {name} -% {version} /*
%dir /opt/% {name}
%dir /opt/% {name} /bin
/opt/% {name} /bin/cjpeg
/opt/% {name} /bin/djpeg
```

```

/opt/% { name }/bin/jpegtran
/opt/% { name }/bin/tjbench
/opt/% { name }/bin/rdjpgcom
/opt/% { name }/bin/wrjpgcom
%dir /opt/% { name }/% { __lib }
%ifarch x86_64
%else
/opt/% { name }/lib32
%endif
/opt/% { name }/% { __lib }/libjpeg.so.@SO_MAJOR_VERSION@.@SO_AGE@.@SO_MINOR_VERSION@
/opt/% { name }/% { __lib }/libjpeg.so.@SO_MAJOR_VERSION@
/opt/% { name }/% { __lib }/libjpeg.so
/opt/% { name }/% { __lib }/libjpeg.a
/opt/% { name }/% { __lib }/libturbojpeg.a
/usr/% { __lib }/libturbojpeg.so.0.0.0
/usr/% { __lib }/libturbojpeg.so.0
/usr/% { __lib }/libturbojpeg.so
/usr/% { __lib }/libturbojpeg.a
/usr/include/turbojpeg.h
%dir
/opt/% { name }/include
/opt/% { name }/include/jconfig.h
/opt/% { name }/include/jerror.h
/opt/% { name }/include/jmorecfg.h
/opt/% { name }/include/jpeglib.h
/opt/% { name }/include/turbojpeg.h
%dir /opt/% { name }/man
%dir /opt/% { name }/man/man1
/opt/% { name }/man/man1/cjpeg.1*
/opt/% { name }/man/man1/djpeg.1*
/opt/% { name }/man/man1/jpegtran.1*
/opt/% { name }/man/man1/rdjpgcom.1*
/opt/% { name }/man/man1/wrjpgcom.1*
@JAVA_RPM_CONTENTS_1@
@JAVA_RPM_CONTENTS_2@

```

%changelog

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/release/libjpeg-turbo.spec.in

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Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jsimd_arm_neon.S
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/*

* jaricom.c

*

* Developed 1997-2009 by Guido Vollbeding.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains probability estimation tables for common use in

* arithmetic entropy encoding and decoding routines.

*

* This data represents Table D.2 in the JPEG spec (ISO/IEC IS 10918-1

* and CCITT Recommendation ITU-T T.81) and Table 24 in the JBIG spec

* (ISO/IEC IS 11544 and CCITT Recommendation ITU-T T.82).

*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jaricom.c
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/*

* jidctfst.c

*

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*

* This file contains a fast, not so accurate integer implementation of the

* inverse DCT (Discrete Cosine Transform). In the IJG code, this routine

* must also perform dequantization of the input coefficients.

*

* A 2-D IDCT can be done by 1-D IDCT on each column followed by 1-D IDCT

* on each row (or vice versa, but it's more convenient to emit a row at

* a time). Direct algorithms are also available, but they are much more

* complex and seem not to be any faster when reduced to code.

*

* This implementation is based on Arai, Agui, and Nakajima's algorithm for

* scaled DCT. Their original paper (Trans. IEICE E-71(11):1095) is in

* Japanese, but the algorithm is described in the Pennebaker & Mitchell

* JPEG textbook (see REFERENCES section in file README). The following code

* is based directly on figure 4-8 in P&M.

* While an 8-point DCT cannot be done in less than 11 multiplies, it is
* possible to arrange the computation so that many of the multiplies are
* simple scalings of the final outputs. These multiplies can then be
* folded into the multiplications or divisions by the JPEG quantization
* table entries. The AA&N method leaves only 5 multiplies and 29 adds
* to be done in the DCT itself.
* The primary disadvantage of this method is that with fixed-point math,
* accuracy is lost due to imprecise representation of the scaled
* quantization values. The smaller the quantization table entry, the less
* precise the scaled value, so this implementation does worse with high-
* quality-setting files than with low-quality ones.
*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jidctfst.c
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/*

* jpeglib.h

*

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* Modified 2002-2009 by Guido Vollbeding.
* Modifications:
* Copyright (C) 2009-2011, 2013, D. R. Commander.
* For conditions of distribution and use, see the accompanying README file.
*
* This file defines the application interface for the JPEG library.
* Most applications using the library need only include this file,
* and perhaps jerror.h if they want to know the exact error codes.
*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jpeglib.h
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/*

* jdhuft.c

*

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* Modifications:
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* For conditions of distribution and use, see the accompanying README file.
*
* This file contains Huffman entropy decoding routines.

*
* Much of the complexity here has to do with supporting input suspension.
* If the data source module demands suspension, we want to be able to back
* up to the start of the current MCU. To do this, we copy state variables
* into local working storage, and update them back to the permanent
* storage only upon successful completion of an MCU.
*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jdhuff.c
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/*

* rdbmp.c

*

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* Modified 2009-2010 by Guido Vollbeding.
* Modifications:
* Modified 2011 by Siarhei Siamashka.
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*

* This file contains routines to read input images in Microsoft "BMP"
* format (MS Windows 3.x, OS/2 1.x, and OS/2 2.x flavors).
* Currently, only 8-bit and 24-bit images are supported, not 1-bit or
* 4-bit (feeding such low-depth images into JPEG would be silly anyway).
* Also, we don't support RLE-compressed files.

*

* These routines may need modification for non-Unix environments or
* specialized applications. As they stand, they assume input from
* an ordinary stdio stream. They further assume that reading begins
* at the start of the file; start_input may need work if the
* user interface has already
* read some data (e.g., to determine that
* the file is indeed BMP format).

*

* This code contributed by James Arthur Boucher.

*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/rdbmp.c

1.122 linenoise 1.0

1.122.1 Available under license :

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1.123 shared-mime-info 1.6

1.123.1 Available under license :

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```

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```
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```

```
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1.126 libxcrypt 4.4.10-10ubuntu4

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1.127 libxdmcp 1.1.2-3

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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/META-INF/maven/org.flywaydb/flyway-core/pom.xml

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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/postgresql/PostgreSQLTable.java

* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/configuration/package-info.java

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*

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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/InsertRowLock.java

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 jar/org/flywaydb/core/internal/parser/PlaceholderReplacingReader.java
 * /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
 jar/org/flywaydb/core/internal/clazz/NoopClassProvider.java
 * /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
 jar/org/flywaydb/core/api/output/MigrateResult.java
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 /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
 jar/org/flywaydb/core/internal/scanner/classpath/ClassPathScanner.java
 * /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
 jar/org/flywaydb/core/internal/database/cockroachdb/CockroachDBConnection.java
 * /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
 jar/org/flywaydb/core/internal/database/base/SchemaObject.java
 * /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
 jar/org/flywaydb/core/internal/jdbc/JdbcNullTypes.java
 * /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
 jar/org/flywaydb/core/internal/database/mysql/MySQLDatabase.java
 * /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
 jar/org/flywaydb/core/internal/strategy/BackoffStrategy.java
 * /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
 jar/org/flywaydb/core/internal/database/sqlserver/synapse/SynapseDatabaseType.java
 *
 /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
 jar/org/flywaydb/core/internal/util/Locations.java
 * /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
 jar/org/flywaydb/core/internal/sqlscript/SqlScriptExecutorFactory.java
 * /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
 jar/org/flywaydb/core/internal/scanner/ResourceNameCache.java
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 jar/org/flywaydb/core/internal/database/oracle/OracleParser.java
 * /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
 jar/org/flywaydb/core/internal/database/redshift/RedshiftDatabaseType.java
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 /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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 * /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
 jar/org/flywaydb/core/api/logging/LogFactory.java
 * /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
 jar/org/flywaydb/core/internal/database/sqlserver/package-info.java
 * /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
 jar/org/flywaydb/core/internal/sqlscript/SqlStatement.java
 * /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
 jar/org/flywaydb/core/internal/util/DateUtils.java
 * /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-

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jar/org/flywaydb/core/internal/logging/log4j2/Log4j2Log.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/redshift/RedshiftDatabase.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/db2/DB2Table.java
*
/opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/api/output/BaselineResult.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/parser/PositionTrackingReader.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/scanner/ClasspathClassScanner.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/api/Location.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/oracle/OracleSchema.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/api/callback/Warning.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/util/package-info.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/callback/SimpleContext.java
*
/opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/api/output/OperationResult.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/sybasease/SybaseASETTable.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/configuration/ConfigUtils.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/jdbc/WarningImpl.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/db2/DB2Connection.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/postgresql/PostgreSQLConnection.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/parser/Recorder.java
*
/opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/logging/apachecommons/ApacheCommonsLogCreator.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/logging/apachecommons/package-info.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/derby/DerbyParser.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/api/output/ErrorOutput.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/scanner/classpath/JarUtils.java

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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/android/ContextHolder.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/sqlite/SQLiteParser.java
*
/opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/oracle/OracleResults.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/output/ValidateOutput.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/scanner/filesystem/FileSystemScanner.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/output/ValidateResult.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/authentication/ExternalAuthPropertiesProvider.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/output/package-info.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/callback/SqlScriptCallbackFactory.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/parser/ParsingContext.java
*
/opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/redshift/RedshiftType.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/logging/slf4j/Slf4jLog.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/authentication/postgres/PgpassFileReader.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/sqlite/SQLiteDatabase.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/migration/Context.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/resolver/ResolvedMigrationImpl.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/logging/javautil/JavaUtilLog.java
*
/opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/resolver/package-info.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/resource/s3/AwsS3Resource.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/util/CloseableIterator.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/exception/FlywayDbUpgradeRequiredException.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/h2/package-info.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-

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jar/org/flywaydb/core/internal/database/cockroachdb/package-info.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/mysql/MySQLParser.java
*
/opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/h2/H2DatabaseType.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/derby/DerbyDatabase.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/sybasease/package-info.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/api/configuration/Configuration.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/util/AsciiTable.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/jdbc/ExecutionTemplateFactory.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/resolver/sql/package-info.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/util/SqlCallable.java
*
/opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/hsqldb/HSQLDBParser.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/postgresql/PostgreSQLDatabaseType.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/api/output/RepairOutput.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/sybasease/SybaseASEJConnectDatabaseType.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/db2/DB2Type.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/api/resolver/package-info.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/sqlscript/SqlScriptMetadata.java
*
/opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/authentication/ExternalAuthFileReader.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/api/MigrationPattern.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/info/package-info.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/mysql/MySQLTable.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/saphana/SAPHANADatabase.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/Flyway.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-

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jar/org/flywaydb/core/internal/resource/classpath/ClassPathResource.java
*
/opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/resource/classpath/package-info.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/scanner/package-info.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/api/FlywayException.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/api/callback/Context.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/api/migration/JavaMigration.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/api/output/RepairResult.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/postgresql/PostgreSQLDatabase.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/schemahistory/SchemaHistory.java
*
/opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/logging/android/AndroidLogCreator.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/informix/InformixTable.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/scanner/classpath/JarFileClassPathLocationScanner.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/derby/DerbyDatabaseType.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/sqlscript/SqlScriptFactory.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/api/exception/FlywayValidateException.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/jdbc/StatementInterceptor.java
*
/opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/redshift/RedshiftSchema.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/info/MigrationInfoContext.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/sqlscript/ParserSqlScript.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/api/resolver/ChecksumMatcher.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/util/BomFilter.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/api/callback/Statement.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/jdbc/ErrorImpl.java

* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/logging/LogCreatorFactory.java

*

/opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/migration/package-info.java

* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/logging/slf4j/package-info.java

* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/output/MigrateOutput.java

* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/sqlserver/SQLServerTable.java

* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/parser/ParserContext.java

* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/logging/package-info.java

* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/saphana/SAPHANAParser.java

*

/opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/output/CommandResultFactory.java

* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/resolver/java/JavaMigrationExecutor.java

* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/snowflake/package-info.java

* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/base/Database.java

* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/util/FileCopyUtils.java

* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/mysql/MySQLNamedLockTemplate.java

* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/hsqldb/HSQLDBDatabase.java

* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/util/BooleanEvaluator.java

*

/opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/scanner/classpath/package-info.java

* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/callback/CallbackExecutor.java

* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/sqlserver/SQLServerSchema.java

* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/derby/DerbyTable.java

* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/scanner/cloud/s3/AwsS3Scanner.java

* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/db2/package-info.java

* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-

jar/org/flywaydb/core/internal/resolver/sql/DefaultSqlMigrationExecutorFactory.java
*
/opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/snowflake/SnowflakeParser.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/logging/javautil/JavaUtilLogCreator.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/cockroachdb/CockroachDBTable.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/oracle/package-info.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/sqlserver/SQLServerConnection.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/redshift/RedshiftParser.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/resource/StringResource.java
*
/opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/resource/gcs/package-info.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/parser/PositionTracker.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/jdbc/PlainExecutionTemplate.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/resolver/CompositeMigrationResolver.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/scanner/classpath/jboss/JBossVFSv2UrlResolver.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/h2/H2Database.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/parser/Statement.java
*
/opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/api/callback/BaseCallback.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/api/resolver/ResolvedMigration.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/postgresql/PostgreSQLCopyParsedStatement.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/db2/DB2Parser.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/firebird/FirebirdTable.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/scanner/classpath/ResourceAndClassScanner.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/oracle/OracleConnection.java
*

/opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/DefaultExecutionStrategy.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/resource/LoadableResource.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/MigrationType.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/output/CleanResult.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/util/ClassUtils.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/logging/apachecommons/ApacheCommonsLog.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/package-info.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/h2/H2Table.java
*
/opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/callback/package-info.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/license/FlywayTeamsUpgradeMessage.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/ErrorDetails.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/firebird/FirebirdDatabase.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/db2/DB2DatabaseType.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/sqlserver/synapse/SynapseDatabase.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/postgresql/PostgreSQLType.java
*
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/base/Function.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/resource/ResourceType.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/parser/TokenType.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/util/AbbreviationUtils.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/ErrorCode.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/hsqldb/HSQLDBTable.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/jdbc/JdbcConnectionFactory.java

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*
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/sqlserver/SQLServerDatabaseType.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/firebird/FirebirdConnection.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/api/callback/Event.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/api/executor/package-info.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/sqlscript/ParsedSqlStatement.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/sqlserver/SQLServerDatabase.java
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/base/TestContainersDatabaseType.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/scanner/Scanner.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/scanner/classpath/jboss/JBossVFSv3ClassPathLocationScanner.java
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/util/UrlUtils.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/hsqldb/HSQLDBSchema.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/resource/android/AndroidResource.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/parser/PeekingReader.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/resolver/ChecksumCalculator.java
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/opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/sqlserver/SQLServerApplicationLockTemplate.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/output/InfoOutput.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/cockroachdb/CockroachDBParser.java
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/resource/Resource.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/resource/gcs/GCSResource.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/scanner/classpath/OsgiClassPathLocationScanner.java
*
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/license/FlywayEditionUpgradeRequiredException.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/postgresql/PostgreSQLSchema.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/hsqldb/HSQLDBConnection.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/resolver/Context.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/util/BomStrippingReader.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/output/UndoOutput.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/license/FlywayTeamsUpgradeRequiredException.java
*
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/sybasease/SybaseASESchema.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/jdbc/TableLockingExecutionTemplate.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/util/TimeFormat.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/util/StopWatch.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/logging/android/AndroidLog.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/resource/s3/package-info.java
*

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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/base/Schema.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/configuration/S3ClientFactory.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/derby/DerbyConnection.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/scanner/classpath/UrlResolver.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/parser/package-info.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/sqlserver/SQLServerParser.java
*
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/jdbc/RowMapper.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/redshift/RedshiftConnection.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/resource/ResourceNameValidator.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/executor/MigrationExecutor.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/util/StringUtils.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/scanner/android/package-info.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/scanner/classpath/ClassPathLocationScanner.java
*
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/util/FeatureDetector.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/postgresql/PostgreSQLParser.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/resource/ResourceNameParser.java
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*

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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/oracle/OracleDatabaseType.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/command/DbClean.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/snowflake/SnowflakeSchema.java
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/DatabaseExecutionStrategy.java
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/mysql/mariadb/MariaDBDatabase.java
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/firebird/FirebirdParser.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/db2/DB2Database.java
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/firebird/package-info.java
*
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/schemahistory/package-info.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/sybasease/SybaseASEConnection.java
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/resource/NoopResourceProvider.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/resolver/sql/SqlMigrationExecutorFactory.java
*
/opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/scanner/classpath/DefaultUrlResolver.java
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/sqlserver/SQLServerEngineEdition.java
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/oracle/OracleTable.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/informix/InformixConnection.java
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/callback/NoopCallbackExecutor.java
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 * /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
 jar/org/flywaydb/core/internal/resource/package-info.java
 * /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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 * /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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 * /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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 jar/org/flywaydb/core/internal/schemahistory/SchemaHistoryFactory.java
 * /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
 jar/org/flywaydb/core/internal/info/AppliedMigrationAttributes.java
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 jar/org/flywaydb/core/internal/database/saphana/SAPHANATable.java
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 jar/org/flywaydb/core/internal/logging/javautil/package-info.java
 * /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
 jar/org/flywaydb/core/api/ResourceProvider.java

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 * /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
 jar/org/flywaydb/core/internal/resolver/ResolvedMigrationComparator.java
 * /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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1.129 sg3-utils 1.42

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1.133 reactive-streams 1.0.3

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```
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jar/org/reactivestreams/Publisher.java  
* /opt/cola/permits/1135840663_1613613063.73/0/reactive-streams-1-0-3-sources-3-  
jar/org/reactivestreams/FlowAdapters.java  
*  
/opt/cola/permits/1135840663_1613613063.73/0/reactive-streams-1-0-3-sources-3-  
jar/org/reactivestreams/Processor.java  
* /opt/cola/permits/1135840663_1613613063.73/0/reactive-streams-1-0-3-sources-3-
```


jar/org/reactivestreams/Subscription.java

* /opt/cola/permits/1135840663_1613613063.73/0/reactive-streams-1-0-3-sources-3-

jar/org/reactivestreams/Subscriber.java

1.134 commons-dbcp 1.4

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1.135 jul-to-slf4j 1.7.30

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1.136 aspect-j 1.9.6

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1.137 asm 5.0.4

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 - * /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/util/package.html
 - * /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/package.html
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* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/xml/SAXAdapter.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/xml/SAXAnnotationAdapter.java
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/opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/xml/Processor.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/xml/SAXFieldAdapter.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/xml/ASMContentHandler.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/xml/SAXCodeAdapter.java

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*/

/**

* Creates a new { @link GeneratorAdapter}. *Subclasses must not use this*

* constructor*.* Instead, they must use the

```

* {@link #GeneratorAdapter(int, MethodVisitor, int, String, String)}
* version.
*
* @param mv
*     the
method visitor to which this adapter delegates calls.
* @param access
*     the method's access flags (see {@link Opcodes}).
* @param name
*     the method's name.
* @param desc
*     the method's descriptor (see {@link Type Type}).
* @throws IllegalStateException
*     If a subclass calls this constructor.
*/

```

Found in path(s):

```

* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
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* constructor</i>*. Instead, they must use the
* { @link #JSRInlinerAdapter(int, MethodVisitor, int, String, String, String, String[])}
* version.
*
* @param mv
*
the `MethodVisitor` to send the resulting inlined
* method code to (use `null` for none).
* @param access
* the method's access flags (see { @link Opcodes}). This
* parameter also indicates if the method is synthetic and/or
* deprecated.
* @param name
* the method's name.
* @param desc
* the method's descriptor (see { @link Type}).
* @param signature
* the method's signature. May be `null`.
* @param exceptions
* the internal names of the method's exception classes (see
* { @link Type#getInternalName() getInternalName}). May be
* `null`.
* @throws IllegalStateException
* If a subclass calls this constructor.
*/

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* THE POSSIBILITY OF SUCH DAMAGE.
*/
/**
 * Constructs a new {@link ClassNode}. <i>Subclasses must not use this
 * constructor</i>. Instead, they must use the {@link #ClassNode(int)}
 * version.
 *
 * @throws IllegalStateException
 *         If a subclass calls this constructor.
 */

```

Found in path(s):

```

* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/ClassNode.java
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```

```

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* THE POSSIBILITY OF SUCH DAMAGE.

*/

/**

* Constructs a new {@link Textifier}. *<i>Subclasses must not use this
* constructor</i>. Instead, they must use the {@link #Textifier(int)}
* version.*

*

* @throws IllegalStateException

* If a subclass calls this constructor.

*/

Found in path(s):

* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/util/Textifier.java

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*/

/**

* Constructs a new {@link LocalVariableAnnotationNode}. *Subclasses must*
* not use this constructor. Instead, they must use the
* {@link #LocalVariableAnnotationNode(int, TypePath, LabelNode[], LabelNode[], int[], String)}
* version.

*

* @param typeRef

* a reference to the annotated type. See {@link TypeReference}.

* @param typePath

* the path to the annotated type argument, wildcard bound, array
* element type, or static inner type within 'typeRef'. May be
* `<tt>null</tt>` if the annotation targets 'typeRef' as a whole.

* @param start

* the first instructions corresponding to the continuous ranges
* that make the scope of this local variable (inclusive).

* @param end

* the last instructions corresponding to the continuous ranges
* that make the scope of this local variable (exclusive). This
* array must have the same size as the 'start' array.

* @param index

* the local variable's index in each range. This array must have
* the same size as the 'start' array.

* @param desc

* the class descriptor of

the annotation class.

*/

Found in path(s):

* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
jar/org/objectweb/asm/tree/LocalVariableAnnotationNode.java

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- * /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/Label.java
- * /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/Type.java
- * /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/AnnotationWriter.java
- *
- /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/analysis/SimpleVerifier.java
- * /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/optimizer/NameMapping.java
- * /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/util/Printer.java
- * /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/optimizer/Shrinker.java
- * /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/commons/Method.java
- * /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/util/CheckAnnotationAdapter.java
- * /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/commons/RemappingSignatureAdapter.java
- * /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/commons/RemappingFieldAdapter.java
- *
- /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/ClassWriter.java
- * /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/Attribute.java

* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/analysis/SourceInterpreter.java
 * /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/MethodInsnNode.java
 * /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/MethodVisitor.java
 * /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/util/TraceFieldVisitor.java
 * /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/analysis/SourceValue.java
 * /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/commons/AdviceAdapter.java
 * /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/commons/Remapper.java
 *
 /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/analysis/BasicValue.java
 * /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/FieldWriter.java
 * /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/ByteVector.java
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 * /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/JumpInsnNode.java
 * /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/commons/TableSwitchGenerator.java
 * /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/FieldNode.java
 * /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/FieldInsnNode.java
 *
 /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/LabelNode.java
 * /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/optimizer/ClassConstantsCollector.java
 * /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/util/CheckSignatureAdapter.java
 * /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/analysis/BasicVerifier.java
 * /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/commons/CodeSizeEvaluator.java
 * /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/commons/InstructionAdapter.java
 * /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/IntInsnNode.java
 * /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/commons/RemappingClassAdapter.java
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 /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/MultiANewArrayInsnNode.java

* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/ClassReader.java
 * /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/VarInsnNode.java
 * /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/commons/RemappingMethodAdapter.java
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 * /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/commons/StaticInitMerger.java
 * /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/optimizer/AnnotationConstantsCollector.java
 * /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/AnnotationVisitor.java
 * /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/InsnNode.java
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 /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/signature/SignatureReader.java
 * /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/LdcInsnNode.java
 * /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/LookupSwitchInsnNode.java
 * /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/LineNumberNode.java
 * /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/optimizer/JarOptimizer.java
 * /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/commons/LocalVariablesSorter.java
 * /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/util/TraceAnnotationVisitor.java
 * /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/optimizer/Constant.java
 * /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/TypeAnnotationNode.java
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 /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/Handle.java
 * /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/TryCatchBlockNode.java
 * /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/optimizer/ClassOptimizer.java
 * /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/util/ASMifier.java
 * /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/util/TraceClassVisitor.java
 * /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/TableSwitchInsnNode.java
 * /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/analysis/Frame.java
 * /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/InvokeDynamicInsnNode.java

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/opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/analysis/AnalyzerException.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/analysis/Subroutine.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/commons/SerialVersionUIDAdder.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/InnerClassNode.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/ParameterNode.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/LocalVariableNode.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/analysis/Analyzer.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/analysis/SmallSet.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/commons/RemappingAnnotationAdapter.java
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/opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/TypeInsnNode.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/util/TraceSignatureVisitor.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/InsnNode.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/optimizer/MethodOptimizer.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/util/CheckFieldAdapter.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/Frame.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/util/CheckMethodAdapter.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/commons/SimpleRemapper.java
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/opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/AnnotationNode.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/FieldVisitor.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/Context.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/util/TraceMethodVisitor.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/optimizer/MethodConstantsCollector.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/Handler.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/MethodNode.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/InsnList.java

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* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
jar/org/objectweb/asm/optimizer/FieldConstantsCollector.java
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/opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/MethodWriter.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
jar/org/objectweb/asm/tree/analysis/BasicInterpreter.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
jar/org/objectweb/asm/signature/SignatureWriter.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
jar/org/objectweb/asm/commons/TryCatchBlockSorter.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/Item.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/Edge.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/ClassVisitor.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
jar/org/objectweb/asm/tree/FrameNode.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
jar/org/objectweb/asm/optimizer/ConstantPool.java
*
/opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/Opcodes.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
jar/org/objectweb/asm/util/CheckClassAdapter.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
jar/org/objectweb/asm/signature/SignatureVisitor.java
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*/

/**

* Creates a new { @link AnalyzerAdapter}. *Subclasses must not use this
* constructor*. Instead, they must use the
* { @link #AnalyzerAdapter(int, String, int, String, String, MethodVisitor)}
* version.

*

* @param owner

*

the owner's class name.

* @param access

* the method's access flags (see { @link Opcodes}).

* @param name

* the method's name.

* @param desc

* the method's descriptor (see { @link Type Type}).

* @param mv

* the method visitor to which this adapter delegates calls. May

* be `<tt>null</tt>`.

* @throws IllegalStateException

* If a subclass calls this constructor.

*/

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1.138 jakarta-annotation-api 1.3.5

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1.140 classmate 1.5.1

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Java ClassMate library was originally written by Tatu Saloranta (tatu.saloranta@iki.fi)

Other developers who have contributed code are:

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1.142 activation 1.2.2

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* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/UnexpectedTypeException.java

* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/metadata/BeanDescriptor.java

* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/constraints/Digits.java

* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/bootstrap/ProviderSpecificBootstrap.java

* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/valueextraction/UnwrapByDefault.java

* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/constraints/NegativeOrZero.java

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* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/groups/package-info.java

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* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/ElementKind.java

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* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/bootstrap/GenericBootstrap.java

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* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/valueextraction/ValueExtractorDeclarationException.java

* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/metadata/ConstructorDescriptor.java

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* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/GroupDefinitionException.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/constraints/Min.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/groups/ConvertGroup.java
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* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/Valid.java
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* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/TraversableResolver.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/executable/ExecutableValidator.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/ValidationProviderResolver.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/ValidatorFactory.java
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* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/metadata/ConstraintDescriptor.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/metadata/ParameterDescriptor.java
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* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/GroupSequence.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/constraints/Negative.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/ConstraintValidatorFactory.java
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/opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/ValidationException.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-

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jar/javax/validation/OverridesAttribute.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-
jar/javax/validation/spi/BootstrapState.java
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jar/javax/validation/metadata/PropertyDescriptor.java
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/opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-
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* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-
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jar/javax/validation/constraints/Positive.java
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jar/javax/validation/constraints/NotEmpty.java
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/opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-
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jar/javax/validation/constraints/Past.java
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~ Jakarta Bean Validation API

~

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Comments to: <bean-validation-dev@eclipse.org>.

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Found in path(s):

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* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/META-
INF/maven/jakarta.validation/jakarta.validation-api/pom.xml
```

1.144 hibernate-commons-annotations

5.1.0.Final

1.144.1 Available under license :

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Version 2.1, February 1999

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1.145 log4j-to-slf4j 2.13.3

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1.146 javassist 3.24.0-GA

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* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/bytecode/annotation/MemberValue.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/bytecode/annotation/AnnotationMemberValue.java
*
/opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/bytecode/annotation/StringMemberValue.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/bytecode/annotation/Annotation.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/bytecode/annotation/MemberValueVisitor.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/bytecode/annotation/ClassMemberValue.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/bytecode/annotation/DoubleMemberValue.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/bytecode/annotation/FloatMemberValue.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/bytecode/annotation/EnumMemberValue.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/bytecode/annotation/CharMemberValue.java
*
/opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/bytecode/annotation/ByteMemberValue.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/bytecode/annotation/BooleanMemberValue.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/bytecode/annotation/IntegerMemberValue.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/bytecode/annotation/ShortMemberValue.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/bytecode/annotation/ArrayMemberValue.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/bytecode/annotation/LongMemberValue.java

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```
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/tools/rmi/StubGenerator.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/compiler/ast/BinExpr.java
*
 /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/compiler/SymbolTable.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/bytecode/BadBytecode.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/tools/web/Webserver.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/bytecode/NestMembersAttribute.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/convert/TransformBefore.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/tools/rmi/Proxy.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/bytecode/analysis/SubroutineScanner.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/bytecode/InstructionPrinter.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/tools/Callback.java
*
 /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/runtime/Inner.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/CtNewWrappedConstructor.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/util/proxy/DefineClassHelper.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/ByteArrayClassPath.java
```


* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/DuplicateMemberException.java
 * /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/expr/NewArray.java
 * /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/CtBehavior.java
 * /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/ExceptionTable.java
 *
 /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/tools/reflect/ClassMetaobject.java
 * /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/tools/rmi/ObjectImporter.java
 * /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/stackmap/TypedBlock.java
 * /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/compiler/ProceedHandler.java
 * /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/ByteStream.java
 * /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/stackmap/MapMaker.java
 * /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/scopedpool/ScopedClassPoolFactoryImpl.java
 * /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/util/proxy/MethodFilter.java
 *
 /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/compiler/ast/Expr.java
 * /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/tools/reflect/CannotCreateException.java
 * /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/compiler/KeywordTable.java
 * /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/compiler/Parser.java
 * /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/Loader.java
 * /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/compiler/ast/DoubleConst.java
 * /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/expr/ConstructorCall.java
 * /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/tools/reflect/Metalevel.java
 * /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/analysis/IntQueue.java
 *
 /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/tools/Dump.java
 * /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/compiler/ast/Symbol.java
 * /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/analysis/Frame.java
 * /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/compiler/TokenId.java
 * /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-

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jar/javassist/tools/rmi/AppletServer.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/bytecode/CodeAttribute.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/compiler/ast/InstanceOfExpr.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/bytecode/AccessFlag.java
*
/opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/expr/ExprEditor.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/CtClassType.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/bytecode/analysis/Analyzer.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/expr/Handler.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/bytecode/AnnotationsAttribute.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/tools/reflect/CannotInvokeException.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/bytecode/LongVector.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/tools/reflect/Compiler.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/tools/web/Viewer.java
*
/opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/compiler/ast/FieldDecl.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/CtNewConstructor.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/compiler/ast/CastExpr.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/SerialVersionUID.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/util/proxy/DefinePackageHelper.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/tools/reflect/Metaobject.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/convert/TransformAfter.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/bytecode/Descriptor.java
*
/opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/compiler/JvstTypeChecker.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/bytecode/AnnotationDefaultAttribute.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/compiler/ast/Variable.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-

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jar/javassist/scopedpool/ScopedClassPoolFactory.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/LoaderClassPath.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/ParameterAnnotationsAttribute.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/expr/Instanceof.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/compiler/ast/ASTree.java
*
/opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/CtNewMethod.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/tools/reflect/Sample.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/NestHostAttribute.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/convert/TransformAccessArrayField.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/ExceptionsAttribute.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/ClassPool.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/URLClassPath.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/compiler/TypeChecker.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/compiler/ast/ArrayInit.java
*
/opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/ClassPath.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/tools/reflect/Loader.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/convert/TransformFieldAccess.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/compiler/Lex.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/compiler/ast/CondExpr.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/Mnemonic.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/compiler/ast/Keyword.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/ConstPool.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/StackMapTable.java
*
/opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/tools/rmi/RemoteRef.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/compiler/CompileError.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/compiler/MemberCodeGen.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/util/HotSwapper.java

* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/ConstantAttribute.java
 * /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/util/HotSwapAgent.java
 * /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/Bytecode.java
 * /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/expr/FieldAccess.java
 *
 /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/compiler/AccessorMaker.java
 * /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/util/proxy/SerializedProxy.java
 * /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/InnerClassesAttribute.java
 * /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/runtime/Cflow.java
 * /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/analysis/Subroutine.java
 * /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/util/proxy/FactoryHelper.java
 * /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/annotation/AnnotationImpl.java
 * /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/compiler/NoFieldException.java
 *
 /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/convert/TransformNew.java
 * /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/convert/Transformer.java
 * /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/SyntheticAttribute.java
 * /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/tools/reflect/Reflection.java
 * /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/util/proxy/SecurityActions.java
 * /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/compiler/SyntaxError.java
 * /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/tools/reflect/CannotReflectException.java
 * /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/convert/TransformCall.java
 * /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/compiler/ast/AssignExpr.java
 *
 /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/CtNewWrappedMethod.java
 * /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/SourceFileAttribute.java
 * /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/CtPrimitiveType.java

* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/compiler/ast/NewExpr.java
 * /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/DeprecatedAttribute.java
 * /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/compiler/ast/ASTList.java
 * /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/stackmap/Tracer.java
 * /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/ClassFilePrinter.java
 *
 /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/stackmap/BasicBlock.java
 * /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/ClassPoolTail.java
 * /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/CodeAnalyzer.java
 * /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/convert/TransformWriteField.java
 * /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/util/proxy/ProxyObjectOutputStream.java
 * /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/scopedpool/ScopedClassPool.java
 * /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/ClassMap.java
 * /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/util/proxy/ProxyObjectInputStream.java
 *
 /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/StackMap.java
 * /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/compiler/ast/Declarator.java
 * /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/util/proxy/ProxyObject.java
 * /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/CtArray.java
 * /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/analysis/Util.java
 * /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/tools/rmi/Sample.java
 * /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/analysis/ControlFlow.java
 * /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/expr/Cast.java
 * /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/CtMethod.java
 *
 /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/CtMember.java
 * /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/CodeIterator.java
 * /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/scopedpool/ScopedClassPoolRepository.java
 * /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/CodeConverter.java
 * /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-

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jar/javassist/compiler/ast/Stmnt.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/bytecode/annotation/NoSuchClassError.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/ClassClassPath.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/convert/TransformNewClass.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/compiler/JvstCodeGen.java
*
/opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/bytecode/LineNumberAttribute.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/compiler/ast/Visitor.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/bytecode/ByteArray.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/compiler/ast/IntConst.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/tools/framedump.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/compiler/ast/CallExpr.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/util/proxy/ProxyFactory.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/expr/MethodCall.java
*
/opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/bytecode/SignatureAttribute.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/bytecode/ClassFileWriter.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/convert/TransformReadField.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/tools/web/BadHttpRequest.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/bytecode/stackmap/TypeData.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/CtNewClass.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/bytecode/EnclosingMethodAttribute.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/Modifier.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/compiler/ast/Pair.java
*
/opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/bytecode/analysis/FramePrinter.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/bytecode/MethodInfo.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/NotFoundException.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/CtClass.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-

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jar/javassist/scopedpool/SoftValueHashMap.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/CtField.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/compiler/MemberResolver.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/compiler/CodeGen.java
*
/opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/Translator.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/Opcodes.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/expr/NewExpr.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/bytecode/annotation/AnnotationsWriter.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/CtConstructor.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/util/proxy/MethodHandler.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/compiler/Javac.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/bytecode/LocalVariableTypeAttribute.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/bytecode/LocalVariableAttribute.java
*
/opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/bytecode/stackmap/TypeTag.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/bytecode/analysis/Type.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/runtime/DotClass.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/runtime/Desc.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/compiler/ast/StringL.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/scopedpool/ScopedClassPoolRepositoryImpl.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/compiler/ast/Member.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/expr/Expr.java
*
/opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/util/proxy/Proxy.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/tools/rmi/RemoteException.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/bytecode/analysis/Executor.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/bytecode/analysis/MultiType.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/compiler/ast/MethodDecl.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/bytecode/ClassFile.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/bytecode/analysis/MultiArrayType.java

```

* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/CannotCompileException.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/util/proxy/RuntimeSupport.java
*
/opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/AttributeInfo.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/FieldInfo.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/tools/rmi/ObjectNotFoundException.java

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1.151 libpciaccess 0.11.0

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1.152 libtasn 4.16.0-2

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1.159 react-day-picker 7.4.8

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1.160 gson 2.8.6

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jar/com/google/gson/internal/LinkedTreeMap.java
* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-
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jar/com/google/gson/internal/bind/CollectionTypeAdapterFactory.java
* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-
jar/com/google/gson/internal/bind/TypeAdapters.java
* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-
jar/com/google/gson/internal/bind/JsonTreeReader.java
*
/opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-
jar/com/google/gson/internal/bind/ArrayTypeAdapter.java
* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-
jar/com/google/gson/internal/bind/ObjectAdapter.java
* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-
jar/com/google/gson/internal/bind/MapTypeAdapterFactory.java
* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-
jar/com/google/gson/TypeAdapter.java
* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-
jar/com/google/gson/internal/JsonReaderInternalAccess.java

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* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-
jar/com/google/gson/internal/bind/JsonTreeWriter.java
* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-
jar/com/google/gson/TypeAdapterFactory.java
* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-
jar/com/google/gson/internal/bind/ReflectiveTypeAdapterFactory.java
*
/opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-
jar/com/google/gson/internal/bind/TypeAdapterRuntimeTypeWrapper.java
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jar/com/google/gson/internal/GsonBuildConfig.java
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jar/com/google/gson/internal/reflect/PreJava9ReflectionAccessor.java
* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-
jar/com/google/gson/internal/PreJava9DateFormatProvider.java
* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-
jar/com/google/gson/internal/reflect/ReflectionAccessor.java
*
/opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-
jar/com/google/gson/internal/reflect/UnsafeReflectionAccessor.java
* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-
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* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-
jar/com/google/gson/JsonParseException.java
* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/JsonPrimitive.java
* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-
jar/com/google/gson/ExclusionStrategy.java
*
/opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/JsonDeserializer.java
* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-
jar/com/google/gson/internal/$Gson$Preconditions.java
* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-
jar/com/google/gson/internal/Excluder.java
* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-
jar/com/google/gson/JsonSerializationContext.java
* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/JsonArray.java
* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-
jar/com/google/gson/annotations/Since.java
* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-
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jar/com/google/gson/internal/Primitives.java
* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-
jar/com/google/gson/reflect/TypeToken.java
* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/Gson.java
*
/opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/JsonIOException.java
* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/JsonObject.java
* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/JsonSerializer.java
* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-
jar/com/google/gson/internal/ObjectConstructor.java
* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/JsonNull.java
* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-
jar/com/google/gson/JsonDeserializationContext.java
* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/JsonElement.java
* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/GsonBuilder.java
* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-
jar/com/google/gson/FieldNamingPolicy.java
* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-
jar/com/google/gson/FieldNamingStrategy.java
*
/opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-
jar/com/google/gson/DefaultDateTypeAdapter.java
* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-
jar/com/google/gson/annotations/Until.java
* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-
jar/com/google/gson/annotations/SerializedName.java
* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-
jar/com/google/gson/annotations/Expose.java
* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/InstanceCreator.java
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* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/internal/bind/JsonAdapterAnnotationTypeAdapterFactory.java
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* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/internal/bind/SqlDateTypeAdapter.java

* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/internal/ConstructorConstructor.java

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/* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/internal/bind/TimeTypeAdapter.java

* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/internal/bind/DateTypeAdapter.java

* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/internal/UnsafeAllocator.java

* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/internal/bind/TreeTypeAdapter.java

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jar/com/google/gson/JsonSyntaxException.java
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* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/stream/JsonToken.java

* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/stream/JsonWriter.java

* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/stream/JsonScope.java

*

/opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/stream/MalformedJsonException.java

* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/stream/JsonReader.java

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* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/FieldAttributes.java

*

/opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/JsonParser.java

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1.162 open-ldap 2.4.58

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1.163 asyncio 3.4.3

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1.164 runc v1.0.0-rc9

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procfs provides functions to retrieve system, kernel and process metrics from the pseudo-filesystem proc.

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Protocol Buffers for Go with Gadgets

Go support for Protocol Buffers - Google's data interchange format

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1.166 runc 1.0.0-rc9

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Go support for Protocol Buffers - Google's data interchange format

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1.167 importlib-metadata 0.18

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1.169 swagger 2.1.9

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* /opt/cola/permits/1165124373_1631713413.68/0/swagger-annotations-2-1-9-sources-jar/io/swagger/v3/oas/annotations/security/SecuritySchemes.java
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jar/io/swagger/v3/oas/annotations/callbacks/Callbacks.java
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jar/io/swagger/v3/oas/annotations/security/SecurityRequirements.java
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jar/io/swagger/v3/oas/annotations/servers/ServerVariable.java

1.170 Iz4 1.9.2-ubuntu0.20.04.1

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Upstream-Name: lz4

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1.171 containerd 1.3.0

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procfs provides functions to retrieve system, kernel and process metrics from the pseudo-filesystem proc.

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Niels Miller, Sparc assembler by Niels Miller. Released under the LGPL.

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ARCFOUR

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CAMELLIA

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CAST128

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DES

The implementation of the DES cipher is written by Dana L. How, and released under the LGPL.

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MD2

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.
MD4

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MD5

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SERPENT

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SHA1

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SHA224, SHA256, SHA384, and SHA512

Written by Niels Miller, using Peter Gutmann's SHA1 code as a
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TWOFISH

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a)

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b) Use a suitable shared library mechanism for linking with the Library. A suitable mechanism is one that (1) uses at run time a copy of the library already present on the user's computer system, rather than copying library functions into the executable, and (2) will

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That's all there is to it!

1.178 golang 1.8

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1.179 nginx 1.18.0

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1.180 hd-parm 9.38

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1.181 kubernetes-client 1.8.11

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procfs provides functions to retrieve system, kernel and process metrics from the pseudo-filesystem proc.

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Protocol Buffers for Go with Gadgets

Go support for Protocol Buffers - Google's data interchange format

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<https://github.com/golang/protobuf>

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1.182 kubernetes-apimachinery 1.8.11

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Protocol Buffers for Go with Gadgets

Go support for Protocol Buffers - Google's data interchange format

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<https://github.com/golang/protobuf>

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1.183 kubernetes-api 1.8.11

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procfs provides functions to retrieve system, kernel and process metrics from the pseudo-filesystem proc.

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Gocheck - A rich testing framework for Go

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1.186 @tensorflow/tfjs-core 3.11.0

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1.187 @tensorflow/tfjs-backend-wasm 3.11.0

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```
{ "version":3, "file": "FlipLeftRight.js", "sourceRoot": "", "sources": [ "../src/kernels/FlipLeftRight.ts" ], "names": [], "mappings": "AAAA;,,,,,;;GAeG;AAEH,OAAO,EAAC,aAAa,EAA4D,MAAM,uBAAB,CAAC;AAI/G,IAAI,iBAE2C,CAAC;AAEHd,SAAS,KAAC,CAAC,OAAoB;IACjC,iBAaiB,GAAG,OAAO,CAAC,IAAI,CAAC,KAAC,CAAC,aAAa,EAAE,IAAI,CAAC,UAAU,EAAE;QACrE,QAAQ;QACR,QAAQ;QACR,QAAQ;QACR,QAAQ;QACR,QAAQ;QACR,QAAQ;KACT,CAAC,CAAC;AACL,CAAC;AAED,MAAM,UAAU,aAAa,CACzB,IAAyD;IAC3D,MAAM,EAAC,MAAM,EAAE,OAAO,EAAC,GAAG,IAAI,CAAC;IAC/B,MAAM,EAAC,KAAC,EAAC,GAAG,MAAM,CAAC;IAEvB,MAAM,GAAG,GAAG,OAAO,CAAC,UAAU,CAAC,KAAC,CAAC,KAAC,EAAE,KAAC,CAAC,KAAC,CAAC;IACzD,MAAM,OAAO,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,KAAC,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;IACvD,MAAM,KAAC,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,GAAG,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;IAEnD,MAAM,CAAC,KAAC,EAAE,WAAW,EAAE,UAAU,EAAE,WAAW,CAAC,GAAG,KAAC,CAAC,KAAC,CAAC;IAEIE,iBAaiB,CACb,OAAO,EAAE,KAAC,EAAE,WAAW,EAAE,UAAU,EAAE,WAAW,EAAE,KAAC,CAAC,CAAC;IACjE,OAAO,GAAG,CAAC;AACb,CAAC;AAED,MAAM,CAAC,MAAM,mBAAmB,GAAiB;IAC/C,UAAU,EAAE,aAAa;IACzB,WAAW,EAAE,MAAM;IACnB,UAAU,EAAE,aAAiC;IAC7C,SAAS,EAAE,KAAC;CACjB,CAAC", "sourcesContent": [ /*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */ ] }
```

```

*\n\nimport {FlipLeftRight, FlipLeftRightInputs, KernelConfig, KernelFunc, TensorInfo}
from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nlet wasmFlipLeftRight: (\n
xId: number, batch: number, imageHeight: number, imageWidth: number,\n  numChannels: number, outId:
number) => void;\n\nfunction setup(backend: BackendWasm) {\n  wasmFlipLeftRight =
backend.wasm.cwrap(FlipLeftRight, null /* void */, [\n  'number', // xId\n  'number', // batch\n  'number', //
imageHeight\n  'number', // imageWidth\n  'number', // numChannels\n  'number', // outId\n  ]);\n}\n\nexport
function flipLeftRight(\n  args: {inputs: FlipLeftRightInputs, backend: BackendWasm}): TensorInfo {\n  const
{inputs, backend} = args;\n  const {image} = inputs;\n\n  const out = backend.makeOutput(image.shape,
image.dtype);\n  const imageId = backend.dataIdMap.get(image.dataId).id;\n  const outId =
backend.dataIdMap.get(out.dataId).id;\n\n  const [batch, imageHeight, imageWidth, numChannels] =
image.shape;\n\n  wasmFlipLeftRight(\n    imageId, batch,
imageHeight, imageWidth, numChannels, outId);\n  return out;\n}\n\nexport const flipLeftRightConfig:
KernelConfig = {\n  kernelName: FlipLeftRight,\n  backendName: 'wasm',\n  kernelFunc: flipLeftRight as {} as
KernelFunc,\n  setupFunc: setup\n};\n"}

```

Found in path(s):

```

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
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```

No license file was found, but licenses were detected in source scan.

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```
=====\n*\n\nimport { _FusedMatMul, _FusedMatMulAttrs, _FusedMatMulInputs, KernelConfig, KernelFunc } from  
'@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { FusableActivation } from  
 './types';\n\nlet wasmFusedMatMul: (\n  aId: number, aShape: Uint8Array, aShapeSize: number, bId: number,\n  bShape: Uint8Array, bShapeSize: number, transposeA: boolean,\n  transposeB: boolean, activation: number,  
 biasId: number,\n  preluActivationWeightsId: number, leakyreluAlpha:  
  number, outId: number) => \n  void;\n\nfunction setup(backend: BackendWasm) {\n  wasmFusedMatMul =  
  backend.wasm.cwrap(_FusedMatMul, null /* void */, [\n    'number', // a_id\n    'array', // a_shape\n    'number', // a_shape.length\n    'number', // b_id\n    'array', // b_shape\n    'number', // b_shape.length\n    'number', // transpose_a\n    'number', // transpose_b\n    'number', // activation\n    'number', // biasId\n    'number', // preluActivationWeightsId\n    'number', // leakyreluAlpha\n    'number' // out_id\n  ]);\n\n  function  
  fusedBatchMatMul(args: {\n    inputs: _FusedMatMulInputs,\n    backend: BackendWasm,\n    attrs:  
  _FusedMatMulAttrs\n  }) {\n    const { inputs, backend, attrs } = args;\n    const { a, b, bias, preluActivationWeights } =  
  inputs;\n\n    if (a.dtype !== 'float32' || b.dtype !== 'float32') {\n      throw new Error(\n        ` _FusedMatMul for non  
non-float32 tensors not yet supported.`);\n    }\n\n    const { transposeA, transposeB, activation, leakyreluAlpha }  
  = attrs;\n    const aId = backend.dataIdMap.get(a.dataId).id;\n    const bId = backend.dataIdMap.get(b.dataId).id;\n\n    let biasId = 0;\n    if (bias != null) {\n      const biasData = backend.dataIdMap.get(bias.dataId);\n      if  
(biasData.shape.length !== 1) {\n        throw new Error(\n          ` _FusedMatMul only supports rank-1 bias but got `  
+\n          `rank ${biasData.shape.length}`);\n      }\n      biasId = biasData.id;\n    }\n\n    const preluActivationWeightsId =  
  preluActivationWeights == null ?\n    0 :  
  backend.dataIdMap.get(preluActivationWeights.dataId).id;\n    const  
  fusedActivation =  
  FusableActivation[activation as { } as keyof typeof FusableActivation];\n    if  
(fusedActivation == null) {\n      throw new Error(\n        ` ${activation} activation not yet supported for  
FusedConv2D ` +\n        ` in the wasm backend.`);\n    }\n\n    const leftDim = transposeA ? a.shape[2] : a.shape[1];\n    const rightDim = transposeB ? b.shape[1] : b.shape[2];\n    const batchDim = a.shape[0];\n\n    const out = backend.makeOutput([batchDim, leftDim, rightDim], a.dtype);\n    const outId =  
  backend.dataIdMap.get(out.dataId).id;\n\n    const aShapeBytes = new Uint8Array(new  
  Int32Array(a.shape).buffer);\n    const bShapeBytes = new Uint8Array(new Int32Array(b.shape).buffer);\n\n    wasmFusedMatMul(\n      aId, aShapeBytes, a.shape.length, bId, bShapeBytes, b.shape.length,\n      transposeA,  
  transposeB, fusedActivation, biasId, preluActivationWeightsId,\n      leakyreluAlpha || 0, outId);\n\n    return  
  out;\n  }\n\n  export const fusedMatMulConfig: KernelConfig = {\n    kernelName: _FusedMatMul,\n    backendName:  
  'wasm',\n    setupFunc: setup,\n    kernelFunc: fusedBatchMatMul as { } as KernelFunc\n  };
}
```

Found in path(s):

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/_FusedMatMul.js.map

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***** */

/**

* @deprecated Use `setWasmPaths` instead.

* Sets the path to the `.wasm` file which will be fetched when the wasm

* backend is initialized. See

* <https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-wasm/README.md#using-bundlers>

* for more details.

* @param path wasm file path or url

* @param usePlatformFetch optional boolean to use platform fetch to download

* the wasm file, default to false.

*

* @doc {heading: 'Environment', namespace: 'wasm'}

*/

Found in path(s):

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/tf-backend-wasm.js

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* =====

*/

/**

* @deprecated Use `setWasmPaths` instead.

* Sets the path to the `wasm` file which will be fetched when the wasm

* backend is initialized. See

* <https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-wasm/README.md#using-bundlers>

* for more details.

* @param path wasm file path or url

* @param usePlatformFetch optional boolean to use platform fetch to download

* the wasm file, default to false.

*

* @doc {heading: 'Environment', namespace: 'wasm'}

*/

Found in path(s):

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/backend_wasm.ts

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/backend_wasm.d.ts

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/backend_wasm.js

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```

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```
* =====\n*\nimport {KernelConfig, Tanh} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from './unary_kernel';\nexport const tanhConfig: KernelConfig = createUnaryKernelConfig(Tanh);\n
```

Found in path(s):

```
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Tanh.js.map
```

No license file was found, but licenses were detected in source scan.

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```

```
=====\n*\nimport {DataType, KernelConfig, TensorInfo, UnaryInputs, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {CppType} from './types';\nexport function createUnaryKernelConfig(kernelName: string, outType?: DataType): KernelConfig {\n  let wasmFunc: (xId: number, dtype: number, outId: number) => void;\n  function setupFunc(backend: BackendWasm): void {\n    wasmFunc = backend.wasm.cwrap(kernelName, null /* void */, [\n      'number', // x_id\n      'number', // dtype\n      'number', // out_id\n    ]);\n  }\n  function kernelFunc(args: {backend: BackendWasm, inputs: UnaryInputs}): TensorInfo {\n    const {backend, inputs: {x}} = args;\n    const xId = backend.dataIdMap.get(x.dataId).id;\n    const out = backend.makeOutput(x.shape, outType || x.dtype);\n    const outId = backend.dataIdMap.get(out.dataId).id;\n    // Short-circuit zero-sized tensors.\n    if (util.sizeFromShape(out.shape) === 0) {\n      return out;\n    }\n    wasmFunc(xId, CCppType[x.dtype], outId);\n    return out;\n  }\n  return {kernelName, backendName: 'wasm', setupFunc, kernelFunc};\n}
```

Found in path(s):

```
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
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wasm/dist/kernels/unary_kernel.js.map

No license file was found, but licenses were detected in source scan.

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License.\n
 * =====\n
*/\nimport {KernelConfig, Sin} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'./unary_kernel';\nexport const sinConfig: KernelConfig = createUnaryKernelConfig(Sin);\n"]}

```

Found in path(s):

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Sin.js.map

No license file was found, but licenses were detected in source scan.

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License.\n
 * =====\n
*/\nimport {KernelConfig, Tan} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'./unary_kernel';\nexport const tanConfig: KernelConfig = createUnaryKernelConfig(Tan);\n"]}

```

Found in path(s):

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Tan.js.map

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=====\n*\n\nimport {KernelConfig,
KernelFunc, TensorInfo, Transpose, TransposeAttrs, TransposeInputs} from '@tensorflow/tfjs-core';\nimport
{BackendWasm} from './backend_wasm';\nimport {identity} from './Identity';\nimport {CppType} from
 './types';\n\nlet wasmTranspose: (\n xId: number, xShape: Uint8Array, xShapeLength: number, dtype:
 CCppType,\n outId: number, perm: Uint8Array, permLength: number) => void;\n\nfunction setup(backend:
 BackendWasm) {\n wasmTranspose = backend.wasm.cwrap(Transpose, null /* void */, [\n 'number', // xId\n 'array', // x.shape\n 'number', // x.shape.length\n 'number', // dtype\n 'number', // outId\n 'array', // perm\n]\n

```
'number', // perm.length\n ]);\n\nexport function transpose(\n  args:\n  {inputs: TransposeInputs, backend: BackendWasm, attrs: TransposeAttrs});\n  TensorInfo {\n  const {inputs, backend, attrs} = args;\n  // Reduce any dimensions with size one. Lower-rank transpose kernel performs\n  // better due to simpler memory access pattern.\n  const [reducedShape, perm] = removeOneSizeDims(inputs.x.shape, attrs.perm);\n  let permIsNoOp = true;\n  for (let i = 0; i < perm.length; i++) {\n    if (perm[i] !== i) {\n      permIsNoOp = false;\n    }\n  }\n  const outShape = computeOutShape(inputs.x.shape, attrs.perm);\n  const x = {\n    dataId: inputs.x.dataId,\n    shape: reducedShape,\n    dtype: inputs.x.dtype\n  };\n  if (permIsNoOp) {\n    const cloned = identity({inputs, backend});\n    cloned.shape = outShape;\n    return cloned;\n  }\n  const out = backend.makeOutput(outShape, x.dtype);\n  const xId = backend.dataIdMap.get(x.dataId).id;\n  const outId = backend.dataIdMap.get(out.dataId).id;\n  const permBytes = new Uint8Array(new Int32Array(perm).buffer);\n  const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n  wasmTranspose(\n    xId, xShapeBytes, x.shape.length, CppDType[x.dtype], outId, permBytes,\n    perm.length);\n  return out;\n}\n\nfunction computeOutShape(inShape: number[], perm: number[]): number[] {\n  const outShape = new Array(inShape.length);\n  for (let i = 0; i < outShape.length; i++) {\n    outShape[i] = inShape[perm[i]];\n  }\n  return outShape;\n}\n\nfunction removeOneSizeDims(\n  shape: number[], perm: number[]): [number[], number[]] {\n  const newShape: number[] = [];\n  const newPerm: number[] = [];\n  for (let i = 0; i < shape.length; ++i) {\n    if (shape[i] !== 1) {\n      newShape.push(shape[i]);\n    }\n    if (shape[perm[i]] !== 1) {\n      newPerm.push(perm[i]);\n    }\n  }\n  for (let i = 0; i < newPerm.length; ++i) {\n    let minValIdx = -1;\n    for (let j = 0; j < newPerm.length; ++j) {\n      if (newPerm[j] >= i && (minValIdx === -1 || newPerm[minValIdx] > newPerm[j])) {\n        minValIdx = j;\n      }\n    }\n    newPerm[minValIdx] = i;\n  }\n  return [newShape, newPerm];\n}\n\nexport const transposeConfig: KernelConfig = {\n  kernelName: Transpose,\n  backendName: 'wasm',\n  kernelFunc: transpose as {} as KernelFunc,\n  setupFunc: setup,\n};\n}}\n
```

Found in path(s):

```
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Transpose.js.map
```

No license file was found, but licenses were detected in source scan.

```
{"version":3,"file":"Minimum.js","sourceRoot":"","sources":["../../src/kernels/Minimum.ts"],"names":[],"mappings":":AAAA;;;;;;;;;;GAeG;AACH,OAAO,EAAe,OAAO,EAAC,MAAM,uBAAuB,CAAC;AAE5D,OAAO,EAAC,wBAAwB,EAAC,MAAM,iBAAiB,CAAC;AACzD,MAAM,qBAAqB,GAAG,KAAK,CAAC;AACpC,MAAM,CAAC,MAAM,aAAa,GACTB,wBAAwB,CAAC,OAAO,EAAE,qBAAqB,CAAC,CAAC","sourcesContent":["/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing\n * permissions and\n * limitations under the License.\n * =====\n */\n\nimport {KernelConfig, Minimum} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const minimumConfig: KernelConfig =\n  createBinaryKernelConfig(Minimum, supportsFullBroadcast);\n}]\n
```

Found in path(s):

```
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Minimum.js.map
```

No license file was found, but licenses were detected in source scan.

```
 {"version":3,"file":"PadV2.js","sourceRoot":"","sources":["../src/kernels/PadV2.ts"],"names":[],"mappings":"AA
AA;;;;;;;;;;;;;;GAeG;AAEH,OAAO,EAA2B,KAAC,EAA2B,IAAI,EAAC,MAAM,uBAAuB,CAAC;AAIrG,OAAO
,EAAC,IAAI,EAAC,MAAM,QAAQ,CAAC;AAE5B,OAAO,EAAC,QAAQ,EAAC,MAAM,SAAS,CAAC;AAEjC,
IAAI,SAG6C,CAAC;AAEID,SAAS,KAAC,CAAC,OAAoB;IACjC,SAAS,GAAG,OAAO,CAAC,IAAI,CAAC,KA
AK,CAAC,KAAC,EAAE,IAAI,CAAC,UAAU,EAAE;QACrD,QAAQ;QACR,OAAO;QACP,QAAQ;QACR,QAA
Q;QACR,OAAO;QACP,OAAO;QACP,QAAQ;QACR,QAAQ;KACT,CAAC,CAAC;AACL,CAAC;AAED,SAAS,
GAAG,CACR,IAAoE;IACtE,MAAM,EAAC,MAAM,EAAE,EAAC,CAAC,EAAC,EAAE,OAAO,EAAE,KAAC,E
AAE,EAAC,QAAQ,EAAE,aAAa,EAAC,EAAC,GAAG,IAAI,CAAC;IAEtE,MAAM,QAAQ,GAAG,QAAQ,CAA
C,GAAG,CACzB,CAAC,CAAC,EAAE,CAAC,EAAE,EAAE,CAAC,CAAC,CAAC,CAAC,CAAC,CAAC,eAAe,G
AAG,CAAC,CAAC,KAAC,CAAC,CAAC,GAAG,CAAC,CAAC,CAAC,CAAC,CAAC,cAAc,CAAC,CAA
C;IAEvE,IAAI,IAAI,CAAC,aAAa,CAAC,CAAC,CAAC,KAAC,CAAC,KAAC,CAAC,EAAE;QACrC,kEAAkE;Q
ACIE,oDAAoD;QACpD,OAAO,IAAI,CAAC;YACV,OAAO;YACP,KAAC,EAAE,EAAC,KAAC,EAAE,QAAQ,
EAAE,KAAC,EAAE,aAAa,EAAE,KAAC,EAAE,CAAC,CAAC,KAAC,EAAC;SAC/D,CAAC,CAAC;KACJ;IAE
D,MAAM,GAAG,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,CAAC,CAAC,MAAM,CAAC,CAAC,EAA
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W,GAAiB;IACvC,UAAU,EAAE,KAAC;IACjB,WAAW,EAAE,MAAM;IACnB,UAAU,EAAE,GAAuB;IACnC,S
AAS,EAAE,KAAC;CACjB,CAAC", "sourcesContent":["/**\n
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copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport { KernelConfig, KernelFunc, PadV2, PadV2Attrs, PadV2Inputs, util } from '@tensorflow/tfjs-
core';\n\nimport
{ BackendWasm } from './backend_wasm';\n\nimport { fill } from './Fill';\n\nimport { CppDType } from
'./types';\n\nlet wasmPadV2: (\n  xId: number, xShapeBytes: Uint8Array, xShapeLength: number, xDtype:
number,\n  prePaddingsBytes: Uint8Array, postPaddingsBytes: Uint8Array,\n  constantValue: number, outId:
number) => void;\n\nfunction setup(backend: BackendWasm) {\n  wasmPadV2 = backend.wasm.cwrap(PadV2, null
/* void */, [\n    'number', // xId\n    'array', // x.shape\n    'number', // x.shape.length\n    'number', // x.dtype\n
'array', // pre-paddings\n    'array', // post-paddings\n    'number', // constantValue\n    'number', // outId\n
]);\n\nfunction pad(\n  args: {inputs: PadV2Inputs, backend: BackendWasm, attrs: PadV2Attrs}) {\n  const
{inputs: {x}, backend, attrs: {paddings, constantValue}} = args;\n\n  const outShape = paddings.map(\n    (p, i) =>
p[0] /* beforePad */ + x.shape[i] + p[1] /* afterPad */);\n\n  if (util.sizeFromShape(x.shape)
```

```

==== 0) {\n // Short-circuit the computation, since x doesn't have value, only\n // the shape is used to compute
output shape to pad.\n return fill({\n backend,\n attrs: {shape: outShape, value: constantValue, dtype:
x.dtype}\n });\n }\n\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out =
backend.makeOutput(outShape, x.dtype);\n const outTensorData = backend.dataIdMap.get(out.dataId);\n const
outId = outTensorData.id;\n\n const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n\n const
prePaddingsFlat = paddings.map(padTuple => padTuple[0]);\n const postPaddingsFlat = paddings.map(padTuple
=> padTuple[1]);\n const prePaddingsBytes =\n new Uint8Array(new Int32Array(prePaddingsFlat).buffer);\n\n const
postPaddingsBytes =\n new Uint8Array(new Int32Array(postPaddingsFlat).buffer);\n\n wasmPadV2(\n
xId, xShapeBytes, x.shape.length, CppDType[x.dtype], prePaddingsBytes,\n postPaddingsBytes, constantValue,
outId);\n
return out;\n}\n\nexport const padV2Config: KernelConfig = {\n kernelName: PadV2,\n backendName: 'wasm',\n
kernelFunc: pad as {} as KernelFunc,\n setupFunc: setup\n};\n"}

```

Found in path(s):

```

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
wasm/dist/kernels/PadV2.js.map

```

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```

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 *
 * =====
 */

```

Found in path(s):

```

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
wasm/dist/kernels/FloorDiv.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/setup_test.js
*
/opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
wasm/dist/kernels/GatherNd.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
wasm/src/kernels/RotateWithOffset.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/types.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
wasm/src/kernels/LogicalAnd.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-

```

wasm/dist/kernels/ArgMax.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Cast.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Log.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/RealDiv.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Sum.js
*
/opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Minimum.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Multiply.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Max.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/_FusedMatMul.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Exp.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Prelu.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/FusedConv2D.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Rsqrt.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/GreaterEqual.js
*
/opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Sub.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/ExpandDims.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/RealDiv.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/ArgMax.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/AvgPool.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Min.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Relu.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/FloorDiv.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/LeakyRelu.d.ts
*
/opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/binary_kernel.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/NonMaxSuppressionV5.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Greater.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Add.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Rsqrt.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Tanh.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Concat.d.ts

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/binary_kernel.ts

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/GatherV2.d.ts

*

/opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/ScatterNd.d.ts

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Sigmoid.ts

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/GatherNd.ts

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/BatchMatMul.js

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/NonMaxSuppressionV3.ts

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Exp.js

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/FusedDepthwiseConv2D.ts

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Multiply.d.ts

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/NonMaxSuppressionV5.ts

*

/opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Prelu.d.ts

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Cos.ts

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/AddN.ts

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Minimum.d.ts

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/FlipLeftRight.js

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Log.ts

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Tile.d.ts

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/FusedConv2D.ts

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/RealDiv.d.ts

*

/opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/LeakyRelu.ts

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/DepthToSpace.d.ts

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Tanh.ts

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/unary_kernel.js

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/index.ts

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/GreaterEqual.ts

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Sub.d.ts

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/ResizeBilinear.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Maximum.ts
*
/opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/SquaredDifference.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Tanh.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/index_test.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/FusedConv2D.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Concat.js
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* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/BatchMatMul.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Log.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/FusedBatchNorm.ts
*
/opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Unpack.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Transpose.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/AvgPool.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Add.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Less.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Reshape.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/ResizeBilinear.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/index_test.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Pow.d.ts
*
/opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Abs.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/NonMaxSuppressionV3.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Conv2D.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/LessEqual.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/binary_kernel.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/GatherNd.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/CropAndResize.d.ts
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* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Square.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Max.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Square.d.ts
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* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/unary_kernel.d.ts
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* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Relu.d.ts
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* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/MaxPool.js
*

/opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/CropAndResize.ts

- * /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Sum.ts
- * /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/index.js
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- * /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/FlipLeftRight.ts
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- * /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/ClipByValue.js
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- * /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/MaxPool.d.ts
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- * /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Sigmoid.js

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```
=====\n*\n\nimport { _FusedMatMul, _FusedMatMulAttrs, _FusedMatMulInputs, KernelConfig, KernelFunc } from\n '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport { FusibleActivation } from\n './types';\n\nlet wasmFusedMatMul: (\n  aId: number, aShape: Uint8Array, aShapeSize: number, bId: number,\n  bShape: Uint8Array, bShapeSize: number, transposeA: boolean,\n  transposeB: boolean, activation: number,\n  biasId: number,\n  preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>\n  void;\n\nfunction setup(backend: BackendWasm) {\n  wasmFusedMatMul = backend.wasm.cwrap(_FusedMatMul,\n  null /* void */, [\n    'number',\n    // a_id\n    'array', // a_shape\n    'number', // a_shape.length\n    'number', // b_id\n    'array', // b_shape\n    'number', // b_shape.length\n    'number', // transpose_a\n    'number', // transpose_b\n    'number', // activation\n    'number', // biasId\n    'number', // preluActivationWeightsId\n    'number', // leakyreluAlpha\n    'number' //\n    out_id\n  ]);\n\n  function fusedBatchMatMul(args: {\n    inputs: _FusedMatMulInputs,\n    backend: BackendWasm,\n    attrs: _FusedMatMulAttrs\n  }) {\n    const { inputs, backend, attrs } = args;\n    const { a, b, bias, preluActivationWeights } = inputs;\n\n    if (a.dtype !== 'float32' || b.dtype !== 'float32') {\n      throw new Error(\n        `_FusedMatMul for non non-float32 tensors not yet supported.`);\n    }\n\n    const { transposeA, transposeB, activation, leakyreluAlpha } = attrs;\n    const aId = backend.dataIdMap.get(a.dataId).id;\n    const bId = backend.dataIdMap.get(b.dataId).id;\n\n    let biasId = 0;\n    if (bias != null) {\n      const biasData = backend.dataIdMap.get(bias.dataId);\n      if (biasData.shape.length !== 1) {\n        throw new Error(\n          `_FusedMatMul only supports rank-1 bias but got ` +\n            `rank ${biasData.shape.length}`);\n      }\n      biasId = biasData.id;\n    }\n\n    const preluActivationWeightsId = preluActivationWeights == null ?\n      0 : backend.dataIdMap.get(preluActivationWeights.dataId).id;\n\n    const fusedActivation =\n      FusibleActivation[activation as { } as keyof typeof FusibleActivation];\n    if (fusedActivation == null) {\n      throw new Error(\n        `${activation} activation not yet supported for FusedConv2D ` +\n          `in the wasm backend.`);\n    }\n\n    const leftDim = transposeA ? a.shape[2] : a.shape[1];\n    const rightDim = transposeB ? b.shape[1] : b.shape[2];\n    const batchDim = a.shape[0];\n\n    const out = backend.makeOutput([batchDim, leftDim, rightDim],\n    a.dtype);\n    const outId = backend.dataIdMap.get(out.dataId).id;\n\n    const aShapeBytes = new Uint8Array(new Int32Array(a.shape).buffer);\n    const bShapeBytes = new Uint8Array(new Int32Array(b.shape).buffer);\n\n    wasmFusedMatMul(\n      aId, aShapeBytes, a.shape.length, bId, bShapeBytes, b.shape.length,\n      transposeA, transposeB, fusedActivation, biasId, preluActivationWeightsId,\n      leakyreluAlpha || 0, outId);\n\n    return out;\n  }\n\n  export const fusedMatMulConfig: KernelConfig = {\n    kernelName: _FusedMatMul,\n    backendName: 'wasm',\n    setupFunc: setup,\n    kernelFunc: fusedBatchMatMul as { } as KernelFunc\n  }; \n}\n\n/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *\n
```

```
=====\n*\n\nimport { DataType, KernelConfig, TensorInfo, UnaryInputs, util } from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport { CppDType } from './types';\n\nexport function
```

```

createUnaryKernelConfig(\n  kernelName: string, outType?: DataType): KernelConfig {\n  let wasmFunc: (xId:
number, dtype: number, outId: number) => void;\n\n  function setupFunc(backend: BackendWasm): void {\n
wasmFunc = backend.wasm.cwrap(kernelName, null /* void */, [\n  'number', // x_id\n  'number', // dtype\n
'number', // out_id\n  ]);\n  }\n\n  function kernelFunc(args: {backend: BackendWasm, inputs: UnaryInputs});\n
TensorInfo {\n  const {backend, inputs: {x}} = args;\n  const xId = backend.dataIdMap.get(x.dataId).id;\n
  const out = backend.makeOutput(x.shape, outType || x.dtype);\n  const outId =
backend.dataIdMap.get(out.dataId).id;\n\n  // Short-circuit zero-sized tensors.\n  if (util.sizeFromShape(out.shape)
=== 0) {\n  return out;\n  }\n\n  wasmFunc(xId, CppDType[x.dtype], outId);\n  return out;\n  }\n\n  return
{kernelName, backendName: 'wasm', setupFunc, kernelFunc};\n}\n\n/*\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n *
limitations under the License.\n *

```

```

=====\n
*\nimport {Abs, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'/unary_kernel';\nexport const absConfig: KernelConfig = createUnaryKernelConfig(Abs);\n\n/*\n * @license\n *
Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of
the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n *
limitations under the License.\n *

```

```

=====\n
*\n\nimport {backend_util, BinaryInputs, DataType, KernelConfig, TensorInfo, util} from '@tensorflow/tfjs-
core';\nimport {BackendWasm} from '../backend_wasm';\nimport {CppType} from './types';\nexport
function createBinaryKernelConfig(\n  kernelName: string, supportsFullBroadcast: boolean,\n  dtype?:
DataType): KernelConfig {\n  let wasmFunc:\n    (aId: number, aShape: Uint8Array, aShapeLen: number, bId:
number,\n    bShape: Uint8Array, bShapeLen: number, dtype: number, outId: number) =>\n      void;\n\n  function
setupFunc(backend: BackendWasm): void {\n    wasmFunc = backend.wasm.cwrap(kernelName, null /*
void */, [\n      'number', // a_id,\n      'array', // a_shape\n      'number', // a_shape.length\n     
'number', // b_id\n      'array', // b_shape\n      'number', // b_shape.length\n      'number', // dtype\n
      'number' // out_id\n    ]);\n  }\n\n  function kernelFunc(args: {backend: BackendWasm, inputs: BinaryInputs});\n
  TensorInfo {\n    const {backend, inputs} = args;\n    const {a, b} = inputs;\n    const aId =
backend.dataIdMap.get(a.dataId).id;\n    const bId = backend.dataIdMap.get(b.dataId).id;\n\n    const outputType =
dtype != null ? dtype : a.dtype;\n    const newShape = backend_util.assertAndGetBroadcastShape(a.shape,
b.shape);\n    const out = backend.makeOutput(newShape, outputType);\n\n    // Short-circuit zero-sized tensors.\n
if (util.sizeFromShape(newShape) === 0) {\n    return out;\n    }\n\n    const aShapeBytes = new Uint8Array(new
Int32Array(a.shape).buffer);\n    const bShapeBytes = new Uint8Array(new Int32Array(b.shape).buffer);\n    const
outId = backend.dataIdMap.get(out.dataId).id;\n    const kernelFunc = () => wasmFunc(\n      aId, aShapeBytes,
a.shape.length, bId, bShapeBytes, b.shape.length,\n      CppDType[a.dtype], outId);\n\n    // Currently only some
float operations support full broadcast.\n    if (supportsFullBroadcast && a.dtype === 'float32')\n      {\n
kernelFunc();\n      return out;\n      }\n\n    const aBroadcastDims = backend_util.getBroadcastDims(a.shape,
newShape);\n    const bBroadcastDims = backend_util.getBroadcastDims(b.shape, newShape);\n    const
loopsOverAllOfA = aBroadcastDims.every((v, i) => v === i);\n    const loopsOverAllOfB =
bBroadcastDims.every((v, i) => v === i);\n    if (loopsOverAllOfA && loopsOverAllOfB) {\n      kernelFunc();\n

```

```

return out;\n  } else {\n    throw new Error(\n      `Broadcasting along outer dims is not yet ` +\n
`supported for ${a.dtype} ${kernelName}.`);\n  }\n }\n\n return {kernelName, backendName: 'wasm', setupFunc,\n
kernelFunc};\n}\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the\n
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the\n
License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required\n
by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\"\n
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the\n
License for the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {Add, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from\n
'/binary_kernel';\n\nconst supportsFullBroadcast = true;\n\nexport const addConfig: KernelConfig =\n
createBinaryKernelConfig(Add, supportsFullBroadcast);\n", "/*\n * @license\n * Copyright 2019 Google LLC. All\n
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this\n
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable\n
law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {AddN, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport\n
{BackendWasm} from '../backend_wasm';\n\nimport {CppType} from './types';\n\nlet wasmFunc:\n
(inputIds:\n
Uint8Array, inputIdsLen: number, dtype: number, outId: number) =>\n
void;\n\nfunction setupFunc(backend:\n
BackendWasm): void {\n
  wasmFunc = backend.wasm.cwrap(AddN, null /* void */, [\n
    'array', // input_ids\n
    'number', // input_ids.length\n
    'number', // dtype\n
    'number', // out_id\n
  ]);\n\n  function addn(args: {inputs:\n
TensorInfo[], backend: BackendWasm}) {\n
    const {inputs,\n
        backend} = args;\n
    const out = backend.makeOutput(inputs[0].shape, inputs[0].dtype);\n
    // Short-circuit zero-\n
    sized tensors.\n
    if (util.sizeFromShape(out.shape) === 0) {\n
      return out;\n
    }\n
    const inputIds = inputs.map(x\n
=> backend.dataIdMap.get(x.dataId).id);\n
    const inputIdsBytes = new Uint8Array(new\n
Int32Array(inputIds).buffer);\n
    const outId = backend.dataIdMap.get(out.dataId).id;\n
    wasmFunc(inputIdsBytes,\n
inputIds.length, CCppType[out.dtype], outId);\n
    return out;\n
  }\n\n  export const addNConfig: KernelConfig = {\n
kernelName: AddN,\n
backendName: 'wasm',\n
setupFunc,\n
kernelFunc: addn as {} as KernelFunc,\n
};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n
2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a\n
copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable\n
law or agreed\n
to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT\n
WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific\n
language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {Identity, IdentityInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\n\nimport\n
{TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nexport function\n
identity(args: {inputs: IdentityInputs, backend: BackendWasm}):\n
TensorInfo {\n
  const {inputs: {x}, backend} =\n
args;\n
  const out = backend.makeOutput(x.shape, x.dtype);\n
  const inVals = backend.typedArrayFromHeap(x);\n
  const outVals = backend.typedArrayFromHeap(out);\n
  outVals.set(inVals);\n
  return out;\n
}\n\nexport const\n
identityConfig: KernelConfig = {\n
kernelName: Identity,\n
backendName: 'wasm',\n
kernelFunc: identity as {} as KernelFunc,\n
};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights\n
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file

```


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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

```
=====\n*\n\nimport { KernelConfig, KernelFunc, TensorInfo, Transpose, TransposeAttrs, TransposeInputs } from  
'@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { identity } from  
 './Identity';\nimport { CppDType }  
 from './types';\n\nlet wasmTranspose: (xId: number, xShape: Uint8Array, xShapeLength: number, dtype:  
 CppDType, outId: number, perm: Uint8Array, permLength: number) => void;\n\nfunction setup(backend:  
 BackendWasm) {\n  wasmTranspose = backend.wasm.cwrap(Transpose, null /* void */, [\n    'number', // xId\n    'array', // x.shape\n    'number', // x.shape.length\n    'number', // dtype\n    'number', // outId\n    'array', // perm\n    'number', // perm.length\n  ]);\n\n  export function transpose(\n    args: {\n      inputs: TransposeInputs, backend:  
 BackendWasm, attrs: TransposeAttrs);\n    TensorInfo {\n      const {inputs, backend, attrs} = args;\n      // Reduce any  
 dimensions with size one. Lower-rank transpose kernel performs\n      // better due to simpler memory access pattern.\n    } const [reducedShape, perm] = removeOneSizeDims(inputs.x.shape, attrs.perm);\n    let permIsNoOp = true;\n    for (let i = 0; i < perm.length; i++) {\n      if (perm[i] !== i) {\n        permIsNoOp = false;\n      }\n    }\n    const outShape = computeOutShape(inputs.x.shape, attrs.perm);\n    const x = {\n      dataId:  
 inputs.x.dataId,\n      shape: reducedShape,\n      dtype: inputs.x.dtype\n    };\n    if (permIsNoOp) {\n      const cloned = identity({inputs, backend});\n      cloned.shape = outShape;\n      return cloned;\n    }\n    const out = backend.makeOutput(outShape, x.dtype);\n    const xId = backend.dataIdMap.get(x.dataId).id;\n    const outId = backend.dataIdMap.get(out.dataId).id;\n    const permBytes = new Uint8Array(new Int32Array(perm).buffer);\n    const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n    wasmTranspose(xId, xShapeBytes, x.shape.length, CppDType[x.dtype], outId, permBytes, perm.length);\n    return out;\n  }\n\n  function computeOutShape(inShape: number[], perm: number[]): number[] {\n    const outShape = new Array(inShape.length);\n    for (let i = 0; i < outShape.length; i++) {\n      outShape[i] = inShape[perm[i]];\n    }\n    return outShape;\n  }\n\n  function removeOneSizeDims(\n    shape: number[], perm: number[]): [number[], number[]] {\n    const newShape: number[] = [];\n    const newPerm: number[] = [];\n    for (let i = 0; i < shape.length; ++i) {\n      if (shape[i] !== 1) {\n        newShape.push(shape[i]);\n        if (shape[perm[i]] !== 1) {\n          newPerm.push(perm[i]);\n        }\n      }\n    }\n    for (let i = 0; i < newPerm.length; ++i) {\n      let minValIdx = -1;\n      for (let j = 0; j < newPerm.length; ++j) {\n        if (newPerm[j] >= i && (minValIdx === -1 || newPerm[minValIdx] > newPerm[j])) {\n          minValIdx = j;\n        }\n      }\n      newPerm[minValIdx] = i;\n    }\n    return [newShape, newPerm];\n  }\n\n  export const transposeConfig:  
 KernelConfig = {\n    kernelName: Transpose,\n    backendName: 'wasm',\n    kernelFunc: transpose as KernelFunc\n  } as KernelFunc,\n  setupFunc: setup;\n};\n\n/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this  
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,  
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES  
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language  
governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport { All, AllAttrs, AllInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util } from  
'@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { permuteAxesAndTranspose } from './kernel_utils';\n\nlet wasmAll: (xId: number, reduceSize: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n  wasmAll = backend.wasm.cwrap(All, null /* void */, ['number, number, number']);\n}
```

```

all(args: {backend: BackendWasm, inputs: AllInputs, attrs: AllAttrs});\n  TensorInfo {\n  const {backend, inputs,\n  attrs} = args;\n  const {axis, keepDims} = attrs;\n  const {x} = inputs;\n  const xId =\n  backend.dataIdMap.get(x.dataId).id;\n  let inputId = xId;\n  let input = x;\n\n  const {transposed, axes, originalAxes,\n  inputWasTransposed} =\n    permuteAxesAndTranspose(x, axis, backend);\n\n  if (inputWasTransposed) {\n  const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n  input = transposed;\n  inputId =\n  transposedId;\n  }\n\n  const inputRank = input.shape.length;\n  backend_util.assertAxesAreInnerMostDims('all',\n  axes, inputRank);\n  const [outShape, reduceShape] =\n  backend_util.computeOutAndReduceShapes(input.shape, axes);\n  const reduceSize =\n  util.sizeFromShape(reduceShape);\n\n  const out = backend.makeOutput(outShape, x.dtype);\n  if\n  (util.sizeFromShape(input.shape) !== 0) {\n  const outId = backend.dataIdMap.get(out.dataId).id;\n  wasmAll(inputId,\n  reduceSize, outId);\n  }\n\n  if (inputWasTransposed) {\n  // dispose of the transposed tensor.\n  backend.disposeData(transposed.dataId);\n  }\n\n  if (keepDims) {\n  // reshape\n  const newShape =\n  backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n  out.shape = newShape;\n  }\n\n  return\n  out;\n}\n\nexport const allConfig: KernelConfig = {\n  kernelName: All,\n  backendName: 'wasm',\n  setupFunc:\n  setup,\n  kernelFunc: all as { } as KernelFunc\n};\n"/**\n * @license\n * Copyright 2020 Google Inc. All Rights\n  Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file\n  except in compliance with the License.\n * You may obtain a copy of the License at\n *  

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=====\n
*/\n\nimport {backend_util, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from\n './backend_wasm';\nimport {transpose} from './Transpose';\n\n/**\n * Compute permutation axes and do a transpose\n  if necessary.\n *  

Used by reduction ops.\n * @param x input TensorInfo\n * @param axis reduction axes\n *  

@param backend wasm backend instance\n */\nexport function permuteAxesAndTranspose(\n  x: TensorInfo,\n  axis: number|number[], backend: BackendWasm): {\n  transposed: TensorInfo|null,\n  axes: number[],\n  originalAxes: number[],\n  inputWasTransposed: boolean\n} {\n  const xShape = x.shape;\n  const xRank =\n  x.shape.length;\n\n  const originalAxes = util.parseAxisParam(axis, xShape);\n  let axes = originalAxes;\n  const\n  permutedAxes = backend_util.getAxesPermutation(axes,\n  xRank);\n  let xTransposed = null;\n  let inputWasTransposed = false;\n  if (permutedAxes !== null) {\n  const\n  newShape: number[] = new Array(xRank);\n  for (let i = 0; i < newShape.length; i++) {\n  newShape[i] =\n  xShape[permutedAxes[i]];\n  }\n\n  axes = backend_util.getInnerMostAxes(axes.length, xRank);\n  xTransposed\n  =\n  transpose({inputs: {x}, attrs: {perm: permutedAxes}, backend});\n\n  const xId =\n  backend.dataIdMap.get(x.dataId).id;\n  const transposedId = backend.dataIdMap.get(xTransposed.dataId).id;\n  if\n  (transposedId !== xId) {\n  inputWasTransposed = true;\n  }\n  }\n\n  return {transposed: xTransposed,\n  originalAxes, axes, inputWasTransposed};\n}\n"/**\n * @license\n * Copyright 2021 Google LLC. All Rights\n  Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file\n  except in compliance with the License.\n * You may obtain a copy of the License at\n *  

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=====\n
*/\n\nimport {Any, AnyAttrs, AnyInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util} from

```

```
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport
{permuteAxesAndTranspose} from './kernel_utils';\n\nlet wasmAny: (xId: number, reduceSize: number, outId:
number) => void;\n\nfunction setup(backend: BackendWasm): void {\n  wasmAny = backend.wasm.cwrap(Any,
null /*void*/, [number, number, number]);\n}\n\nfunction any(args: {backend: BackendWasm, inputs: AnyInputs,
attrs: AnyAttrs}):\n  TensorInfo {\n  const {backend, inputs,
  attrs} = args;\n  const {axis, keepDims} = attrs;\n  const {x} = inputs;\n  const xId =
backend.dataIdMap.get(x.dataId).id;\n  let inputId = xId;\n  let input = x;\n\n  const {transposed, axes, originalAxes,
inputWasTransposed} =\n    permuteAxesAndTranspose(x, axis, backend);\n\n  if (inputWasTransposed) {\n
const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n  input = transposed;\n  inputId =
transposedId;\n  }\n\n  const inputRank = input.shape.length;\n  backend_util.assertAxesAreInnerMostDims('any',
axes, inputRank);\n  const [outShape, reduceShape] =\n    backend_util.computeOutAndReduceShapes(input.shape, axes);\n  const reduceSize =
util.sizeFromShape(reduceShape);\n\n  const out = backend.makeOutput(outShape, x.dtype);\n  if
(util.sizeFromShape(input.shape) !== 0) {\n    const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmAny(inputId, reduceSize, outId);\n  }\n\n  if (inputWasTransposed) {\n    // dispose of the transposed tensor.\n
backend.disposeData(transposed.dataId);\n  }\n\n  if (keepDims) {\n    // reshape\n    const newShape = backend_util.expandShapeToKeepDim(out.shape,
originalAxes);\n    out.shape = newShape;\n  }\n\n  return out;\n}\n\nexport const anyConfig: KernelConfig = {\n
kernelName: Any,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: any as {} as
KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n\n *
=====*\n\nimport {ArgMax, ArgMaxAttrs, ArgMaxInputs, KernelConfig, KernelFunc, util} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {permuteAxesAndTranspose} from
 './kernel_utils';\n\nimport {CppType} from './types';\n\nlet wasmFunc: (\n  xId: number, dtype: number, outerSize:
number, innerSize: number,\n  outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n
wasmFunc = backend.wasm.cwrap(ArgMax, null /* void */, [\n  'number', // x_id\n  'number', // dtype\n
'number', // outer_size\n  'number', // inner_size\n  'number' // out_id\n]);\n}\n\nfunction argmax(\n  args:
{inputs: ArgMaxInputs, backend: BackendWasm, attrs: ArgMaxAttrs}) {\n  const {backend, inputs, attrs} = args;\n
const {axis} = attrs as {} as ArgMaxAttrs;\n  const {x} = inputs as {} as ArgMaxInputs;\n  const xId =
backend.dataIdMap.get(x.dataId).id;\n  let inputId
= xId;\n  let input = x;\n\n  const {transposed, axes, inputWasTransposed} =\n    permuteAxesAndTranspose(x,
axis, backend);\n\n  if (inputWasTransposed) {\n    const transposedId =
backend.dataIdMap.get(transposed.dataId).id;\n    if (transposedId !== xId) {\n      // transpose was not a no-op. We
will need to dispose of this\n      // once we are done.\n      input = transposed;\n      inputId = transposedId;\n    }\n  }\n\n  const outShape = input.shape.slice(0, -1);\n  const out = backend.makeOutput(outShape, 'int32');\n  const
outId = backend.dataIdMap.get(out.dataId).id;\n  const outerSize = util.sizeFromShape(out.shape);\n  const
innerSize = input.shape[axes[0]];\n  wasmFunc(inputId, CppDType[input.dtype], outerSize, innerSize, outId);\n\n  if
(inputWasTransposed) {\n    // dispose of the transposed tensor.\n    backend.disposeData(transposed.dataId);\n  }\n}\n\nreturn out;\n}\n\nexport const argMaxConfig: KernelConfig = {\n  kernelName: ArgMax,\n  backendName:
'wasm',\n  kernelFunc: argmax as {} as KernelFunc,\n  setupFunc: setup\n};\n\n"/**\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not
```

use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * <http://www.apache.org/licenses/LICENSE-2.0>\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

```
=====\n*\n\nimport { AvgPool, AvgPoolAttrs, AvgPoolInputs, backend_util, KernelConfig, KernelFunc, Tensor4D } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nlet wasmAvgPool: (\n  xId: number, batchSize: number, inputHeight: number, inputWidth: number, filterHeight: number, filterWidth: number, padTop: number, padRight: number, padBottom: number, padLeft: number, strideHeight: number, strideWidth: number, channels: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n  wasmAvgPool = backend.wasm.cwrap(AvgPool, null /* void */, [\n    'number', // xId\n    'number', // batchSize\n    'number', // inputHeight\n    'number', // inputWidth\n    'number', // filterHeight\n    'number', // filterWidth\n    'number', // padTop\n    'number', // padRight\n    'number', // padBottom\n    'number', // padLeft\n    'number', // strideHeight\n    'number', // strideWidth\n    'number', // channels\n    'number', // outId\n  ]);\n}\n\nfunction avgPool(\n  args: { inputs: AvgPoolInputs, backend: BackendWasm, attrs: AvgPoolAttrs }) {\n  const { inputs, attrs, backend } = args;\n  const x = inputs.x as Tensor4D;\n  const xId = backend.dataIdMap.get(x.dataId).id;\n  const { filterSize, strides, pad, dimRoundingMode } = attrs;\n  const convInfo = backend_util.computePool2DInfo(\n    x.shape, filterSize, strides, 1 /* dilations */, pad, dimRoundingMode);\n  const filterHeight = convInfo.filterHeight;\n  const filterWidth = convInfo.filterWidth;\n  const padTop = convInfo.padInfo.top;\n  const padRight = convInfo.padInfo.right;\n  const padBottom = convInfo.padInfo.bottom;\n  const padLeft = convInfo.padInfo.left;\n  const strideHeight = convInfo.strideHeight;\n  const strideWidth = convInfo.strideWidth;\n  const channels = convInfo.inChannels;\n  if (convInfo.dataFormat !== 'channelsLast') {\n    throw new Error(\n      `wasm backend does not support dataFormat: "${convInfo.dataFormat}". Please use 'channelsLast'.`);\n  }\n  if (convInfo.dilationWidth !== 1 || convInfo.dilationHeight !== 1) {\n    throw new Error(\n      `was backend only supports average pooling with dilation = [1, 1],` +\n      `got [${convInfo.dilationHeight}, ${convInfo.dilationWidth}].`);\n  }\n  const out = backend.makeOutput(convInfo.outShape, 'float32');\n  const outId = backend.dataIdMap.get(out.dataId).id;\n  wasmAvgPool(\n    xId, x.shape[0], x.shape[1], x.shape[2], filterHeight, filterWidth,\n    padTop, padRight, padBottom, padLeft, strideHeight, strideWidth, channels,\n    outId);\n  return out;\n}\n\nexport const avgPoolConfig: KernelConfig = {\n  kernelName: AvgPool,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: avgPool as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,  
software\n * distributed under the License is distributed  
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

=====\n*\n\nimport { KernelConfig, KernelFunc, Reshape, ReshapeAttrs, ReshapeInputs, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nexport function reshape(\n args: { inputs: ReshapeInputs, attrs: ReshapeAttrs, backend: BackendWasm }) {\n const { inputs, attrs } = args;\n const { x } = inputs;\n const { shape } = attrs;\n const xSize = util.sizeFromShape(x.shape);\n const \$shape = util.inferFromImplicitShape(shape, xSize);\n util.assert(\n xSize === util.sizeFromShape(\$shape),\n () => `new shape: \${\$shape}, old shape: \${x.shape}. New shape and old` +\n ` shape must have the same number of elements.`);\n // Backend needs to track refCount

```

for the dataId for reshape op\n  args.backend.incref(x.dataId);\n  return {dataId: x.dataId, shape: $shape, dtype:\n  x.dtype};\n}\n\nexport const reshapeConfig: KernelConfig = {\n  kernelName: Reshape,\n  backendName: 'wasm',\n  kernelFunc: reshape as {} as KernelFunc\n};\n", /**\n * @license\n * Copyright 2019 Google LLC. All Rights\n * Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file\n * except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n *

```

```

=====\n
*/\n\nimport\n  {BatchMatMul, BatchMatMulAttrs, BatchMatMulInputs, KernelConfig, KernelFunc, util} from '@tensorflow/tfjs-\n  core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {reshape} from './Reshape';\n\nlet\n  wasmBatchMatMul: (\n    aId: number, aShape: Uint8Array, aShapeSize: number, bId: number,\n    bShape: Uint8Array, bShapeSize: number, transposeA: boolean,\n    transposeB: boolean, outId: number) =>\n  void;\n\nfunction setup(backend: BackendWasm) {\n  wasmBatchMatMul = backend.wasm.cwrap(BatchMatMul,\n  null /* void */, [\n    'number', // a_id\n    'array', // a_shape\n    'number', // a_shape.length\n    'number', // b_id\n    'array', // b_shape\n    'number', // b_shape.length\n    'number', // transpose_a\n    'number', // transpose_b\n    'number' // out_id\n  ]);\n\n  function batchMatMul(args: {\n    inputs: BatchMatMulInputs,\n    backend: BackendWasm,\n    attrs: BatchMatMulAttrs\n  }) {\n    const {inputs, backend, attrs} = args;\n    const {a, b} = inputs;\n    const\n      {transposeA, transposeB} = attrs;\n\n    if (a.dtype !== 'float32' || b.dtype !== 'float32') {\n      throw new Error(\n        `BatchMatMul for non non-float32 tensors not yet supported.`);\n    }\n\n    const aRank = a.shape.length;\n    const bRank = b.shape.length;\n\n    const innerShapeA = transposeA ? a.shape[aRank - 2] : a.shape[aRank - 1];\n    const innerShapeB = transposeB ? b.shape[bRank - 1] : b.shape[bRank - 2];\n\n    const outerShapeA = transposeA ?\n      a.shape[aRank - 1] : a.shape[aRank - 2];\n    const outerShapeB = transposeB ? b.shape[bRank - 2] : b.shape[bRank -\n      1];\n\n    const outerDimsA = a.shape.slice(0, -2);\n    const outerDimsB = b.shape.slice(0, -2);\n\n    const batchDimA = util.sizeFromShape(outerDimsA);\n    const batchDimB = util.sizeFromShape(outerDimsB);\n\n    const\n      batchDimsCompatible =\n        batchDimA === batchDimB || batchDimA === 1 || batchDimB === 1;\n\n    util.assert(\n      aRank >= 2 && bRank >= 2 && batchDimsCompatible,\n      () => `Error in matMul: the input\n      batch dimensions\n      must either be the ` +\n      `same or at least one input batch dimension must be 1. Got input ` +\n      `batch\n      dimensions of (${outerDimsA}) and (${outerDimsB}).`);\n\n    const outShapeOuterDims =\n      batchDimA >\n      batchDimB ? a.shape.slice(0, -2) : b.shape.slice(0, -2);\n    const outShape =\n      outShapeOuterDims.concat([outerShapeA, outerShapeB]);\n\n    util.assert(\n      innerShapeA === innerShapeB,\n      () => `Error in matMul: inner shapes (${innerShapeA}) and (` +\n      `${innerShapeB}) of Tensors with shapes\n      ${a.shape} and ` +\n      `${b.shape} and transposeA=${transposeA}` +\n      ` and transposeB=${transposeB}\n      must match.`);\n\n    const a3dShape = transposeA ? [batchDimA, innerShapeA, outerShapeA] :\n      [batchDimA, outerShapeA, innerShapeA];\n    const b3dShape = transposeB ? [batchDimB, outerShapeB,\n      innerShapeB] :\n      [batchDimB, innerShapeB, outerShapeB];\n\n    // The rest of the\n    implementation is\n    designed to operate on rank-3 tensors\n    const a3d = reshape({inputs: {x: a}, backend, attrs: {shape: a3dShape}});\n    const b3d = reshape({inputs: {x: b}, backend, attrs: {shape: b3dShape}});\n\n    const a3dId =\n      backend.dataIdMap.get(a3d.dataId).id;\n    const b3dId = backend.dataIdMap.get(b3d.dataId).id;\n\n    const leftDim =\n      transposeA ? a3d.shape[2] : a3d.shape[1];\n    const rightDim = transposeB ? b3d.shape[1] : b3d.shape[2];\n    const\n      batchDim = Math.max(batchDimA, batchDimB);\n\n    const out = backend.makeOutput([batchDim, leftDim,\n      rightDim], a3d.dtype);\n    const outId = backend.dataIdMap.get(out.dataId).id;\n\n    const aShapeBytes = new\n      Uint8Array(new Int32Array(a3d.shape).buffer);\n    const bShapeBytes = new Uint8Array(new

```


XG5cbiAgY29uc3QgZGVjb2RIZERhdGEgPSBkdHlwZSA9PT0gJ3N0cmZycyP1xuICAgICAgYmFja2VuZGF91dGlsLmZyb21VaW50OFRvU3RyaW5nQXJyYXkodmFscYBhcyBVAw50OEFycmF5W10pIDpCbiAgICAgIHZhbHMgYXMGVHlwZWRBcnJheTtcb1x1ICBjb25zdCBpbk1J1ZiA9IGJ1ZmZlcihzaGFwZSwgZHR5cGU5IGR1Y29kZWREYXRhKTtcbiAgY29uc3Qgb3V0QnVmID0gYnVmZmVYKHNPemUsIGR0eXB1KTtcbiAgZm9yIChsZXQgaSA9IDA7IGkgPCBvdXRCDWYuc216ZTsgKypKSB7XG4gICAgY29uc3Qgb3V0TG9jID0gb3V0QnVmLmluZGV4V G9Mb2MoaSk7XG4gICAgY29uc3QgaW5Mb2MgPSBvdXRMB2MubWFWKChpZHG6IG51bWJlciwgaikgPT4gaWR4ICsgYmVnaW5bal0pO1xuICAgIG91dEJ1Zi5zZXQoaW5CdWYuc2V0KC4uLmluTG9jKSwgLi4ub3V0TG9jKTtcbiAgfVxuXG4gIGlmICchkdHlwZSA9PT0gJ3N0cmZycyP1htcbiAgICByZXR1cm4gYmFja2VuZGF91dGlsLmZyb21TdHJpbmdBcnJheVRvVWludDgob3V0QnVmLnZhbHVlcYBhcyBzdHJpbmdbXSk7XG4gIH1cbiAgcmV0dXJuIG91dEJ1Zi52YWx1ZXMgYXMGVHlwZWRBcnJheTtcbn1cb1x1ZmZlcjB3J0IGZ1bmN0aW9uIHNSaWNlKfXUICAgIGFyZ3M6IHtpbnB1dHM6IFNSaWNlSW5wdXRzLCBiYWNrZW5kOiBNYXR0cmFja2VuZENQVSwgYXR0cnN9ID0gYXJncztcbiAgY29uc3Qge3h9ID0gaW5wdXRzO1xuICBjb25zdCB7YmVnaW4sIHNPemV9ID0gYXR0cnM7XG5cbiAgYXNzZXJ0Tm90Q29tcGxleCh4LCAnc2xpY2UnKTtcb1x1ICBjb25zdCBbJGJlZ2luLCAkc216ZV0gPSBzbGljZV91dGlsLnBhcnNlU2xpY2VQYXJhbXMoeCwgYmVnaW4sIHNPemUpO1xuICBzbGljZV91dGlsLmFzc2VydFBhcmtFtc1ZhbGlkKHGsICRiZWdpciwgJHNpemUpO1xuXG4gIGNvbN0IHZhbHMgPSBiYWNRZW5kLmRhdGEuZ2V0KHguZGF0YUlKKS52YWx1ZXM7XG4gIGNvbN0IG91dFZhbHMgPSBzbGljZUltcGwodmFscywgJGJlZ2luLCAkc216ZSweC5zaGFwZSwgeC5kdHlwZSk7XG4gIHJldHVybiBiYWNRZW5kLm1ha2VUZW5zb3JjbmZvKCRzaXplLCB4LmR0eXB1LCBvdXRWYWxzKTtcbn1cb1x1ZmZlcjB3J0IGNvbN0IHNSaWNlQ29uZmlnOiBlZXJ1ZjZ5maWcgPSB7XG4gIGtlcm51bE5hbWU6IFNSaWNlF1x1ICBiYWNrZW5kTmFtZTogJ2NwdScsXG4gIGtlcm51bE51bmM6IHNSaWNlIGFzIHt9IGFzIEtlcm51bE51bmNcbn07XG4iXX0=", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```
=====\n *\n\nimport {backend_util, KernelConfig, KernelFunc, Slice, slice_util, SliceAttrs, SliceInputs, TypedArray, util}
from '@tensorflow/tfjs-core';
import {BackendWasm} from '../backend_wasm';
import {sliceImplCPU} from
'./kernel_utils/shared';
export function slice(\n  args: {inputs: SliceInputs, attrs: SliceAttrs, backend:
BackendWasm}) {\n  const {inputs: {x}, attrs: {begin, size}, backend} = args;\n\n  const [begin_, size_] =
slice_util.parseSliceParams(x, begin, size);\n\n  const isContinuous
= slice_util.isSliceContinuous(x.shape, begin_, size_);\n  const xVals = backend.readSync(x.dataId);\n  const out =
backend.makeOutput(size_, x.dtype);\n  const xStrides = util.computeStrides(x.shape);\n  const outData =
backend.dataIdMap.get(out.dataId);\n\n  if (isContinuous) {\n    const flatOffset =
slice_util.computeFlatOffset(begin_, xStrides);\n\n    if (x.dtype === 'string') {\n      outData.stringBytes =\n(xVals as Uint8Array[]).slice(flatOffset, flatOffset + util.sizeFromShape(size_));\n    } else {\n      const
outVals = backend.typedArrayFromHeap(out);\n      outVals.set(\n        (xVals as TypedArray).
.subarray(flatOffset, flatOffset + util.sizeFromShape(size_));\n      )\n\n      return out;\n    }\n\n    if (x.dtype ===
'string') {\n      const res = sliceImplCPU(xVals, begin_, size_, x.shape, x.dtype);\n      outData.stringBytes = res as
Uint8Array[];\n      return out;\n    }\n\n    const outVals = backend.typedArrayFromHeap(out);\n    const rank
= x.shape.length;\n    if (rank === 2) {\n      slice2d(\n        xVals as TypedArray, xStrides[0], outVals, begin_ as
[number, number],\n        size_ as [number, number]);\n    } else if (rank === 3) {\n      slice3d(\n        xVals as
TypedArray, xStrides[0], xStrides[1], outVals,\n        begin_ as [number, number, number], size_ as [number,
number, number]);\n    } else if (rank === 4) {\n      slice4d(\n        xVals as TypedArray, xStrides[0], xStrides[1],
xStrides[2], outVals,\n        begin_ as [number, number, number, number],\n        size_ as [number, number, number,
number]);\n    } else {\n      const res =\n        sliceImplCPU(xVals, begin_, size_, x.shape, x.dtype) as TypedArray;\n    }\n  }\n}
```



```

outVals.set(res);\n }\n\n return out;\n}\n\nfunction slice2d(\n  xVals: backend_util.TypedArray, xStride:
number,\n  outVals: backend_util.TypedArray, begin: [number, number],\n  size: [number, number]): void {\n let
outOffset = 0;\n const beginI = begin[0];\n const beginJ = begin[1];\n const
endI = beginI + size[0];\n for (let i = beginI; i < endI; i++) {\n  const xOffset = i * xStride + beginJ;\n
outVals.set(xVals.subarray(xOffset, xOffset + size[1]), outOffset);\n  outOffset += size[1];\n }\n}\n\nfunction
slice3d(\n  xVals: backend_util.TypedArray, xStride1: number, xStride2: number,\n  outVals:
backend_util.TypedArray, begin: [number, number, number],\n  size: [number, number, number]): void {\n let
outOffset = 0;\n const beginI = begin[0];\n const beginJ = begin[1];\n const beginK = begin[2];\n const endI =
beginI + size[0];\n const endJ = beginJ + size[1];\n for (let i = beginI; i < endI; i++) {\n  for (let j = beginJ; j <
endJ; j++) {\n  const xOffset = i * xStride1 + j * xStride2 + beginK;\n  outVals.set(xVals.subarray(xOffset,
xOffset + size[2]), outOffset);\n  outOffset += size[2];\n }\n }\n}\n\nfunction slice4d(\n  xVals:
backend_util.TypedArray, xStride1: number, xStride2: number,\n  xStride3: number, outVals:
backend_util.TypedArray,\n  begin: [number, number, number, number],\n  size: [number, number, number, number]): void {\n let outOffset
= 0;\n const beginI = begin[0];\n const beginJ = begin[1];\n const beginK = begin[2];\n const endI = beginI +
size[0];\n const endJ = beginJ + size[1];\n const endK = beginK + size[2];\n const beginL = begin[3];\n\n for (let i
= beginI; i < endI; i++) {\n  for (let j = beginJ; j < endJ; j++) {\n  for (let k = beginK; k < endK; k++) {\n
const xOffset = i * xStride1 + j * xStride2 + k * xStride3 + beginL;\n  outVals.set(xVals.subarray(xOffset,
xOffset + size[3]), outOffset);\n  outOffset += size[3];\n }\n }\n }\n}\n\nexport const sliceConfig:
KernelConfig = {\n kernelName: Slice,\n backendName: 'wasm',\n kernelFunc: slice as {} as
KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {backend_util, BatchToSpaceND, BatchToSpaceNDAttrs, BatchToSpaceNDInputs, KernelConfig,
KernelFunc} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport
{reshape} from './Reshape';\n\nimport {slice} from './Slice';\n\nimport {transpose} from './Transpose';\n\nfunction
batchToSpaceND(args: {\n inputs: BatchToSpaceNDInputs,\n backend: BackendWasm,\n attrs:
BatchToSpaceNDAttrs\n}) {\n const {inputs,
backend, attrs} = args;\n const {x} = inputs;\n const {blockShape, crops} = attrs;\n\n const prod =
blockShape.reduce((a, b) => a * b);\n\n const reshaped = backend_util.getReshaped(x.shape, blockShape, prod);\n
const permuted = backend_util.getPermuted(reshaped.length, blockShape.length);\n const reshapedPermuted =\n
backend_util.getReshapedPermuted(x.shape, blockShape, prod);\n const sliceBeginCoords =\n
backend_util.getSliceBeginCoords(crops, blockShape.length);\n const sliceSize =\n
backend_util.getSliceSize(reshapedPermuted, crops, blockShape.length);\n\n const xReshaped = reshape({inputs:
{x}, backend, attrs: {shape: reshaped}});\n const xTransposed =\n  transpose({inputs: {x: xReshaped}, backend,
attrs: {perm: permuted}});\n const xTransposedReshaped = reshape(\n  {inputs: {x: xTransposed}, backend,
attrs: {shape: reshapedPermuted}});\n const result = slice({\n  inputs: {x: xTransposedReshaped},\n  backend,\n
attrs: {begin: sliceBeginCoords,
size: sliceSize}\n });\n\n backend.disposeData(xReshaped.dataId);\n backend.disposeData(xTransposed.dataId);\n
backend.disposeData(xReshaped.dataId);\n\n return result;\n}\n\nexport const batchToSpaceNDConfig:
KernelConfig = {\n kernelName: BatchToSpaceND,\n backendName: 'wasm',\n kernelFunc: batchToSpaceND as
{} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed
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```
=====\n*\n\nimport {Cast, CastAttrs, CastInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\nimport {TensorInfo} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\n\nexport function cast(\n  args: {inputs: CastInputs, attrs: CastAttrs, backend: BackendWasm};\n  TensorInfo {\n    const {inputs: {x}, attrs: {dtype}, backend} = args;\n    const out = backend.makeOutput(x.shape, dtype);\n    const inVals = backend.typedArrayFromHeap(x);\n    const outVals = backend.typedArrayFromHeap(out);\n    outVals.set(inVals);\n    return out;\n  })\n\nexport const castConfig: KernelConfig = {\n  kernelName: Cast,\n  backendName: 'wasm',\n  kernelFunc: cast as KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain
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```
=====\n*\n\nimport {ClipByValue, ClipByValueAttrs, ClipByValueInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmClip: (xId: number, min: number, max: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n  wasmClip = backend.wasm.cwrap(ClipByValue, null /* void */, [\n    'number', // x_id\n    'number', // min\n    'number', // max\n    'number' // out_id\n  ]);\n\n  function clip(args: {\n    inputs: ClipByValueInputs,\n    backend: BackendWasm,\n    attrs: ClipByValueAttrs\n  }) {\n    const {inputs, backend, attrs} = args;\n    const {x} = inputs;\n    const {clipValueMin, clipValueMax} = attrs;\n    const xId = backend.dataIdMap.get(x.dataId).id;\n    const out = backend.makeOutput(x.shape, x.dtype);\n    const outId = backend.dataIdMap.get(out.dataId).id;\n    wasmClip(xId, clipValueMin, clipValueMax, outId);\n    return out;\n  }\n\n  export const clipByValueConfig: KernelConfig = {\n    kernelName: ClipByValue,\n    backendName: 'wasm',\n    setupFunc: setup,\n    kernelFunc: clip as KernelFunc\n  };
\n"/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport {KernelConfig, Ceil} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from './unary_kernel';\n\nexport const ceilConfig: KernelConfig = createUnaryKernelConfig(Ceil);\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```

*\n\nimport { backend_util, Concat, ConcatAttrs, ConcatInputs, KernelConfig, KernelFunc, util } from
'@tensorflow/tfjs-core';\n\nimport { BackendWasm } from './backend_wasm';\nimport { concatImplCPU } from
'./kernel_utils/shared';\nimport { identity } from './Identity';\nimport { reshape } from './Reshape';\n\nexport function
concat(\n  args: { inputs: ConcatInputs, backend: BackendWasm, attrs: ConcatAttrs }) {\n  const { inputs, backend }
= args;\n  const axis = util.parseAxisParam(args.attrs.axis, inputs[0].shape)[0];\n  let outShape =
backend_util.computeOutShape(inputs.map(t => t.shape), axis);\n  // Keep only non-empty tensors (ignore tensors
with 0 in their shape).\n  const $inputs = inputs.filter(t => util.sizeFromShape(t.shape) > 0);\n  if ($inputs.length ===
1)
  {\n    return identity({ inputs: { x: $inputs[0] }, backend });\n  }\n  const out = backend.makeOutput(outShape,
inputs[0].dtype);\n  if (util.sizeFromShape(outShape) === 0) {\n    return out;\n  }\n  const shapes =
$inputs.map(t => t.shape);\n  backend_util.assertParamsConsistent(shapes, axis);\n  if ($inputs[0].dtype ===
'string') {\n    // Any concat of n-dimensional tensors across any axis can be reduced to\n    // a concatenation of two-
dimensional tensors across the axis 1 by first\n    // partitioning the axes of the original tensors into those less than
the\n    // axis to be concatenated and the rest. Then reshape the tensors\n    // into a two-dimensional tensor by
collapsing these two sets of axes and\n    // concatenate the resulting matrices across the axis 1, finally reshaping\n
// the result to have the proper shape.\n    const inputs2D = $inputs.map(t => {\n      const innerSize =
util.sizeFromShape(t.shape.slice(axis));\n      const shape = [-1, innerSize];\n      return reshape({ inputs: { x: t }, backend, attrs: { shape } });\n    });\n    const inputsValShapes = inputs2D.map(t
=> {\n      return { vals: backend.readSync(t.dataId), shape: t.shape};\n    });\n    // Concat 2d tensors along
axis=1.\n    outShape =\n      backend_util.computeOutShape(inputs2D.map(t => t.shape), 1 /* axis */);\n    const
simplyConcat = inputs2D[0].shape[0] === 1;\n    const outVals = concatImplCPU(\n
inputsValShapes, outShape, inputs[0].dtype,\n      simplyConcat) as string[];\n    const finalOutShape
=\n      backend_util.computeOutShape($inputs.map(t => t.shape), axis);\n    out.shape = finalOutShape;\n
const outData = backend.dataIdMap.get(out.dataId);\n    outData.stringBytes =
backend_util.fromStringArrayToUint8(outVals);\n    inputs2D.forEach(t => backend.disposeData(t.dataId));\n\n
return out;\n  }\n  const batchSize = util.sizeFromShape($inputs[0].shape.slice(0, axis));\n  let sumInnerDims =
0;\n  const innerDims = $inputs.map(input => {\n    const innerDim = util.sizeFromShape(input.shape.slice(axis));\n
sumInnerDims += innerDim;\n    return innerDim;\n  });\n  const inVals = $inputs.map(input =>
backendtypedArrayFromHeap(input));\n  const outVals = backendtypedArrayFromHeap(out);\n  for (let b = 0; b <
batchSize; b++) {\n    let outOffset = b * sumInnerDims;\n    for (let i = 0; i < inVals.length; i++) {\n      const
innerDim = innerDims[i];\n      const inOffset = b * innerDim;\n      const vals = inVals[i].subarray(inOffset,
inOffset + innerDim);\n      outVals.set(vals, outOffset);\n      outOffset += innerDim;\n    }\n  }\n  return
out;\n}\n\nexport const concatConfig: KernelConfig = {\n  kernelName: Concat,\n  backendName: 'wasm',\n  kernelFunc: concat as {} as KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
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with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-
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distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *
=====
*\nimport { backend_util, util } from '@tensorflow/tfjs-core';\nexport function concatImpl(inputs, outShape, dtype,
simplyConcat) {\n  const outVals = util.getArrayFromDType(dtype, util.sizeFromShape(outShape));\n  if
(simplyConcat && dtype !== 'string') {\n    // Use built-in TypedArray.set() method for speed.\n    let offset =
0;\n    inputs.forEach(input => {\n      const size = util.sizeFromShape(input.shape);\n      outVals.set(input.vals,

```



```
(convInfo.dataFormat !== 'channelsLast') {\n  throw new Error(\n    `wasm backend Conv2D does not support\n    dataFormat:` +\n    `${convInfo.dataFormat}`. Please use 'channelsLast'.`);\n }\n\n const out =\n  backend.makeOutput(convInfo.outShape, 'float32');\n  const outId = backend.dataIdMap.get(out.dataId).id;\n  wasmConv2d(\n    xId, x.shape[0], x.shape[1], x.shape[2], filterId, filterHeight,\n    filterWidth, padTop, padRight, padBottom, padLeft, isSamePad,\n    dilationHeight, dilationWidth, strideHeight, strideWidth, inputChannels,\n    outputChannels, outId);\n  return out;\n}\n\nexport const\nconv2DConfig: KernelConfig = {\n  kernelName: Conv2D,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: conv2d as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n*\n\nimport\n  {backend_util, Conv2DBackpropInput, Conv2DBackpropInputAttrs, Conv2DBackpropInputInputs, KernelConfig,\n  KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\n  import {BackendWasm} from\n  './backend_wasm';\n  let wasmConv2DBackpropInput: (\n    dyId: number, filterId: number, batchSize: number,\n    filterHeight: number, filterWidth: number, inHeight: number, inWidth: number, inChannels: number,\n    outHeight: number, outWidth: number, outChannels: number, strideHeight: number, strideWidth: number,\n    topPad: number, leftPad: number, fltS0: number, fltS1: number, fltS2: number, xBatchStride: number,\n    xRowStride: number, xColStride: number, xChannelStride: number, yBatchStride: number, yRowStride:\n    number, yColStride: number, yChannelStride: number, outId: number) => void;\n  function setup(backend:\n  BackendWasm): void {\n    wasmConv2DBackpropInput = backend.wasm.cwrap(Conv2DBackpropInput, null, [\n    'number', // dyId\n    'number', // filterId\n    'number', // batchSize\n    'number', // filterHeight\n    'number', // filterWidth\n    'number', // inHeight\n    'number', // inWidth\n    'number', // inChannels\n    'number', // outHeight\n    'number', // outWidth\n    'number', // outChannels\n    'number', // strideHeight\n    'number', // strideWidth\n    'number', // topPad\n    'number', // leftPad\n    'number', // fltS0\n    'number', // fltS1\n    'number', // fltS2\n    'number', // xBatchStride\n    'number', // xRowStride\n    'number', // xColStride\n    'number', // xChannelStride\n    'number', // yBatchStride\n    'number', // yRowStride\n    'number', // yColStride\n    'number', // yChannelStride\n    'number', // outId\n    ]);\n  }\n  function conv2DBackpropInput(args: {\n    backend: BackendWasm,\n    inputs:\n    Conv2DBackpropInputInputs,\n    attrs: Conv2DBackpropInputAttrs\n}): TensorInfo {\n    const {backend, inputs,\n    attrs} = args;\n    const {dy, filter} = inputs;\n    const {strides, pad, dataFormat, dimRoundingMode,\n    inputShape} = attrs;\n    const dilations = 1;\n    const $dataFormat =\n    backend_util.convertConv2DDataFormat(dataFormat);\n    const convInfo = backend_util.computeConv2DInfo(\n    inputShape, filter.shape as [number, number, number, number], strides,\n    dilations, pad, dimRoundingMode, false /* depthwise */, $dataFormat);\n    const {\n    batchSize, filterHeight, filterWidth, inChannels,\n    inHeight, inWidth, outChannels, outHeight, outWidth,\n    strideHeight, strideWidth} =\n    convInfo;\n    const topPad = filterHeight - 1 - convInfo.padInfo.top;\n    const leftPad = filterWidth - 1 -\n    convInfo.padInfo.left;\n    const isChannelsLast = convInfo.dataFormat === 'channelsLast';\n    const dxStrides =\n    util.computeStrides(convInfo.inShape);\n    const dyStrides = util.computeStrides(dy.shape);\n    const [fltS0, fltS1,\n    fltS2] = util.computeStrides(filter.shape);\n    const xBatchStride = dxStrides[0];\n    const xRowStride =\n    isChannelsLast ?\n    dxStrides[1] : dxStrides[2];\n    const xColStride = isChannelsLast ? dxStrides[2] : 1;\n    const xChannelStride =\n    isChannelsLast ? 1 : dxStrides[1];\n    const yBatchStride = dyStrides[0];\n    const yRowStride = isChannelsLast ?\n    dyStrides[1] : dyStrides[2];\n    const yColStride = isChannelsLast ? dyStrides[2] : 1;\n    const yChannelStride =
```

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isChannelsLast ? 1 : dyStrides[1];\n\n const out = backend.makeOutput(convInfo.inShape, 'float32');\n const outId
= backend.dataIdMap.get(out.dataId).id;\n const dyId = backend.dataIdMap.get(dy.dataId).id;\n const filterId =
backend.dataIdMap.get(filter.dataId).id;\n\n wasmConv2DBackpropInput(\n  dyId, filterId, batchSize,
filterHeight, filterWidth, inHeight, inWidth,\n  inChannels, outHeight, outWidth, outChannels, strideHeight,
strideWidth,\n  topPad, leftPad, fltS0, fltS1, fltS2, xBatchStride, xRowStride,\n  xColStride, xChannelStride,
yBatchStride, yRowStride, yColStride,\n  yChannelStride, outId);\n return out;\n}\n\nexport
const conv2DBackpropInputConfig: KernelConfig = {\n kernelName: Conv2DBackpropInput,\n backendName:
'wasm',\n setupFunc: setup,\n kernelFunc: conv2DBackpropInput as {} as KernelFunc\n};\n\n"/**\n * @license\n *
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\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {CropAndResize, CropAndResizeAttrs, CropAndResizeInputs, KernelConfig, KernelFunc,
TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {cast}
from './Cast';\n\n// Must match enum in CropAndResize.cc\nenum InterpolationMethod {\n  bilinear = 0,\n  nearest
= 1\n}\n\nlet wasmCropAndResize: (\n  imagesId: number, boxesId: number, boxIndId: number, numBoxes:
number,\n  imagesShape: Uint8Array, cropHeight: number, cropWidth: number,\n  method: number,
extrapolationValue: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n
wasmCropAndResize = backend.wasm.cwrap(CropAndResize, null /*void*/, [\n  'number', // imagesId\n
'number', // boxesId\n  'number', // boxIndId\n  'number', // numBoxes\n  'array', // images shape\n
'number', // cropHeight\n  'number', // cropWidth\n  'number', // method\n  'number', // extrapolation value\n
'number' // out id\n ]);\n\nfunction cropAndResize(args: {\n  backend: BackendWasm,\n  inputs: CropAndResizeInputs,\n
attrs: CropAndResizeAttrs\n}): TensorInfo {\n  const {backend, inputs, attrs} = args;\n  const {method,
extrapolationValue, cropSize} = attrs;\n  const {image, boxes, boxInd} = inputs;\n  const numBoxes =
boxes.shape[0];\n  const [cropHeight, cropWidth] = cropSize as [number, number];\n  const outShape =
[numBoxes, cropHeight, cropWidth, image.shape[3]];\n  let imagesData =
backend.dataIdMap.get(image.dataId);\n  let castedData;\n  if (image.dtype !== 'float32') {\n  castedData =
cast({backend, inputs: {x: image}, attrs: {dtype: 'float32'}});\n  imagesData =
backend.dataIdMap.get(castedData.dataId);\n  }\n\n  const imagesId = imagesData.id;\n  const boxesId =
backend.dataIdMap.get(boxes.dataId).id;\n  const boxIndId = backend.dataIdMap.get(boxInd.dataId).id;\n\n  const
out = backend.makeOutput(outShape, 'float32');\n  const outId = backend.dataIdMap.get(out.dataId).id;\n\n  const
imagesShapeBytes = new Uint8Array(new Int32Array(image.shape).buffer);\n\n  wasmCropAndResize(\n
imagesId, boxesId, boxIndId, numBoxes, imagesShapeBytes, cropHeight,\n  cropWidth,\n
InterpolationMethod[method as {} as keyof typeof InterpolationMethod],\n  extrapolationValue, outId);\n\n  if
(castedData !== null) {\n  backend.disposeData(castedData.dataId);\n  }\n\n  return out;\n}\n\nexport const
cropAndResizeConfig: KernelConfig = {\n  kernelName: CropAndResize,\n  backendName: 'wasm',\n  setupFunc:
setup,\n  kernelFunc: cropAndResize as {} as KernelFunc\n};\n\n"/**\n * @license\n *
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software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *
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*\n\nimport { Cos, KernelConfig } from '@tensorflow/tfjs-core';\n\nimport { createUnaryKernelConfig } from
'./unary_kernel';\n\nexport const cosConfig: KernelConfig = createUnaryKernelConfig(Cos);\n", "/*\n * @license\n
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions
and\n * limitations under the License.\n *

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=====\n
*\n\nimport { Cosh, KernelConfig } from '@tensorflow/tfjs-core';\n\nimport { createUnaryKernelConfig } from
'./unary_kernel';\n\nexport const coshConfig: KernelConfig = createUnaryKernelConfig(Cosh);\n", "/*\n *
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
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=====\n
*\n\nimport { backend_util, KernelConfig, KernelFunc, Cumsum, CumsumAttrs, CumsumInputs, TensorInfo, util }
from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from './backend_wasm';\n\nimport { CppDType } from
'./types';\n\nimport { transpose } from './Transpose';\n\nlet wasmCumsum: (xId: number, exclusive: number, reverse:
number,\n          finalDim: number, outId: number, dtype: CppDType) => void;\n\nfunction setup(backend:
BackendWasm) {\n  wasmCumsum = backend.wasm.cwrap(Cumsum, null /* void */, [\n    'number', // x_id\n    'number', // exclusive\n    'number', // reverse\n    'number', // final_dim\n    'number', // out_id\n    'number' //
dtype\n  ]);\n\n  export function cumsum(\n    args: {inputs: CumsumInputs, backend: BackendWasm, attrs:
CumsumAttrs});\n  TensorInfo {\n    const {inputs, backend, attrs} = args;\n    const {x} = inputs;\n    const {axis,
exclusive, reverse} = attrs;\n    const xRank = x.shape.length;\n    util.assert(x.dtype
=== 'float32' || x.dtype === 'int32',\n      () => `cumsum does not support ${x.dtype} tensors in the WASM
backend`);\n    // permute required axis to inner most axis\n    const permutation =
backend_util.getAxesPermutation([axis], xRank);\n    let permutedX = x;\n    if (permutation !== null) {\n
permutedX = transpose({inputs: {x}, attrs: {perm: permutation}, backend});\n    }\n    const permutedAxis =
backend_util.getInnerMostAxes(1, xRank)[0];\n    backend_util.assertAxesAreInnerMostDims('cumsum',
[permutedAxis], xRank);\n    const permutedOut = backend.makeOutput(permutedX.shape, permutedX.dtype);\n
const finalDim = permutedX.shape[permutedAxis];\n    const permutedXId =
backend.dataIdMap.get(permutedX.dataId).id;\n    const permutedOutId =
backend.dataIdMap.get(permutedOut.dataId).id;\n    wasmCumsum(permutedXId, exclusive ? 1 : 0, reverse ? 1 : 0,
finalDim,\n      permutedOutId, CppDType[x.dtype]);\n    // transpose data back if permuted\n    let out =
permutedOut;\n    if (permutation
!== null) {\n      const undoPermutation = backend_util.getUndoAxesPermutation(permutation);\n      out =
transpose(\n        {inputs: {x: permutedOut}, attrs: {perm: undoPermutation}, backend});\n    }\n    backend.disposeData(permutedX.dataId);\n    backend.disposeData(permutedOut.dataId);\n  }\n  return
out;\n}\n\nexport const cumsumConfig: KernelConfig = {\n  kernelName: Cumsum,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: cumsum as {} as KernelFunc\n};\n", "/*\n * @license\n
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use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
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* See the License for the specific language governing permissions and\n * limitations under the License.\n *

```
=====\n*\n\nimport {DepthToSpace, DepthToSpaceAttrs, DepthToSpaceInputs, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmDepthToSpace: (\n  xId: number, blockSize: number, channelsLast: number, xStrides: Uint8Array,\n  xStridesLength: number, outputShape: Uint8Array, outputStrides: Uint8Array,\n  outSize: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n  wasmDepthToSpace = backend.wasm.cwrap(DepthToSpace, null /*void*/, [\n    'number', // xId\n    'number', // blockSize\n    'number', // channelsLast\n    'array', // xStrides\n    'number', // xStridesLength\n    'array', // outputShape\n    'array', // outputStrides\n    'number', // outSize\n    'number', // outId\n  ]);\n}\n\nexport\nfunction depthToSpace(args: {\n  backend: BackendWasm,\n  inputs: DepthToSpaceInputs,\n  attrs: DepthToSpaceAttrs\n}): TensorInfo {\n  const {backend, inputs, attrs} = args;\n  const {x} = inputs;\n  const {blockSize, dataFormat} = attrs;\n\n  const batchSize = x.shape[0];\n  const inputHeight = (dataFormat === 'NHWC') ? x.shape[1] : x.shape[2];\n  const inputWidth = (dataFormat === 'NHWC') ? x.shape[2] : x.shape[3];\n  const inputDepth = (dataFormat === 'NHWC') ? x.shape[3] : x.shape[1];\n\n  const outputHeight = inputHeight * blockSize;\n  const outputWidth = inputWidth * blockSize;\n  const outputDepth = inputDepth / (blockSize * blockSize);\n\n  const outputShape = (dataFormat === 'NHWC') ?\n    [batchSize, outputHeight, outputWidth, outputDepth] :\n    [batchSize, outputDepth, outputHeight, outputWidth];\n\n  const out = backend.makeOutput(outputShape, 'float32');\n\n  const xData = backend.dataIdMap.get(x.dataId);\n  const xId = xData.id;\n  const xStridesBytes\n    =\n    new Uint8Array(new Int32Array(util.computeStrides(x.shape)).buffer);\n\n  const outputShapeBytes = new Uint8Array(new Int32Array(outputShape).buffer);\n  const outStridesBytes =\n    new Uint8Array(new Int32Array(util.computeStrides(outputShape)).buffer);\n\n  const outId = backend.dataIdMap.get(out.dataId).id;\n  const channelsLast = dataFormat === 'NHWC' ? 1 : 0;\n\n  wasmDepthToSpace(\n    xId, blockSize, channelsLast, xStridesBytes, x.shape.length - 1,\n    outputShapeBytes, outStridesBytes, outputShape.length, outId);\n\n  return out;\n}\n\nexport const depthToSpaceConfig: KernelConfig = {\n  kernelName: DepthToSpace,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: depthToSpace as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n=====\n*\n\nimport {backend_util, DepthwiseConv2dNative, DepthwiseConv2dNativeAttrs, DepthwiseConv2dNativeInputs, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmDepthwiseConv2d: (\n  xId: number, batchSize: number, inputHeight: number, inputWidth: number,\n  filterId: number, filterHeight: number, filterWidth: number, padTop: number,\n  padRight: number, padBottom: number, padLeft: number, isSamePad: number,\n  dilationHeight: number, dilationWidth: number, strideHeight: number,\n  strideWidth: number, inputChannels: number, outputChannels: number,\n  outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n  wasmDepthwiseConv2d =\n    backend.wasm.cwrap(DepthwiseConv2dNative, null /*void*/, [\n      'number', // xId\n      'number', // batchSize\n      'number', // inputHeight\n      'number', // inputWidth\n      'number', // filterId\n      'number', // filterHeight\n      'number', // filterWidth\n      'number', // padTop\n      'number', // padRight\n      'number', // padBottom\n      'number', // padLeft\n      'number', // isSamePad\n      'number', // dilationHeight\n    ]\n  );\n}
```

```

'number', // dilationWidth\n      'number', // strideHeight\n      'number', // strideWidth\n      'number', //
inputChannels\n      'number', // outputChannels\n      'number', // outId\n    });\n\nfunction
depthwiseConv2d(args: {\n  inputs: DepthwiseConv2dNativeInputs,\n
  backend: BackendWasm,\n  attrs: DepthwiseConv2dNativeAttrs\n}) {\n  const {inputs, attrs, backend} = args;\n\n
  const {x, filter} = inputs;\n  const xId = backend.dataIdMap.get(x.dataId).id;\n  const filterId =
  backend.dataIdMap.get(filter.dataId).id;\n\n  const {strides, dilations, pad, dimRoundingMode} = attrs;\n\n
  const $dilations = dilations === null ? [1, 1] : dilations;\n\n  const convInfo = backend_util.computeConv2DInfo(\n
  (x as Tensor4D).shape, (filter as Tensor4D).shape, strides,\n    ($dilations as number | [number, number]), pad,
  dimRoundingMode,\n    true /* depthwise */);\n\n  const filterHeight = convInfo.filterHeight;\n  const filterWidth =
  convInfo.filterWidth;\n  const padTop = convInfo.padInfo.top;\n  const padRight = convInfo.padInfo.right;\n  const
  padBottom = convInfo.padInfo.bottom;\n  const padLeft = convInfo.padInfo.left;\n  const dilationHeight =
  convInfo.dilationHeight;\n  const dilationWidth = convInfo.dilationWidth;\n  const strideHeight =
  convInfo.strideHeight;\n
  const strideWidth = convInfo.strideWidth;\n  const inputChannels = convInfo.inChannels;\n  const outputChannels
  = convInfo.outChannels;\n  const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;\n\n  if
  (convInfo.dataFormat !== 'channelsLast') {\n    throw new Error(\n      `wasm backend DepthwiseConv2dNative
  does not support dataFormat:` +\n      `${convInfo.dataFormat}'. Please use 'channelsLast'.`);\n  }\n\n  const out =
  backend.makeOutput(convInfo.outShape, 'float32');\n  const outId = backend.dataIdMap.get(out.dataId).id;\n\n
  wasmDepthwiseConv2d(\n    xId, x.shape[0], x.shape[1], x.shape[2], filterId, filterHeight,\n    filterWidth,
  padTop, padRight, padBottom, padLeft, isSamePad,\n    dilationHeight, dilationWidth, strideHeight, strideWidth,
  inputChannels,\n    outputChannels, outId);\n  return out;\n}\n\nexport const depthwiseConv2dNativeConfig:
  KernelConfig = {\n  kernelName: DepthwiseConv2dNative,\n  backendName: 'wasm',\n  setupFunc: setup,\n
  kernelFunc: depthwiseConv2d as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2021 Google LLC. All
  Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
  file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
  http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
  software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
  OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
  governing permissions and\n * limitations under the License.\n *
  =====\n\n*/\nimport {Elu, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
  './unary_kernel';\n\nexport const eluConfig: KernelConfig = createUnaryKernelConfig(Elu);\n\n"/**\n * @license\n *
  Copyright
  2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n *
  you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
  http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
  software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
  OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
  governing permissions and\n * limitations under the License.\n *
  =====\n\n*/\nimport {Equal, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
  './binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const equalConfig: KernelConfig =\n  createBinaryKernelConfig(Equal, supportsFullBroadcast, 'bool');\n\n"/**\n * @license\n * Copyright
  2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n *
  you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
  http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
  software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
  OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language

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governing permissions and\n * limitations under the License.\n *

```
=====\n\n*\nimport {Exp, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from\n './unary_kernel';\n\nexport const expConfig: KernelConfig = createUnaryKernelConfig(Exp, 'float32');\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License,\n * Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may\n * obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by\n * applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS"\n * BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the\n * License for the specific language governing permissions and\n * limitations under the License.\n *\n
```

```
=====\n\n*\n\nimport {ExpandDims, ExpandDimsAttrs, ExpandDimsInputs, KernelConfig, KernelFunc, util} from\n '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {reshape} from\n './Reshape';\n\nexport function expandDims(args: {\n  inputs: ExpandDimsInputs,\n  attrs: ExpandDimsAttrs,\n  backend: BackendWasm\n}) {\n  const {inputs, attrs, backend} = args;\n  const {input}\n    = inputs;\n  const {dim} = attrs;\n  const inputRank = input.shape.length;\n  const newShape =\n    input.shape.slice();\n  let $dim = dim;\n  if (dim < 0) {\n    // Negative value is counted from the tail of rank.\n    util.assert(\n      -(inputRank + 1) <= dim,\n      () => `Axis must be in the interval [${-(inputRank + 1)}, ${\n        inputRank\n      }]);\n    $dim = inputRank + dim + 1;\n  }\n  newShape.splice($dim, 0, 1);\n  return reshape({inputs:\n    {x: input}, backend, attrs: {shape: newShape}});\n}\n\nexport const expandDimsConfig: KernelConfig = {\n  kernelName: ExpandDims,\n  backendName: 'wasm',\n  kernelFunc: expandDims as {} as KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n * 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a\n * copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required\n * by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS"\n * BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the\n * License for the specific language governing permissions and\n * limitations under the License.\n *\n
```

```
=====\n\n*\n\nimport {KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\nimport {Fill, FillAttrs} from\n '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\n\nexport function fill(args: {attrs:\n  FillAttrs, backend: BackendWasm}) {\n  const {attrs: {shape, value, dtype}, backend} = args;\n  const out =\n    backend.makeOutput(shape, dtype);\n  const outVals = backend.typedArrayFromHeap(out);\n  outVals.fill(value as\n    number);\n  return out;\n}\n\nexport const fillConfig: KernelConfig = {\n  kernelName: Fill,\n  backendName:\n  'wasm',\n  kernelFunc: fill as {} as KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n * 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a\n * copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable\n * law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n *\n
```

```
=====\n\n*\n\nimport {FlipLeftRight, FlipLeftRightInputs, KernelConfig, KernelFunc, TensorInfo} from '@tensorflow/tfjs-\n core';\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmFlipLeftRight: (\n  xId: number, batch:\n  number, imageHeight: number, imageWidth: number,\n  numChannels: number,\n  outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n  wasmFlipLeftRight =\n    backend.wasm.cwrap(FlipLeftRight, null /* void */, [\n      'number', // xId\n      'number', // batch\n      'number', //\n      imageHeight\n      'number', // imageWidth\n      'number', // numChannels\n      'number', // outId\n    ]);\n}\n\nexport\n function flipLeftRight(\n  args: {inputs: FlipLeftRightInputs, backend: BackendWasm}): TensorInfo {\n  const
```

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{inputs, backend} = args;\n const {image} = inputs;\n\n const out = backend.makeOutput(image.shape,
image.dtype);\n const imageId = backend.dataIdMap.get(image.dataId).id;\n const outId =
backend.dataIdMap.get(out.dataId).id;\n\n const [batch, imageHeight, imageWidth, numChannels] =
image.shape;\n\n wasmFlipLeftRight(\n  imageId, batch, imageHeight, imageWidth, numChannels, outId);\n
return out;\n}\n\nexport const flipLeftRightConfig: KernelConfig = {\n  kernelName: FlipLeftRight,\n  backendName: 'wasm',\n  kernelFunc: flipLeftRight as {}
  as KernelFunc,\n  setupFunc: setup\n};\n", "/**\n * @license\n * Copyright 2019 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {FusedBatchNorm, FusedBatchNormAttrs, FusedBatchNormInputs, KernelConfig, KernelFunc,
TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nlet
wasmBatchNorm: (\n  xId: number, meanId:
  number, varianceId: number, offsetId: number,\n  scaleId: number, varianceEpsilon: number, outId: number) =>
void;\n\nfunction setup(backend: BackendWasm): void {\n  wasmBatchNorm = backend.wasm.cwrap(\n
FusedBatchNorm, null /* void */,\n  ['number', 'number', 'number', 'number', 'number', 'number',
'number',
'number']);\n}\n\nfunction fusedBatchNorm(args: {\n  backend: BackendWasm,\n  inputs:
FusedBatchNormInputs,\n  attrs: FusedBatchNormAttrs\n}): TensorInfo {\n  const {backend, inputs, attrs} = args;\n
const {varianceEpsilon} = attrs;\n  const {x, mean, variance, offset, scale} = inputs;\n  const xId =
backend.dataIdMap.get(x.dataId).id;\n  const meanId = backend.dataIdMap.get(mean.dataId).id;\n  const varianceId
= backend.dataIdMap.get(variance.dataId).id;\n  const offsetId = offset !== null ?
backend.dataIdMap.get(offset.dataId).id : 0;\n  const scaleId = scale !== null ?
backend.dataIdMap.get(scale.dataId).id : 0;\n\n  const out = backend.makeOutput(x.shape, x.dtype);\n  //
Short-circuit zero-sized tensors.\n  if (util.sizeFromShape(x.shape) === 0) {\n    return out;\n  }\n\n  const outId =
backend.dataIdMap.get(out.dataId).id;\n\n  wasmBatchNorm(\n    xId, meanId, varianceId, offsetId, scaleId,
varianceEpsilon, outId);\n  return out;\n}\n\nexport const fusedBatchNormConfig: KernelConfig = {\n  kernelName:
FusedBatchNorm,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: fusedBatchNorm as {}
  as
  KernelFunc\n};\n", "/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the
  License for the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {Floor, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'/unary_kernel';\n\nexport const floorConfig: KernelConfig = createUnaryKernelConfig(Floor);\n", "/**\n *
@license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under

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the License.\n *

```
=====\n
*\n\nimport {FloorDiv, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from
 './binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const floorDivConfig: KernelConfig =\n
createBinaryKernelConfig(FloorDiv, supportsFullBroadcast);\n\n"/**\n * @license\n * Copyright 2019 Google
 LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not
 use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
 http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
 software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
 OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
 governing permissions and\n * limitations under
 the License.\n *
```

```
=====\n
*\n\nimport {backend_util, FusedConv2D, FusedConv2DAttrs, FusedConv2DInputs, KernelConfig, KernelFunc,
 Tensor4D} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport
 {FusableActivation} from './types';\n\nlet wasmFusedConv2d: (xId: number, batchSize: number, inputHeight:
 number, inputWidth: number,\n  filterId: number, filterHeight: number, filterWidth: number,\n  biasId: number,
 padTop: number, padRight: number, padBottom: number,\n  padLeft: number, isSamePad: number,
 dilationHeight: number,\n  dilationWidth: number, strideHeight: number, strideWidth: number,\n  inputChannels: number, outputChannels: number, activation: number,\n  preluActivationWeightsId: number,
 leakyreluAlpha: number, outId: number) =>\n  void;\n\nfunction setup(backend: BackendWasm) {\n
 wasmFusedConv2d = backend.wasm.cwrap(FusedConv2D, null /* void
 */,\n [\n  'number', // xId\n  'number', // batchSize\n  'number', // inputHeight\n  'number', // inputWidth\n
 'number', // filterId\n  'number', // filterHeight\n  'number', // filterWidth\n  'number', // biasId\n
 'number', // padTop\n  'number', // padRight\n  'number', // padBottom\n  'number', // padLeft\n
 'number', // isSamePad\n  'number', // dilationHeight\n  'number', // dilationWidth\n  'number', // strideHeight\n
 'number', // strideWidth\n  'number', // inputChannels\n  'number', // outputChannels\n  'number', // activation\n
 'number', // preluActivationWeightsId\n  'number', // leakyreluAlpha\n  'number', // outId\n ]);\n\nfunction
 fusedConv2d(args: {\n  inputs: FusedConv2DInputs,\n  backend: BackendWasm,\n  attrs: FusedConv2DAttrs\n})
 {\n  const {inputs, attrs, backend} = args;\n  const {x, filter, bias, preluActivationWeights} = inputs;\n  const {\n
 strides,\n  pad,\n  dilations,\n  dataFormat,\n  dimRoundingMode,\n  activation,\n  leakyreluAlpha\n } = attrs;\n\n  const convInfo =
 backend_util.computeConv2DInfo(\n    (x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations,\n
 pad, dimRoundingMode);\n\n  const fusedActivation =\n    FusableActivation[activation as {}] as keyof typeof
 FusableActivation;\n\n  if (fusedActivation == null) {\n    throw new Error(\n      `${activation} activation not yet
 supported for FusedConv2D` +\n      `in the wasm backend.`);\n  }\n\n  const xId =
 backend.dataIdMap.get(x.dataId).id;\n  const filterId = backend.dataIdMap.get(filter.dataId).id;\n\n  const
 outputChannels = convInfo.outChannels;\n\n  let biasId = 0;\n  if (bias != null) {\n    const biasData =
 backend.dataIdMap.get(bias.dataId);\n    if (biasData.shape.length !== 1) {\n      throw new Error(\n
 `FusedConv2D only supports rank-1 bias but got ` +\n        `rank ${biasData.shape.length}`);\n    }\n    if
 (biasData.shape[0] !== outputChannels)\n      {\n        throw new Error(\n          `FusedConv2D bias shape (${biasData.shape}) does not ` +\n
          `match the number of output channels (${outputChannels})`);\n      }\n    biasId = biasData.id;\n  }\n\n  const filterHeight =
 convInfo.filterHeight;\n  const filterWidth = convInfo.filterWidth;\n  const padTop = convInfo.padInfo.top;\n  const
 padRight = convInfo.padInfo.right;\n  const padBottom = convInfo.padInfo.bottom;\n  const padLeft =
 convInfo.padInfo.left;\n  const dilationHeight = convInfo.dilationHeight;\n  const dilationWidth =
 convInfo.dilationWidth;\n  const strideHeight = convInfo.strideHeight;\n  const strideWidth =
 convInfo.strideWidth;\n  const inputChannels = convInfo.inChannels;\n  const isSamePad = convInfo.padInfo.type
```

```

=== 'SAME' ? 1 : 0;\n const batchSize = convInfo.batchSize;\n const inHeight = convInfo.inHeight;\n const
inWidth = convInfo.inWidth;\n\n if (dataFormat !== 'NHWC') {\n   throw new Error(\n     `wasm backend
FusedConv2D does not support
   dataFormat:` +\n     `${dataFormat}`. Please use 'NHWC'.`);\n }\n\n const out =
backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n const
preluActivationWeightsId = preluActivationWeights == null ?\n   0 :\n   backend.dataIdMap.get(preluActivationWeights.dataId).id;\n\n wasmFusedConv2d(\n   xId, batchSize, inHeight,
inWidth, filterId, filterHeight, filterWidth,\n   biasId, padTop, padRight, padBottom, padLeft, isSamePad,
dilationHeight,\n   dilationWidth, strideHeight, strideWidth, inputChannels, outputChannels,\n   fusedActivation,
preluActivationWeightsId, leakyreluAlpha || 0, outId);\n\n return out;\n}\n\nexport const fusedConv2DConfig:
KernelConfig = {\n  kernelName: FusedConv2D,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc:
fusedConv2d as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the
  \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\\n
*/\\n\\nimport { backend_util, FusedDepthwiseConv2D, FusedDepthwiseConv2DAttrs,
FusedDepthwiseConv2DInputs, KernelConfig, KernelFunc, Tensor4D } from '@tensorflow/tfjs-core';\\n\\nimport
{ BackendWasm } from '../backend_wasm';\\n\\nimport { FusibleActivation } from './types';\\n\\nlet
wasmFusedDepthwiseConv2d:\\n  (xId: number, batchSize: number, inputHeight: number, inputWidth: number,\\n
filterId: number, filterHeight:
  number, filterWidth: number,\\n  biasId: number, padTop: number, padRight: number, padBottom: number,\\n
padLeft: number, isSamePad: number, dilationHeight: number,\\n  dilationWidth: number, strideHeight: number,
strideWidth: number,\\n  inputChannels: number, outputChannels: number, activation: number,\\n
preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>\\n  void;\\n\\nfunction
setup(backend: BackendWasm) {\n  wasmFusedDepthwiseConv2d =\n  backend.wasm.cwrap(FusedDepthwiseConv2D, null /* void */, [\n    'number', // xId\\n    'number', //
batchSize\\n    'number', // inputHeight\\n    'number', // inputWidth\\n    'number', // filterId\\n    'number', //
filterHeight\\n    'number', // filterWidth\\n    'number', // biasId\\n    'number', // padTop\\n    'number', //
padRight\\n    'number', // padBottom\\n    'number', // padLeft\\n    'number', // isSamePad\\n    'number', //
dilationHeight\\n    'number', // dilationWidth\\n    'number', // strideHeight\\n    'number', // strideWidth\\n
    'number', // inputChannels\\n    'number', // outputChannels\\n    'number', // activation\\n    'number', //
preluActivationWeightsId\\n    'number', // leakyreluAlpha\\n    'number', // outId\\n  ]);\n}\\n\\nfunction
fusedDepthwiseConv2d(args: {\n  inputs: FusedDepthwiseConv2DInputs,\\n  backend: BackendWasm,\\n  attrs:
FusedDepthwiseConv2DAttrs\n}) {\n  const { inputs, attrs, backend } = args;\n  const { x, filter, bias,
preluActivationWeights } = inputs;\n  const {\n    strides,\\n    pad,\\n    dilations,\\n    dataFormat,\\n
dimRoundingMode,\\n    activation,\\n    leakyreluAlpha\n  } = attrs;\n  const convInfo =
backend_util.computeConv2DInfo(\n    (x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations,\\n
pad, dimRoundingMode, true /* depthwise */);\n  const fusedActivation =\n    FusibleActivation[activation
as {} as keyof typeof FusibleActivation];\n  if (fusedActivation == null) {\n    throw new Error(\n
`${activation} activation not yet supported for FusedDepthwiseConv2D` +\n    `in the wasm backend.`);\n  }\n  const xId = backend.dataIdMap.get(x.dataId).id;\n  const filterId = backend.dataIdMap.get(filter.dataId).id;\n  const outputChannels = convInfo.outChannels;\n  let biasId = 0;\n  if (bias != null) {\n    const biasData =
backend.dataIdMap.get(bias.dataId);\n    if (biasData.shape.length !== 1) {\n      throw new Error(\n
`FusedDepthwiseConv2D only supports rank-1 bias but got ` +\n      `rank ${biasData.shape.length}`);\n    }\n

```

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if (biasData.shape[0] !== outputChannels) {\n    throw new Error(\n        `FusedDepthwiseConv2D bias shape
(${biasData.shape}) does not ` +\n        `match the number of output channels (${outputChannels})`);\n    }\n
biasId = biasData.id;\n }\n\n const filterHeight = convInfo.filterHeight;\n const
filterWidth = convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const padRight =
convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n const padLeft = convInfo.padInfo.left;\n
const dilationHeight = convInfo.dilationHeight;\n const dilationWidth = convInfo.dilationWidth;\n const
strideHeight = convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n const inputChannels =
convInfo.inChannels;\n const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;\n const batchSize =
convInfo.batchSize;\n const inHeight = convInfo.inHeight;\n const inWidth = convInfo.inWidth;\n\n if
(dataFormat !== 'NHWC') {\n    throw new Error(\n        `wasm backend FusedDepthwiseConv2D does not support
dataFormat:` +\n        `${dataFormat}`. Please use 'NHWC'.`);\n    }\n\n const out =
backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n const
preluActivationWeightsId = preluActivationWeights == null
?\n    0:\n    backend.dataIdMap.get(preluActivationWeights.dataId).id;\n\n wasmFusedDepthwiseConv2d(\n
xId, batchSize, inHeight, inWidth, filterId, filterHeight, filterWidth,\n    biasId, padTop, padRight, padBottom,
padLeft, isSamePad, dilationHeight,\n    dilationWidth, strideHeight, strideWidth, inputChannels,
outputChannels,\n    fusedActivation, preluActivationWeightsId, leakyreluAlpha || 0, outId);\n\n return
out;\n}\n\nexport const fusedDepthwiseConv2DConfig: KernelConfig = {\n kernelName:
FusedDepthwiseConv2D,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: fusedDepthwiseConv2d as
{\n } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * \n *
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agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
*/\n\nimport {gather_util, GatherNd, GatherNdInputs, KernelConfig, TensorInfo} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {CppType} from './types';\n\nlet
wasmGatherNd: (\n    xId: number, dtype: CCppType, indicesId: number, numSlices: number,\n    sliceRank:
number, sliceSize: number, strides: Uint8Array, outId: number) =>\n    void;\n\nfunction setup(backend:
BackendWasm): void {\n    wasmGatherNd = backend.wasm.cwrap(GatherNd, null /*void*/, [\n        'number', // xId\n
'number', // dtype\n        'number', // indicesId\n        'number', // numSlices\n        'number', // sliceRank\n
'number', // sliceSize\n        'array', // strides\n        'number' // outId\n    ]);\n\n    function gatherNd(args: {backend:
BackendWasm, inputs: GatherNdInputs}):\n        TensorInfo {\n        const {backend, inputs} = args;\n        const {params,
indices} = inputs;\n\n        const [resultShape, numSlices, sliceSize, strides] =\n
gather_util.prepareAndValidate(params, indices);\n\n        const out = backend.makeOutput(resultShape,
params.dtype);\n        if (numSlices === 0) {\n            return out;\n        }\n\n        const indicesShape = indices.shape;\n        const
sliceRank = indicesShape[indicesShape.length - 1];\n\n        const xData = backend.dataIdMap.get(params.dataId);\n
const xId = xData.id;\n        const indicesData = backend.dataIdMap.get(indices.dataId);\n        const indicesId =
indicesData.id;\n\n        const stridesBytes = new Uint8Array(new Int32Array(strides).buffer);\n\n        const outId =
backend.dataIdMap.get(out.dataId).id;\n        wasmGatherNd(\n            xId, CCppType[params.dtype], indicesId,
numSlices, sliceRank, sliceSize,\n            stridesBytes, outId);\n\n        return out;\n    }\n\n    export const gatherNdConfig: KernelConfig = {\n        kernelName:
GatherNd,\n        backendName: 'wasm',\n        setupFunc: setup,\n        kernelFunc: gatherNd\n    };
\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
"License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
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```

agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```
=====\n*\n\nimport {backend_util, GatherV2, GatherV2Attrs, GatherV2Inputs, KernelConfig, KernelFunc, Tensor, TensorInfo, TypedArray, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {reshape} from './Reshape';\nimport {CppType} from './types';\n\nlet wasmGather: (\n  xId: number, dtype: CppDType, xStrides: Uint8Array, stridesSize: number,\n  indicesId: number, batchSize: number, outStrides: Uint8Array,\n  outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n  wasmGather = backend.wasm.cwrap('Gather', null /*void*/, [\n    'number', // xId\n    'number', // dtype\n    'array', // xStrides\n    'number', // stridesSize\n    'number', // indicesId\n    'number', // batchSize\n    'array', // outStrides\n    'number' // outId\n  ]);\n\n  function gatherV2(\n    args: {backend: BackendWasm, inputs: GatherV2Inputs, attrs: GatherV2Attrs}): TensorInfo {\n    const {backend, inputs, attrs} = args;\n    const {x, indices} = inputs;\n    const {axis, batchDims} = attrs;\n\n    // Throw error when any index is out of bound.\n    const parsedAxis = util.parseAxisParam(axis, x.shape)[0];\n    const indicesVals = backend.readSync(indices.dataId) as TypedArray;\n    const axisDim = x.shape[parsedAxis];\n    for (let i = 0; i < indicesVals.length; ++i) {\n      const index = indicesVals[i];\n      util.assert(\n        index <= axisDim - 1 && index >= 0,\n        () =>`\n        GatherV2: the index value ${index} is not in [0, ${axisDim - 1}]);\n    }\n\n    const shapeInfo = backend_util.segment_util.collectGatherOpShapeInfo(\n      x as Tensor, indices as Tensor, parsedAxis, batchDims);\n\n    const flattenX = reshape({\n      inputs: {x},\n      attrs: {\n        shape: [\n          shapeInfo.batchSize, shapeInfo.outerSize, shapeInfo.dimSize,\n          shapeInfo.sliceSize\n        ]\n      },\n      backend\n    });\n    const indicesSize = util.sizeFromShape(indices.shape);\n    const flattenIndex = reshape({\n      inputs: {x: indices},\n      attrs: {\n        shape: [shapeInfo.batchSize, indicesSize / shapeInfo.batchSize],\n        backend\n      }\n    });\n    const flattenOutputShape = [\n      shapeInfo.batchSize, shapeInfo.outerSize, indicesSize / shapeInfo.batchSize,\n      shapeInfo.sliceSize\n    ];\n\n    const out = backend.makeOutput(flattenOutputShape, x.dtype);\n    if (util.sizeFromShape(x.shape) === 0) {\n      return out;\n    }\n\n    const stridesSize = flattenX.shape.length - 1;\n\n    const xData = backend.dataIdMap.get(flattenX.dataId);\n    const xId = xData.id;\n\n    const indicesData = backend.dataIdMap.get(flattenIndex.dataId);\n    const indicesId = indicesData.id;\n\n    const outId = backend.dataIdMap.get(out.dataId).id;\n\n    const xStridesBytes = new Uint8Array(\n      new Int32Array(util.computeStrides(flattenX.shape)).buffer);\n    const outStridesBytes = new Uint8Array(\n      new Int32Array(util.computeStrides(flattenOutputShape)).buffer);\n\n    wasmGather(\n      xId, CppDType[x.dtype], xStridesBytes, stridesSize, indicesId,\n      shapeInfo.batchSize, outStridesBytes, outId);\n\n    backend.disposeData(flattenX.dataId);\n    backend.disposeData(flattenIndex.dataId);\n\n    // reshape\n    out.shape = shapeInfo.outputShape;\n    return out;\n  }\n\n  export const gatherV2Config: KernelConfig = {\n    kernelName: GatherV2,\n    backendName: 'wasm',\n    setupFunc: setup,\n    kernelFunc: gatherV2 as { } as KernelFunc\n  };\n}\n\n/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *\n
```

```
=====\n*\n\nimport {KernelConfig, KernelFunc, LeakyRelu, LeakyReluAttrs, LeakyReluInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {CppType} from './types';\n\nlet wasmFunc: (\n  xId: number, dtype: number, leakyreluAlpha: number, outId: number) => void;\n\nfunction setupFunc(backend: BackendWasm): void {\n  wasmFunc = backend.wasm.cwrap(LeakyRelu, null /* void */, [\n    'number', // x_id\n    'number', // dtype\n    'number', // leakyrelu_alpha\n  ]\n
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out_id\n ]);\n}\n\nexport function leakyRelu(\n  args:\n    {inputs: LeakyReluInputs, attrs: LeakyReluAttrs,
backend: BackendWasm});\n  TensorInfo {\n    const {inputs: {x}, attrs: {alpha}, backend} = args;\n\n    const xId =
backend.dataIdMap.get(x.dataId).id;\n    // According to TF API, LeakyRelu returns float32 when input is either
float32\n    // or int32.\n    const out = backend.makeOutput(x.shape, 'float32');\n\n    if (util.sizeFromShape(x.shape)
!== 0)
    {\n      const outId = backend.dataIdMap.get(out.dataId).id;\n      wasmFunc(xId, CppDType[x.dtype], alpha, outId);\n
}\n\n    return out;\n  }\n}\n\nexport const leakyReluConfig: KernelConfig = {\n  kernelName: LeakyRelu,\n
backendName: 'wasm',\n  setupFunc,\n  kernelFunc: leakyRelu as {} as KernelFunc,\n};\n", "/*\n * @license\n *
Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
'License');\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an 'AS IS' BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {Greater, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from
'/binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const greaterConfig: KernelConfig =\ncreateBinaryKernelConfig(Greater, supportsFullBroadcast, 'bool');\n", "/*\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the 'License');\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an 'AS IS' BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {GreaterEqual, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig}
from './binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const greaterEqualConfig: KernelConfig =\ncreateBinaryKernelConfig(GreaterEqual, supportsFullBroadcast, 'bool');\n", "/*\n * @license\n * Copyright 2019
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may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an 'AS IS' BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {backend_util, KernelConfig, KernelFunc, Max, MaxAttrs, MaxInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport
{permuteAxesAndTranspose} from './kernel_utils';\n\nimport {CppType} from './types';\n\nlet wasmMax: (xId:
number, dtype: number, reduceSize: number, outId: number) =>\n  void;\n\nfunction setup(backend:
BackendWasm): void {\n  wasmMax = backend.wasm.cwrap(Max, null /*void*/, [\n    'number', // x_id\n
'number', // dtype\n    'number', // reduce_size\n    'number', // out_id\n  ]);\n}\n\nfunction max(args: {backend:
BackendWasm, inputs: MaxInputs, attrs: MaxAttrs});\n  TensorInfo {\n    const {backend, inputs, attrs} = args;\n
const {reductionIndices: axis, keepDims} = attrs;\n    const {x} = inputs;\n    const xId =
backend.dataIdMap.get(x.dataId).id;\n    let inputId = xId;\n    let input = x;\n\n    const {transposed, axes, originalAxes,
inputWasTransposed}
    =\n      permuteAxesAndTranspose(x, axis, backend);\n\n    if (inputWasTransposed) {\n      const transposedId =
backend.dataIdMap.get(transposed.dataId).id;\n      input = transposed;\n      inputId = transposedId;\n    }\n\n    const
inputRank = input.shape.length;\n    backend_util.assertAxesAreInnerMostDims('max', axes, inputRank);\n    const

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[outShape, reduceShape] =\n  backend_util.computeOutAndReduceShapes(input.shape, axes);\n const
reduceSize = util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, x.dtype);\n if
(util.sizeFromShape(input.shape) !== 0) {\n  const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmMax(inputId, CppDType[x.dtype], reduceSize, outId);\n }\n\n if (inputWasTransposed) {\n  // dispose of the
transposed tensor.\n  backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n  // reshape\n  const
newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n  out.shape = newShape;\n }\n\n
return out;\n}\n\nexport
const maxConfig: KernelConfig = {\n  kernelName: Max,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: max as { } as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*\nimport { KernelConfig, Less } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from
'/binary_kernel';\nconst
supportsFullBroadcast = false;\nexport const lessConfig: KernelConfig =\n  createBinaryKernelConfig(Less,
supportsFullBroadcast, 'bool');\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n *
Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*\nimport { KernelConfig, LessEqual } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from
'/binary_kernel';\nconst
supportsFullBroadcast = false;\nexport const lessEqualConfig: KernelConfig =\n  createBinaryKernelConfig(LessEqual, supportsFullBroadcast, 'bool');\n", "/*\n * @license\n * Copyright 2019
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may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*\nimport { KernelConfig, Log } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from
'/unary_kernel';\nexport
const logConfig: KernelConfig = createUnaryKernelConfig(Log);\n", "/*\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n

```

```

*\nimport {KernelConfig, LogicalAnd} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from
 './binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const logicalAndConfig: KernelConfig
 =\n  createBinaryKernelConfig(LogicalAnd, supportsFullBroadcast, 'bool');\n\n"/**\n * @license\n * Copyright
 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n *
 you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
 http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
 software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
 OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
 governing permissions and\n * limitations under the License.\n *

```

```

=====\n
*\nimport {backend_util, KernelConfig, KernelFunc, MaxPool, MaxPoolAttrs, MaxPoolInputs, Tensor4D, util}
 from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nlet
  wasmMaxPool: (\n    xId: number, batchSize: number, inputHeight: number, inputWidth: number,\n    filterHeight:
  number, filterWidth: number, padTop: number, padRight: number,\n    padBottom: number, padLeft: number,
  dilationHeight: number,\n    dilationWidth: number, strideHeight: number, strideWidth: number,\n    inputChannels:
  number, outputChannels: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n
  wasmMaxPool = backend.wasm.cwrap(MaxPool, null /* void */, [\n    'number', // xId\n    'number', // batchSize\n
  'number', // inputHeight\n    'number', // inputWidth\n    'number', // filterHeight\n    'number', // filterWidth\n
  'number', // padTop\n    'number', // padRight\n    'number', // padBottom\n    'number', // padLeft\n    'number', //
  dilationHeight\n    'number', // dilationWidth\n    'number', // strideHeight\n    'number', // strideWidth\n    'number',
  // inputChannels\n    'number', // outputChannels\n    'number', // outId\n
  ]);\n}\n\nfunction maxPool(\n  args: {inputs: MaxPoolInputs, backend: BackendWasm, attrs: MaxPoolAttrs}) {\n
  const {inputs, attrs, backend} = args;\n\n  const x = inputs.x as Tensor4D;\n\n  const xId =
  backend.dataIdMap.get(x.dataId).id;\n\n  // TF API supports int32 input. CPU and WebGL backend also support
  int32\n  // input. WASM backend doesn't support it because it uses xnnpack which only\n  // supports float32.\n  // Add the following assert only for the WASM backend instead of at core op\n  // level.\n  // TODO: add support for int32 input.\n  util.assert(\n    x.dtype === 'float32',\n    () =>\n      `Error in MaxPool: only float32
  input is supported. Got ${x.dtype}.`);\n\n  const {filterSize, strides, pad, dimRoundingMode} = attrs;\n\n  const
  convInfo = backend_util.computePool2DInfo(\n    x.shape, filterSize, strides, 1 /* dilations */, pad,
  dimRoundingMode);\n\n  const filterHeight = convInfo.filterHeight;\n  const filterWidth = convInfo.filterWidth;\n
  const padTop = convInfo.padInfo.top;\n  const padRight = convInfo.padInfo.right;\n  const padBottom =
  convInfo.padInfo.bottom;\n  const padLeft = convInfo.padInfo.left;\n  const dilationHeight =
  convInfo.dilationHeight;\n  const dilationWidth = convInfo.dilationWidth;\n  const strideHeight =
  convInfo.strideHeight;\n  const strideWidth = convInfo.strideWidth;\n  const inputChannels =
  convInfo.inChannels;\n  const outputChannels = convInfo.outChannels;\n\n  if (convInfo.dataFormat !==
  'channelsLast') {\n    throw new Error(\n      `wasm backend does not support dataFormat: ` +\n
    `${convInfo.dataFormat}`. Please use 'channelsLast'.`);\n  }\n\n  const out =
  backend.makeOutput(convInfo.outShape, 'float32');\n\n  const outId = backend.dataIdMap.get(out.dataId).id;\n\n
  wasmMaxPool(\n    xId, x.shape[0], x.shape[1], x.shape[2], filterHeight, filterWidth,\n    padTop, padRight,
  padBottom, padLeft, dilationHeight, dilationWidth,\n    strideHeight, strideWidth, inputChannels, outputChannels,
  outId);\n\n  return out;\n}\n\nexport const maxPoolConfig: KernelConfig = {\n  kernelName: MaxPool,\n
  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: maxPool as { } as KernelFunc\n};\n\n"/**\n * @license\n *
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```

```

=====
*\nimport {KernelConfig, Maximum} from '@tensorflow/tfjs-core';\n\nimport
  {createBinaryKernelConfig} from './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const
maximumConfig: KernelConfig =\n  createBinaryKernelConfig(Maximum, supportsFullBroadcast);\n"/**\n *
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the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {backend_util, KernelConfig, KernelFunc, Mean, MeanAttrs, MeanInputs,
  TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\nimport {cast}
from './Cast';\n\nimport {permuteAxesAndTranspose} from './kernel_utils';\n\nlet wasmMean: (xId: number,
  reduceSize: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n  wasmMean =\n    backend.wasm.cwrap(Mean, null /*void*/, ['number, number, number']);\n\n  export function mean(\n    args:
    {backend: BackendWasm, inputs: MeanInputs, attrs: MeanAttrs};\n    TensorInfo {\n      const {backend, inputs,
      attrs} = args;\n      const {axis, keepDims} = attrs;\n      const {x} = inputs;\n      const xId =
      backend.dataIdMap.get(x.dataId).id;\n      let inputId = xId;\n      let input = x;\n\n      const {transposed, axes, originalAxes,
      inputWasTransposed} =\n        permuteAxesAndTranspose(x, axis, backend);\n\n      let reductionAxes = axes;\n      if
      (inputWasTransposed) {\n        const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n        if (transposedId
      !== xId) {\n          //
      transpose was not a no-op. We will need to dispose of this\n          // once we are done.\n          input = transposed;\n
      inputId = transposedId;\n          reductionAxes = backend_util.getInnerMostAxes(\n            reductionAxes.length,
      input.shape.length);\n        }\n      }\n      backend_util.assertAxesAreInnerMostDims(\n        'mean', reductionAxes,
      input.shape.length);\n      const [outShape, reduceShape] =\n        backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n      const reduceSize =
      util.sizeFromShape(reduceShape);\n      let castedInput = input;\n      if (input.dtype !== 'float32') {\n        castedInput =\n          cast({backend, inputs: {x: input}, attrs: {dtype: 'float32'}});\n        inputId =
      backend.dataIdMap.get(castedInput.dataId).id;\n      }\n      const out = backend.makeOutput(outShape, 'float32');\n      if
      (util.sizeFromShape(input.shape) !== 0) {\n        const outId = backend.dataIdMap.get(out.dataId).id;\n        wasmMean(inputId, reduceSize, outId);\n      }\n      if (inputWasTransposed) {\n        //
      dispose of the transposed tensor.\n        backend.disposeData(transposed.dataId);\n      }\n      if (keepDims) {\n        //
      reshape\n        const newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n        out.shape =
      newShape;\n      }\n      if (input.dtype !== 'float32') {\n        backend.disposeData(castedInput.dataId);\n      }\n      return
      out;\n    }\n  }\n\nexport const meanConfig: KernelConfig = {\n  kernelName: Mean,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: mean as { } as KernelFunc\n};\n"/**\n *
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OR CONDITIONS OF ANY KIND,
either express or implied.\n * See the License for the specific language governing permissions and\n * limitations
under the License.\n *
=====
*\n\nimport {backend_util, KernelConfig, KernelFunc, Min, MinAttrs, MinInputs, TensorInfo, util} from
  '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport
  {permuteAxesAndTranspose} from './kernel_utils';\nimport {CppType} from './types';\n\nlet wasmMin: (xId:

```

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number, dtype: number, reduceSize: number, outId: number) =>\n void;\n\nfunction setup(backend:
BackendWasm): void {\n  wasmMin = backend.wasm.cwrap(Min, null /*void*/, [\n  'number', // x_id\n  'number', // dtype\n  'number', // reduce_size\n  'number', // out_id\n  ]);\n}\n\nfunction min(args: {backend:
BackendWasm, inputs: MinInputs, attrs: MinAttrs}):\n  TensorInfo {\n  const {backend, inputs, attrs} = args;\n  const {axis, keepDims} = attrs;\n  const {x} = inputs;\n  const xId = backend.dataIdMap.get(x.dataId).id;\n  let inputId = xId;\n  let input = x;\n  const {transposed, axes,
originalAxes, inputWasTransposed} =\n    permuteAxesAndTranspose(x, axis, backend);\n  if
(inputWasTransposed) {\n    const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n    if (transposedId
!== xId) {\n      // transpose was not a no-op. We will need to dispose of this\n      // once we are done.\n      input =
transposed;\n      inputId = transposedId;\n    }\n  }\n  const inputRank = input.shape.length;\n  backend_util.assertAxesAreInnerMostDims('min', axes, inputRank);\n  const [outShape, reduceShape] =\n  backend_util.computeOutAndReduceShapes(input.shape, axes);\n  const reduceSize =
util.sizeFromShape(reduceShape);\n  const out = backend.makeOutput(outShape, input.dtype);\n  if
(util.sizeFromShape(input.shape) !== 0) {\n    const outId = backend.dataIdMap.get(out.dataId).id;\n    wasmMin(inputId, CppDType[x.dtype], reduceSize,
outId);\n  }\n  if (inputWasTransposed) {\n    // dispose of the transposed tensor.\n    backend.disposeData(transposed.dataId);\n  }\n  if (keepDims) {\n    // reshape\n    const newShape =
backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n    out.shape = newShape;\n  }\n  return
out;\n}\n\nexport const minConfig: KernelConfig = {\n  kernelName: Min,\n  backendName: 'wasm',\n  setupFunc:
setup,\n  kernelFunc: min as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2021 Google LLC. All Rights
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See
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=====\n
*/\n\nimport {KernelConfig, KernelFunc, MirrorPad, MirrorPadAttrs, MirrorPadInputs} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {CppType} from './types';\n\n// Must match
enum in MirrorPad.cc\nenum MirrorPaddingMode {\n  reflect = 0,\n  symmetric = 1\n}\n\nlet wasmMirrorPad: (\n
xId: number, xShapeBytes: Uint8Array, xShapeLength: number, xDtype: number,\n  prePaddingsBytes:
Uint8Array, postPaddingsBytes: Uint8Array, mode: number,\n  outId: number) => void;\n\nfunction
setup(backend: BackendWasm) {\n  wasmMirrorPad = backend.wasm.cwrap(MirrorPad, null /* void */, [\n
'number', // xId\n  'array', // x.shape\n  'number', // x.shape.length\n  'number', // x.dtype\n  'array', // pre-
paddings\n  'array', // post-paddings\n  'number', //
mode\n  'number', // outId\n  ]);\n}\n\nfunction mirrorPad(args: {\n  inputs: MirrorPadInputs,\n  backend:
BackendWasm,\n  attrs: MirrorPadAttrs\n}) {\n  const {inputs: {x}, backend, attrs: {paddings, mode}} = args;\n  const outShape = paddings.map(\n    (p, i) => p[0] /* beforePad */ + x.shape[i] + p[1] /* afterPad */);\n  const xId =
backend.dataIdMap.get(x.dataId).id;\n  const out = backend.makeOutput(outShape, x.dtype);\n  const outId =
backend.dataIdMap.get(out.dataId).id;\n  const xShapeBytes = new Uint8Array(new
Int32Array(x.shape).buffer);\n  const prePaddingsFlat = paddings.map(padTuple => padTuple[0]);\n  const
postPaddingsFlat = paddings.map(padTuple => padTuple[1]);\n  const prePaddingsBytes =\n    new
Uint8Array(new Int32Array(prePaddingsFlat).buffer);\n  const postPaddingsBytes =\n    new Uint8Array(new
Int32Array(postPaddingsFlat).buffer);\n  const wasmMirrorPad(\n    xId, xShapeBytes, x.shape.length,\n    CppDType[x.dtype], prePaddingsBytes,\n    postPaddingsBytes,\n    MirrorPaddingMode[mode], outId);\n  return out;\n}\n\nexport const mirrorPadConfig: KernelConfig = {\n
kernelName: MirrorPad,\n  backendName: 'wasm',\n  kernelFunc: mirrorPad as { } as KernelFunc,\n  setupFunc:
setup\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the

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=====  
* \nimport {KernelConfig, Minimum} from '@tensorflow/tfjs-core'; \nimport  
  {createBinaryKernelConfig} from './binary_kernel'; \nconst supportsFullBroadcast = false; \nexport const  
minimumConfig: KernelConfig = \n  createBinaryKernelConfig(Minimum, supportsFullBroadcast); \n", /*  
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=====  
* \n\nimport {KernelConfig, KernelFunc, NonMaxSuppressionV3,  
  NonMaxSuppressionV3Attrs, NonMaxSuppressionV3Inputs, TensorInfo} from '@tensorflow/tfjs-core'; \n\nimport  
{BackendWasm} from './backend_wasm'; \n\nimport {parseResultStruct} from './NonMaxSuppression_util'; \n\nlet  
wasmFunc: (\n  boxesId: number, scoresId: number, maxOutputSize: number, \n  iouThreshold: number,  
scoreThreshold: number) => number; \n\nfunction setup(backend: BackendWasm): void {\n  wasmFunc =  
backend.wasm.cwrap(\n  NonMaxSuppressionV3, \n  'number', // Result*\n  [\n  'number', // boxesId\n  'number', // scoresId\n  'number', // maxOutputSize\n  'number', // iouThreshold\n  'number', //  
scoreThreshold\n  ]);\n\nfunction kernelFunc(args: {\n  backend: BackendWasm, \n  inputs:  
NonMaxSuppressionV3Inputs, \n  attrs: NonMaxSuppressionV3Attrs\n}): TensorInfo {\n  const {backend, inputs,  
attrs} = args; \n  const {iouThreshold, maxOutputSize, scoreThreshold} = attrs; \n  const {boxes, scores} =  
inputs; \n  const boxesId =  
  backend.dataIdMap.get(boxes.dataId).id; \n  const scoresId = backend.dataIdMap.get(scores.dataId).id; \n  const  
resOffset = \n  wasmFunc(boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold); \n  const  
{pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs} = \n  parseResultStruct(backend, resOffset); \n  \n  // Since we are not using scores for V3, we have to delete it from the heap. \n  
  backend.wasm._free(pSelectedScores); \n  backend.wasm._free(pValidOutputs); \n  const selectedIndicesTensor  
= \n  backend.makeOutput([selectedSize], 'int32', pSelectedIndices); \n  \n  return  
selectedIndicesTensor; \n}\n\nexport const nonMaxSuppressionV3Config: KernelConfig = {\n  kernelName:  
NonMaxSuppressionV3, \n  backendName: 'wasm', \n  setupFunc: setup, \n  kernelFunc: kernelFunc as {} as  
KernelFunc,\n}; \n", /*  
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=====
```

```
=====  
* \n\nimport {KernelConfig, Multiply} from '@tensorflow/tfjs-core'; \n\nimport {createBinaryKernelConfig} from  
'./binary_kernel'; \n\nconst supportsFullBroadcast = true; \nexport const multiplyConfig: KernelConfig = \n  createBinaryKernelConfig(Multiply, supportsFullBroadcast); \n", /*  
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```
=====\n*\nimport {KernelConfig, Neg} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from\n './unary_kernel';\nexport const negConfig: KernelConfig = createUnaryKernelConfig(Neg);\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n *\n *
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```
=====\n*\nimport {BackendWasm} from './backend_wasm';\n\n// Analogous to `struct Result` in\n `non_max_suppression_impl.h`\ninterface Result {\n  pSelectedIndices: number;\n  selectedSize: number;\n  pSelectedScores: number;\n  pValidOutputs: number;\n}\n\n * Parse the result of the c++ method, which has the\n shape equivalent to\n * `Result`\n\nexport function parseResultStruct(\n  backend: BackendWasm, resOffset:\n  number): Result {\n  const result = new Int32Array(backend.wasm.HEAPU8.buffer, resOffset, 4);\n  const\n  pSelectedIndices\n  = result[0];\n  const selectedSize = result[1];\n  const pSelectedScores = result[2];\n  const pValidOutputs =\n  result[3];\n  // Since the result was allocated on the heap, we have to delete it.\n  backend.wasm._free(resOffset);\n  return {pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs};\n}\n", "/*\n * @license\n * Copyright\n * 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *  
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language  
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```

```
=====\n*\nimport {KernelConfig, KernelFunc, NonMaxSuppressionV4, NonMaxSuppressionV4Attrs,\n NonMaxSuppressionV4Inputs, TensorInfo} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from\n './backend_wasm';\nimport {parseResultStruct} from './NonMaxSuppression_util';\n\nlet wasmFunc: (\n  boxesId: number, scoresId: number, maxOutputSize: number,\n  iouThreshold: number, scoreThreshold: number,\n  padToMaxOutputSize: boolean) => number;\n\nfunction setup(backend: BackendWasm): void {\n  wasmFunc =\n  backend.wasm.cwrap(\n    NonMaxSuppressionV4,\n    'number', // Result*\n    [\n      'number', // boxesId\n      'number', // scoresId\n      'number', // maxOutputSize\n      'number', // iouThreshold\n      'number', //\n      scoreThreshold\n      'bool', // padToMaxOutputSize\n    ];\n  );\n\n  function nonMaxSuppressionV4(args: {\n    backend: BackendWasm,\n    inputs: NonMaxSuppressionV4Inputs,\n    attrs: NonMaxSuppressionV4Attrs\n  }):\n  TensorInfo[]\n  {\n    const {backend, inputs, attrs} = args;\n    const {iouThreshold, maxOutputSize, scoreThreshold,\n      padToMaxOutputSize} =\n      attrs;\n    const {boxes, scores} = inputs;\n    const boxesId =\n      backend.dataIdMap.get(boxes.dataId).id;\n    const scoresId =\n      backend.dataIdMap.get(scores.dataId).id;\n    const\n    resOffset = wasmFunc(\n      boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold,\n      padToMaxOutputSize);\n    const {pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs} =\n  
```

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parseResultStruct(backend, resOffset);\n\n // Since we are not using scores for V4, we have to delete it from the
heap.\n backend.wasm._free(pSelectedScores);\n\n const selectedIndicesTensor =\n
backend.makeOutput([selectedSize], 'int32', pSelectedIndices);\n\n const validOutputsTensor =
backend.makeOutput([], 'int32', pValidOutputs);\n\n return [selectedIndicesTensor,
validOutputsTensor];\n}\n\nexport const nonMaxSuppressionV4Config: KernelConfig = {\n kernelName:
NonMaxSuppressionV4,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: nonMaxSuppressionV4 as
{} as KernelFunc,\n};\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed
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implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n */
=====\n
*/\n\nimport { KernelConfig, KernelFunc, NonMaxSuppressionV5, NonMaxSuppressionV5Attrs,
NonMaxSuppressionV5Inputs, TensorInfo } from '@tensorflow/tfjs-core';\n\nimport
{ BackendWasm } from './backend_wasm';\n\nimport { parseResultStruct } from './NonMaxSuppression_util';\n\nlet
wasmFunc:\n (boxesId: number, scoresId: number, maxOutputSize: number,\n iouThreshold: number,
scoreThreshold: number, softNmsSigma: number) =>\n number;\n\nfunction setup(backend: BackendWasm):
void {\n wasmFunc = backend.wasm.cwrap(\n NonMaxSuppressionV5,\n 'number', // Result*\n [\n
'number', // boxesId\n 'number', // scoresId\n 'number', // maxOutputSize\n 'number', //
iouThreshold\n 'number', // scoreThreshold\n 'number', // softNmsSigma\n ]);\n}\n\nfunction
kernelFunc(args: {\n backend: BackendWasm,\n inputs: NonMaxSuppressionV5Inputs,\n attrs:
NonMaxSuppressionV5Attrs\n}): TensorInfo[] {\n const {backend, inputs, attrs} = args;\n const {iouThreshold,
maxOutputSize, scoreThreshold, softNmsSigma} = attrs;\n const {boxes, scores} = inputs;\n\n const boxesId =
backend.dataIdMap.get(boxes.dataId).id;\n
const scoresId = backend.dataIdMap.get(scores.dataId).id;\n\n const resOffset = wasmFunc(\n boxesId,
scoresId, maxOutputSize, iouThreshold, scoreThreshold,\n softNmsSigma);\n\n const {pSelectedIndices,
selectedSize, pSelectedScores, pValidOutputs} =\n parseResultStruct(backend, resOffset);\n\n // Since we are
not using validOutputs for V5, we have to delete it from the\n // heap.\n backend.wasm._free(pValidOutputs);\n\n
const selectedIndicesTensor =\n backend.makeOutput([selectedSize], 'int32', pSelectedIndices);\n const
selectedScoresTensor =\n backend.makeOutput([selectedSize], 'float32', pSelectedScores);\n\n return
[selectedIndicesTensor, selectedScoresTensor];\n}\n\nexport const nonMaxSuppressionV5Config: KernelConfig =
{\n kernelName: NonMaxSuppressionV5,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: kernelFunc
as {} as KernelFunc,\n};\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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=====\n
*/\n\nimport { KernelConfig, KernelFunc, OneHot, OneHotAttrs, OneHotInputs } from '@tensorflow/tfjs-
core';\n\nimport { BackendWasm } from './backend_wasm';\n\nlet wasmOneHot: (\n indicesId: number, depth:
number, onValue: number, offValue: number,\n outId: number) => void;\n\nfunction setup(backend:
BackendWasm) {\n wasmOneHot = backend.wasm.cwrap(OneHot,
null /* void */, [\n 'number', // indices_id\n 'number', // depth,\n 'number', // onValue\n 'number', //
offValue\n 'number' // out_id\n ]);\n}\n\nfunction oneHot(\n args: {inputs: OneHotInputs, attrs: OneHotAttrs,

```



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backend: BackendWasm)) {\n const {inputs, backend, attrs} = args;\n const {indices} = inputs;\n const {depth,
onValue, offValue} = attrs;\n\n const out = backend.makeOutput([...indices.shape, depth], 'int32');\n const outId =
backend.dataIdMap.get(out.dataId).id;\n\n const indicesData = backend.dataIdMap.get(indices.dataId);\n const
indicesId = indicesData.id;\n\n wasmOneHot(indicesId, depth, onValue, offValue, outId);\n\n return
out;\n}\n\nexport const oneHotConfig: KernelConfig = {\n kernelName: OneHot,\n backendName: 'wasm',\n
setupFunc: setup,\n kernelFunc: oneHot as {} as KernelFunc,\n};\n", "/**\n * @license\n * Copyright 2020 Google
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=====
*\nimport {KernelConfig, NotEqual} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
'/binary_kernel';\nconst supportsFullBroadcast = false;\nexport const notEqualConfig: KernelConfig =\ncreateBinaryKernelConfig(NotEqual, supportsFullBroadcast, 'bool');\n", "/**\n * @license\n * Copyright 2020
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=====
*\nimport {KernelConfig, KernelFunc, OnesLike, OnesLikeInputs} from '@tensorflow/tfjs-core';\nimport
{BackendWasm} from '../backend_wasm';\nfunction onesLike(args: {inputs: OnesLikeInputs, backend:
BackendWasm}) {\n const {inputs: {x}, backend} = args;\n const out = backend.makeOutput(x.shape, x.dtype);\n
const outVals = backend.toArrayFromHeap(out);\n outVals.fill(1);\n return out;\n}\n\nexport
const onesLikeConfig: KernelConfig = {\n kernelName: OnesLike,\n backendName: 'wasm',\n kernelFunc:
onesLike as {} as KernelFunc,\n};\n", "/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n *
Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\nimport {KernelConfig, KernelFunc, Pack, PackAttrs, PackInputs, TensorInfo, util} from '@tensorflow/tfjs-
core';\nimport {BackendWasm}
from '../backend_wasm';\nimport {concat} from './Concat';\nimport {expandDims} from
'/ExpandDims';\nexport function pack(\n args: {inputs: PackInputs, backend: BackendWasm, attrs:
PackAttrs}): \n TensorInfo {\n const {inputs, backend, attrs} = args;\n const {axis} = attrs;\n\n if (inputs.length
=== 1) {\n return expandDims(\n {inputs: {input: inputs[0]}, backend, attrs: {dim: axis}});\n }\n\n const
shape = inputs[0].shape;\n const dtype = inputs[0].dtype;\n\n inputs.forEach(t => {\n util.assertShapesMatch(\n
shape, t.shape,\n 'All tensors passed to stack must have matching shapes');\n util.assert(\n dtype ===
t.dtype,\n () => 'All tensors passed to stack must have matching dtypes');\n });\n\n const
intermediateTensorInfos: TensorInfo[] = [];\n const expandedTensors = inputs.map(t => {\n const expandedT =\n
expandDims({inputs: {input: t}, backend, attrs: {dim: axis}});\n intermediateTensorInfos.push(expandedT);\n

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return expandedT;\n });\n\n const result = concat({inputs: expandedTensors, backend, attrs: {axis}});\n\n intermediateTensorInfos.forEach(t => backend.disposeData(t.dataId));\n\n return result;\n\n}\n\nexport const\n\n packConfig: KernelConfig = {\n\n  kernelName: Pack,\n\n  backendName: 'wasm',\n\n  kernelFunc: pack as {} as\n\n  KernelFunc\n\n};\n\n"/**\n\n * @license\n\n * Copyright 2019 Google LLC. All Rights Reserved.\n\n * Licensed under the\n\n Apache License, Version 2.0 (the "License");\n\n * you may not use this file except in compliance with the\n\n License.\n\n * You may obtain a copy of the License at\n\n * http://www.apache.org/licenses/LICENSE-2.0\n\n *\n\n Unless required by applicable law or agreed to in writing, software\n\n * distributed under the License is distributed\n\n on an "AS IS" BASIS,\n\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n\n implied.\n\n * See the License for the specific language governing permissions and\n\n * limitations under the\n\n License.\n\n */
```

```
=====\n\n*/\n\nimport {KernelConfig, KernelFunc, PadV2, PadV2Attrs, PadV2Inputs, util} from '@tensorflow/tfjs-\n\n core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {fill} from './Fill';\n\nimport {CppType} from './types';\n\nlet wasmPadV2: (\n\n  xId: number, xShapeBytes: Uint8Array, xShapeLength: number, xDtype:\n\n  number,\n\n  prePaddingsBytes: Uint8Array, postPaddingsBytes: Uint8Array,\n\n  constantValue: number, outId:\n\n  number) => void;\n\nfunction setup(backend: BackendWasm) {\n\n  wasmPadV2 = backend.wasm.cwrap(PadV2, null\n\n /* void */, [\n\n  'number', // xId\n\n  'array', // x.shape\n\n  'number', // x.shape.length\n\n  'number', // x.dtype\n\n  'array', // pre-paddings\n\n  'array', // post-paddings\n\n  'number', // constantValue\n\n  'number', // outId\n\n ]);\n\n}\n\nfunction pad(\n\n  args: {inputs: PadV2Inputs, backend: BackendWasm, attrs: PadV2Attrs}) {\n\n  const\n\n {inputs: {x}, backend, attrs:\n\n {paddings, constantValue}} = args;\n\n  const outShape = paddings.map(\n\n (p, i) => p[0] /* beforePad */ +\n\n x.shape[i] + p[1] /* afterPad */);\n\n  if (util.sizeFromShape(x.shape) === 0) {\n\n // Short-circuit the computation,\n\n since x doesn't have value, only\n\n // the shape is used to compute output shape to pad.\n\n return fill({\n\n backend,\n\n attrs: {shape: outShape, value: constantValue, dtype: x.dtype}\n\n });\n\n }\n\n  const xId =\n\n backend.dataIdMap.get(x.dataId).id;\n\n  const out = backend.makeOutput(outShape, x.dtype);\n\n  const\n\n outTensorData = backend.dataIdMap.get(out.dataId);\n\n  const outId = outTensorData.id;\n\n  const xShapeBytes =\n\n new Uint8Array(new Int32Array(x.shape).buffer);\n\n  const prePaddingsFlat = paddings.map(padTuple =>\n\n padTuple[0]);\n\n  const postPaddingsFlat = paddings.map(padTuple => padTuple[1]);\n\n  const prePaddingsBytes =\n\n new Uint8Array(new Int32Array(prePaddingsFlat).buffer);\n\n  const postPaddingsBytes =\n\n new\n\n Uint8Array(new Int32Array(postPaddingsFlat).buffer);\n\n}\n\n  wasmPadV2(\n\n  xId, xShapeBytes, x.shape.length, CppDType[x.dtype], prePaddingsBytes,\n\n  postPaddingsBytes, constantValue, outId);\n\n  return out;\n\n}\n\nexport const padV2Config: KernelConfig = {\n\n kernelName: PadV2,\n\n backendName: 'wasm',\n\n kernelFunc: pad as {} as KernelFunc,\n\n setupFunc:\n\n setup\n\n};\n\n"/**\n\n * @license\n\n * Copyright 2019 Google LLC. All Rights Reserved.\n\n * Licensed under the\n\n Apache License, Version 2.0 (the "License");\n\n * you may not use this file except in compliance with the\n\n License.\n\n * You may obtain a copy of the License at\n\n * http://www.apache.org/licenses/LICENSE-2.0\n\n *\n\n Unless required by applicable law or agreed to in writing, software\n\n * distributed under the License is distributed\n\n on an "AS IS" BASIS,\n\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n\n implied.\n\n * See the License for the specific language governing permissions and\n\n * limitations under the\n\n License.\n\n */
```

```
=====\n\n*/\n\nimport {KernelConfig, KernelFunc, Prelu, PreluInputs} from '@tensorflow/tfjs-core';\n\nimport\n\n {BackendWasm} from './backend_wasm';\n\nimport {cast} from './Cast';\n\nlet wasmPrelu: (xId: number,\n\n weightsId: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n\n  wasmPrelu =\n\n backend.wasm.cwrap(Prelu, null /* void */, [\n\n  'number', // x_id\n\n  'number', // weights_id\n\n  'number' //\n\n out_id\n\n ]);\n\n}\n\nfunction prelu(args: {inputs: PreluInputs, backend: BackendWasm}) {\n\n  const\n\n {inputs, backend}\n\n = args;\n\n  const {x, alpha} = inputs;\n\n  const xId = backend.dataIdMap.get(x.dataId).id;\n\n  const weightsId =\n\n backend.dataIdMap.get(alpha.dataId).id;\n\n  let inputId = xId;\n\n  const input = x;\n\n  let castedInput = input;\n\n  if
```

```

(input.dtype !== 'float32') {\n  castedInput = cast({backend, inputs: {x}, attrs: {dtype: 'float32'}});\n  inputId =
backend.dataIdMap.get(castedInput.dataId).id;\n
  }\n\n  const out = backend.makeOutput(x.shape, 'float32');\n  const outId =
backend.dataIdMap.get(out.dataId).id;\n  wasmPrelu(inputId, weightsId, outId);\n\n  if (input.dtype !== 'float32') {\n
  backend.disposeData(castedInput.dataId);\n  }\n  return out;\n}\n\nexport const preluConfig: KernelConfig = {\n
kernelName: Prelu,\nbackendName: 'wasm',\nsetupFunc: setup,\nkernelFunc: prelu as {} as
KernelFunc\n};\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
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on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\nimport {KernelConfig, Pow} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
'/binary_kernel';\nconst supportsFullBroadcast = false;\nexport const powConfig: KernelConfig =\ncreateBinaryKernelConfig(Pow, supportsFullBroadcast);\n"/**\n * @license\n * Copyright 2020 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
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http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions
and\n * limitations under the License.\n *
=====\n
*/\n\nimport {backend_util, KernelConfig, KernelFunc, Prod, ProdAttrs, ProdInputs, TensorInfo, util} from
 '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport
{permuteAxesAndTranspose} from './kernel_utils';\nimport {CppType} from './types';\n\nlet wasmProd: (\n
xId: number, reduceSize: number,\n  dtype: number, outId: number) => void;\n\nfunction setup(backend:
BackendWasm): void {\n  wasmProd = backend.wasm.cwrap(Prod, null /*void*/, [\n    'number',\n    'number',\n
    'number',\n    'number'\n  ]);\n}\n\nfunction prod(args: {\n  backend: BackendWasm,\n  inputs: ProdInputs,\n
  attrs: ProdAttrs\n}): TensorInfo {\n  const {backend, inputs, attrs} = args;\n  const {axis, keepDims} =
attrs;\n  const {x}
= inputs;\n  const xId = backend.dataIdMap.get(x.dataId).id;\n  let inputId = xId;\n  let input = x;\n\n  const
{transposed,
  axes, originalAxes, inputWasTransposed} =\n    permuteAxesAndTranspose(x, axis, backend);\n\n  let
reductionAxes = axes;\n  if (inputWasTransposed) {\n    const transposedId =
backend.dataIdMap.get(transposed.dataId).id;\n    if (transposedId !== xId) {\n      // transpose was not a
no-op. We
will need to dispose of this\n      // once we are done.\n      input = transposed;\n      inputId =
transposedId;\n    }\n    reductionAxes = backend_util.getInnerMostAxes(\n      reductionAxes.length,
input.shape.length);\n  }\n\n  backend_util.assertAxesAreInnerMostDims(\n    'prod', reductionAxes,
input.shape.length);\n  const [outShape,
  reduceShape] =\n    backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n  const
reduceSize
= util.sizeFromShape(reduceShape);\n\n  const out = backend.makeOutput(outShape, input.dtype);\n  if
(util.sizeFromShape(input.shape) !== 0) {\n    const outId = backend.dataIdMap.get(out.dataId).id;\n
    wasmProd(inputId, reduceSize,
    CppDType[out.dtype], outId);\n  }\n\n  if (inputWasTransposed) {\n    // dispose of the transposed
tensor.\n    backend.disposeData(transposed.dataId);\n  }\n\n  if (keepDims) {\n    // reshape\n    const
newShape =
backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n    out.shape = newShape;\n  }\n\n  return
out;\n}\n\nexport const prodConfig: KernelConfig = {\n  kernelName: Prod,\n  backendName: 'wasm',\n  setupFunc:

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setup,\n kernelFunc: prod as { } as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```
=====\n*\n\nimport { KernelConfig, KernelFunc, ResizeBilinear, ResizeBilinearAttrs, ResizeBilinearInputs, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { cast } from './Cast';\nlet wasmResizeBilinear: (\n  xId: number, batch: number, oldHeight: number, oldWidth: number,\n  numChannels: number, newHeight: number, newWidth: number,\n  alignCorners: number, halfPixelCenters: number, outId: number) => void;\nfunction setup(backend: BackendWasm): void {\n  wasmResizeBilinear = backend.wasm.cwrap(ResizeBilinear, null /*void*/, [\n    'number', // xId\n    'number', // batch\n    'number', // oldHeight\n    'number', // oldWidth\n    'number', // numChannels\n    'number', // newHeight\n    'number', // newWidth\n    'number', // alignCorners\n    'number', // halfPixelCenters\n    'number' // outId\n  ]);\n}\nfunction resizeBilinear(args: {\n  backend: BackendWasm,\n  inputs: ResizeBilinearInputs,\n  attrs: ResizeBilinearAttrs\n}): TensorInfo {\n  const { backend, inputs, attrs } = args;\n  const { images } = inputs;\n  const { alignCorners, halfPixelCenters, size } = attrs;\n  const [newHeight, newWidth] = size;\n  const [batch, oldHeight, oldWidth, numChannels] = images.shape;\n  const outShape = [batch, newHeight, newWidth, numChannels];\n  let xData = backend.dataIdMap.get(images.dataId);\n  let castedData;\n  if (xData.dtype !== 'float32') {\n    castedData = cast({ backend, inputs: { x: images }, attrs: { dtype: 'float32' }});\n    xData = backend.dataIdMap.get(castedData.dataId);\n  }\n  const xId = xData.id;\n  const out = backend.makeOutput(outShape, 'float32');\n  if (util.sizeFromShape(images.shape) === 0) {\n    return out;\n  }\n  const outId = backend.dataIdMap.get(out.dataId).id;\n  wasmResizeBilinear(\n    xId, batch, oldHeight, oldWidth, numChannels, newHeight, newWidth,\n    alignCorners ? 1 : 0, halfPixelCenters ? 1 : 0, outId);\n  if (castedData !== null) {\n    backend.disposeData(castedData.dataId);\n  }\n  return out;\n}\n\nexport const resizeBilinearConfig:\nKernelConfig = {\n  kernelName: ResizeBilinear,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: resizeBilinear as { } as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

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=====\n*\n\nimport { KernelConfig, KernelFunc, Range, RangeAttrs, TensorInfo } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { rangeImplCPU } from '../kernel_utils/shared';\nexport const range = (\n  args: { backend: BackendWasm, attrs: RangeAttrs }): TensorInfo => {\n  const { backend, attrs } = args;\n  const { start, stop, step, dtype } = attrs;\n  const values = rangeImplCPU(start, stop, step, dtype);\n  const out = backend.makeOutput([values.length], dtype);\n  const outVals = backend.typedArrayFromHeap(out);\n  outVals.set(values);\n  return out;\n};\n\nexport const rangeConfig:\nKernelConfig = {\n  kernelName: Range,\n  backendName: 'wasm',\n  kernelFunc: range as { } as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights
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xcbiAgICBkdHlwZTogJ2Zsb2F0MzInfCdpbnQzMicpOiBEYXRhVHlwZU1hcFsnZmxvYXQzMicgfCAAnaW50Mz
InXSB7XG4gIGNvbnN0IHNBWVtdGFydFN0b3AgPSBzdGFydCA9PT0gc3RvcDtcbiAgY29uc3QgaW5jcmVhc
2luZ1JhbmdlTmVnYXRpdmVTdGVwID0gc3RhcncQgPCBzdG9wICYmIHN0ZXAgPCAwO1xuICBjb25zdCBkZ
WNyZWZfaW5nUmFuZ2VQb3NpdG12ZVN0ZXAgPSBzdG9wIDwgc3RhcncQgJiYgc3RlcCA+IDE7XG5cbiAga
WYgKHNhbWVtdGFydFN0b3AgfHwgaW5jcmVhc2luZ1JhbmdlTmVnYXRpdmVTdGVwIHx8XG4gICAgICBk
ZWNyZWZfaW5nUmFuZ2VQb3NpdG12ZVN0ZXApIHtcbiAgICByZXR1cm4gdXRpbC5tYWtlWmVyb3NUeXB
lZEFycmF5KDAslGR0eXB1KTtcbiAgfVxuXG4gIGNvbnN0IG51bUVsZW1lbnRzID0gTWF0aC5hYnMoTWF0aC
5jZWlsKChzdG9wIC0gc3RhcncQIC8gc3RlcCkpc01xuICBjb25zdCB2YWx1ZXMGPSB1dGlsLm1ha2VaZXJvc1R
5cGVkQXJyYXkobnVtRWxlbWVudHMslGR0eXB1KTtcbiAgfVxuXG4gIGNvbnN0IG51bUVsZW1lbnRzID0gTWF0aC5hYnMoTWF0aC
T09IDEpIHtcbiAgICAvLyBBdXRvIGFkanVzdCB0aGUgc3RlcCdzIHNPZ24gaWYgaXQgaGFzbid0IGJlZ24gZ2V
0XG4gICAgLy8gKG9yIHdhcyBzZXQgdG8gMSlcbiAgICBzdGVwID0gLTE7XG4gIH1cblxuICB2YWx1ZXNBm
F0gPSBzdGFydDtcbiAgZm9yIChsZXQgaSA9IDE7IGkgPCB2YWx1ZXMGubGVuZ3RoOyBpKyspIHtcbiAgICB2
YWx1ZXNBaV0gPSB2YWx1ZXNBaSAtdFdcSgc3RlcDtcbiAgfVxuICByZXR1cm4gdmFsdWVzO1xufVxuIl19"
,"/**\n

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=====\n*\n\nimport

{KernelConfig, RealDiv} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from './binary_kernel';\n\nconst supportsFullBroadcast = true;\n\nexport const realDivConfig: KernelConfig =\n createBinaryKernelConfig(RealDiv, supportsFullBroadcast);\n\n",/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

=====\n*\n\nimport

{KernelConfig, Relu} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from './unary_kernel';\n\nexport const reluConfig: KernelConfig = createUnaryKernelConfig(Relu);\n\n",/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

=====\n*\n\nimport {KernelConfig, Relu6} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig}

from './unary_kernel';\n\nexport const relu6Config: KernelConfig = createUnaryKernelConfig(Relu6);\n\n",/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *

WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

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=====\n*\n\nimport { KernelConfig, KernelFunc, Reverse, ReverseAttrs, ReverseInputs, TensorInfo, util } from\n '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport\n { identity } from './Identity';\nimport { reshape } from './Reshape';\n\nlet wasmReverse: (\n  xId: number, axes:\n  Uint8Array, axesLength: number, outShape: Uint8Array,\n  outShapeLength: number, outId: number) =>\n  void;\n\nfunction setup(backend: BackendWasm) {\n  wasmReverse = backend.wasm.cwrap(Reverse, null, [\n  'number', // x_id\n  'array', // axes\n  'number', // axes_length\n  'array', // out_shape\n  'number', //\n  out_shape_length\n  'number' // out_id\n  ]);\n\n  export function reverse(\n    args: {inputs: ReverseInputs,\n    backend: BackendWasm, attrs: ReverseAttrs});\n    TensorInfo {\n    const {inputs, backend, attrs} = args;\n    const\n    {x} = inputs;\n    const {dims} = attrs;\n\n    const axes = util.parseAxisParam(dims, x.shape);\n\n    if (x.shape.length\n    === 0) {\n    return identity({inputs: {x}, backend});\n    }\n\n    const out = backend.makeOutput(x.shape, x.dtype);\n    const xId = backend.dataIdMap.get(x.dataId).id;\n    const outId = backend.dataIdMap.get(out.dataId).id;\n\n    const axesBytes = new Uint8Array(new Int32Array(axes).buffer);\n    const outShapeBytes = new Uint8Array(new\n    Int32Array(x.shape).buffer);\n\n    wasmReverse(\n    xId, axesBytes, axes.length, outShapeBytes, x.shape.length,\n    outId);\n\n    const reshaped =\n    reshape({inputs: {x: out}, attrs: {shape: x.shape}, backend});\n\n    backend.disposeData(out.dataId);\n    return reshaped;\n  }\n\n  export const reverseConfig: KernelConfig = {\n  kernelName: Reverse,\n  backendName: 'wasm',\n  kernelFunc: reverse as { } as KernelFunc,\n  setupFunc:\n  setup\n  };}\n\n/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the\n Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the\n License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n License.\n *
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```
=====\n*\n\nimport { KernelConfig, KernelFunc, RotateWithOffset, RotateWithOffsetAttrs, RotateWithOffsetInputs,\n TensorInfo } from '@tensorflow/tfjs-core';\nimport { backend_util } from '@tensorflow/tfjs-core';\nimport\n { BackendWasm } from './backend_wasm';\n\nlet wasmRotate: (\n  xId: number, batch: number, imageHeight:\n  number, imageWidth: number,\n  numChannels: number, radians: number, centerX: number, centerY: number,\n  fillBytes: Uint8Array, fillLength: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n  wasmRotate = backend.wasm.cwrap(RotateWithOffset, null /* void */, [\n  'number', // xId\n  'number', //\n  batch\n  'number', // imageHeight\n  'number', // imageWidth\n  'number', // numChannels\n  'number', // radians\n  'number', // centerX\n  'number', // centerY\n  'array', //\n  fillBytes\n  'number', // fillLength\n  'number', // outId\n  ]);\n\n  export function rotateWithOffset(args: {\n  inputs: RotateWithOffsetInputs,\n  backend: BackendWasm,\n  attrs: RotateWithOffsetAttrs\n  }): TensorInfo {\n  const {inputs, backend, attrs} = args;\n  const {image} = inputs;\n  const {radians, fillValue, center} = attrs;\n\n  const out = backend.makeOutput(image.shape, image.dtype);\n  const imageId =\n  backend.dataIdMap.get(image.dataId).id;\n  const outId = backend.dataIdMap.get(out.dataId).id;\n\n  const [batch,\n  imageHeight, imageWidth, numChannels] = image.shape;\n\n  const [centerX, centerY] =\n  backend_util.getImageCenter(center, imageHeight, imageWidth);\n\n  const fillIsBlack = fillValue === 0;\n  const\n  fullOpacityValue = 255;\n\n  const fillValues = typeof fillValue === 'number' ?\n  [fillValue, fillValue, fillValue,\n  fillIsBlack ? 0 : fullOpacityValue] :\n  [...fillValue, fullOpacityValue];\n\n  const fillBytes = new Uint8Array(new\n  Int32Array(fillValues).buffer);\n\n  wasmRotate(\n  imageId, batch, imageHeight, imageWidth, numChannels,\n  radians, centerX,\n  centerY, fillBytes, fillValues.length, outId);\n  return out;\n}\n\n  export const\n  rotateWithOffsetConfig: KernelConfig = {\n  kernelName: RotateWithOffset,\n  backendName: 'wasm',\n  kernelFunc: rotateWithOffset as { } as KernelFunc,\n  setupFunc: setup\n  };}\n\n/*\n * @license\n * Copyright 2019
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OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```
=====\n*\n\nimport { KernelConfig, KernelFunc, scatter_util, ScatterNd, ScatterNdAttrs, ScatterNdInputs, TensorInfo, util }
from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { CppDType } from
 './types';\nlet wasmScatterNd: (\n  indicesId: number, updatesId: number, dtype: CppDType, sliceRank:
number,\n  numUpdates: number, sliceSize: number, strides: Uint8Array,\n  outputSize: number, outId: number)
=> void;\nfunction setup(backend: BackendWasm): void {\n  wasmScatterNd = backend.wasm.cwrap(ScatterNd,
null /*void*/, [\n    'number', // indicesId\n    'number', // updatesId\n    'number', // dtype\n    'number', //
sliceRank\n    'number', // numUpdates\n    'number', // sliceSize\n    'array', // strides\n
'number', // outputSize\n    'number' // outId\n  ]);\n}\nfunction scatterNd(\n  args: \n    { backend:
BackendWasm, inputs: ScatterNdInputs, attrs: ScatterNdAttrs });\n  TensorInfo {\n    const { backend, inputs, attrs } =
args;\n    const { indices, updates } = inputs;\n    const { shape } = attrs;\n\n    const out = backend.makeOutput(shape,
updates.dtype);\n    if (util.sizeFromShape(shape) === 0) {\n      return out;\n    }\n\n    const { sliceRank, numUpdates,
sliceSize, strides, outputSize } =\n      scatter_util.calculateShapes(updates, indices, shape);\n\n    const indicesData =
backend.dataIdMap.get(indices.dataId);\n    const indicesId = indicesData.id;\n\n    const updatesData =
backend.dataIdMap.get(updates.dataId);\n    const updatesId = updatesData.id;\n\n    const stridesBytes = new
Uint8Array(new Int32Array(strides).buffer);\n\n    const outId = backend.dataIdMap.get(out.dataId).id;\n\n    wasmScatterNd(\n      indicesId, updatesId, CppDType[updates.dtype], sliceRank, numUpdates,\n      sliceSize,
stridesBytes, outputSize, outId);\n\n    return out;\n  }\n\nexport const scatterNdConfig: KernelConfig = {\n
kernelName: ScatterNd,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: scatterNd as {} as
KernelFunc\n};\n"/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the
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on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
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```
=====\n*\n\nimport { KernelConfig, Round } from '@tensorflow/tfjs-core';\nimport
{ createUnaryKernelConfig } from '../unary_kernel';\nexport const roundConfig: KernelConfig =
createUnaryKernelConfig(Round);\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed
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on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
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```
=====\n*\n\nimport { KernelConfig, Rsqrt } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from
 '../unary_kernel';\nexport
const rsqrtConfig: KernelConfig = createUnaryKernelConfig(Rsqrt);\n"/**\n * @license\n * Copyright 2020
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```
=====\n*\n\nimport { KernelConfig, KernelFunc, Select, SelectInputs, util } from '@tensorflow/tfjs-core';\nimport\n{ BackendWasm } from '../backend_wasm';\n\nlet wasmSelect: (\n  conditionId: number, tId: number, eId:\n  number, offset: number,\n  outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n  wasmSelect\n  = backend.wasm.cwrap('SelectV2', null, [\n    'number', // conditionId\n    'number', // tId\n    'number', // eId\n    'number', // offset\n    'number', // outId\n  ]);\n\n  function select(args: { inputs: SelectInputs, backend:\n    BackendWasm }) {\n    const { inputs, backend } = args;\n    const { condition, t, e } = inputs;\n\n    const conditionId =\n    backend.dataIdMap.get(condition.dataId).id;\n    const tId = backend.dataIdMap.get(t.dataId).id;\n    const eId =\n    backend.dataIdMap.get(e.dataId).id;\n    const out = backend.makeOutput(t.shape, t.dtype);\n    const outId =\n    backend.dataIdMap.get(out.dataId).id;\n\n    const cRank = condition.shape.length;\n    const tRank =\n    t.shape.length;\n\n    const offset = cRank === 0 || cRank > 1 || tRank === 1 ?\n    1 : 0;\n\n    util.sizeFromShape(t.shape.slice(1));\n\n    wasmSelect(conditionId, tId, eId, offset, outId);\n    return out;\n  }\n\n  export\n  const selectConfig:
```

```
  KernelConfig = {\n    kernelName: 'Select',\n    backendName: 'wasm',\n    kernelFunc: select as {} as KernelFunc,\n    setupFunc: setup\n  };,\n  "/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed\n * under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the  
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on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or  
implied.\n * See the License for the specific language governing permissions and\n * limitations under the  
License.\n *
```

```
=====\n*\n\nimport { KernelConfig, KernelFunc, Sigmoid, SigmoidInputs, TensorInfo, util } from '@tensorflow/tfjs-\ncore';\nimport { BackendWasm } from\n '../backend_wasm';\n\nlet wasmFunc: (xId: number, outId: number) => void;\n\nfunction setup(backend:\n BackendWasm): void {\n  wasmFunc = backend.wasm.cwrap(Sigmoid, null /* void */, ['number',\n 'number']);\n\n  function sigmoid(args: { backend: BackendWasm, inputs: SigmoidInputs }):\n    TensorInfo {\n    const { backend, inputs: { x } } = args;\n    const xId = backend.dataIdMap.get(x.dataId).id;\n    const out =\n    backend.makeOutput(x.shape, x.dtype);\n    const outId = backend.dataIdMap.get(out.dataId).id;\n\n    // Short-circuit\n    zero-sized tensors.\n    if (util.sizeFromShape(out.shape) === 0) {\n      return out;\n    }\n\n    wasmFunc(xId, outId);\n    return out;\n  }\n\n  export\n  const sigmoidConfig: KernelConfig = {\n    kernelName: 'Sigmoid',\n    backendName:\n    'wasm',\n    setupFunc: setup,\n    kernelFunc: sigmoid as {} as KernelFunc\n  };,\n  "/**\n * @license\n * Copyright\n * 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except
```

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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language  
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```

```
=====\n*\n\nimport { KernelConfig, KernelFunc, Softmax, SoftmaxAttrs, SoftmaxInputs, TensorInfo, util } from\n '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\n\nlet wasmFunc: (xId: number, outId:\n number, channels: number, batch: number) =>\n void;\n\nfunction setup(backend: BackendWasm): void {\n
```

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wasmFunc = backend.wasm.cwrap(Softmax, null /* void */, [\n 'number', // xId\n 'number', // outId\n
'number', // channels\n
'number' // batch\n ]);\n\nfunction softmax(\n  args: {backend: BackendWasm, inputs: SoftmaxInputs, attrs:
SoftmaxAttrs});\n  TensorInfo {\n    const {backend, inputs: {logits}, attrs: {dim}} = args;\n    const xId =
backend.dataIdMap.get(logits.dataId).id;\n    const out = backend.makeOutput(logits.shape, logits.dtype);\n    const
outId = backend.dataIdMap.get(out.dataId).id;\n    const channels = logits.shape[dim];\n    const batch =
util.sizeFromShape(logits.shape) / channels;\n\n    // Short-circuit zero-sized tensors.\n    if
(util.sizeFromShape(out.shape) === 0) {\n      return out;\n    }\n\n    wasmFunc(xId, outId, channels, batch);\n    return
out;\n  }\n\nexport const softmaxConfig: KernelConfig = {\n  kernelName: Softmax,\n  backendName: 'wasm',\n
setupFunc: setup,\n  kernelFunc: softmax as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google
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in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\nimport {KernelConfig, Sin} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'/unary_kernel';\nexport const sinConfig: KernelConfig = createUnaryKernelConfig(Sin);\n\n"/**\n * @license\n *
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\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {backend_util, KernelConfig, KernelFunc, ReshapeAttrs, ReshapeInputs, SpaceToBatchND,
SpaceToBatchNDAttrs, SpaceToBatchNDInputs, TensorInfo, TransposeAttrs, TransposeInputs, util} from
'@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {padV2Config} from
'/PadV2';\nimport {reshape} from './Reshape';\nimport {transpose} from './Transpose';\n\nfunction
spaceToBatchND(args: {\n  inputs: SpaceToBatchNDInputs,\n  backend: BackendWasm,\n  attrs:
SpaceToBatchNDAttrs\n}) {\n  const {inputs, backend,
attrs} = args;\n  const {x} = inputs;\n  const {blockShape, paddings} = attrs;\n\n  const prod =
util.sizeFromShape(blockShape);\n  const completePaddings: Array<[number, number]> = [[0, 0]];\n
completePaddings.push(...(paddings as Array<[number, number]>));\n  for (let i = 1 + blockShape.length; i <
x.shape.length; ++i) {\n    completePaddings.push([0, 0]);\n  }\n  const paddedX = padV2Config.kernelFunc({\n
inputs: {x},\n  backend,\n  attrs: {paddings: completePaddings, constantValue: 0}\n}) as TensorInfo;\n  const
reshapedPaddedShape =\n    backend_util.getReshaped(paddedX.shape, blockShape, prod, false);\n  const
permutedReshapedPaddedPermutation = backend_util.getPermuted(\n    reshapedPaddedShape.length,
blockShape.length, false);\n  const flattenShape =\n    backend_util.getReshapedPermuted(paddedX.shape,
blockShape, prod, false);\n  const reshapeInputs: ReshapeInputs = {x: paddedX};\n  const reshapeAttrs:
ReshapeAttrs = {shape: reshapedPaddedShape};\n
const paddedXReshaped =\n    reshape({inputs: reshapeInputs, backend, attrs: reshapeAttrs});\n  const
transposeInputs: TransposeInputs = {x: paddedXReshaped};\n  const transposeAttrs:\n    TransposeAttrs = {perm:
permutedReshapedPaddedPermutation};\n  const paddedXT =\n    transpose({inputs: transposeInputs, backend,
attrs: transposeAttrs});\n  const resultReshapeInputs: ReshapeInputs = {x: paddedXT};\n  const

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resultReshapeAttrs: ReshapeAttrs = {shape: flattenShape};\n const result = reshape(\n  {inputs:
resultReshapeInputs, backend, attrs: resultReshapeAttrs});\n\n backend.disposeData(paddedX.dataId);\n
backend.disposeData(paddedXReshaped.dataId);\n backend.disposeData(paddedXT.dataId);\n\n return
result;\n}\n\nexport const spaceToBatchNDConfig: KernelConfig = {\n  kernelName: SpaceToBatchND,\n
backendName: 'wasm',\n  kernelFunc: spaceToBatchND as {} as KernelFunc\n};\n", "/**\n * @license\n *
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on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====
*\n\nimport {KernelConfig, KernelFunc, SplitV, SplitVAttrs, SplitVInputs, util} from '@tensorflow/tfjs-
core';\nimport {backend_util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from
'./backend_wasm';\nimport {slice} from './Slice';\n\nexport function splitV(\n  args: {inputs: SplitVInputs, attrs:
SplitVAttrs, backend: BackendWasm}) {\n  const {inputs,
attrs, backend} = args;\n  const {x} = inputs;\n  const {numOrSizeSplits, axis} = attrs;\n\n  const $axis =
util.parseAxisParam(axis, x.shape)[0];\n\n  const splitSizes = backend_util.prepareSplitSize(x, numOrSizeSplits,
$axis);\n  const begin = new Array(x.shape.length).fill(0);\n  const size = x.shape.slice();\n  return splitSizes.map(s
=> {\n    const xSliceSize = [...size];\n    xSliceSize[$axis] = s;\n    const xSlice =\n      slice({inputs: {x}, attrs:
{begin, size: xSliceSize}, backend});\n    begin[$axis] += s;\n    return xSlice;\n  });\n}\n\nexport const
splitVConfig: KernelConfig = {\n  kernelName: SplitV,\n  backendName: 'wasm',\n  kernelFunc: splitV as {} as
KernelFunc\n};\n", "/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
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distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *
=====
*\n\nimport {KernelConfig, KernelFunc, Step, StepAttrs, StepInputs, TensorInfo} from '@tensorflow/tfjs-
core';\nimport {BackendWasm} from './backend_wasm';\nimport {CppType} from './types';\n\nlet wasmStep:
(xId: number, alpha: number, dtype: number, outId: number) =>\n  void;\n\nfunction setup(backend:
BackendWasm): void {\n  wasmStep = backend.wasm.cwrap(Step, null /*void*/, [\n    'number', // x_id\n
'number', // alpha\n    'number', // dtype\n    'number', // out_id\n  ]);\n}\n\nfunction step(\n  args: {backend:
BackendWasm, inputs: StepInputs, attrs:
StepAttrs}): \n  TensorInfo {\n  const {backend, inputs, attrs} = args;\n  const {alpha} = attrs;\n  const {x} =
inputs;\n  const xId = backend.dataIdMap.get(x.dataId).id;\n\n  const out = backend.makeOutput(x.shape,
x.dtype);\n  const outId = backend.dataIdMap.get(out.dataId).id;\n  wasmStep(xId, alpha, CCppType[x.dtype],
outId);\n  return out;\n}\n\nexport const stepConfig: KernelConfig = {\n  kernelName: Step,\n  backendName:
'wasm',\n  setupFunc: setup,\n  kernelFunc: step as {} as KernelFunc\n};\n", "/**\n * @license\n * Copyright 2020
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http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
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```
=====\n\n*\n\nimport { KernelConfig, Sqrt } from '@tensorflow/tfjs-core';\n\nimport { createUnaryKernelConfig } from\n './unary_kernel';\n\nexport const sqrtConfig: KernelConfig = createUnaryKernelConfig(Sqrt);\n\n", /**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language\n * governing permissions and\n * limitations under the License.\n *
```

```
=====\n\n*\n\nimport { KernelConfig, Square } from '@tensorflow/tfjs-core';\n\nimport { createUnaryKernelConfig } from\n './unary_kernel';\n\nexport const squareConfig: KernelConfig = createUnaryKernelConfig(Square);\n\n", /**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n * 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a\n * copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable\n * law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n\n*\n\nimport { KernelConfig, SquaredDifference } from '@tensorflow/tfjs-core';\n\nimport { createBinaryKernelConfig }\n from './binary_kernel';\n\nconst supportsFullBroadcast = true;\n\nexport const squaredDifferenceConfig: KernelConfig\n =\n createBinaryKernelConfig(SquaredDifference, supportsFullBroadcast);\n\n", /**\n * @license\n * Copyright\n * 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n *
```

```
*\n\n=====\n\n*\n\nimport { KernelConfig, KernelFunc, slice_util, StridedSlice, StridedSliceAttrs, StridedSliceInputs, TensorInfo,\n util } from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport { reshape } from\n './Reshape';\n\nimport { slice } from './Slice';\n\nlet wasmStridedSlice: (\n xId: number, xStridesBytes: Uint8Array,\n xRank: number,\n beginBytes: Uint8Array, endBytes: Uint8Array, stridesBytes: Uint8Array,\n outShapeBytes:\n Uint8Array, outStridesBytes: Uint8Array,\n outShapeLength: number, outId: number) => void;\n\nfunction\n setup(backend: BackendWasm): void {\n wasmStridedSlice = backend.wasm.cwrap(StridedSlice, null /*void*/, [\n 'number', // xId\n 'array', // xStrides\n 'number', // xRank\n 'array', // beginBytes\n 'array', // endBytes\n 'array', // stridesBytes\n 'array', // outShapeBytes\n 'array', // outStridesBytes\n 'number',\n // outShapeLength\n 'number', // outId\n ]);\n\n}\n\nexport function stridedSlice(args: {\n backend:\n BackendWasm,\n inputs: StridedSliceInputs,\n attrs: StridedSliceAttrs\n}): TensorInfo {\n const { backend, inputs,\n attrs } = args;\n\nconst { x = inputs,\n\nconst {\n begin,\n end,\n strides,\n beginMask,\n endMask,\n ellipsisMask,\n newAxisMask,\n shrinkAxisMask\n } = attrs;\n\nconst {\n finalShapeSparse,\n finalShape,\n isIdentity,\n sliceDim0,\n isSimpleSlice,\n begin: $begin,\n end: $end,\n strides: $strides\n }\n =\n slice_util.sliceInfo(\n x.shape, begin, end, strides, beginMask, endMask, ellipsisMask,\n newAxisMask, shrinkAxisMask);\n\nlet result;\n\nif (isIdentity) {\n // Optimization #1, slice is a no-op plus\n reshape\n result = reshape({ inputs: { x }, backend, attrs: { shape: finalShape } });\n } else if (sliceDim0 ||
```

```

isSimpleSlice) {\n // Optimization #2, slice is memory contiguous
(only occurs in dim 0)\n util.assert(\n x.shape.length >= 1,\n () => `Input must have rank at least 1, got:
${x.shape.length}`);\n\n const size = slice_util.computeOutShape($begin, $end, $strides);\n // To tolerate
begin[0] > end[0] (a 0-output slice), we min(begin, end).\n const sliced = slice({inputs: {x}, backend, attrs:
{begin: $begin, size}});\n result =\n reshape({inputs: {x: sliced}, backend, attrs: {shape: finalShape}});\n
backend.disposeData(sliced.dataId);\n } else {\n const out = backend.makeOutput(finalShapeSparse,
'float32');\n\n const xId = backend.dataIdMap.get(x.dataId).id;\n const xStridesBytes =\n new
Uint8Array(new Int32Array(util.computeStrides(x.shape)).buffer);\n const beginBytes = new Uint8Array(new
Int32Array($begin).buffer);\n const endBytes = new Uint8Array(new Int32Array($end).buffer);\n const
stridesBytes = new Uint8Array(new Int32Array($strides).buffer);\n\n const outputShapeBytes =\n
new Uint8Array(new Int32Array(finalShapeSparse).buffer);\n const outStridesBytes = new Uint8Array(\n
new Int32Array(util.computeStrides(finalShapeSparse)).buffer);\n const outId =
backend.dataIdMap.get(out.dataId).id;\n\n wasmStridedSlice(\n xId, xStridesBytes, x.shape.length,
beginBytes, endBytes, stridesBytes,\n outputShapeBytes, outStridesBytes, finalShapeSparse.length, outId);\n\n
result = reshape({inputs: {x: out}, backend, attrs: {shape: finalShape}});\n\n backend.disposeData(out.dataId);\n
}\n\n return result;\n}\n\nexport const stridedSliceConfig: KernelConfig = {\n kernelName: StridedSlice,\n
backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: stridedSlice as { } as KernelFunc\n};\n\n"/**\n *
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writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT
WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {backend_util, KernelConfig, KernelFunc, Sum, SumAttrs, SumInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport
{permuteAxesAndTranspose} from './kernel_utils';\n\nimport {CppType} from './types';\n\nlet wasmSum: (xId:
number, reduceSize: number, dtype: number, outId: number) =>\n void;\n\nfunction setup(backend:
BackendWasm): void {\n wasmSum = backend.wasm.cwrap(Sum, null /*void*/, [\n 'number', // input_id\n
'number', // reduce_size\n
'number', // dtype\n 'number', // out_id\n ]);\n}\n\nfunction sum(args: {backend: BackendWasm, inputs:
SumInputs, attrs: SumAttrs}): TensorInfo {\n const {backend, inputs, attrs} = args;\n const {axis, keepDims} =
attrs;\n const {x} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input =
x;\n\n const {transposed, axes, originalAxes, inputWasTransposed} =\n permuteAxesAndTranspose(x, axis,
backend);\n\n let reductionAxes = axes;\n if (inputWasTransposed) {\n const transposedId =
backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId !== xId) {\n // transpose was not a no-op. We
will need to dispose of this\n // once we are done.\n input = transposed;\n inputId = transposedId;\n
reductionAxes = backend_util.getInnerMostAxes(\n reductionAxes.length, input.shape.length);\n }\n }\n\n
backend_util.assertAxesAreInnerMostDims(\n 'sum', reductionAxes, input.shape.length);\n
const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n
const reduceSize = util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape,
input.dtype);\n if (util.sizeFromShape(input.shape) !== 0) {\n const outId =
backend.dataIdMap.get(out.dataId).id;\n wasmSum(inputId, reduceSize, CppDType[out.dtype], outId);\n }\n\n if
(inputWasTransposed) {\n // dispose of the transposed tensor.\n backend.disposeData(transposed.dataId);\n
}\n\n if (keepDims) {\n // reshape\n const newShape = backend_util.expandShapeToKeepDim(out.shape,
originalAxes);\n out.shape = newShape;\n }\n\n return out;\n}\n\nexport const sumConfig: KernelConfig = {\n
kernelName: Sum,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: sum as { } as

```

KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```
=====\n*\nimport {KernelConfig, Sub} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from './binary_kernel';\nconst supportsFullBroadcast = true;\nexport const subConfig: KernelConfig =\ncreateBinaryKernelConfig(Sub, supportsFullBroadcast);\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\nimport {KernelConfig, KernelFunc, Tile, TileAttrs, TileInputs} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {CppType} from './types';\nlet wasmTile: (xId: number, xShape: Uint8Array, xShapeSize: number, newShape: Uint8Array, newShapeSize: number, dtype: number, outId: number) => void;\nfunction setup(backend: BackendWasm) {\n  wasmTile = backend.wasm.cwrap(Tile, null /* void */, [\n    'number',\n    // x_id\n    'array', // x_shape\n    'number', // x_shape.length\n    'array', // new_shape\n    'number', // new_shape.length\n    'number' // out_id\n  ]);\n  function tile(\n    args: {inputs: TileInputs, backend: BackendWasm, attrs: TileAttrs}) {\n    const {inputs, backend, attrs} = args;\n    const {x} = inputs;\n    const xId = backend.dataIdMap.get(x.dataId).id;\n    const {reps} = attrs;\n    const newShape: number[] = new Array(x.shape.length);\n    for (let i = 0; i < newShape.length; i++) {\n      newShape[i] = x.shape[i] * reps[i];\n    }\n    const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n    const newShapeBytes = new Uint8Array(new Int32Array(newShape).buffer);\n    const out = backend.makeOutput(newShape, x.dtype);\n    const outId = backend.dataIdMap.get(out.dataId).id;\n    wasmTile(\n      xId, xShapeBytes, x.shape.length, newShapeBytes, newShape.length,\n      CCppType[out.dtype], outId);\n    return out;\n  }\n  export const tileConfig: KernelConfig
```

```
= {kernelName: Tile,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: tile as } as\nKernelFunc\n};\n", "/*\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\nimport {KernelConfig, Tan} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from './unary_kernel';\nexport const tanConfig: KernelConfig =\ncreateUnaryKernelConfig(Tan);\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
```

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```
=====  
*\nimport {KernelConfig, Tanh} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from  
 './unary_kernel';\nexport const tanhConfig: KernelConfig = createUnaryKernelConfig(Tanh);\n"/**\n * @license  
 * Copyright 2020 Google LLC. All
```

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```
=====  
*\nimport {KernelConfig, KernelFunc, TensorInfo, TopK, TopKAttrs, TopKInputs} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {CppType} from './types';\n\nlet wasmTopK:  
(\n  xId: number, xShapeBytes: Uint8Array, xShapeLength: number,\n  xDtype: CppDType, k: number, sorted:  
  boolean, outValuesId:  
    number,\n  outIndicesId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n  wasmTopK =  
  backend.wasm.cwrap(TopK, null /* void */, [\n    'number', // xId\n    'array', // x.shape\n    'number', //  
    x.shape.length\n    'number', // x.dtype\n    'number', // k\n    'bool', // sorted\n    'number', // outValuesId\n    'number', // outIndicesId\n  ]);\n}\n\nexport const topK:  
(\n  args: {inputs: TopKInputs, backend: BackendWasm,  
  attrs: TopKAttrs}) => \n  TensorInfo[] | TensorInfo = ({inputs, backend, attrs}) => {\n    const {x} = inputs;\n    const {k, sorted} = attrs;\n    const xId = backend.dataIdMap.get(x.dataId).id;\n    const xShapeBytes  
= new Uint8Array(new Int32Array(x.shape).buffer);\n    const outputShape = x.shape.slice();\n    outputShape[outputShape.length - 1] = k;\n    const outValues = backend.makeOutput(outputShape, x.dtype);\n    const outValuesId = backend.dataIdMap.get(outValues.dataId).id;\n    const outIndices = backend.makeOutput(outputShape, 'int32');\n    const outIndicesId =  
  backend.dataIdMap.get(outIndices.dataId).id;\n    wasmTopK(\n      xId, xShapeBytes, x.shape.length,  
      CppDType[x.dtype], k, sorted,\n      outValuesId, outIndicesId);\n    return [outValues, outIndices];\n  };\n}\n\nexport const topKConfig: KernelConfig = {\n  kernelName: TopK,\n  backendName: 'wasm',\n  setupFunc:  
  setup,\n  kernelFunc: topK as { } as KernelFunc,\n};\n"/**\n * @license  
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software distributed under the License is distributed on an "AS IS" BASIS, WITHOUT WARRANTIES  
OR CONDITIONS  
OF ANY KIND, either express or implied. See the License for the specific language governing permissions  
and limitations under the License.
```

```
=====  
*\nimport {KernelConfig, KernelFunc, TensorInfo, Transform, TransformAttrs, TransformInputs, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\n\nlet wasmTransform:  
(\n  imageId:  
  number, transformsId: number, isBatchTransform: boolean,\n  batch: number, outHeight: number, outWidth:  
  number, numChannels: number,\n  imageWidth: number, imageHeight: number, strides: Uint8Array,\n  stridesLength: number, interpolationModeId: number, fillModeId: number,\n  fillValue: number, outId: number)  
=> void;\n\nfunction setup(backend: BackendWasm): void {\n  wasmTransform = backend.wasm.cwrap(Transform,  
  null /* void */, [\n    'number', // imageId\n    'number', // transformsId\n    'bool', // isBatchTransform\n    'number',
```

```

// batch\n 'number', // outHeight\n 'number', // outWidth\n 'number', // numChannels\n 'number', //
imageWidth\n 'number', // imageHeight\n 'array', // strides\n 'number', // stridesLength\n 'number', //
interpolationModeId\n 'number', // fillModeId\n 'number', // fillValue\n 'number' // outId\n
]);\n\nfunction transform(\n  args:\n    {backend: BackendWasm, inputs: TransformInputs, attrs:
TransformAttrs});\n  TensorInfo {\n    const {backend, inputs, attrs} = args;\n    const {image, transforms} = inputs;\n
const {interpolation, fillMode, fillValue, outputShape} = attrs;\n    const [batch, imageHeight, imageWidth,
numChannels] = image.shape;\n    const [outHeight, outWidth] =\n      outputShape != null ? outputShape :
[imageHeight, imageWidth];\n    const outShape =\n      [batch, outHeight, outWidth,\n        numChannels] as
[number, number, number, number];\n    const strides =\n      new Uint8Array(new
Int32Array(util.computeStrides(image.shape)).buffer);\n\n
const out = backend.makeOutput(outShape, image.dtype);\n    const outId =
backend.dataIdMap.get(out.dataId).id;\n\n    const imageData = backend.dataIdMap.get(image.dataId);\n    const
imageId = imageData.id;\n\n    const transformsData = backend.dataIdMap.get(transforms.dataId);\n    const
transformsId = transformsData.id;\n\n    const interpolationModeId = interpolation === 'nearest' ? 1 : 2;\n    let
fillModeId;\n    switch (fillMode) {\n      case 'constant':\n        fillModeId = 1;\n        break;\n      case 'reflect':\n
fillModeId = 2;\n        break;\n      case 'wrap':\n        fillModeId = 3;\n        break;\n      case 'nearest':\n
fillModeId = 4;\n        break;\n      default:\n        fillModeId = 1;\n        break;\n    }\n\n    wasmTransform(\n      imageId, transformsId,
(transforms.shape[0] > 1), batch, outHeight,\n        outWidth, numChannels, imageWidth, imageHeight, strides,\n      image.shape.length - 1, interpolationModeId, fillModeId, fillValue,\n        outId);\n\n    return out;\n  })\n\nexport const transformConfig: KernelConfig = {\n  kernelName: Transform,\n  backendName:
'wasm',\n  setupFunc: setup,\n  kernelFunc: transform as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright
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http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====*\n\nimport {KernelConfig, KernelFunc, TensorInfo, Unpack, UnpackAttrs, UnpackInputs} from
 '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {slice} from
 './Slice';\n\nfunction unpack(\n  args: {inputs: UnpackInputs, backend: BackendWasm, attrs: UnpackAttrs});\n
TensorInfo[] {\n  const {inputs, backend, attrs} = args;\n  const {value} = inputs;\n  let {axis} = attrs;\n  if (axis <
0) {\n    axis += value.shape.length;\n  }\n\n  const numOutputs = value.shape[axis];\n  const rank =
value.shape.length;\n  const outShape: number[] = new Array(rank - 1);\n  let outIndex = 0;\n  for (let i = 0; i < rank;\n    i++) {\n    if (i !== axis) {\n      outShape[outIndex++] = value.shape[i];\n    }\n  }\n  const outs: TensorInfo[] = new
Array(numOutputs);\n  const begin = new Array(rank).fill(0);\n  const size = value.shape.slice();\n  size[axis] = 1;\n  for (let i = 0; i < outs.length; i++) {\n    begin[axis] = i;\n    outs[i] = slice({inputs: {x: value}, attrs: {begin, size},
backend});\n  }\n  return outs.map(({dataId, dtype}) => ({dataId, dtype,
shape: outShape}));\n}\n\nexport const unpackConfig: KernelConfig = {\n  kernelName: Unpack,\n  backendName:
'wasm',\n  kernelFunc: unpack as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All
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file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====*\n\nWe explicitly import the modular kernels so they get registered in the\n// global registry when we compile

```


the library. A modular build would replace the contents of this file and import only the kernels that are needed.

```

import {KernelConfig, registerKernel} from '@tensorflow/tfjs-core';
import {fusedMatMulConfig} from './kernels/_FusedMatMul';
import {absConfig} from './kernels/Abs';
import {addConfig} from './kernels/Add';
import {addNConfig} from './kernels/AddN';
import {allConfig} from './kernels/All';
import {anyConfig} from './kernels/Any';
import {argMaxConfig} from './kernels/ArgMax';
import {avgPoolConfig} from './kernels/AvgPool';
import {batchMatMulConfig} from './kernels/BatchMatMul';
import {batchToSpaceNDConfig} from './kernels/BatchToSpaceND';
import {castConfig} from './kernels/Cast';
import {ceilConfig} from './kernels/Ceil';
import {clipByValueConfig} from './kernels/ClipByValue';
import {concatConfig} from './kernels/Concat';
import {conv2DConfig} from './kernels/Conv2D';
import {conv2DBackpropInputConfig} from './kernels/Conv2DBackpropInput';
import {cosConfig} from './kernels/Cos';
import {coshConfig} from './kernels/Cosh';
import {cropAndResizeConfig} from './kernels/CropAndResize';
import {cumsumConfig} from './kernels/Cumsum';
import {depthToSpaceConfig} from './kernels/DepthToSpace';
import {depthwiseConv2dNativeConfig} from './kernels/DepthwiseConv2dNative';
import {eluConfig} from './kernels/Elu';
import {equalConfig} from './kernels/Equal';
import {expConfig} from './kernels/Exp';
import {expandDimsConfig} from './kernels/ExpandDims';
import {fillConfig} from './kernels/Fill';
import {flipLeftRightConfig} from './kernels/FlipLeftRight';
import {floorConfig} from './kernels/Floor';
import {floorDivConfig} from './kernels/FloorDiv';
import {fusedBatchNormConfig} from './kernels/FusedBatchNorm';
import {fusedConv2DConfig} from './kernels/FusedConv2D';
import {fusedDepthwiseConv2DConfig} from './kernels/FusedDepthwiseConv2D';
import {gatherNdConfig} from './kernels/GatherNd';
import {gatherV2Config} from './kernels/GatherV2';
import {greaterConfig} from './kernels/Greater';
import {greaterEqualConfig} from './kernels/GreaterEqual';
import {identityConfig} from './kernels/Identity';
import {leakyReluConfig} from './kernels/LeakyRelu';
import {lessConfig} from './kernels/Less';
import {lessEqualConfig} from './kernels/LessEqual';
import {logConfig} from './kernels/Log';
import {logicalAndConfig} from './kernels/LogicalAnd';
import {maxConfig} from './kernels/Max';
import {maximumConfig} from './kernels/Maximum';
import {maxPoolConfig} from './kernels/MaxPool';
import {meanConfig} from './kernels/Mean';
import {minConfig} from './kernels/Min';
import {minimumConfig} from './kernels/Minimum';
import {mirrorPadConfig} from './kernels/MirrorPad';
import {multiplyConfig} from './kernels/Multiply';
import {negConfig} from './kernels/Neg';
import {nonMaxSuppressionV3Config} from './kernels/NonMaxSuppressionV3';
import {nonMaxSuppressionV4Config} from './kernels/NonMaxSuppressionV4';
import {nonMaxSuppressionV5Config} from './kernels/NonMaxSuppressionV5';
import {notEqualConfig} from './kernels/NotEqual';
import {oneHotConfig} from './kernels/OneHot';
import {onesLikeConfig} from './kernels/OnesLike';
import {packConfig} from './kernels/Pack';
import {padV2Config} from './kernels/PadV2';
import {powConfig} from './kernels/Pow';
import {preluConfig} from './kernels/Prelu';
import {prodConfig} from './kernels/Prod';
import {rangeConfig} from './kernels/Range';
import {realDivConfig} from './kernels/RealDiv';
import {reluConfig} from './kernels/Relu';
import {relu6Config} from './kernels/Relu6';
import {reshapeConfig} from './kernels/Reshape';
import {resizeBilinearConfig} from './kernels/ResizeBilinear';
import {reverseConfig} from './kernels/Reverse';
import {rotateWithOffsetConfig} from './kernels/RotateWithOffset';
import {roundConfig} from './kernels/Round';
import {rsqrtConfig} from './kernels/Rsqrt';
import {scatterNdConfig} from './kernels/ScatterNd';
import {selectConfig} from './kernels/Select';
import {sigmoidConfig} from './kernels/Sigmoid';
import {sinConfig} from './kernels/Sin';
import {sliceConfig} from './kernels/Slice';
import {softmaxConfig} from './kernels/Softmax';
import {spaceToBatchNDConfig} from './kernels/SpaceToBatchND';
import {splitVConfig} from './kernels/SplitV';
import {sqrtConfig} from './kernels/Sqrt';
import {squareConfig} from './kernels/Square';
import {squaredDifferenceConfig} from './kernels/SquaredDifference';
import {stepConfig} from './kernels/Step';
import {stridedSliceConfig} from './kernels/StridedSlice';
import {subConfig} from

```

```

./kernels/Sub';\nimport {sumConfig} from './kernels/Sum';\nimport {tanConfig} from './kernels/Tan';\nimport
{tanhConfig} from './kernels/Tanh';\nimport {tileConfig} from './kernels/Tile';\nimport {topKConfig} from
./kernels/TopK';\nimport {transformConfig} from './kernels/Transform';\nimport {transposeConfig} from
./kernels/Transpose';\nimport
{unpackConfig} from './kernels/Unpack';\nimport {zerosLikeConfig} from './kernels/ZerosLike';\n\n// List all
kernel configs here\nconst kernelConfigs: KernelConfig[] = [\n  absConfig,\n  addConfig,\n  addNConfig,\n
allConfig,\n  anyConfig,\n  argMaxConfig,\n  avgPoolConfig,\n  batchMatMulConfig,\n  batchToSpaceNDConfig,\n
castConfig,\n  ceilConfig,\n  clipByValueConfig,\n  concatConfig,\n  conv2DConfig,\n
conv2DBackpropInputConfig,\n  cosConfig,\n  coshConfig,\n  cropAndResizeConfig,\n  cumsumConfig,\n
depthToSpaceConfig,\n  depthwiseConv2dNativeConfig,\n  eluConfig,\n  equalConfig,\n  expConfig,\n
expandDimsConfig,\n  fillConfig,\n  flipLeftRightConfig,\n  floorConfig,\n  floorDivConfig,\n
fusedMatMulConfig,\n  fusedBatchNormConfig,\n  fusedConv2DConfig,\n  fusedDepthwiseConv2DConfig,\n
gatherNdConfig,\n  gatherV2Config,\n  greaterConfig,\n  greaterEqualConfig,\n  identityConfig,\n
leakyReluConfig,\n  lessConfig,\n  lessEqualConfig,\n  logConfig,\n  logicalAndConfig,\n
maxConfig,\n  maximumConfig,\n  maxPoolConfig,\n  meanConfig,\n  minConfig,\n  minimumConfig,\n
mirrorPadConfig,\n  multiplyConfig,\n  negConfig,\n  nonMaxSuppressionV3Config,\n
nonMaxSuppressionV4Config,\n  nonMaxSuppressionV5Config,\n  notEqualConfig,\n  oneHotConfig,\n
onesLikeConfig,\n  packConfig,\n  padV2Config,\n  powConfig,\n  preluConfig,\n  prodConfig,\n
rangeConfig,\n  realDivConfig,\n  reluConfig,\n  relu6Config,\n  reshapeConfig,\n  resizeBilinearConfig,\n
reverseConfig,\n  rotateWithOffsetConfig,\n  rsqrtConfig,\n  roundConfig,\n  scatterNdConfig,\n
selectConfig,\n  sigmoidConfig,\n  sinConfig,\n  sliceConfig,\n  softmaxConfig,\n  spaceToBatchNDConfig,\n
splitVConfig,\n  sqrtConfig,\n  squareConfig,\n  squaredDifferenceConfig,\n  stepConfig,\n
stridedSliceConfig,\n  subConfig,\n  sumConfig,\n  tanConfig,\n  tanhConfig,\n  tileConfig,\n
topKConfig,\n  transformConfig,\n  transposeConfig,\n  unpackConfig,\n  zerosLikeConfig\n];\n\nfor (const kernelConfig of kernelConfigs)
{\n  registerKernel(kernelConfig);\n}\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *
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software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {KernelConfig, KernelFunc, ZerosLike, ZerosLikeInputs} from '@tensorflow/tfjs-core';\nimport
{BackendWasm} from '../backend_wasm';\n\nfunction zerosLike(args: {inputs: ZerosLikeInputs, backend:
BackendWasm}) {\n
  const {inputs: {x}, backend} = args;\n  const out = backend.makeOutput(x.shape, x.dtype);\n  const outVals =
backend.typedArrayFromHeap(out);\n  outVals.fill(0);\n  return out;\n}\n\nexport const zerosLikeConfig:
KernelConfig = {\n  kernelName: ZerosLike,\n  backendName: 'wasm',\n  kernelFunc: zerosLike as {} as
KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {env} from '@tensorflow/tfjs-core';\n\nconst ENV = env();\n\n/**\n * True if SIMD is supported.\n
*\n * From: https://github.com/GoogleChromeLabs/wasm-feature-detect\nENV.registerFlag(\n // This typed array

```

```

passed in to WebAssembly.validate is WebAssembly binary\n // code. In this case it is a small program that
contains SIMD\n // instructions.\n 'WASM_HAS_SIMD_SUPPORT', async () => WebAssembly.validate(new
Uint8Array([\n 0, 97, 115, 109, 1, 0, 0, 0, 1, 4, 1, 96, 0, 0, 3,\n 2, 1, 0, 10, 9, 1, 7, 0, 65, 0, 253, 15, 26,
11\n ]));\n\n**\n * True if threads are supported.\n *^\n// From: https://github.com/GoogleChromeLabs/wasm-
feature-detect\nENV.registerFlag('WASM_HAS_MULTITHREAD_SUPPORT', async () => {\n //
TODO(annxingyuan): Enable node support once this is resolved:\n //
https://github.com/tensorflow/tfjs/issues/3830\n if (ENV.get('IS_NODE')) {\n return false;\n }\n\n try {\n
// Test for transferability of SABs (needed for Firefox)\n //
https://groups.google.com/forum/#!msg/mozilla.dev.platform/IHkBZIHETpA/dwsMNchWEQAJ\n new
MessageChannel().port1.postMessage(new SharedArrayBuffer(1));\n // This typed array is a WebAssembly
program containing threaded\n // instructions.\n return WebAssembly.validate(new Uint8Array([\n 0, 97,
115, 109, 1, 0, 0, 0, 1, 4, 1, 96, 0, 0, 3, 2, 1, 0, 5,\n 4, 1, 3, 1, 1, 10, 11, 1, 9, 0, 65, 0, 254, 16, 2, 0, 26,
11\n ]));\n } catch (e) {\n return false;\n }\n});\n\n", "\nvar WasmBackendModuleThreadedSimd = (function() {\n
var _scriptDir = typeof document !== 'undefined' && document.currentScript ? document.currentScript.src :
undefined;\n if (typeof __filename !== 'undefined') _scriptDir = _scriptDir || __filename;\n return
(\nfunction(WasmBackendModuleThreadedSimd) {\n WasmBackendModuleThreadedSimd =
WasmBackendModuleThreadedSimd || {};\n\nfunction
GROWABLE_HEAP_I8(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}
return
HEAP8}function
GROWABLE_HEAP_U8(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)
}return HEAPU8}function
GROWABLE_HEAP_I32(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)
}return HEAP32}function
GROWABLE_HEAP_U32(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)
}return HEAPU32}function
GROWABLE_HEAP_F64(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)
}return HEAPF64}var Module=typeof
WasmBackendModuleThreadedSimd!="undefined"?WasmBackendModuleThreadedSimd:{};var
readyPromiseResolve,readyPromiseReject;Module["ready"]=new
Promise(function(resolve,reject){readyPromiseResolve=resolve;readyPromiseReject=reject});var
moduleOverrides={};var key;for(key in
Module){if(Module.hasOwnProperty(key)){moduleOverrides[key]=Module[key]}}var arguments_=[];var
thisProgram=\.this.program";var quit_=function(status,toThrow){throw
toThrow};var ENVIRONMENT_IS_WEB=false;var ENVIRONMENT_IS_WORKER=false;var
ENVIRONMENT_IS_NODE=false;var ENVIRONMENT_IS_SHELL=false;ENVIRONMENT_IS_WEB=typeof
window==="object";ENVIRONMENT_IS_WORKER=typeof
importScripts==="function";ENVIRONMENT_IS_NODE=typeof process==="object"&&typeof
process.versions==="object"&&typeof
process.versions.node==="string";ENVIRONMENT_IS_SHELL=!ENVIRONMENT_IS_WEB&&!ENVIRONM
ENT_IS_NODE&&!ENVIRONMENT_IS_WORKER;var
ENVIRONMENT_IS_PTHREAD=Module["ENVIRONMENT_IS_PTHREAD"]||false;if(ENVIRONMENT_IS_P
THREAD){buffer=Module["buffer"];var scriptDirectory=\.";function
locateFile(path){if(Module["locateFile"]){return Module["locateFile"](path,scriptDirectory)}return
scriptDirectory+path}var read_,readAsync,readBinary,setWindowTitle;var nodeFS;var
nodePath;if(ENVIRONMENT_IS_NODE){if(ENVIRONMENT_IS_WORKER){scriptDirectory=require(\`path\`
).dirname(scriptDirectory)+\`^`}else{scriptDirectory=__dirname+\`^`}read_=function
shell_read(filename,binary){if(!nodeFS)nodeFS=require(\`fs\`);if(!nodePath)nodePath=require(\`path\`);filename=n

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odePath["normalize"](filename);return
nodeFS["readFileSync"](filename,binary?null:"utf8");readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret};if(process["argv"].length>1){thisProgram=process["argv"][1].replace(/\\/g,"\\")}arguments_=process["arg
v"].slice(2);process["on"]("uncaughtException",function(ex){if(!(ex instanceof ExitStatus)){throw
ex}});process["on"]("unhandledRejection",abort);quit_=function(status){process["exit"](status)};Module["insp
ect"]=function(){return"[Emscripten Module object]"};var
nodeWorkerThreads;try{nodeWorkerThreads=require("worker_threads")}catch(e){console.error("The
\"worker_threads\" module is not supported in this node.js build - perhaps a newer version is needed?");throw
e}global.Worker=nodeWorkerThreads.Worker}else if(ENVIRONMENT_IS_SHELL){if(typeof
read!="undefined"){read_=function shell_read(f){return read(f)}readBinary=function readBinary(f){var
data;if(typeof readbuffer==="function"){return new
Uint8Array(readbuffer(f))}data=read(f,"binary");assert(typeof data==="object");return data};if(typeof
scriptArgs!="undefined"){arguments_=scriptArgs}else if(typeof
arguments!="undefined"){arguments_=arguments}if(typeof
quit==="function"){quit_=function(status){quit(status)}}if(typeof print!="undefined"){if(typeof
console==="undefined")console={};console.log=print;console.warn=console.error=typeof
printErr!="undefined"?printErr:print}else
if(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER){if(ENVIRONMENT_IS_WORKER){scriptDire
ctory=self.location.href}else if(typeof
document!="undefined"&&document.currentScript){scriptDirectory=document.currentScript.src}if(typeof
_scriptDir !=="undefined"&&
_scriptDir){scriptDirectory=_scriptDir}if(scriptDirectory.indexOf("blob:")!==0){scriptDirectory=scriptDirectory.s
ubstr(0,scriptDirectory.lastIndexOf("/")+1)}else{scriptDirectory=""}if(ENVIRONMENT_IS_NODE){read_=fun
ction
shell_read(filename,binary){if(!nodeFS)nodeFS=require("fs");if(!nodePath)nodePath=require("path");filename=n
odePath["normalize"](filename);return
nodeFS["readFileSync"](filename,binary?null:"utf8");readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret}}else{read_=function(url){var xhr=new XMLHttpRequest;xhr.open("GET",url,false);xhr.send(null);return
xhr.responseText};if(ENVIRONMENT_IS_WORKER){readBinary=function(url){var xhr=new
XMLHttpRequest;xhr.open("GET",url,false);xhr.responseType="arraybuffer";xhr.send(null);return new
Uint8Array(xhr.response)}}readAsync=function(url,onload,onerror){var xhr=new
XMLHttpRequest;xhr.open("GET",url,true);xhr.responseType="arraybuffer";xhr.onload=function(){if(xhr.status
===200||xhr.status===0&&xhr.response){onload(xhr.response);return}onerror();}xhr.onerror=onerror;xhr.send(null)
}setWindowTitle=function(title){document.title=title}else{}if(ENVIRONMENT_IS_NODE){if(typeof
performance==="undefined"){global.performance=require("perf_hooks").performance}}var
out=Module["print"]||console.log.bind(console);var err=Module["printErr"]||console.warn.bind(console);for(key
in
moduleOverrides){if(moduleOverrides.hasOwnProperty(key)){Module[key]=moduleOverrides[key]}}moduleOverr
ides=null;if(Module["arguments"])arguments_=Module["arguments"];if(Module["thisProgram"])thisProgram=
Module["thisProgram"];if(Module["quit"])quit_=Module["quit"];function
warnOnce(text){if(!warnOnce.shown)warnOnce.shown={};if(!warnOnce.shown[text]){warnOnce.shown[text]=1;er
r(text)}var Atomics_load=Atomics.load;var Atomics_store=Atomics.store;var
Atomics_compareExchange=Atomics.compareExchange;var
wasmBinary;if(Module["wasmBinary"])wasmBinary=Module["wasmBinary"];var
noExitRuntime=Module["noExitRuntime"]||true;if(typeof WebAssembly!=="object"){abort("no

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```

native wasm support detected\")}var wasmMemory;var wasmModule;var ABORT=false;var
EXITSTATUS;function assert(condition,text){if(!condition){abort(\"Assertion failed: \"+text)}}function
getCFunc(ident){var func=Module[\"_\"+ident];assert(func,\"Cannot call unknown function \"+ident+\", make sure
it is exported\");return func}function ccall(ident,returnType,argTypes,args,opts){var
toC={\"string\":function(str){var ret=0;if(str!==null&&str!==undefined&&str!==0){var
len=(str.length<<2)+1;ret=stackAlloc(len);stringToUTF8(str,ret,len)}return ret},\"array\":function(arr){var
ret=stackAlloc(arr.length);writeArrayToMemory(arr,ret);return ret}};function
convertReturnValue(ret){if(returnType===\"string\")return UTF8ToString(ret);if(returnType===\"boolean\")return
Boolean(ret);return ret}var func=getCFunc(ident);var cArgs=[];var stack=0;if(args){for(var
i=0;i<args.length;i++){var
converter=toC[argTypes[i]];if(converter){if(stack===0)stack=stackSave();cArgs[i]=converter(args[i])}else{cArgs[i]
]=args[i]}}var
ret=func.apply(null,cArgs);ret=convertReturnValue(ret);if(stack!==0)stackRestore(stack);return ret}function
cwrap(ident,returnType,argTypes,opts){argTypes=argTypes||[];var
numericArgs=argTypes.every(function(type){return type===\"number\"});var
numericRet=returnType!==\"string\";if(numericRet&&numericArgs&&!opts){return getCFunc(ident)}return
function(){return ccall(ident,returnType,argTypes,arguments,opts)}}function
UTF8ArrayToString(heap,idx,maxBytesToRead){var endIdx=idx+maxBytesToRead;var
str=\"\";while(!(idx>=endIdx)){var u0=heap[idx++];if(!u0)return
str;if(!(u0&128)){str+=String.fromCharCode(u0);continue}var
u1=heap[idx++]&63;if((u0&224)==192){str+=String.fromCharCode((u0&31)<<6|u1);continue}var
u2=heap[idx++]&63;if((u0&240)==224){u0=(u0&15)<<12|u1<<6|u2}else{u0=(u0&7)<<18|u1<<12|u2<<6|heap[id
x++]&63}if(u0<65536){str+=String.fromCharCode(u0)}else{var ch=u0-
65536;str+=String.fromCharCode(55296|ch>>10,56320|ch&1023)}}return str}function
UTF8ToString(ptr,maxBytesToRead){return
ptr?UTF8ArrayToString(GROWABLE_HEAP_U8(),ptr,maxBytesToRead):\"\"}function
stringToUTF8Array(str,heap,outIdx,maxBytesToWrite){if(!(maxBytesToWrite>0))return 0;var startIdx=outIdx;var
endIdx=outIdx+maxBytesToWrite-1;for(var i=0;i<str.length;++i){var
u=str.charCodeAt(i);if(u>=55296&&u<=57343){var
u1=str.charCodeAt(++i);u=65536+((u&1023)<<10|u1&1023)}if(u<=127){if(outIdx>=endIdx)break;heap[outIdx++]
=u}else if(u<=2047){if(outIdx+1>=endIdx)break;heap[outIdx++]=192|u>>6;heap[outIdx++]=128|u&63}else
if(u<=65535){if(outIdx+2>=endIdx)break;heap[outIdx++]=224|u>>12;heap[outIdx++]=128|u>>6&63;heap[outIdx
++]=128|u&63}else{if(outIdx+3>=endIdx)break;heap[outIdx++]=240|u>>18;heap[outIdx++]=128|u>>12&63;heap[
outIdx++]=128|u>>6&63;heap[outIdx++]=128|u&63}}heap[outIdx]=0;return outIdx-startIdx}function
stringToUTF8(str,outPtr,maxBytesToWrite){return
stringToUTF8Array(str,GROWABLE_HEAP_U8(),outPtr,maxBytesToWrite)}function lengthBytesUTF8(str){var
len=0;for(var i=0;i<str.length;++i){var
u=str.charCodeAt(i);if(u>=55296&&u<=57343)u=65536+((u&1023)<<10|str.charCodeAt(++i)&1023);if(u<=127)+
+len;else if(u<=2047)len+=2;else if(u<=65535)len+=3;else len+=4}return len}function
writeArrayToMemory(array,buffer){GROWABLE_HEAP_I8().set(array,buffer)}function
alignUp(x,multiple){if(x%multiple>0){x+=multiple-x%multiple}return x}var
buffer,HEAP8,HEAPU8,HEAP16,HEAPU16,HEAP32,HEAPU32,HEAPF32,HEAPF64;function
updateGlobalBufferAndViews(buf){buffer=buf;Module[\"HEAP8\"]=HEAP8=new
Int8Array(buf);Module[\"HEAP16\"]=HEAP16=new Int16Array(buf);Module[\"HEAP32\"]=HEAP32=new
Int32Array(buf);Module[\"HEAPU8\"]=HEAPU8=new Uint8Array(buf);Module[\"HEAPU16\"]=HEAPU16=new
Uint16Array(buf);Module[\"HEAPU32\"]=HEAPU32=new
Uint32Array(buf);Module[\"HEAPF32\"]=HEAPF32=new
Float32Array(buf);Module[\"HEAPF64\"]=HEAPF64=new Float64Array(buf)}var

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INITIAL_MEMORY=Module["INITIAL_MEMORY"]||16777216;if(ENVIRONMENT_IS_PTHREAD){wasmMemory=Module["wasmMemory"];buffer=Module["buffer"]}else{if(Module["wasmMemory"]){wasmMemory=Module["wasmMemory"]}else{wasmMemory=new
WebAssembly.Memory({"initial":INITIAL_MEMORY/65536,"maximum":2147483648/65536,"shared":true});
if(!(wasmMemory.buffer instanceof SharedArrayBuffer)){err("requested a shared WebAssembly.Memory but the
returned buffer is not a SharedArrayBuffer, indicating that while the browser has SharedArrayBuffer it does not
have WebAssembly threads support - you may need to set a
flag");if(ENVIRONMENT_IS_NODE){console.log("(on node you may need: --experimental-wasm-threads --
experimental-wasm-bulk-memory and also use a recent version)")}throw Error("bad
memory")}}if(wasmMemory){buffer=wasmMemory.buffer}INITIAL_MEMORY=buffer.byteLength;updateGlobalBufferAndViews(buffer);var wasmTable;var __ATPRERUN__=[];var __ATINIT__=[];var __ATMAIN__=[];var
__ATEXIT__=[];var __ATPOSTRUN__=[];var runtimeInitialized=false;var
runtimeExited=false;if(!ENVIRONMENT_IS_PTHREAD)__ATINIT__.push({func:function(){__wasm_call_ctors()});function
preRun(){if(ENVIRONMENT_IS_PTHREAD)return;if(Module["preRun"]){if(typeof
Module["preRun"]=="function")Module["preRun"]=[Module["preRun"]];while(Module["preRun"].length){a
ddOnPreRun(Module["preRun"].shift())}callRuntimeCallbacks(__ATPRERUN__)}function
initRuntime(){runtimeInitialized=true;if(ENVIRONMENT_IS_PTHREAD)return;callRuntimeCallbacks(__ATINIT
__)}function
preMain(){if(ENVIRONMENT_IS_PTHREAD)return;callRuntimeCallbacks(__ATMAIN__)}function
exitRuntime(){if(ENVIRONMENT_IS_PTHREAD)return;runtimeExited=true}function
postRun(){if(ENVIRONMENT_IS_PTHREAD)return;if(Module["postRun"]){if(typeof
Module["postRun"]=="function")Module["postRun"]=[Module["postRun"]];while(Module["postRun"].lengt
h){addOnPostRun(Module["postRun"].shift())}callRuntimeCallbacks(__ATPOSTRUN__)}function
addOnPreRun(cb){__ATPRERUN__.unshift(cb)}function addOnPostRun(cb){__ATPOSTRUN__.unshift(cb)}var
runDependencies=0;var runDependencyWatcher=null;var dependenciesFulfilled=null;function
addRunDependency(id){assert(!ENVIRONMENT_IS_PTHREAD,"addRunDependency cannot be used in a
pthread
worker");runDependencies++;if(Module["monitorRunDependencies"]){Module["monitorRunDependencies"](ru
nDependencies)}}function removeRunDependency(id){runDependencies--
;if(Module["monitorRunDependencies"]){Module["monitorRunDependencies"](runDependencies)}if(runDepend
encies==0){if(runDependencyWatcher!==null){clearInterval(runDependencyWatcher);runDependencyWatcher=nul
l}if(dependenciesFulfilled){var
callback=dependenciesFulfilled;dependenciesFulfilled=null;callback()}}Module["preloadedImages"]={};Module
["preloadedAudios"]={};function
abort(what){if(Module["onAbort"]){Module["onAbort"](what)}if(ENVIRONMENT_IS_PTHREAD)console.err
or("Pthread aborting at "+(new
Error).stack);what+="\n";err(what);ABORT=true;EXITSTATUS=1;what+="abort("+what+"). Build with -s
ASSERTIONS=1 for more info.";var e=new WebAssembly.RuntimeError(what);readyPromiseReject(e);throw
e}function hasPrefix(str,prefix){return
String.prototype.startsWith?str.startsWith(prefix):str.indexOf(prefix)===0}var
dataURIPrefix="data:application/octet-stream;base64,";function isDataURI(filename){return
hasPrefix(filename,dataURIPrefix)}var fileURIPrefix="file://^";function isFileURI(filename){return
hasPrefix(filename,fileURIPrefix)}var wasmBinaryFile="tfjs-backend-wasm-threaded-
simd.wasm";if(!isDataURI(wasmBinaryFile)){wasmBinaryFile=locateFile(wasmBinaryFile)}function
getBinary(file){try{if(file===wasmBinaryFile&&wasmBinaryFile){return new
Uint8Array(wasmBinaryFile)}if(readBinary){return readBinary(file)}else{throw"both async and sync fetching of the
wasm failed"}}catch(err){abort(err)}}function

```

```

getBinaryPromise(){if(!wasmBinary&&(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER)){if(typeof
fetch===\"function\"&&!isFileURI(wasmBinaryFile)){return fetch(wasmBinaryFile,{credentials:\"same-
origin\"}).then(function(response){if(!response[\"ok\"]){throw\"failed to load wasm binary file at
\"+wasmBinaryFile+\"\"}return
response[\"arrayBuffer\"]()).catch(function(){return getBinary(wasmBinaryFile)}})else{if(readAsync){return new
Promise(function(resolve,reject){readAsync(wasmBinaryFile,function(response){resolve(new
Uint8Array(response)),reject}})}return Promise.resolve().then(function(){return
getBinary(wasmBinaryFile)})}function createWasm(){var info={\"a\":asmLibraryArg};function
receiveInstance(instance,module){var
exports=instance.exports;Module[\"asm\"]=exports;wasmTable=Module[\"asm\"][\"I\"];wasmModule=module;if(!E
NVIRONMENT_IS_PTHREAD){var
numWorkersToLoad=PThread.unusedWorkers.length;PThread.unusedWorkers.forEach(function(w){PThread.load
WasmModuleToWorker(w,function(){if(!--numWorkersToLoad)removeRunDependency(\"wasm-
instantiate\")}))}if(!ENVIRONMENT_IS_PTHREAD){addRunDependency(\"wasm-instantiate\")}function
receiveInstantiatedSource(output){receiveInstance(output[\"instance\"],output[\"module\"])}function
instantiateArrayBuffer(receiver){return getBinaryPromise().then(function(binary){return
WebAssembly.instantiate(binary,info)}).then(receiver,function(reason){err(\"failed to asynchronously prepare
wasm: \"+reason);abort(reason)})}function instantiateAsync(){if(!wasmBinary&&typeof
WebAssembly.instantiateStreaming===\"function\"&&!isDataURI(wasmBinaryFile)&&!isFileURI(wasmBinaryFil
e)&&typeof fetch===\"function\"){return fetch(wasmBinaryFile,{credentials:\"same-
origin\"}).then(function(response){var result=WebAssembly.instantiateStreaming(response,info);return
result.then(receiveInstantiatedSource,function(reason){err(\"wasm streaming compile failed: \"+reason);err(\"falling
back to ArrayBuffer instantiation\");return instantiateArrayBuffer(receiveInstantiatedSource)}))}else{return
instantiateArrayBuffer(receiveInstantiatedSource)}if(Module[\"instantiateWasm\"]){try{var
exports=Module[\"instantiateWasm\"](info,receiveInstance);return exports}catch(e){err(\"Module.instantiateWasm
callback failed with error: \"+e);return false}}instantiateAsync().catch(rejectPromiseReject);return}}var
ASM_CONSTS={10520:function(){throw\"Canceled!\"},10538:function($0,$1){setTimeout(function(){__emscript
en_do_dispatch_to_thread($0,$1),0});function initPthreadsJS(){PThread.initRuntime()}function
callRuntimeCallbacks(callbacks){while(callbacks.length>0){var callback=callbacks.shift();if(typeof
callback===\"function\"){callback(Module);continue}var func=callback.func;if(typeof
func===\"number\"){if(callback.arg===undefined){wasmTable.get(func)}else{wasmTable.get(func)(callback.arg
)}}else{func(callback.arg===undefined?null:callback.arg)}}}var
ERRNO_CODES={EPERM:63,ENOENT:44,ESRCH:71,EINTR:27,EIO:29,ENXIO:60,E2BIG:1,ENOEXEC:45,E
BADF:8,ECHILD:12,EAGAIN:6,EWOULDBLOCK:6,ENOMEM:48,EACCES:2,EFAULT:21,ENOTBLK:105,EB
USY:10,EEXIST:20,EXDEV:75,ENODEV:43,ENOTDIR:54,EISDIR:31,EINVAL:28,ENFILE:41,EMFILE:33,EN
OTTY:59,ETXTBSY:74,EFBIG:22,ENOSPC:51,ESPIPE:70,EROFS:69,EMLINK:34,EPIPE:64,EDOM:18,ERAN
GE:68,ENOMSG:49,EIDRM:24,ECHRNG:106,EL2NSYNC:156,EL3HLT:107,EL3RST:108,ELNRNG:109,EUNA
TCH:110,ENOSIG:111,EL2HLT:112,EDEADLK:16,ENOLCK:46,EBADE:113,EBADR:114,EXFULL:115,ENOA
NO:104,EBADRQC:103,EBADSLT:102,EDEADLOCK:16,EBFONT:101,ENOSTR:100,ENODATA:116,ETIME:
117,ENOSR:118,ENONET:119,ENOPKG:120,EREMOTE:121,ENOLINK:47,EADV:122,ESRMNT:123,ECOMM
:124,EPROTO:65,EMULTIHOP:36,EDOTDOT:125,EBADMSG:9,ENOTUNIQ:126,EBADFD:127,EREMCHG:1
28,ELIBACC:129,ELIBBAD:130,ELIBSCN:131,ELIBMAX:132,ELIBEXEC:133,ENOSYS:52,ENOTEMPTY:55,
ENAMETOOLONG:37,ELOOP:32,EOPNOTSUPP:138,EPFNOSUPPORT:139,ECONNRESET:15,ENOBUFS:42,
EAFNOSUPPORT:5,EPROTOTYPE:67,ENOTSOCK:57,ENOPROTOOPT:50,ESHUTDOWN:140,ECONNREFU
SED:14,EADDRINUSE:3,ECONNABORTED:13,ENETUNREACH:40,ENETDOWN:38,ETIMEDOUT:73,EHOS
TDOWN:142,EHOSTUNREACH:23,EINPROGRESS:26,EALREADY:7,EDESTADDRREQ:17,EMSGSIZE:35,E
PROTONOSUPPORT:66,ESOCKTNOSUPPORT:137,EADDRNOTAVAIL:4,ENETRESET:39,EISCONN:30,EN
OTCONN:53,ETOOMANYREFS:141,EUSERS:136,EDQUOT:19,ESTALE:72,ENOTSUP:138,ENOMEDIUM:14

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```

8,EILSEQ:25,E_OVERFLOW:61,ECANCELED:11,ENOTRECOVERABLE:56,EOWNERDEAD:62,ESTRPIPE:13
5};function
_emsripten_futex_wake(addr,count){if(addr<=0||addr>GROWABLE_HEAP_I8().length||addr&3!=0||count<0)retu
rn-28;if(count==0)return 0;if(count>=2147483647)count=Infinity;var
mainThreadWaitAddress=Atomics.load(GROWABLE_HEAP_I32(),__emsripten_main_thread_futex>>2);var
mainThreadWoken=0;if(mainThreadWaitAddress==addr){var
loadedAddr=Atomics.compareExchange(GROWABLE_HEAP_I32(),__emsripten_main_thread_futex>>2,mainTh
readWaitAddress,0);if(loadedAddr==mainThreadWaitAddress){--count;mainThreadWoken=1;if(count<=0)return
1}}var ret=Atomics.notify(GROWABLE_HEAP_I32(),addr>>2,count);if(ret>=0)return
ret+mainThreadWoken;throw`Atomics.notify returned an unexpected value
`+ret}Module["_emsripten_futex_wake"]=_emsripten_futex_wake;function
killThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw`Internal Error! killThread() can only ever be
called from main application thread!`;if(!pthread_ptr)throw`Internal Error! Null pthread_ptr in
killThread!`;GROWABLE_HEAP_I32()[pthread_ptr+12>>2]=0;var
pthread=PThread.threads[pthread_ptr];pthread.worker.terminate();PThread.freeThreadData(pthread);PThread.runni
ngWorkers.splice(PThread.runningWorkers.indexOf(pthread.worker),1);pthread.worker pthread=undefined}functio
n cancelThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw`Internal Error! cancelThread() can only
ever be called from main application thread!`;if(!pthread_ptr)throw`Internal Error! Null pthread_ptr in
cancelThread!`;var
pthread=PThread.threads[pthread_ptr];pthread.worker.postMessage({"cmd\":"cancel"})}function
cleanupThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw`Internal Error! cleanupThread() can only
ever be called from main application thread!`;if(!pthread_ptr)throw`Internal Error! Null pthread_ptr in
cleanupThread!`;var
pthread=PThread.threads[pthread_ptr];if(pthread){GROWABLE_HEAP_I32()[pthread_ptr+12>>2]=0;var
worker=pthread.worker;PThread.returnWorkerToPool(worker)}var
PThread={unusedWorkers:[],runningWorkers:[],initMainThreadBlock:function(){var
pthreadPoolSize=8;for(var
i=0;i<pthreadPoolSize;++i){PThread.allocateUnusedWorker()};initRuntime:function(){var
tb=_malloc(228);for(var
i=0;i<228/4;++i)GROWABLE_HEAP_U32()[tb/4+i]=0;GROWABLE_HEAP_I32()[tb+12>>2]=tb;var
headPtr=tb+152;GROWABLE_HEAP_I32()[headPtr>>2]=headPtr;var tlsMemory=_malloc(512);for(var
i=0;i<128;++i)GROWABLE_HEAP_U32()[tlsMemory/4+i]=0;Atomics.store(GROWABLE_HEAP_U32(),tb+100
>>2,tlsMemory);Atomics.store(GROWABLE_HEAP_U32(),tb+40>>2,tb);__emsripten_thread_init(tb,!ENVIRON
MENT_IS_WORKER,1);_emsripten_register_main_browser_thread_id(tb);initWorker:function(){},threads:{},t
hreadExitHandlers:[],setThreadStatus:function(){},runExitHandlers:function(){while(PThread.threadExitHandlers.l
ength>0){PThread.threadExitHandlers.pop()};if(ENVIRONMENT_IS_PTHREAD&&pthread_self())__pthread
_tsd_run_dtors(),runExitHandlersAndDeinitThread:function(tb,exitCode){Atomics.store(GROWABLE_HEAP_U
32(),tb+56>>2,1);Atomics.store(GROWABLE_HEAP_U32(),tb+60>>2,0);PThread.runExitHandlers();Atomics.stor
e(GROWABLE_HEAP_U32(),tb+4>>2,exitCode);Atomics.store(GROWABLE_HEAP_U32(),tb+0>>2,1);_emscri
pten_futex_wake(tb+0,2147483647);__emsripten_thread_init(0,0,0)},threadExit:function(exitCode){var
tb=_pthread_self();if(tb){PThread.runExitHandlersAndDeinitThread(tb,exitCode);if(ENVIRONMENT_IS_PTHRE
AD){postMessage({"cmd\":"exit"})}},threadCancel:function(){PThread.runExitHandlersAndDeinitThread(_pthr
ead_self(),-1);postMessage({"cmd\":"cancelDone"})},terminateAllThreads:function(){for(var t in
PThread.threads){var
pthread=PThread.threads[t];if(pthread&&pthread.worker){PThread.returnWorkerToPool(pthread.worker)}}PThr
ead.threads={};for(var i=0;i<PThread.unusedWorkers.length;++i){var
worker=PThread.unusedWorkers[i];worker.terminate()}PThread.unusedWorkers=[];for(var
i=0;i<PThread.runningWorkers.length;++i){var worker=PThread.runningWorkers[i];var

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pthread=worker.pthread;PThread.freeThreadData(pthread);worker.terminate()}PThread.runningWorkers=[],freeTh
readData:function(pthread){if(!pthread)return;if(pthread.threadInfoStruct){var
tlsMemory=GROWABLE_HEAP_I32()[pthread.threadInfoStruct+100>>2];GROWABLE_HEAP_I32()[pthread.thr
eadInfoStruct+100>>2]=0;_free(tlsMemory);_free(pthread.threadInfoStruct)}pthread.threadInfoStruct=0;if(pthread.
allocatedOwnStack&&pthread.stackBase)_free(pthread.stackBase);pthread.stackBase=0;if(pthread.worker)pthread.
worker.pthread=null},returnWorkerToPool:function(worker){PThread.runWithoutMainThreadQueuedCalls(funcio
n()){delete
PThread.pthreads[worker.pthread.threadInfoStruct];PThread.unusedWorkers.push(worker);PThread.runningWorker
s.splice(PThread.runningWorkers.indexOf(worker),1);PThread.freeThreadData(worker.pthread);worker.pthread=un
defined}},runWithoutMainThreadQueuedCalls:function(func){GROWABLE_HEAP_I32()[__emscripten_allow_m
ain_runtime_queued_calls>>2]=0;try{func()}finally{GROWABLE_HEAP_I32()[__emscripten_allow_main_runti
me_queued_calls>>2]=1}},receiveObjectTransfer:function(data){},loadWasmModuleToWorker:function(worker,o
nFinishedLoading){worker.onmessage=function(e){var
d=e["data"];var
cmd=d["cmd"];if(worker.pthread)PThread.currentProxiedOperationCallerThread=worker.pthread.threadInfoStruct;
if(d["targetThread"]&&d["targetThread"]!=_pthread_self()){var
thread=PThread.pthreads[d.targetThread];if(thread){thread.worker.postMessage(e.data,d["transferList"])}else{con
sole.error('Internal error! Worker sent a message \''+cmd+'\' to target pthread '+d["targetThread"]+'\', but that
thread no longer
exists!')}PThread.currentProxiedOperationCallerThread=undefined;return}if(cmd===\'processQueuedMainThread
Work\'){_emscripten_main_thread_process_queued_calls()}else
if(cmd===\'spawnThread\'){spawnThread(e.data)}else
if(cmd===\'cleanupThread\'){cleanupThread(d["thread"])}else
if(cmd===\'killThread\'){killThread(d["thread"])}else
if(cmd===\'cancelThread\'){cancelThread(d["thread"])}else
if(cmd===\'loaded\'){worker.loaded=true;if(onFinishedLoading)onFinishedLoading(worker);if(worker.runPthread)
{worker.runPthread();delete
worker.runPthread}}else if(cmd===\'print\'){out("Thread \''+d["threadId"]+'\' : \''+d["text"]')}else
if(cmd===\'printErr\'){err("Thread \''+d["threadId"]+'\' : \''+d["text"]')}else if(cmd===\'alert\'){alert("Thread
'+d["threadId"]+'\' : \''+d["text"]')}else if(cmd===\'exit\'){var
detached=worker.pthread&&Atomics.load(GROWABLE_HEAP_U32(),worker.pthread.threadInfoStruct+64>>2);if
(detached){PThread.returnWorkerToPool(worker)}else
if(cmd===\'exitProcess\'){try{exit(d["returnCode"])}catch(e){if(e instanceof ExitStatus)return;throw e}}else
if(cmd===\'cancelDone\'){PThread.returnWorkerToPool(worker)}else
if(cmd===\'objectTransfer\'){PThread.receiveObjectTransfer(e.data)}else
if(e.data.target===\'setimmediate\'){worker.postMessage(e.data)}else{err(\'worker sent an unknown command
'+cmd)}PThread.currentProxiedOperationCallerThread=undefined};worker.onerror=function(e){err("pthread sent
an error! \''+e.filename+'\' : \''+e.lineno+'\' :
'+e.message)};if(ENVIRONMENT_IS_NODE){worker.on("message",function(data){worker.onmessage({data:d
ata}});worker.on("error",function(data){worker.onerror(data)});worker.on("exit",function(data){})}worker.post
Message({"cmd":\'load\',\'urlOrBlob\':Module["mainScriptUrlOrBlob"]||_scriptDir,\'wasmMemory\':wasmMe
memory,\'wasmModule\':wasmModule}),allocateUnusedWorker:function(){var
pthreadMainJs=locateFile(\'tfjs-backend-wasm-threaded-simd.worker.js\');PThread.unusedWorkers.push(new
Worker(pthreadMainJs)),getNewWorker:function(){if(PThread.unusedWorkers.length===0){PThread.allocateUnus
edWorker();PThread.loadWasmModuleToWorker(PThread.unusedWorkers[0])}if(PThread.unusedWorkers.length>
0)return PThread.unusedWorkers.pop();else return null},busySpinWait:function(msecs){var
t=performance.now()+msecs;while(performance.now()<t){}}};function
establishStackSpace(stackTop,stackMax){_emscripten_stack_set_limits(stackTop,stackMax);stackRestore(stackTop

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})Module["establishStackSpace"]=establishStackSpace;function getNoExitRuntime(){return
noExitRuntime}Module["getNoExitRuntime"]=getNoExitRuntime;function invokeEntryPoint(ptr,arg){return
wasmTable.get(ptr)(arg)}Module["invokeEntryPoint"]=invokeEntryPoint;function
__assert_fail(condition,filename,line,func){abort("Assertion failed: "+UTF8ToString(condition)+"", at:
"+[filename?UTF8ToString(filename):"unknown filename"],line,func?UTF8ToString(func):"unknown
function")})function __call_main(argc,argv){var returnCode=_main(argc,argv)}var
_emsripten_get_now;if(ENVIRONMENT_IS_NODE){_emsripten_get_now=function(){var
t=process["hrtime"]();return t[0]*1e3+t[1]/1e6}}else
if(ENVIRONMENT_IS_PTHREAD){_emsripten_get_now=function(){return performance.now()-
Module["__performance_now_clock_drift"]}}else if(typeof
dateNow!="undefined"){_emsripten_get_now=dateNow}else _emsripten_get_now=function(){return
performance.now()};function setErrNo(value){GROWABLE_HEAP_I32()[__errno_location()>>2]=value;return
value}function _atexit(func,arg){if(ENVIRONMENT_IS_PTHREAD)return
_emsripten_proxy_to_main_thread_js(1,1,func,arg)}function
_emsripten_notify_thread_queue(targetThreadId,mainThreadId){if(targetThreadId==mainThreadId){postMessag
e({"cmd":"processQueuedMainThreadWork"})}else
if(ENVIRONMENT_IS_PTHREAD){postMessage({"targetThread":targetThreadId,"cmd":"processThreadQueue
e"})}else {var pthread=PThread.pthreads[targetThreadId];var
worker=pthread&&pthread.worker;if(!worker){return}worker.postMessage({"cmd":"processThreadQueuee"})}ret
urn 1}function _abort(){abort()}function _emsripten_asm_const_int(code,sigPtr,argbuf){var
args=readAsmConstArgs(sigPtr,argbuf);return ASM_CONSTS[code].apply(null,args)}function
_emsripten_conditional_set_current_thread_status(expectedStatus,newStatus){}function
_emsripten_futex_wait(addr,val,timeout){if(addr<=0||addr>GROWABLE_HEAP_I8().length||addr&3!=0)return-
28;if(!ENVIRONMENT_IS_WEB){var
ret=Atomics.wait(GROWABLE_HEAP_I32(),addr>>2,val,timeout);if(ret==="timed-out")return-
73;if(ret==="not-equal")return-6;if(ret==="ok")return
0;throw"Atomics.wait returned an unexpected value
"+ret}else {if(Atomics.load(GROWABLE_HEAP_I32(),addr>>2)!=val){return-6}var
tNow=performance.now();var tEnd=tNow+timeout;var
lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emsripten_main_thread_futex>>2,addr);while(1){tNo
w=performance.now();if(tNow>tEnd){lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emsripten_mai
n_thread_futex>>2,0);return-
73}lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emsripten_main_thread_futex>>2,0);if(lastAddr==
0){break}_emsripten_main_thread_process_queued_calls();if(Atomics.load(GROWABLE_HEAP_I32(),addr>>2)
==val){return-
6}lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emsripten_main_thread_futex>>2,addr)}return
0}}function
_emsripten_memcpy_big(dest,src,num){GROWABLE_HEAP_U8().copyWithin(dest,src,src+num)}function
_emsripten_num_logical_cores(){if(ENVIRONMENT_IS_NODE)return require("os").cpus().length;return
navigator["hardwareConcurrency"]}function
_emsripten_proxy_to_main_thread_js(index,sync){var numCallArgs=arguments.length-2;var
stack=stackSave();var serializedNumCallArgs=numCallArgs;var args=stackAlloc(serializedNumCallArgs*8);var
b=args>>3;for(var i=0;i<numCallArgs;i++){var arg=arguments[2+i];GROWABLE_HEAP_F64()[b+i]=arg}var
ret=_emsripten_run_in_main_runtime_thread_js(index,serializedNumCallArgs,args,sync);stackRestore(stack);retur
n ret}var _emsripten_receive_on_main_thread_js_callArgs=[];var readAsmConstArgsArray=[];function
readAsmConstArgs(sigPtr,buf){readAsmConstArgsArray.length=0;var
ch;buf>>=2;while(ch=GROWABLE_HEAP_U8()[sigPtr++){var
double=ch<105;if(double&&buf&1)buf++;readAsmConstArgsArray.push(double?GROWABLE_HEAP_F64()[buf

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++>>1]:GROWABLE_HEAP_I32()[buf]);++buf}return readAsmConstArgsArray}function
_emsripten_receive_on_main_thread_js(index,numCallArgs,args){_emsripten_receive_on_main_thread_js_callA
rgs.length=numCallArgs;var b=args>>3;for(var
i=0;i<numCallArgs;i++){_emsripten_receive_on_main_thread_js_callArgs[i]=GROWABLE_HEAP_F64()[b+i]}v
ar
isEmAsmConst=index<0;var func=!isEmAsmConst?proxiedFunctionTable[index]:ASM_CONSTS[-index-
1];return func.apply(null,_emsripten_receive_on_main_thread_js_callArgs)}function
_emsripten_get_heap_size(){return GROWABLE_HEAP_U8().length}function
emsripten_realloc_buffer(size){try{wasmmMemory.grow(size-
buffer.byteLength+65535>>>16);updateGlobalBufferAndViews(wasmmMemory.buffer);return
1}catch(e){}}function _emsripten_resize_heap(requestedSize){var
oldSize=_emsripten_get_heap_size();if(requestedSize<=oldSize){return false}var
maxHeapSize=2147483648;if(requestedSize>maxHeapSize){return false}for(var
cutDown=1;cutDown<=4;cutDown*=2){var
overGrownHeapSize=oldSize*(1+.2/cutDown);overGrownHeapSize=Math.min(overGrownHeapSize,requestedSize
+100663296);var
newSize=Math.min(maxHeapSize,alignUp(Math.max(requestedSize,overGrownHeapSize),65536));var
replacement=emsripten_realloc_buffer(newSize);if(replacement){return true}}return false}var
JSEvents={inEventHandler:0,removeAllEventListeners:function(){for(var
i=JSEvents.eventHandlers.length-1;i>=0;--
i){JSEvents._removeHandler(i)}JSEvents.eventHandlers=[];JSEvents.deferredCalls=[]},registerRemoveEventListen
ers:function(){if(!JSEvents.removeEventListenersRegistered){__ATEXIT__.push(JSEvents.removeAllEventListene
rs);JSEvents.removeEventListenersRegistered=true}},deferredCalls:[],deferCall:function(targetFunction,precedence
,argsList){function arraysHaveEqualContent(arrA,arrB){if(arrA.length!=arrB.length)return false;for(var i in
arrA){if(arrA[i]!=arrB[i])return false}return true}for(var i in JSEvents.deferredCalls){var
call=JSEvents.deferredCalls[i];if(call.targetFunction==targetFunction&&arraysHaveEqualContent(call.argsList,args
List)){return}}JSEvents.deferredCalls.push({targetFunction:targetFunction,precedence:precedence,argsList:argsList
});JSEvents.deferredCalls.sort(function(x,y){return
x.precedence<y.precedence}),removeDeferredCalls:function(targetFunction){for(var
i=0;i<JSEvents.deferredCalls.length;++i){if(JSEvents.deferredCalls[i].targetFunction==targetFunction){JSEvents.d
eferredCalls.splice(i,1);--i}},canPerformEventHandlerRequests:function(){return
JSEvents.inEventHandler&&JSEvents.currentEventHandler.allowsDeferredCalls},runDeferredCalls:function(){if(!J
SEvents.canPerformEventHandlerRequests()){return}for(var i=0;i<JSEvents.deferredCalls.length;++i){var
call=JSEvents.deferredCalls[i];JSEvents.deferredCalls.splice(i,1);--
i;call.targetFunction.apply(null,call.argsList)},eventHandlers:[],removeAllHandlersOnTarget:function(target,event
TypeString){for(var
i=0;i<JSEvents.eventHandlers.length;++i){if(JSEvents.eventHandlers[i].target==target&&(!eventTypeString||event
TypeString==JSEvents.eventHandlers[i].eventTypeString)){JSEvents._removeHandler(i--
)}}},_removeHandler:function(i){var
h=JSEvents.eventHandlers[i];h.target.removeEventListener(h.eventTypeString,h.eventListenerFunc,h.useCapture);J
SEvents.eventHandlers.splice(i,1)},registerOrRemoveHandler:function(eventHandler){var
jsEventHandler=function
jsEventHandler(event){++JSEvents.inEventHandler;JSEvents.currentEventHandler=eventHandler;JSEvents.runDef
erredCalls();eventHandler.handlerFunc(event);JSEvents.runDeferredCalls();--
JSEvents.inEventHandler};if(eventHandler.callbackfunc){eventHandler.eventListenerFunc=jsEventHandler;eventH
andler.target.addEventListener(eventHandler.eventTypeString,jsEventHandler,eventHandler.useCapture);JSEvents.e
ventHandlers.push(eventHandler);JSEvents.registerRemoveEventListeners()}else{for(var
i=0;i<JSEvents.eventHandlers.length;++i){if(JSEvents.eventHandlers[i].target==eventHandler.target&&JSEvents.e

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ventHandlers[i].eventTypeString===eventHandler.eventTypeString){JSEvents._removeHandler(i--
)}}},queueEventHandlerOnThread_iiii:function(targetThread,eventHandlerFunc,eventTypeId,eventData,userData)
{var stackTop=stackSave();var
varargs=stackAlloc(12);GROWABLE_HEAP_I32()[varargs>>2]=eventTypeId;GROWABLE_HEAP_I32()[varargs
+4>>2]=eventData;GROWABLE_HEAP_I32()[varargs+8>>2]=userData;__emscripten_call_on_thread(0,targetThr
ead,637534208,eventHandlerFunc,eventData,varargs);stackRestore(stackTop)},getTargetThreadForEventCallback:f
unction(targetThread){switch(targetThread){case
1:return 0;case 2:return PThread.currentProxiedOperationCallerThread;default:return
targetThread}},getNodeNameForTarget:function(target){if(!target)return\"";if(target===window)return\"#window\";
if(target===screen)return\"#screen\";return
target&&target.nodeName?target.nodeName:\"\"},fullscreenEnabled:function(){return
document.fullscreenEnabled||document.webkitFullscreenEnabled}};function stringToNewUTF8(jsString){var
length=lengthBytesUTF8(jsString)+1;var cString=_malloc(length);stringToUTF8(jsString,cString,length);return
cString}function
_emscripten_set_offscreencanvas_size_on_target_thread_js(targetThread,targetCanvas,width,height){var
stackTop=stackSave();var varargs=stackAlloc(12);var
targetCanvasPtr=0;if(targetCanvas){targetCanvasPtr=stringToNewUTF8(targetCanvas)}GROWABLE_HEAP_I32(
)[varargs>>2]=targetCanvasPtr;GROWABLE_HEAP_I32()[varargs+4>>2]=width;GROWABLE_HEAP_I32()[var
args+8>>2]=height;__emscripten_call_on_thread(0,targetThread,657457152,0,targetCanvasPtr,varargs);stackRestor
e(stackTop)}function
_emscripten_set_offscreencanvas_size_on_target_thread(targetThread,targetCanvas,width,height){targetCanvas=tar
getCanvas?UTF8ToString(targetCanvas):\"\";_emscripten_set_offscreencanvas_size_on_target_thread_js(targetThr
ead,targetCanvas,width,height)}function maybeCStringToJsString(cString){return
cString>2?UTF8ToString(cString):cString}var specialHTMLTargets=[0,typeof
document!=\"undefined\"?document:0,typeof window!=\"undefined\"?window:0];function
findEventTarget(target){target=maybeCStringToJsString(target);var
domElement=specialHTMLTargets[target]||(typeof
document!=\"undefined\"?document.querySelector(target):undefined);return domElement}function
findCanvasEventTarget(target){return findEventTarget(target)}function
_emscripten_set_canvas_element_size_calling_thread(target,width,height){var
canvas=findCanvasEventTarget(target);if(!canvas)return-
4;if(canvas.canvasSharedPtr){GROWABLE_HEAP_I32()[canvas.canvasSharedPtr>>2]=width;GROWABLE_HEA
P_I32()[canvas.canvasSharedPtr+4>>2]=height;if(canvas.offscreenCanvas||!canvas.controlTransferredOffscreen){if
(canvas.offscreenCanvas)canvas=canvas.offscreenCanvas;var
autoResizeViewport=false;if(canvas.GLctxObject&&canvas.GLctxObject.GLctx){var
prevViewport=canvas.GLctxObject.GLctx.getParameter(2978);autoResizeViewport=prevViewport[0]===0&&prev
Viewport[1]===0&&prevViewport[2]===canvas.width&&prevViewport[3]===canvas.height}canvas.width=width;
canvas.height=height;if(autoResizeViewport){canvas.GLctxObject.GLctx.viewport(0,0,width,height)}}else
if(canvas.canvasSharedPtr){var
targetThread=GROWABLE_HEAP_I32()[canvas.canvasSharedPtr+8>>2];_emscripten_set_offscreencanvas_size_o
n_target_thread(targetThread,target,width,height);return 1}else{return-4}return 0}function
_emscripten_set_canvas_element_size_main_thread(target,width,height){if(ENVIRONMENT_IS_PTHREAD)retur
n
_emscripten_proxy_to_main_thread_js(2,1,target,width,height);return
_emscripten_set_canvas_element_size_calling_thread(target,width,height)}function
_emscripten_set_canvas_element_size(target,width,height){var
canvas=findCanvasEventTarget(target);if(canvas){return
_emscripten_set_canvas_element_size_calling_thread(target,width,height)}else{return

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_emsripten_set_canvas_element_size_main_thread(target,width,height)}function
_emsripten_set_current_thread_status(newStatus){}function
_emsripten_set_thread_name(threadId,name){}function __webgl_enable_ANGLE_instanced_arrays(ctx){var
ext=ctx.getExtension("ANGLE_instanced_arrays");if(ext){ctx["vertexAttribDivisor"]=function(index,divisor){ext["vertexAttribDivisorANGLE"](index,divisor)};ctx["drawArraysInstanced"]=function(mode,first,count,primcount){ext["drawArraysInstancedANGLE"](mode,first,count,primcount)};ctx["drawElementsInstanced"]=function(mode,count,type,indices,primcount){ext["drawElementsInstancedANGLE"](mode,count,type,indices,primcount)};return
1}}function __webgl_enable_OES_vertex_array_object(ctx){var
ext=ctx.getExtension("OES_vertex_array_object");if(ext){ctx["createVertexArray"]=function(){return
ext["createVertexArrayOES"]();};ctx["deleteVertexArray"]=function(vao){ext["deleteVertexArrayOES"](vao)};ctx["bindVertexArray"]=function(vao){ext["bindVertexArrayOES"](vao)};ctx["isVertexArray"]=function(vao){return
ext["isVertexArrayOES"](vao)};return 1}}function __webgl_enable_WEBGL_draw_buffers(ctx){var
ext=ctx.getExtension("WEBGL_draw_buffers");if(ext){ctx["drawBuffers"]=function(n,bufs){ext["drawBuffersWEBGL"](n,bufs)};return 1}}function
__webgl_enable_WEBGL_multi_draw(ctx){return!(ctx.multiDrawWebgl=ctx.getExtension("WEBGL_multi_draw"))}var
GL={counter:1,buffers:[],programs:[],framebuffers:[],renderbuffers:[],textures:[],uniforms:[],shaders:[],vaos:[],contexts:{},offscreenCanvases:{},timerQueriesEXT:[],programInfos:{},stringCache:{},unpackAlignment:4,recordError:
function
recordError(errorCode){if(!GL.lastError){GL.lastError=errorCode}},getNewId:function(table){var
ret=GL.counter++;for(var i=table.length;i<ret;i++){table[i]=null}return
ret},getSource:function(shader,count,string,length){var source="";for(var i=0;i<count;++i){var
len=length?GROWABLE_HEAP_I32()[length+i*4>>2]:-
1;source+=UTF8ToString(GROWABLE_HEAP_I32()[string+i*4>>2],len<0?undefined:len)}return
source},createContext:function(canvas,webGLContextAttributes){var
ctx=canvas.getContext("webgl",webGLContextAttributes);if(!ctx)return 0;var
handle=GL.registerContext(ctx,webGLContextAttributes);return
handle},registerContext:function(ctx,webGLContextAttributes){var
handle=_malloc(8);GROWABLE_HEAP_I32()[handle+4>>2]=_pthread_self();var
context={handle:handle,attributes:webGLContextAttributes,version:webGLContextAttributes.majorVersion,GLctx:
ctx};if(ctx.canvas)ctx.canvas.GLctxObject=context;GL.contexts[handle]=context;if(typeof
webGLContextAttributes.enableExtensionsByDefault===undefined||webGLContextAttributes.enableExtensions
ByDefault){GL.initExtensions(context)}return
handle},makeContextCurrent:function(contextHandle){GL.currentContext=GL.contexts[contextHandle];Module.ctx
=GLctx=GL.currentContext&&GL.currentContext.GLctx;return!(contextHandle&&!GLctx)},getContext:function(c
ontextHandle){return
GL.contexts[contextHandle]},deleteContext:function(contextHandle){if(GL.currentContext===GL.contexts[context
Handle])GL.currentContext=null;if(typeof
JSEvents===object")JSEvents.removeAllHandlersOnTarget(GL.contexts[contextHandle].GLctx.canvas);if(GL.co
ntexts[contextHandle]&&GL.contexts[contextHandle].GLctx.canvas)GL.contexts[contextHandle].GLctx.canvas.GL
ctxObject=undefined;_free(GL.contexts[contextHandle].handle);GL.contexts[contextHandle]=null},initExtensions:f
unction(context){if(!context)context=GL.currentContext;if(context.initExtensionsDone)return;context.initExtension
sDone=true;var
GLctx=context.GLctx;__webgl_enable_ANGLE_instanced_arrays(GLctx);__webgl_enable_OES_vertex_array_obj
ect(GLctx);__webgl_enable_WEBGL_draw_buffers(GLctx);GLctx.disjointTimerQueryExt=GLctx.getExtension("
EXT_disjoint_timer_query");__webgl_enable_WEBGL_multi_draw(GLctx);var

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exts=GLctx.getSupportedExtensions()||[];exts.forEach(function(ext){if(ext.indexOf("lose_context")<0&&ext.index
xOf("debug")<0){GLctx.getExtension(ext)}}),populateUniformTable:function(program){var
p=GL.programs[program];var
ptable=GL.programInfos[program]={uniforms:{},maxUniformLength:0,maxAttributeLength:-
1,maxUniformBlockNameLength:-1};var utable=ptable.uniforms;var
numUniforms=GLctx.getProgramParameter(p,35718);for(var i=0;i<numUniforms;++i){var
u=GLctx.getActiveUniform(p,i);var
name=u.name;ptable.maxUniformLength=Math.max(ptable.maxUniformLength,name.length+1);if(name.slice(-
1)!="\"){name=name.slice(0,name.lastIndexOf("\["))}var loc=GLctx.getUniformLocation(p,name);if(loc){var
id=GL.getNewId(GL.uniforms);utable[name]=[u.size,id];GL.uniforms[id]=loc;for(var
j=1;j<u.size;++j){var
n=name+"\["+j+"]";loc=GLctx.getUniformLocation(p,n);id=GL.getNewId(GL.uniforms);GL.uniforms[id]=loc}}
};var __emscripten_webgl_power_preferences=["default","\low-power","\high-performance"];function
__emscripten_webgl_do_create_context(target,attributes){var a=attributes>>2;var
powerPreference=GROWABLE_HEAP_I32()[a+(24>>2)];var
contextAttributes={"alpha":!!GROWABLE_HEAP_I32()[a+(0>>2)],"depth":!!GROWABLE_HEAP_I32()[a+(4
>>2)],"stencil":!!GROWABLE_HEAP_I32()[a+(8>>2)],"antialias":!!GROWABLE_HEAP_I32()[a+(12>>2)],"p
remultipliedAlpha":!!GROWABLE_HEAP_I32()[a+(16>>2)],"preserveDrawingBuffer":!!GROWABLE_HEAP_
I32()[a+(20>>2)],"powerPreference":__emscripten_webgl_power_preferences[powerPreference],"failIfMajorPerf
ormanceCaveat":!!GROWABLE_HEAP_I32()[a+(28>>2)],majorVersion:GROWABLE_HEAP_I32()[a+(32>>2)],
minorVersion:GROWABLE_HEAP_I32()[a+(36>>2)],enableExtensionsByDefault:GROWABLE_HEAP_I32()[a+(
40>>2)],explicitSwapControl:GROWABLE_HEAP_I32()[a+(44>>2)],proxyContextToMainThread:GROWABLE_
HEAP_I32()[a+(48>>2)],renderViaOffscreenBackBuffer:GROWABLE_HEAP_I32()[a+(52>>2)]};var
canvas=findCanvasEventTarget(target);if(!canvas){return 0}if(contextAttributes.explicitSwapControl){return
0}var contextHandle=GL.createContext(canvas,contextAttributes);return contextHandle}function
__emscripten_webgl_create_context(a0,a1){return __emscripten_webgl_do_create_context(a0,a1)}var
SYSCALLS={mappings:{},buffers:[null,[],[]],printChar:function(stream,curr){var
buffer=SYSCALLS.buffers[stream];if(curr===0||curr===10){(stream===1?out:err)(UTF8ArrayToString(buffer,0));
buffer.length=0}else{buffer.push(curr)}},varargs:undefined,get:function(){SYSCALLS.varargs+=4;var
ret=GROWABLE_HEAP_I32()[SYSCALLS.varargs-4>>2];return ret},getStr:function(ptr){var
ret=UTF8ToString(ptr);return ret},get64:function(low,high){return low}};function
_fd_close(fd){if(ENVIRONMENT_IS_PTHREAD)return __emscripten_proxy_to_main_thread_js(3,1,fd);return
0}function _fd_seek(fd,offset_low,offset_high,whence,newOffset){if(ENVIRONMENT_IS_PTHREAD)return
__emscripten_proxy_to_main_thread_js(4,1,fd,offset_low,offset_high,whence,newOffset)}function
_fd_write(fd,iov,iocnt,pnum){if(ENVIRONMENT_IS_PTHREAD)return
__emscripten_proxy_to_main_thread_js(5,1,fd,iov,iocnt,pnum);var num=0;for(var i=0;i<iocnt;i++){var
ptr=GROWABLE_HEAP_I32()[iovcnt+i*8>>2];var len=GROWABLE_HEAP_I32()[iovcnt+(i*8+4)>>2];for(var
j=0;j<len;j++){SYSCALLS.printChar(fd,GROWABLE_HEAP_U8)[ptr+j]}num+=len}GROWABLE_HEAP_I32
()[pnum>>2]=num;return 0}function _pthread_cleanup_pop(execute){var
routine=PThread.threadExitHandlers.pop();if(execute)routine()}function
_pthread_cleanup_push(routine,arg){PThread.threadExitHandlers.push(function(){wasmTable.get(routine)(arg)})}f
unction spawnThread(threadParams){if(ENVIRONMENT_IS_PTHREAD)throw"Internal Error! spawnThread()
can only ever be called from main application thread!";var
worker=PThread.getNewWorker();if(worker.pthread!==undefined)throw"Internal
error!";if(!threadParams.pthread_ptr)throw"Internal
error, no pthread ptr!";PThread.runningWorkers.push(worker);var tlsMemory=_malloc(128*4);for(var
i=0;i<128;++i){GROWABLE_HEAP_I32)[tlsMemory+i*4>>2]=0}var
stackHigh=threadParams.stackBase+threadParams.stackSize;var

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pthread=PThread.pthreads[threadParams.pthread_ptr]={ worker:worker,stackBase:threadParams.stackBase,stackSize
:threadParams.stackSize,allocatedOwnStack:threadParams.allocatedOwnStack,threadInfoStruct:threadParams.pthrea
d_ptr};var
tis=pthread.threadInfoStruct>>2;Atomics.store(GROWABLE_HEAP_U32(),tis+(64>>2),threadParams.detached);A
tomics.store(GROWABLE_HEAP_U32(),tis+(100>>2),tlsMemory);Atomics.store(GROWABLE_HEAP_U32(),tis
+(40>>2),pthread.threadInfoStruct);Atomics.store(GROWABLE_HEAP_U32(),tis+(80>>2),threadParams.stackSiz
e);Atomics.store(GROWABLE_HEAP_U32(),tis+(76>>2),stackHigh);Atomics.store(GROWABLE_HEAP_U32(),t
is+(104>>2),threadParams.stackSize);Atomics.store(GROWABLE_HEAP_U32(),tis+(104+8>>2),stackHigh);Atom
ics.store(GROWABLE_HEAP_U32(),tis+(104+12>>2),threadParams.detached);var
global_libc=_emscripten_get_global_libc();var
global_locale=global_libc+40;Atomics.store(GROWABLE_HEAP_U32(),tis+(172>>2),global_locale);worker.pthr
ead=pthread;var
msg={`cmd`:"run`,`start_routine`:threadParams.startRoutine,`arg`:threadParams.arg,`threadInfoStruct`:thre
adParams.pthread_ptr,`stackBase`:threadParams.stackBase,`stackSize`:threadParams.stackSize};worker.runPthre
ad=function(){msg.time=performance.now();worker.postMessage(msg,threadParams.transferList)};if(worker.loaded
){worker.runPthread();delete worker.runPthread}}function
_pthread_create(pthread_ptr,attr,start_routine,arg){if(typeof SharedArrayBuffer===`undefined`){err(`Current
environment does not support SharedArrayBuffer, pthreads are not available!`);return
6}if(!pthread_ptr){err(`pthread_create called with a null thread pointer!`);return 28}var transferList=[];var
error=0;if(ENVIRONMENT_IS_PTHREAD&&(transferList.length===0||error)){return
_emscripten_sync_run_in_main_thread_4(687865856,pthread_ptr,attr,start_routine,arg)}if(error)return
error;var stackSize=0;var stackBase=0;var detached=0;if(attr&&attr!=-
1){stackSize=GROWABLE_HEAP_I32()[attr>>2];stackSize+=81920;stackBase=GROWABLE_HEAP_I32()[attr+
8>>2];detached=GROWABLE_HEAP_I32()[attr+12>>2]!==0}else{stackSize=2097152}var
allocatedOwnStack=stackBase==0;if(allocatedOwnStack){stackBase=_memalign(16,stackSize)}else{stackBase=
stackSize;assert(stackBase>0)}var threadInfoStruct=_malloc(228);for(var
i=0;i<228>>2;++i)GROWABLE_HEAP_U32()[threadInfoStruct>>2+i]=0;GROWABLE_HEAP_I32()[pthread_p
tr>>2]=threadInfoStruct;GROWABLE_HEAP_I32()[threadInfoStruct+12>>2]=threadInfoStruct;var
headPtr=threadInfoStruct+152;GROWABLE_HEAP_I32()[headPtr>>2]=headPtr;var
threadParams={stackBase:stackBase,stackSize:stackSize,allocatedOwnStack:allocatedOwnStack,detached:detached
,startRoutine:start_routine,pthread_ptr:threadInfoStruct,arg:arg,transferList:transferList};if(ENVIRONMENT_IS_P
THREAD){threadParams.cmd=`spawnThread`;postMessage(threadParams,transferList)}else{spawnThread(thread
Params)}return
0}function __pthread_testcancel_js(){if(!ENVIRONMENT_IS_PTHREAD)return;var
tb=__pthread_self();if(!tb)return;var
cancelDisabled=Atomics.load(GROWABLE_HEAP_U32(),tb+56>>2);if(cancelDisabled)return;var
canceled=Atomics.load(GROWABLE_HEAP_U32(),tb+0>>2);if(canceled==2)throw`Canceled!`}function
_emscripten_check_blocking_allowed(){if(ENVIRONMENT_IS_NODE)return;if(ENVIRONMENT_IS_WORKE
R)return;warnOnce(`Blocking on the main thread is very dangerous, see
https://emscripten.org/docs/porting/pthreads.html#blocking-on-the-main-browser-thread`)}}function
__emscripten_do_pthread_join(thread,status,block){if(!thread){err(`pthread_join attempted on a null thread
pointer!`);return
ERRNO_CODES.ESRCH}if(ENVIRONMENT_IS_PTHREAD&&__pthread_self()==thread){err(`PThread
`+thread+` is attempting to join to itself!`);return ERRNO_CODES.EDEADLK}else
if(!ENVIRONMENT_IS_PTHREAD&&_emscripten_main_browser_thread_id()==thread){err(`Main
thread `+thread+` is attempting to join to itself!`);return ERRNO_CODES.EDEADLK}var
self=GROWABLE_HEAP_I32()[thread+12>>2];if(self!==thread){err(`pthread_join attempted on thread
`+thread+`, which does not point to a valid thread, or does not exist anymore!`);return

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ERRNO_CODES.ESRCH}var
detached=Atomics.load(GROWABLE_HEAP_U32(),thread+64>>2);if(detached){err("Attempted to join thread
\"+thread+\", which was already detached!");return
ERRNO_CODES.EINVAL}if(block){_emscripten_check_blocking_allowed()}for(;;){var
threadStatus=Atomics.load(GROWABLE_HEAP_U32(),thread+0>>2);if(threadStatus==1){var
threadExitCode=Atomics.load(GROWABLE_HEAP_U32(),thread+4>>2);if(status)GROWABLE_HEAP_I32()[sta
tus>>2]=threadExitCode;Atomics.store(GROWABLE_HEAP_U32(),thread+64>>2,1);if(!ENVIRONMENT_IS_PT
HREAD)cleanupThread(thread);else postMessage({"cmd":\"cleanupThread\", \"thread\":thread});return
0}if(!block){return
ERRNO_CODES.EBUSY}__pthread_testcancel_js();if(!ENVIRONMENT_IS_PTHREAD)_emscripten_main_thre
ad_process_queued_calls();_emscripten_futex_wait(thread+0,threadStatus,ENVIRONMENT_IS_PTHREAD?100:1
)}}function
pthread_join(thread,status){return __emscripten_do_pthread_join(thread,status,true)}function
_sysconf(name){if(ENVIRONMENT_IS_PTHREAD)return
_emscripten_proxy_to_main_thread_js(6,1,name);switch(name){case 30:return 16384;case 85:var
maxHeapSize=2147483648;return maxHeapSize/16384;case 132:case 133:case 12:case 137:case 138:case 15:case
235:case 16:case 17:case 18:case 19:case 20:case 149:case 13:case 10:case 236:case 153:case 9:case 21:case 22:case
159:case 154:case 14:case 77:case 78:case 139:case 82:case 68:case 67:case 164:case 11:case 29:case 47:case
48:case 95:case 52:case 51:case 46:return 200809;case 27:case 246:case 127:case 128:case 23:case 24:case 160:case
161:case 181:case 182:case 242:case 183:case 184:case 243:case 244:case 245:case 165:case 178:case 179:case
49:case 50:case 168:case 169:case 175:case 170:case 171:case 172:case
97:case 76:case 32:case 173:case 35:case 80:case 81:case 79:return-1;case 176:case 177:case 7:case 155:case 8:case
157:case 125:case 126:case 92:case 93:case 129:case 130:case 131:case 94:case 91:return 1;case 74:case 60:case
69:case 70:case 4:return 1024;case 31:case 42:case 72:return 32;case 87:case 26:case 33:return 2147483647;case
34:case 1:return 47839;case 38:case 36:return 99;case 43:case 37:return 2048;case 0:return 2097152;case 3:return
65536;case 28:return 32768;case 44:return 32767;case 75:return 16384;case 39:return 1e3;case 89:return 700;case
71:return 256;case 40:return 255;case 2:return 100;case 180:return 64;case 25:return 20;case 5:return 16;case
6:return 6;case 73:return 4;case 84:{if(typeof navigator===\"object\")return
navigator[\"hardwareConcurrency\"]||1;return 1}}setErrNo(28);return-
1}if(!ENVIRONMENT_IS_PTHREAD)PThread.initMainThreadBlock();var GLctx;var
proxiedFunctionTable=[null,_atexit,_emscripten_set_canvas_element_size_main_thread,_fd_close,_fd_seek,_fd_wr
ite,_sysconf];var
asmLibraryArg={\"e\":__assert_fail,\"r\":__call_main,\"x\":_emscripten_notify_thread_queue,\"b\":_abort,\"y\":
_emscripten_asm_const_int,\"j\":_emscripten_conditional_set_current_thread_status,\"d\":_emscripten_futex_wait,\"
c\":_emscripten_futex_wake,\"f\":_emscripten_get_now,\"p\":_emscripten_memcpy_big,\"A\":_emscripten_num_l
ogical_cores,\"u\":_emscripten_receive_on_main_thread_js,\"q\":_emscripten_resize_heap,\"v\":_emscripten_set_ca
nvas_element_size,\"i\":_emscripten_set_current_thread_status,\"s\":_emscripten_set_thread_name,\"w\":_emscrip
ten_webgl_create_context,\"l\":_fd_close,\"n\":_fd_seek,\"g\":_fd_write,\"o\":initPthreadsJS,\"a\":wasmMemory||Mo
dule[\"wasmMemory\"],\"z\":_pthread_cleanup_pop,\"k\":_pthread_cleanup_push,\"h\":_pthread_create,\"m\":_pthr
ead_join,\"t\":_sysconf};var asm=createWasm();var
__wasm_call_ctors=Module[\"__wasm_call_ctors\"]=function(){return(__wasm_call_ctors=Module[\"__wasm
_call_ctors\"]=Module[\"asm\"][\"B\"]).apply(null,arguments)};var
_init=Module[\"_init\"]=function(){return(_init=Module[\"_init\"]=Module[\"asm\"][\"C\"]).apply(null,arguments)};
var
_init_with_threads_count=Module[\"_init_with_threads_count\"]=function(){return(_init_with_threads_count=Mod
ule[\"_init_with_threads_count\"]=Module[\"asm\"][\"D\"]).apply(null,arguments)};var
_get_threads_count=Module[\"_get_threads_count\"]=function(){return(_get_threads_count=Module[\"_get_threads
_count\"]=Module[\"asm\"][\"E\"]).apply(null,arguments)};var

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_register_tensor=Module["_register_tensor"]=function(){return(_register_tensor=Module["_register_tensor"]=Module["asm"]["F"]).apply(null,arguments)};var
_dispose_data=Module["_dispose_data"]=function(){return(_dispose_data=Module["_dispose_data"]=Module["asm"]["G"]).apply(null,arguments)};var
_dispose=Module["_dispose"]=function(){return(_dispose=Module["_dispose"]=Module["asm"]["H"]).apply(null,arguments)};var
_Abs=Module["_Abs"]=function(){return(_Abs=Module["_Abs"]=Module["asm"]["J"]).apply(null,arguments)};var
_Add=Module["_Add"]=function(){return(_Add=Module["_Add"]=Module["asm"]["K"]).apply(null,arguments)};var
_AddN=Module["_AddN"]=function(){return(_AddN=Module["_AddN"]=Module["asm"]["L"]).apply(null,arguments)};var
_All=Module["_All"]=function(){return(_All=Module["_All"]=Module["asm"]["M"]).apply(null,arguments)};var
_Any=Module["_Any"]=function(){return(_Any=Module["_Any"]=Module["asm"]["N"]).apply(null,arguments)};var
_ArgMax=Module["_ArgMax"]=function(){return(_ArgMax=Module["_ArgMax"]=Module["asm"]["O"]).apply(null,arguments)};var
_AvgPool=Module["_AvgPool"]=function(){return(_AvgPool=Module["_AvgPool"]=Module["asm"]["P"]).apply(null,arguments)};var
_BatchMatMul=Module["_BatchMatMul"]=function(){return(_BatchMatMul=Module["_BatchMatMul"]=Module["asm"]["Q"]).apply(null,arguments)};var
_Ceil=Module["_Ceil"]=function(){return(_Ceil=Module["_Ceil"]=Module["asm"]["R"]).apply(null,arguments)};var
_ClipByValue=Module["_ClipByValue"]=function(){return(_ClipByValue=Module["_ClipByValue"]=Module["asm"]["S"]).apply(null,arguments)};var
_Conv2D=Module["_Conv2D"]=function(){return(_Conv2D=Module["_Conv2D"]=Module["asm"]["T"]).apply(null,arguments)};var
_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=function(){return(_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=Module["asm"]["U"]).apply(null,arguments)};var
_Cos=Module["_Cos"]=function(){return(_Cos=Module["_Cos"]=Module["asm"]["V"]).apply(null,arguments)};var
_Cosh=Module["_Cosh"]=function(){return(_Cosh=Module["_Cosh"]=Module["asm"]["W"]).apply(null,arguments)};var
_CropAndResize=Module["_CropAndResize"]=function(){return(_CropAndResize=Module["_CropAndResize"]=Module["asm"]["X"]).apply(null,arguments)};var
_Cumsum=Module["_Cumsum"]=function(){return(_Cumsum=Module["_Cumsum"]=Module["asm"]["Y"]).apply(null,arguments)};var
_DepthToSpace=Module["_DepthToSpace"]=function(){return(_DepthToSpace=Module["_DepthToSpace"]=Module["asm"]["Z"]).apply(null,arguments)};var
_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=function(){return(_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=Module["asm"]["_"]).apply(null,arguments)};var
_Elu=Module["_Elu"]=function(){return(_Elu=Module["_Elu"]=Module["asm"]["$"]).apply(null,arguments)};var
_Equal=Module["_Equal"]=function(){return(_Equal=Module["_Equal"]=Module["asm"]["aa"]).apply(null,arguments)};var
_Exp=Module["_Exp"]=function(){return(_Exp=Module["_Exp"]=Module["asm"]["ba"]).apply(null,arguments)};var

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_FlipLeftRight=Module["_FlipLeftRight"]=function(){return(_FlipLeftRight=Module["_FlipLeftRight"]=Module["asm"][_"ca"]).apply(null,arguments)};var
_Floor=Module["_Floor"]=function(){return(_Floor=Module["_Floor"]=Module["asm"][_"da"]).apply(null,arguments)};var
_FloorDiv=Module["_FloorDiv"]=function(){return(_FloorDiv=Module["_FloorDiv"]=Module["asm"][_"ea"]).apply(null,arguments)};var
_FusedBatchNorm=Module["_FusedBatchNorm"]=function(){return(_FusedBatchNorm=Module["_FusedBatchNorm"]=Module["asm"][_"fa"]).apply(null,arguments)};var
_FusedConv2D=Module["_FusedConv2D"]=function(){return(_FusedConv2D=Module["_FusedConv2D"]=Module["asm"][_"ga"]).apply(null,arguments)};var
_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=function(){return(_FusedDepthwiseConv2D=Module["asm"][_"ha"]).apply(null,arguments)};var
_Gather=Module["_Gather"]=function(){return(_Gather=Module["asm"][_"ia"]).apply(null,arguments)};var
_GatherNd=Module["_GatherNd"]=function(){return(_GatherNd=Module["asm"][_"ja"]).apply(null,arguments)};var
_Greater=Module["_Greater"]=function(){return(_Greater=Module["asm"][_"ka"]).apply(null,arguments)};var
_GreaterEqual=Module["_GreaterEqual"]=function(){return(_GreaterEqual=Module["asm"][_"la"]).apply(null,arguments)};var
_LeakyRelu=Module["_LeakyRelu"]=function(){return(_LeakyRelu=Module["asm"][_"ma"]).apply(null,arguments)};var
_Less=Module["_Less"]=function(){return(_Less=Module["asm"][_"na"]).apply(null,arguments)};var
_LessEqual=Module["_LessEqual"]=function(){return(_LessEqual=Module["asm"][_"oa"]).apply(null,arguments)};var
_Log=Module["_Log"]=function(){return(_Log=Module["asm"][_"pa"]).apply(null,arguments)};var
_LogicalAnd=Module["_LogicalAnd"]=function(){return(_LogicalAnd=Module["asm"][_"qa"]).apply(null,arguments)};var
_Max=Module["_Max"]=function(){return(_Max=Module["asm"][_"ra"]).apply(null,arguments)};var
_MaxPool=Module["_MaxPool"]=function(){return(_MaxPool=Module["asm"][_"sa"]).apply(null,arguments)};var
_Maximum=Module["_Maximum"]=function(){return(_Maximum=Module["asm"][_"ta"]).apply(null,arguments)};var
_Mean=Module["_Mean"]=function(){return(_Mean=Module["asm"][_"ua"]).apply(null,arguments)};var
_Min=Module["_Min"]=function(){return(_Min=Module["asm"][_"va"]).apply(null,arguments)};var
_Minimum=Module["_Minimum"]=function(){return(_Minimum=Module["asm"][_"wa"]).apply(null,arguments)};var
_MirrorPad=Module["_MirrorPad"]=function(){return(_MirrorPad=Module["asm"][_"xa"]).apply(null,arguments)};var
_Multiply=Module["_Multiply"]=function(){return(_Multiply=Module["asm"][_"ya"]).apply(null,arguments)};var
_Neg=Module["_Neg"]=function(){return(_Neg=Module["asm"][_"za"]).apply(null,arguments)};var

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_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=function(){return(_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=Module["asm"][["Aa"]]).apply(null,arguments)};var
_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=function(){return(_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=Module["asm"][["Ba"]]).apply(null,arguments)};var
_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=function(){return(_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=Module["asm"][["Ca"]]).apply(null,arguments)};var
_NotEqual=Module["_NotEqual"]=function(){return(_NotEqual=Module["_NotEqual"]=Module["asm"][["Da"]]).apply(null,arguments)};var
_OneHot=Module["_OneHot"]=function(){return(_OneHot=Module["_OneHot"]=Module["asm"][["Ea"]]).apply(null,arguments)};var
_PadV2=Module["_PadV2"]=function(){return(_PadV2=Module["_PadV2"]=Module["asm"][["Fa"]]).apply(null,arguments)};var
_Pow=Module["_Pow"]=function(){return(_Pow=Module["_Pow"]=Module["asm"][["Ga"]]).apply(null,arguments)};var
_Prelu=Module["_Prelu"]=function(){return(_Prelu=Module["_Prelu"]=Module["asm"][["Ha"]]).apply(null,arguments)};var
_Prod=Module["_Prod"]=function(){return(_Prod=Module["_Prod"]=Module["asm"][["Ia"]]).apply(null,arguments)};var
_RealDiv=Module["_RealDiv"]=function(){return(_RealDiv=Module["_RealDiv"]=Module["asm"][["Ja"]]).apply(null,arguments)};var
_Relu=Module["_Relu"]=function(){return(_Relu=Module["_Relu"]=Module["asm"][["Ka"]]).apply(null,arguments)};var
_Relu6=Module["_Relu6"]=function(){return(_Relu6=Module["_Relu6"]=Module["asm"][["La"]]).apply(null,arguments)};var
_ResizeBilinear=Module["_ResizeBilinear"]=function(){return(_ResizeBilinear=Module["_ResizeBilinear"]=Module["asm"][["Ma"]]).apply(null,arguments)};var
_Reverse=Module["_Reverse"]=function(){return(_Reverse=Module["_Reverse"]=Module["asm"][["Na"]]).apply(null,arguments)};var
_RotateWithOffset=Module["_RotateWithOffset"]=function(){return(_RotateWithOffset=Module["_RotateWithOffset"]=Module["asm"][["Oa"]]).apply(null,arguments)};var
_Round=Module["_Round"]=function(){return(_Round=Module["_Round"]=Module["asm"][["Pa"]]).apply(null,arguments)};var
_Rsqrt=Module["_Rsqrt"]=function(){return(_Rsqrt=Module["_Rsqrt"]=Module["asm"][["Qa"]]).apply(null,arguments)};var
_ScatterNd=Module["_ScatterNd"]=function(){return(_ScatterNd=Module["_ScatterNd"]=Module["asm"][["Ra"]]).apply(null,arguments)};var
_SelectV2=Module["_SelectV2"]=function(){return(_SelectV2=Module["_SelectV2"]=Module["asm"][["Sa"]]).apply(null,arguments)};var
_Sigmoid=Module["_Sigmoid"]=function(){return(_Sigmoid=Module["_Sigmoid"]=Module["asm"][["Ta"]]).apply(null,arguments)};var
_Sin=Module["_Sin"]=function(){return(_Sin=Module["_Sin"]=Module["asm"][["Ua"]]).apply(null,arguments)};var
_Softmax=Module["_Softmax"]=function(){return(_Softmax=Module["_Softmax"]=Module["asm"][["Va"]]).apply(null,arguments)};var
_Sqrt=Module["_Sqrt"]=function(){return(_Sqrt=Module["_Sqrt"]=Module["asm"][["Wa"]]).apply(null,arguments)};var
_Square=Module["_Square"]=function(){return(_Square=Module["_Square"]=Module["asm"][["Xa"]]).apply(null,arguments)};var

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_SquaredDifference=Module["_SquaredDifference"]=function(){return(_SquaredDifference=Module["_SquaredDifference"]=Module["asm"][["Ya"]]).apply(null,arguments)};var
_Step=Module["_Step"]=function(){return(_Step=Module["_Step"]=Module["asm"][["Za"]]).apply(null,arguments)};var
_StridedSlice=Module["_StridedSlice"]=function(){return(_StridedSlice=Module["_StridedSlice"]=Module["asm"][["_a"]]).apply(null,arguments)};var
_Sub=Module["_Sub"]=function(){return(_Sub=Module["_Sub"]=Module["asm"][["$a"]]).apply(null,arguments)};var
_Sum=Module["_Sum"]=function(){return(_Sum=Module["_Sum"]=Module["asm"][["ab"]]).apply(null,arguments)};var
_Tan=Module["_Tan"]=function(){return(_Tan=Module["_Tan"]=Module["asm"][["bb"]]).apply(null,arguments)};var
_Tanh=Module["_Tanh"]=function(){return(_Tanh=Module["_Tanh"]=Module["asm"][["cb"]]).apply(null,arguments)};var
_Tile=Module["_Tile"]=function(){return(_Tile=Module["_Tile"]=Module["asm"][["db"]]).apply(null,arguments)};var
_TopK=Module["_TopK"]=function(){return(_TopK=Module["_TopK"]=Module["asm"][["eb"]]).apply(null,arguments)};var
_Transform=Module["_Transform"]=function(){return(_Transform=Module["_Transform"]=Module["asm"][["fb"]]).apply(null,arguments)};var
_Transpose=Module["_Transpose"]=function(){return(_Transpose=Module["_Transpose"]=Module["asm"][["gb"]]).apply(null,arguments)};var
__FusedMatMul=Module["__FusedMatMul"]=function(){return(__FusedMatMul=Module["__FusedMatMul"]=Module["asm"][["hb"]]).apply(null,arguments)};var
_malloc=Module["_malloc"]=function(){return(_malloc=Module["_malloc"]=Module["asm"][["ib"]]).apply(null,arguments)};var
_free=Module["_free"]=function(){return(_free=Module["_free"]=Module["asm"][["jb"]]).apply(null,arguments)};var
__errno_location=Module["__errno_location"]=function(){return(__errno_location=Module["__errno_location"]=Module["asm"][["kb"]]).apply(null,arguments)};var
_emscripten_get_global_libc=Module["_emscripten_get_global_libc"]=function(){return(_emscripten_get_global_libc=Module["_emscripten_get_global_libc"]=Module["asm"][["lb"]]).apply(null,arguments)};var
_thread_self=Module["_thread_self"]=function(){return(_thread_self=Module["_thread_self"]=Module["asm"][["mb"]]).apply(null,arguments)};var
__pthread_tsd_run_dtors=Module["__pthread_tsd_run_dtors"]=function(){return(__pthread_tsd_run_dtors=Module["__pthread_tsd_run_dtors"]=Module["asm"][["nb"]]).apply(null,arguments)};var
_emscripten_main_thread_process_queued_calls=Module["_emscripten_main_thread_process_queued_calls"]=function(){return(_emscripten_main_thread_process_queued_calls=Module["_emscripten_main_thread_process_queued_calls"]=Module["asm"][["ob"]]).apply(null,arguments)};var
_emscripten_current_thread_process_queued_calls=Module["_emscripten_current_thread_process_queued_calls"]=function(){return(_emscripten_current_thread_process_queued_calls=Module["_emscripten_current_thread_process_queued_calls"]=Module["asm"][["pb"]]).apply(null,arguments)};var
_emscripten_register_main_browser_thread_id=Module["_emscripten_register_main_browser_thread_id"]=function(){return(_emscripten_register_main_browser_thread_id=Module["_emscripten_register_main_browser_thread_id"]=Module["asm"][["qb"]]).apply(null,arguments)};var
_emscripten_main_browser_thread_id=Module["_emscripten_main_browser_thread_id"]=function(){return(_emscripten_main_browser_thread_id=Module["_emscripten_main_browser_thread_id"]=Module["asm"][["rb"]]).apply(null,arguments)};var

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__emscripten_do_dispatch_to_thread=Module["__emscripten_do_dispatch_to_thread"]=function(){return(__emsc
ripten_do_dispatch_to_thread=Module["__emscripten_do_dispatch_to_thread"]=Module["asm"]["sb"]).apply(n
ull,arguments)};var
__emscripten_sync_run_in_main_thread_4=Module["__emscripten_sync_run_in_main_thread_4"]=function(){retur
n(__emscripten_sync_run_in_main_thread_4=Module["__emscripten_sync_run_in_main_thread_4"]=Module["asm"
]["tb"]).apply(null,arguments)};var
__emscripten_run_in_main_runtime_thread_js=Module["__emscripten_run_in_main_runtime_thread_js"]=function(
){return(__emscripten_run_in_main_runtime_thread_js=Module["__emscripten_run_in_main_runtime_thread_js"]=
Module["asm"]["ub"]).apply(null,arguments)};var
__emscripten_call_on_thread=Module["__emscripten_call_on_thread"]=function(){return(__emscripten_call_on_t
hread=Module["__emscripten_call_on_thread"]=Module["asm"]["vb"]).apply(null,arguments)};var
__emscripten_tls_init=Module["__emscripten_tls_init"]=function(){return(__emscripten_tls_init=Module["__emscri
pten_tls_init"]=Module["asm"]["wb"]).apply(null,arguments)};var
__emscripten_thread_init=Module["__emscripten_thread_init"]=function(){return(__emscripten_thread_init=Mod
ule["__emscripten_thread_init"]=Module["asm"]["xb"]).apply(null,arguments)};var
stackSave=Module["stackSave"]=function(){return(stackSave=Module["stackSave"]=Module["asm"]["yb"]).a
pply(null,arguments)};var
stackRestore=Module["stackRestore"]=function(){return(stackRestore=Module["stackRestore"]=Module["asm"
]["zb"]).apply(null,arguments)};var
stackAlloc=Module["stackAlloc"]=function(){return(stackAlloc=Module["stackAlloc"]=Module["asm"]["Ab"
]).apply(null,arguments)};var
__emscripten_stack_set_limits=Module["__emscripten_stack_set_limits"]=function(){return(__emscripten_stack_set_
limits=Module["__emscripten_stack_set_limits"]=Module["asm"]["Bb"]).apply(null,arguments)};var
__memalign=Module["__memalign"]=function(){return(__memalign=Module["__memalign"]=Module["asm"]["Cb
"]).apply(null,arguments)};var
__emscripten_allow_main_runtime_queued_calls=Module["__emscripten_allow_main_runtime_queued_calls"]=1
0512;var
__emscripten_main_thread_futex=Module["__emscripten_main_thread_futex"]=12148;Module["cwrap"]=cwrap
;Module["PThread"]=PThread;Module["PThread"]=PThread;Module["wasmmemory"]=wasmmemory;Module
["ExitStatus"]=ExitStatus;var
calledRun;function ExitStatus(status){this.name="ExitStatus";this.message="Program terminated with
exit("+status+")";this.status=status}dependenciesFulfilled=function
runCaller(){if(!calledRun)run();if(!calledRun)dependenciesFulfilled=runCaller};function
run(args){args=args||arguments;if(runDependencies>0){return}if(ENVIRONMENT_IS_PTHREAD){readyPromis
eResolve(Module);initRuntime();postMessage({"cmd":"loaded"});return}preRun();if(runDependencies>0){retur
n}function
doRun(){if(calledRun)return;calledRun=true;Module["calledRun"]=true;if(ABORT)return;initRuntime();preMain(
);readyPromiseResolve(Module);if(Module["onRuntimeInitialized"])Module["onRuntimeInitialized"]();postRun(
)}if(Module["setStatus"]){Module["setStatus"]("Running...");setTimeout(function(){setTimeout(function(){Mo
dule["setStatus"](""),1});doRun(),1)}else{doRun()}}Module["run"]=run;function
exit(status,implicit){if(implicit&&noExitRuntime&&status===0){return}if(!implicit){if(ENVIRONMENT_IS_PT
HREAD){postMessage({"cmd":"exitProcess","returnCode":status});throw
new
ExitStatus(status)}else{}}if(noExitRuntime){}else{PThread.terminateAllThreads();EXITSTATUS=status;exitRunTi
me();if(Module["onExit"])Module["onExit"](status);ABORT=true}quit_(status,new
ExitStatus(status))}if(Module["preInit"]){if(typeof
Module["preInit"]=="function")Module["preInit"]=[Module["preInit"]];while(Module["preInit"].length>0){
Module["preInit"].pop()}}if(ENVIRONMENT_IS_PTHREAD){noExitRuntime=false;PThread.initWorker()}run

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());
return WasmBackendModuleThreadedSimd.ready();
)(typeof exports === 'object' && typeof module === 'object')
module.exports = WasmBackendModuleThreadedSimd;
else if (typeof define === 'function' && define['amd'])
define([], function() { return WasmBackendModuleThreadedSimd; });
else if (typeof exports === 'object')
exports["WasmBackendModuleThreadedSimd"]
= WasmBackendModuleThreadedSimd;
",
nvar WasmBackendModule = (function() {
var _scriptId = typeof document !== 'undefined' && document.currentScript ? document.currentScript.src : undefined;
if (typeof __filename !== 'undefined')
_scriptDir = _scriptId || __filename;
return (function(WasmBackendModule) {
WasmBackendModule = WasmBackendModule || {};
nvar Module=typeof WasmBackendModule!==\"undefined\"?WasmBackendModule: {};
var readyPromiseResolve,readyPromiseReject;
Module["ready"]=new Promise(function(resolve,reject){
readyPromiseResolve=resolve;
readyPromiseReject=reject;
});
var moduleOverrides={};
var key;
for(key in Module){
if(Module.hasOwnProperty(key)){
moduleOverrides[key]=Module[key];
}
}
var arguments_=[];
var thisProgram=\.\/this.program;
var quit_=function(status,toThrow){
throw toThrow;
};
var ENVIRONMENT_IS_WEB=false;
var ENVIRONMENT_IS_WORKER=false;
var ENVIRONMENT_IS_NODE=false;
var ENVIRONMENT_IS_SHELL=false;
ENVIRONMENT_IS_WEB=typeof window===\"object\";
ENVIRONMENT_IS_WORKER=typeof importScripts===\"function\";
ENVIRONMENT_IS_NODE=typeof process===\"object\" && typeof process.versions===\"object\" && typeof process.versions.node===\"string\";
ENVIRONMENT_IS_SHELL=!ENVIRONMENT_IS_WEB&&!ENVIRONMENT_IS_NODE&&!ENVIRONMENT_IS_WORKER;
var scriptDirectory=\\;
function locateFile(path){
if(Module["locateFile"]){
return Module["locateFile"](path,scriptDirectory);
}
return scriptDirectory+path;
}
var read_,readAsync,readBinary,setWindowTitle;
var nodeFS;
var nodePath;
if(ENVIRONMENT_IS_NODE){
if(ENVIRONMENT_IS_WORKER){
scriptDirectory=require(\"path\").dirname(scriptDirectory)+\"^\";
}
else{
scriptDirectory=__dirname+\"^\";
}
read_=function shell_read(filename,binary){
if(!nodeFS)nodeFS=require(\"fs\");
if(!nodePath)nodePath=require(\"path\");
filename=nodePath[\"normalize\"](filename);
return nodeFS[\"readFileSync\"](filename,binary?null:\"utf8\");
};
readBinary=function readBinary(filename){
var ret=read_(filename,true);
if(!ret.buffer){
ret=new Uint8Array(ret);
assert(ret.buffer);
}
return ret;
};
if(process[\"argv\"].length>1){
thisProgram=process[\"argv\"][1].replace(/\\/g,\"^\\\");
arguments_=process[\"argv\"].slice(2);
process[\"on\"](\"uncaughtException\",function(ex){
if(!(ex instanceof ExitStatus)){
throw ex;
}
});
process[\"on\"](\"unhandledRejection\",abort);
quit_=function(status){
process[\"exit\"](status);
};
Module[\"inspect\"]=function(){
return\"[Emscripten Module object]\";
}
}
else if(ENVIRONMENT_IS_SHELL){
if(typeof read!=\"undefined\"){
read_=function shell_read(f){
return read(f);
}
};
readBinary=function readBinary(f){
var data;if(typeof readbuffer===\"function\"){
return new Uint8Array(readbuffer(f));
}
data=read(f,\"binary\");
assert(typeof data===\"object\");
return data;
};
if(typeof scriptArgs!=\"undefined\"){
arguments_=scriptArgs;
}
else if(typeof arguments!=\"undefined\"){
arguments_=arguments;
}
if(typeof quit===\"function\"){
quit_=function(status){
quit(status);
}
};
if(typeof print!=\"undefined\"){
if(typeof console===\"undefined\"){
console={};
console.log=print;
console.warn=console.error=typeof printErr!=\"undefined\"?printErr:print;
}
}
}
else if(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER){
if(ENVIRONMENT_IS_WORKER){
scriptDirectory=self.location.href;
}
else if(typeof document!=\"undefined\" && document.currentScript){
scriptDirectory=document.currentScript.src;
}
if(_scriptId){
scriptDirectory=_scriptId;
}
if(scriptDirectory.indexOf(\"blob:\")!=\"=0){
scriptDirectory=scriptDirectory.substr(0,scriptDirectory.lastIndexOf(\"^\")+1);
}
else{
scriptDirectory=\\;
}
read_=function(url){
var xhr=new XMLHttpRequest;
xhr.open(\"GET\",url,false);
xhr.send(null);
return xhr.responseText;
};
if(ENVIRONMENT_IS_WORKER){
readBinary=function(url){
var xhr=new

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XMLHttpRequest;xhr.open("\GET",url,false);xhr.responseType="arraybuffer";xhr.send(null);return new
Uint8Array(xhr.response)} }readAsync=function(url,onload,onerror){var xhr=new
XMLHttpRequest;xhr.open("\GET",url,true);xhr.responseType="arraybuffer";xhr.onload=function(){if(xhr.status
==200||xhr.status==0&&xhr.response){onload(xhr.response);return }onerror();};xhr.onerror=onerror;xhr.send(null)}
}setWindowTitle=function(title){document.title=title }else{ }var
out=Module["print"]||console.log.bind(console);var err=Module["printErr"]||console.warn.bind(console);for(key
in
moduleOverrides){if(moduleOverrides.hasOwnProperty(key)){Module[key]=moduleOverrides[key]} }moduleOverr
ides=null;if(Module["arguments\"])arguments_=Module["arguments"];if(Module["thisProgram\"])thisProgram=
Module["thisProgram"];if(Module["quit\"])quit_=Module["quit"];var
wasmBinary;if(Module["wasmBinary\"])wasmBinary=Module["wasmBinary"];var
noExitRuntime=Module["noExitRuntime"]||true;if(typeof WebAssembly!="object"){abort("no native wasm
support detected")}var wasmMemory;var ABORT=false;var EXITSTATUS;function
assert(condition,text){if(!condition){abort("Assertion failed: "+text)}}function getCFunc(ident){var
func=Module["_"+ident];assert(func,"Cannot call unknown function "+ident+", make sure it is exported");return
func }function ccall(ident,returnType,argTypes,args,opts){var
toC={"string":function(str){var ret=0;if(str!==null&&str!==undefined&&str!==0){var
len=(str.length<<2)+1;ret=stackAlloc(len);stringToUTF8(str,ret,len)}return ret},"array":function(arr){var
ret=stackAlloc(arr.length);writeArrayToMemory(arr,ret);return ret}};function
convertReturnValue(ret){if(returnType==="string")return UTF8ToString(ret);if(returnType==="boolean")return
Boolean(ret);return ret}var func=getCFunc(ident);var cArgs=[];var stack=0;if(args){for(var
i=0;i<args.length;i++){var
converter=toC[argTypes[i]];if(converter){if(stack===0)stack=stackSave();cArgs[i]=converter(args[i])}else{cArgs[i
]=args[i]}} }var ret=func.apply(null,cArgs);ret=convertReturnValue(ret);if(stack!==0)stackRestore(stack);return
ret}function cwrap(ident,returnType,argTypes,opts){argTypes=argTypes||[];var
numericArgs=argTypes.every(function(type){return type==="number"});var
numericRet=returnType!="string";if(numericRet&&numericArgs&&!opts){return getCFunc(ident)}return
function(){return ccall(ident,returnType,argTypes,arguments,opts)} }var UTF8Decoder=typeof
TextDecoder!="undefined"?new TextDecoder("utf8"):undefined;function
UTF8ArrayToString(heap,idx,maxBytesToRead){var endIdx=idx+maxBytesToRead;var
endPtr=idx;while(heap[endPtr]&&!(endPtr>=endIdx))++endPtr;if(endPtr-
idx>16&&heap.subarray&&UTF8Decoder){return UTF8Decoder.decode(heap.subarray(idx,endPtr))}else{var
str="";while(idx<endPtr){var u0=heap[idx++];if(!(u0&128)){str+=String.fromCharCode(u0);continue }var
u1=heap[idx++]&63;if((u0&224)==192){str+=String.fromCharCode((u0&31)<<6|u1);continue }var
u2=heap[idx++]&63;if((u0&240)==224){u0=(u0&15)<<12|u1<<6|u2}else{u0=(u0&7)<<18|u1<<12|u2<<6|heap[id
x++]&63}if(u0<65536){str+=String.fromCharCode(u0)}else{var ch=u0-
65536;str+=String.fromCharCode(55296|ch>>10,56320|ch&1023)}} }return str}function
UTF8ToString(ptr,maxBytesToRead){return
ptr?UTF8ArrayToString(HEAPU8,ptr,maxBytesToRead):""}function
stringToUTF8Array(str,heap,outIdx,maxBytesToWrite){if(!(maxBytesToWrite>0))return
0;var startIdx=outIdx;var endIdx=outIdx+maxBytesToWrite-1;for(var i=0;i<str.length;++i){var
u=str.charCodeAt(i);if(u>=55296&&u<=57343){var
u1=str.charCodeAt(++i);u=65536+((u&1023)<<10|u1&1023)}if(u<=127){if(outIdx>=endIdx)break;heap[outIdx++
]=u}else if(u<=2047){if(outIdx+1>=endIdx)break;heap[outIdx++]=192|u>>6;heap[outIdx++]=128|u&63}else
if(u<=65535){if(outIdx+2>=endIdx)break;heap[outIdx++]=224|u>>12;heap[outIdx++]=128|u>>6&63;heap[outIdx
++]=128|u&63}else{if(outIdx+3>=endIdx)break;heap[outIdx++]=240|u>>18;heap[outIdx++]=128|u>>12&63;heap[
outIdx++]=128|u>>6&63;heap[outIdx++]=128|u&63}}heap[outIdx]=0;return outIdx-startIdx}function
stringToUTF8(str,outPtr,maxBytesToWrite){return

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stringToUTF8Array(str,HEAPU8,outPtr,maxBytesToWrite)}function
writeArrayToMemory(array,buffer){HEAP8.set(array,buffer)}function
alignUp(x,multiple){if(x%multiple>0){x+=multiple-x%multiple}return x}var
buffer,HEAP8,HEAPU8,HEAP16,HEAPU16,HEAP32,HEAPU32,HEAPF32,HEAPF64;function
updateGlobalBufferAndViews(buf){buffer=buf;Module["HEAP8"]=HEAP8=new
Int8Array(buf);Module["HEAP16"]=HEAP16=new Int16Array(buf);Module["HEAP32"]=HEAP32=new
Int32Array(buf);Module["HEAPU8"]=HEAPU8=new Uint8Array(buf);Module["HEAPU16"]=HEAPU16=new
Uint16Array(buf);Module["HEAPU32"]=HEAPU32=new
Uint32Array(buf);Module["HEAPF32"]=HEAPF32=new
Float32Array(buf);Module["HEAPF64"]=HEAPF64=new Float64Array(buf)}var
INITIAL_MEMORY=Module["INITIAL_MEMORY"]||16777216;var wasmTable;var __ATPRERUN__=[];var
__ATINIT__=[];var __ATMAIN__=[];var __ATPOSTRUN__=[];var
runtimeInitialized=false;__ATINIT__.push({func:function(){__wasm_call_ctors()}});function
preRun(){if(Module["preRun"]){if(typeof
Module["preRun"]!="function")Module["preRun"]=[Module["preRun"]];while(Module["preRun"].length){a
ddOnPreRun(Module["preRun"].shift())}callRuntimeCallbacks(__ATPRERUN__)}function
initRuntime(){runtimeInitialized=true;callRuntimeCallbacks(__ATINIT__)}function
preMain(){callRuntimeCallbacks(__ATMAIN__)}function
postRun(){if(Module["postRun"]){if(typeof
Module["postRun"]!="function")Module["postRun"]=[Module["postRun"]];while(Module["postRun"].lengt
h){addOnPostRun(Module["postRun"].shift())}callRuntimeCallbacks(__ATPOSTRUN__)}function
addOnPreRun(cb){__ATPRERUN__.unshift(cb)}function addOnPostRun(cb){__ATPOSTRUN__.unshift(cb)}var
runDependencies=0;var runDependencyWatcher=null;var dependenciesFulfilled=null;function
addRunDependency(id){runDependencies++;if(Module["monitorRunDependencies"]){Module["monitorRunDep
endencies"](runDependencies)}function removeRunDependency(id){runDependencies--
;if(Module["monitorRunDependencies"]){Module["monitorRunDependencies"](runDependencies)}if(runDepend
encies==0){if(runDependencyWatcher!=null){clearInterval(runDependencyWatcher);runDependencyWatcher=nu
ll}if(dependenciesFulfilled){var
callback=dependenciesFulfilled;dependenciesFulfilled=null;callback()}}Module["preloadedImages"]={};Module
["preloadedAudios"]={};function
abort(what){if(Module["onAbort"]){Module["onAbort"](what)}what+="\n";err(what);ABORT=true;EXITSTAT
US=1;what="abort(\n"+what+"\n). Build with -s ASSERTIONS=1 for more info.";var e=new
WebAssembly.RuntimeError(what);readyPromiseReject(e);throw e}function hasPrefix(str,prefix){return
String.prototype.startsWith?str.startsWith(prefix):str.indexOf(prefix)===0}var
dataURIPrefix="data:application/octet-stream;base64,";function isDataURI(filename){return
hasPrefix(filename,dataURIPrefix)}var fileURIPrefix="file://";function isFileURI(filename){return
hasPrefix(filename,fileURIPrefix)}var wasmBinaryFile="tfjs-backend-
wasm.wasm";if(!isDataURI(wasmBinaryFile)){wasmBinaryFile=locateFile(wasmBinaryFile)}function
getBinary(file){try{if(file===wasmBinaryFile&&wasmBinary){return new
Uint8Array(wasmBinary)}if(readBinary){return readBinary(file)}else{throw"both async and sync fetching of the
wasm failed"}}catch(err){abort(err)}function
getBinaryPromise(){if(!wasmBinary&&(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER)){if(typeof
fetch==="function"&&!isFileURI(wasmBinaryFile)){return fetch(wasmBinaryFile,{credentials:"same-
origin"}).then(function(response){if(!response["ok"]){throw"failed to load wasm binary file at
"+wasmBinaryFile+""}return response["arrayBuffer"]()).catch(function(){return
getBinary(wasmBinaryFile)})}else{if(readAsync){return new
Promise(function(resolve,reject){readAsync(wasmBinaryFile,function(response){resolve(new
Uint8Array(response))},reject)}))}return Promise.resolve().then(function(){return

```



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getBinary(wasmBinaryFile))}function createWasm(){ var info={"a":asmLibraryArg};function
receiveInstance(instance,module){ var
exports=instance.exports;Module["asm"]=exports;wasmMemory=Module["asm"]["j"];updateGlobalBufferAnd
Views(wasmMemory.buffer);wasmTable=Module["asm"]["r"];removeRunDependency("wasm-
instantiate")}addRunDependency("wasm-instantiate");function
receiveInstantiatedSource(output){receiveInstance(output["instance"]);function
instantiateArrayBuffer(receiver){return getBinaryPromise().then(function(binary){return
WebAssembly.instantiate(binary,info)}).then(receiver,function(reason){err("failed to asynchronously prepare
wasm: "+reason);abort(reason)})}function instantiateAsync(){if(!wasmBinary&&typeof
WebAssembly.instantiateStreaming===function"&&!isDataURI(wasmBinaryFile)&&!isFileURI(wasmBinaryFil
e)&&typeof fetch===function"){return fetch(wasmBinaryFile,{credentials:"same-
origin"}).then(function(response){var result=WebAssembly.instantiateStreaming(response,info);return
result.then(receiveInstantiatedSource,function(reason){err("wasm streaming compile failed: "+reason);err("falling
back to ArrayBuffer instantiation");return instantiateArrayBuffer(receiveInstantiatedSource)}))}else{return
instantiateArrayBuffer(receiveInstantiatedSource)}if(Module["instantiateWasm"]){try{var
exports=Module["instantiateWasm"](info,receiveInstance);return exports}catch(e){err("Module.instantiateWasm
callback failed with error: "+e);return false}}instantiateAsync().catch(readyPromiseReject);return{}}function
callRuntimeCallbacks(callbacks){while(callbacks.length>0){var callback=callbacks.shift();if(typeof
callback===function){callback(Module);continue}var func=callback.func;if(typeof
func===number){if(callback.arg===undefined){wasmTable.get(func)}else{wasmTable.get(func)(callback.arg)
}}else{func(callback.arg===undefined?null:callback.arg)}}function _abort(){abort()}function
_emscripten_memcpy_big(dest,src,num){HEAPU8.copyWithin(dest,src,src+num)}function
_emscripten_get_heap_size(){return HEAPU8.length}function
emscripten_realloc_buffer(size){try{wasmMemory.grow(size-
buffer.byteLength+65535>>>16);updateGlobalBufferAndViews(wasmMemory.buffer);return
1}catch(e){}}function _emscripten_resize_heap(requestedSize){var oldSize=_emscripten_get_heap_size();var
maxHeapSize=2147483648;if(requestedSize>maxHeapSize){return false}for(var
cutDown=1;cutDown<=4;cutDown*=2){var
overGrownHeapSize=oldSize*(1+.2/cutDown);overGrownHeapSize=Math.min(overGrownHeapSize,requestedSize
+100663296);var
newSize=Math.min(maxHeapSize,alignUp(Math.max(requestedSize,overGrownHeapSize),65536));var
replacement=emscripten_realloc_buffer(newSize);if(replacement){return true}}return false}var
SYSCALLS={mappings:{},buffers:[null,[],[]],printChar:function(stream,curr){var
buffer=SYSCALLS.buffers[stream];if(curr===0||curr===10){(stream===1?out:err)(UTF8ArrayToString(buffer,0));
buffer.length=0}else{buffer.push(curr)}},varargs:undefined,get:function(){SYSCALLS.varargs+=4;var
ret=HEAP32[SYSCALLS.varargs-4>>2];return ret},getStr:function(ptr){var ret=UTF8ToString(ptr);return
ret},get64:function(low,high){return low}};function _fd_close(fd){return 0}function
_fd_seek(fd,offset_low,offset_high,whence,newOffset){}function _fd_write(fd,iiov,iiovcnt,pnum){var num=0;for(var
i=0;i<iiovcnt;i++){var ptr=HEAP32[iiov+i*8>>2];var len=HEAP32[iiov+(i*8+4)>>2];for(var
j=0;j<len;j++){SYSCALLS.printChar(fd,HEAPU8[ptr+j])}num+=len}HEAP32[pnum>>2]=num;return
0}function _pthread_create(){return 6}function _pthread_join(){return 28}function
setErrNo(value){HEAP32[___errno_location()>>2]=value;return value}function
_sysconf(name){switch(name){case 30:return 16384;case 85:var maxHeapSize=2147483648;return
maxHeapSize/16384;case 132:case 133:case 12:case 137:case 138:case 15:case 235:case 16:case 17:case 18:case
19:case 20:case 149:case 13:case 10:case 236:case 153:case 9:case 21:case 22:case 159:case 154:case 14:case
77:case 78:case 139:case 82:case 68:case 67:case 164:case 11:case 29:case 47:case 48:case 95:case 52:case 51:case
46:return 200809;case 27:case 246:case 127:case 128:case 23:case 24:case 160:case 161:case 181:case 182:case
242:case 183:case 184:case 243:case 244:case 245:case 165:case 178:case 179:case 49:case 50:case 168:case

```

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169:case 175:case 170:case 171:case 172:case 97:case 76:case 32:case 173:case 35:case 80:case 81:case 79:return-
1;case 176:case 177:case 7:case
  155:case 8:case 157:case 125:case 126:case 92:case 93:case 129:case 130:case 131:case 94:case 91:return 1;case
74:case 60:case 69:case 70:case 4:return 1024;case 31:case 42:case 72:return 32;case 87:case 26:case 33:return
2147483647;case 34:case 1:return 47839;case 38:case 36:return 99;case 43:case 37:return 2048;case 0:return
2097152;case 3:return 65536;case 28:return 32768;case 44:return 32767;case 75:return 16384;case 39:return
1e3;case 89:return 700;case 71:return 256;case 40:return 255;case 2:return 100;case 180:return 64;case 25:return
20;case 5:return 16;case 6:return 6;case 73:return 4;case 84:{if(typeof navigator===\"object\")return
navigator[\"hardwareConcurrency\"]||1;return 1 }setErrNo(28);return-1 }var
asmLibraryArg={\"a\":_abort,\"d\":_emscripten_memcpy_big,\"e\":_emscripten_resize_heap,\"f\":_fd_close,\"c\":_f
d_seek,\"b\":_fd_write,\"h\":_pthread_create,\"g\":_pthread_join,\"i\":_sysconf};var asm=createWasm();var
__wasm_call_ctors=Module[\"__wasm_call_ctors\"]=function(){return(__wasm_call_ctors=Module[\"__wasm
_call_ctors\"]=Module[\"asm\"][\"k\"]).apply(null,arguments)};var
_init=Module[\"_init\"]=function(){return(_init=Module[\"_init\"]=Module[\"asm\"][\"l\"]).apply(null,arguments)};
var
_init_with_threads_count=Module[\"_init_with_threads_count\"]=function(){return(_init_with_threads_count=Mod
ule[\"_init_with_threads_count\"]=Module[\"asm\"][\"m\"]).apply(null,arguments)};var
_get_threads_count=Module[\"_get_threads_count\"]=function(){return(_get_threads_count=Module[\"_get_threads
_count\"]=Module[\"asm\"][\"n\"]).apply(null,arguments)};var
_register_tensor=Module[\"_register_tensor\"]=function(){return(_register_tensor=Module[\"_register_tensor\"]=M
odule[\"asm\"][\"o\"]).apply(null,arguments)};var
_dispose_data=Module[\"_dispose_data\"]=function(){return(_dispose_data=Module[\"_dispose_data\"]=Module[\"
asm\"][\"p\"]).apply(null,arguments)};var
_dispose=Module[\"_dispose\"]=function(){return(_dispose=Module[\"_dispose\"]=Module[\"asm\"][\"q\"]).apply(n
ull,arguments)};var
_Abs=Module[\"_Abs\"]=function(){return(_Abs=Module[\"_Abs\"]=Module[\"asm\"][\"s\"]).apply(null,arguments
)};var
_Add=Module[\"_Add\"]=function(){return(_Add=Module[\"_Add\"]=Module[\"asm\"][\"t\"]).apply(null,argument
s)};var
_AddN=Module[\"_AddN\"]=function(){return(_AddN=Module[\"_AddN\"]=Module[\"asm\"][\"u\"]).apply(null,ar
guments)};var
_All=Module[\"_All\"]=function(){return(_All=Module[\"_All\"]=Module[\"asm\"][\"v\"]).apply(null,arguments)};
var
_Any=Module[\"_Any\"]=function(){return(_Any=Module[\"_Any\"]=Module[\"asm\"][\"w\"]).apply(null,argumen
ts)};var
_ArgMax=Module[\"_ArgMax\"]=function(){return(_ArgMax=Module[\"_ArgMax\"]=Module[\"asm\"][\"x\"]).app
ly(null,arguments)};var
_AvgPool=Module[\"_AvgPool\"]=function(){return(_AvgPool=Module[\"_AvgPool\"]=Module[\"asm\"][\"y\"]).a
pply(null,arguments)};var
_BatchMatMul=Module[\"_BatchMatMul\"]=function(){return(_BatchMatMul=Module[\"_BatchMatMul\"]=Modu
le[\"asm\"][\"z\"]).apply(null,arguments)};var
_Ceil=Module[\"_Ceil\"]=function(){return(_Ceil=Module[\"_Ceil\"]=Module[\"asm\"][\"A\"]).apply(null,argument
s)};var
_ClipByValue=Module[\"_ClipByValue\"]=function(){return(_ClipByValue=Module[\"_ClipByValue\"]=Module[\"
asm\"][\"B\"]).apply(null,arguments)};var
_Conv2D=Module[\"_Conv2D\"]=function(){return(_Conv2D=Module[\"_Conv2D\"]=Module[\"asm\"][\"C\"]).ap
ply(null,arguments)};var
_Conv2DBackpropInput=Module[\"_Conv2DBackpropInput\"]=function(){return(_Conv2DBackpropInput=Modul

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e["_Conv2DBackpropInput"]=Module["asm"]["D"].apply(null,arguments);var
_Cos=Module["_Cos"]=function(){return(_Cos=Module["_Cos"]=Module["asm"]["E"]).apply(null,arguments
)};var
_Cosh=Module["_Cosh"]=function(){return(_Cosh=Module["_Cosh"]=Module["asm"]["F"]).apply(null,argu
ments)};var
_CropAndResize=Module["_CropAndResize"]=function(){return(_CropAndResize=Module["_CropAndResize"]
=Module["asm"]["G"]).apply(null,arguments)};var
_Cumsum=Module["_Cumsum"]=function(){return(_Cumsum=Module["_Cumsum"]=Module["asm"]["H"]).a
pply(null,arguments)};var
_DepthToSpace=Module["_DepthToSpace"]=function(){return(_DepthToSpace=Module["_DepthToSpace"]=M
odule["asm"]["I"]).apply(null,arguments)};var
_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=function(){return(_DepthwiseConv2dNative=M
odule["_DepthwiseConv2dNative"]=Module["asm"]["J"]).apply(null,arguments)};var
_Elu=Module["_Elu"]=function(){return(_Elu=Module["_Elu"]=Module["asm"]["K"]).apply(null,arguments)
};var
_Equal=Module["_Equal"]=function(){return(_Equal=Module["_Equal"]=Module["asm"]["L"]).apply(null,arg
uments)};var
_Exp=Module["_Exp"]=function(){return(_Exp=Module["_Exp"]=Module["asm"]["M"]).apply(null,argument
s)};var
_FlipLeftRight=Module["_FlipLeftRight"]=function(){return(_FlipLeftRight=Module["_FlipLeftRight"]=Mod
ule["asm"]["N"]).apply(null,arguments)};var
_Floor=Module["_Floor"]=function(){return(_Floor=Module["_Floor"]=Module["asm"]["O"]).apply(null,argu
ments)};var
_FloorDiv=Module["_FloorDiv"]=function(){return(_FloorDiv=Module["_FloorDiv"]=Module["asm"]["P"]).
apply(null,arguments)};var
_FusedBatchNorm=Module["_FusedBatchNorm"]=function(){return(_FusedBatchNorm=Module["_FusedBatchN
orm"]=Module["asm"]["Q"]).apply(null,arguments)};var
_FusedConv2D=Module["_FusedConv2D"]=function(){return(_FusedConv2D=Module["_FusedConv2D"]=Mod
ule["asm"]["R"]).apply(null,arguments)};var
_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=function(){return(_FusedDepthwiseConv2D=M
odule["_FusedDepthwiseConv2D"]=Module["asm"]["S"]).apply(null,arguments)};var
_Gather=Module["_Gather"]=function(){return(_Gather=Module["_Gather"]=Module["asm"]["T"]).apply(null
,arguments)};var
_GatherNd=Module["_GatherNd"]=function(){return(_GatherNd=Module["_GatherNd"]=Module["asm"]["U"
]).apply(null,arguments)};var
_Greater=Module["_Greater"]=function(){return(_Greater=Module["_Greater"]=Module["asm"]["V"]).apply(
null,arguments)};var
_GreaterEqual=Module["_GreaterEqual"]=function(){return(_GreaterEqual=Module["_GreaterEqual"]=Module[
"asm"]["W"]).apply(null,arguments)};var
_LeakyRelu=Module["_LeakyRelu"]=function(){return(_LeakyRelu=Module["_LeakyRelu"]=Module["asm"]["
X"]).apply(null,arguments)};var
_Less=Module["_Less"]=function(){return(_Less=Module["_Less"]=Module["asm"]["Y"]).apply(null,argume
nts)};var
_LessEqual=Module["_LessEqual"]=function(){return(_LessEqual=Module["_LessEqual"]=Module["asm"]["
Z"]).apply(null,arguments)};var
_Log=Module["_Log"]=function(){return(_Log=Module["_Log"]=Module["asm"]["_"]).apply(null,arguments
)};var
_LogicalAnd=Module["_LogicalAnd"]=function(){return(_LogicalAnd=Module["_LogicalAnd"]=Module["asm

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\"][\$").apply(null,arguments)};var
_Max=Module["_Max"]=function(){return(_Max=Module["_Max"]=Module["asm"][["aa"]]).apply(null,arguments)};var
_MaxPool=Module["_MaxPool"]=function(){return(_MaxPool=Module["_MaxPool"]=Module["asm"][["ba"]]).apply(null,arguments)};var
_Maximum=Module["_Maximum"]=function(){return(_Maximum=Module["_Maximum"]=Module["asm"][["ca"]]).apply(null,arguments)};var
_Mean=Module["_Mean"]=function(){return(_Mean=Module["_Mean"]=Module["asm"][["da"]]).apply(null,arguments)};var
_Min=Module["_Min"]=function(){return(_Min=Module["_Min"]=Module["asm"][["ea"]]).apply(null,arguments)};var
_Minimum=Module["_Minimum"]=function(){return(_Minimum=Module["_Minimum"]=Module["asm"][["fa"]]).apply(null,arguments)};var
_MirrorPad=Module["_MirrorPad"]=function(){return(_MirrorPad=Module["_MirrorPad"]=Module["asm"][["ga"]]).apply(null,arguments)};var
_Multiply=Module["_Multiply"]=function(){return(_Multiply=Module["_Multiply"]=Module["asm"][["ha"]]).apply(null,arguments)};var
_Neg=Module["_Neg"]=function(){return(_Neg=Module["_Neg"]=Module["asm"][["ia"]]).apply(null,arguments)};var
_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=function(){return(_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=Module["asm"][["ja"]]).apply(null,arguments)};var
_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=function(){return(_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=Module["asm"][["ka"]]).apply(null,arguments)};var
_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=function(){return(_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=Module["asm"][["la"]]).apply(null,arguments)};var
_NotEqual=Module["_NotEqual"]=function(){return(_NotEqual=Module["_NotEqual"]=Module["asm"][["ma"]]).apply(null,arguments)};var
_OneHot=Module["_OneHot"]=function(){return(_OneHot=Module["_OneHot"]=Module["asm"][["na"]]).apply(null,arguments)};var
_PadV2=Module["_PadV2"]=function(){return(_PadV2=Module["_PadV2"]=Module["asm"][["oa"]]).apply(null,arguments)};var
_Pow=Module["_Pow"]=function(){return(_Pow=Module["_Pow"]=Module["asm"][["pa"]]).apply(null,arguments)};var
_Prelu=Module["_Prelu"]=function(){return(_Prelu=Module["_Prelu"]=Module["asm"][["qa"]]).apply(null,arguments)};var
_Prod=Module["_Prod"]=function(){return(_Prod=Module["_Prod"]=Module["asm"][["ra"]]).apply(null,arguments)};var
_RealDiv=Module["_RealDiv"]=function(){return(_RealDiv=Module["_RealDiv"]=Module["asm"][["sa"]]).apply(null,arguments)};var
_RelU=Module["_Relu"]=function(){return(_Relu=Module["_Relu"]=Module["asm"][["ta"]]).apply(null,arguments)};var
_RelU6=Module["_Relu6"]=function(){return(_Relu6=Module["_Relu6"]=Module["asm"][["ua"]]).apply(null,arguments)};var
_ResizeBilinear=Module["_ResizeBilinear"]=function(){return(_ResizeBilinear=Module["_ResizeBilinear"]=Module["asm"][["va"]]).apply(null,arguments)};var
_Reverse=Module["_Reverse"]=function(){return(_Reverse=Module["_Reverse"]=Module["asm"][["wa"]]).apply(null,arguments)};var
_RotateWithOffset=Module["_RotateWithOffset"]=function(){return(_RotateWithOffset=Module["_RotateWithOffset"]

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Offset"]=Module["asm"]["xa"].apply(null,arguments));var
_Round=Module["_Round"]=function(){return(_Round=Module["_Round"]=Module["asm"]["ya"].apply(null,arguments));var
_Rsqrt=Module["_Rsqrt"]=function(){return(_Rsqrt=Module["_Rsqrt"]=Module["asm"]["za"].apply(null,arguments));var
_ScatterNd=Module["_ScatterNd"]=function(){return(_ScatterNd=Module["_ScatterNd"]=Module["asm"]["Aa"].apply(null,arguments));var
_SelectV2=Module["_SelectV2"]=function(){return(_SelectV2=Module["_SelectV2"]=Module["asm"]["Ba"].apply(null,arguments));var
_Sigmoid=Module["_Sigmoid"]=function(){return(_Sigmoid=Module["_Sigmoid"]=Module["asm"]["Ca"].apply(null,arguments));var
_Sin=Module["_Sin"]=function(){return(_Sin=Module["_Sin"]=Module["asm"]["Da"].apply(null,arguments));var
_Softmax=Module["_Softmax"]=function(){return(_Softmax=Module["_Softmax"]=Module["asm"]["Ea"].apply(null,arguments));var
_Sqrt=Module["_Sqrt"]=function(){return(_Sqrt=Module["_Sqrt"]=Module["asm"]["Fa"].apply(null,arguments));var
_Square=Module["_Square"]=function(){return(_Square=Module["_Square"]=Module["asm"]["Ga"].apply(null,arguments));var
_SquaredDifference=Module["_SquaredDifference"]=function(){return(_SquaredDifference=Module["_SquaredDifference"]=Module["asm"]["Ha"].apply(null,arguments));var
_Step=Module["_Step"]=function(){return(_Step=Module["_Step"]=Module["asm"]["Ia"].apply(null,arguments));var
_StridedSlice=Module["_StridedSlice"]=function(){return(_StridedSlice=Module["_StridedSlice"]=Module["asm"]["Ja"].apply(null,arguments));var
_Sub=Module["_Sub"]=function(){return(_Sub=Module["_Sub"]=Module["asm"]["Ka"].apply(null,arguments));var
_Sum=Module["_Sum"]=function(){return(_Sum=Module["_Sum"]=Module["asm"]["La"].apply(null,arguments));var
_Tan=Module["_Tan"]=function(){return(_Tan=Module["_Tan"]=Module["asm"]["Ma"].apply(null,arguments));var
_Tanh=Module["_Tanh"]=function(){return(_Tanh=Module["_Tanh"]=Module["asm"]["Na"].apply(null,arguments));var
_Tile=Module["_Tile"]=function(){return(_Tile=Module["_Tile"]=Module["asm"]["Oa"].apply(null,arguments));var
_TopK=Module["_TopK"]=function(){return(_TopK=Module["_TopK"]=Module["asm"]["Pa"].apply(null,arguments));var
_Transform=Module["_Transform"]=function(){return(_Transform=Module["_Transform"]=Module["asm"]["Qa"].apply(null,arguments));var
_Transpose=Module["_Transpose"]=function(){return(_Transpose=Module["_Transpose"]=Module["asm"]["Ra"].apply(null,arguments));var
__FusedMatMul=Module["__FusedMatMul"]=function(){return(__FusedMatMul=Module["__FusedMatMul"]=Module["asm"]["Sa"].apply(null,arguments));var
_malloc=Module["_malloc"]=function(){return(_malloc=Module["_malloc"]=Module["asm"]["Ta"].apply(null,arguments));var
_free=Module["_free"]=function(){return(_free=Module["_free"]=Module["asm"]["Ua"].apply(null,arguments));var
___errno_location=Module["___errno_location"]=function(){return(___errno_location=Module["___errno_location"]

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on"]=Module["asm"]["Va"].apply(null,arguments);var
stackSave=Module["stackSave"]=function(){return(stackSave=Module["stackSave"]=Module["asm"]["Wa"]);
apply(null,arguments);var
stackRestore=Module["stackRestore"]=function(){return(stackRestore=Module["stackRestore"]=Module["asm"]
)["Xa"].apply(null,arguments);var
stackAlloc=Module["stackAlloc"]=function(){return(stackAlloc=Module["stackAlloc"]=Module["asm"]["Ya"]
).apply(null,arguments);Module["cwrap"]=cwrap;var calledRun;function
ExitStatus(status){this.name="ExitStatus";this.message="Program terminated with
exit("+status+"");this.status=status}dependenciesFulfilled=function
runCaller(){if(!calledRun)run();if(!calledRun)dependenciesFulfilled=runCaller};function
run(args){args=args||arguments_;if(runDependencies>0){return}preRun();if(runDependencies>0){return}function
doRun(){if(calledRun)return;calledRun=true;Module["calledRun"]=true;if(ABORT)return;initRuntime();preMain(
);readyPromiseResolve(Module);if(Module["onRuntimeInitialized"])Module["onRuntimeInitialized"]();postRun(
)}if(Module["setStatus"]){Module["setStatus"]("Running...");setTimeout(function(){setTimeout(function(){Mo
dule["setStatus"](""),1);doRun()},1)}else{doRun()}}Module["run"]=run;if(Module["preInit"]){if(typeof
Module["preInit"]=="function")Module["preInit"]=[Module["preInit"]];while(Module["preInit"].length>0){
Module["preInit"].pop()}run();\n\n\n return WasmBackendModule.ready\n\n\n);nif (typeof exports ===
'object' && typeof module === 'object')\n module.exports = WasmBackendModule;\nelse if (typeof define ===
'function' && define['amd'])\n define([], function() { return WasmBackendModule; });\nelse if (typeof exports ===
'object')\n exports["WasmBackendModule"] = WasmBackendModule;\n", "/**\n * @license\n * Copyright 2019
Google LLC. All Rights Reserved.\n * Licensed under the Apache
License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You
may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required
by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS"
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\nimport './flags_wasm';\nimport {backend_util, BackendTimingInfo, DataStorage, DataType, deprecationWarn,
engine, env, KernelBackend, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasmModule,
WasmFactoryConfig} from './wasm-out/tfjs-backend-wasm';\nimport {BackendWasmThreadedSimdModule} from
'./wasm-out/tfjs-backend-wasm-threaded-simd';\nimport wasmFactoryThreadedSimd
from './wasm-out/tfjs-backend-wasm-threaded-simd.js';\n// @ts-ignore\nimport {wasmWorkerContents} from
'./wasm-out/tfjs-backend-wasm-threaded-simd.worker.js';\nimport wasmFactory from './wasm-out/tfjs-backend-
wasm.js';\ninterface TensorData {\n id: number;\n memoryOffset: number;\n shape: number[];\n dtype:
DataType;\n refCount: number;\n /** Only used for string tensors, storing encoded bytes. */\n stringBytes?:
Uint8Array[];\n}\n\nexport type DataId = object; // object instead of {} to force non-primitive.\n\nexport class
BackendWasm extends KernelBackend {\n // 0 is reserved for null data ids.\n private dataIdNextNumber = 1;\n
dataIdMap: DataStorage<TensorData>;\n\n constructor(public wasm:
BackendWasmModule|BackendWasmThreadedSimdModule) {\n super();\n
this.wasm.tfjs.initWithThreadsCount(threadsCount);\n actualThreadsCount = this.wasm.tfjs.getThreadsCount();\n
this.dataIdMap = new DataStorage(this, engine());\n }\n\n write(values:
backend_util.BackendValues, shape: number[], dtype: DataType):\n DataId {\n const dataId = {id:
this.dataIdNextNumber++};\n this.move(dataId, values, shape, dtype, 1);\n return dataId;\n }\n\n
numDataIds(): number {\n return this.dataIdMap.numDataIds();\n }\n\n async time(f: () => void):
Promise<BackendTimingInfo> {\n const start = util.now();\n f();\n const kernelMs = util.now() - start;\n
return {kernelMs};\n }\n\n move(\n dataId: DataId, values: backend_util.BackendValues, shape: number[],\n
dtype: DataType, refCount: number): void {\n const id = this.dataIdNextNumber++;\n if (dtype === 'string') {\n
const stringBytes = values as Uint8Array[];\n this.dataIdMap.set(\n dataId,\n {id, stringBytes,

```

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shape, dtype, memoryOffset: null, refCount});\n  return;\n }\n\n const size = util.sizeFromShape(shape);\n const numBytes = size * util.bytesPerElement(dtype);\n const memoryOffset = this.wasm._malloc(numBytes);\n\n this.dataIdMap.set(dataId, {id, memoryOffset, shape, dtype, refCount});\n this.wasm.tfjs.registerTensor(id,\n size, memoryOffset);\n\n if (values != null) {\n this.wasm.HEAPU8.set(\n new Uint8Array(\n (values as backend_util.TypedArray).buffer,\n (values as backend_util.TypedArray).byteOffset,\n numBytes),\n memoryOffset);\n }\n }\n\n async read(dataId: DataId):\n Promise<backend_util.BackendValues> {\n return this.readSync(dataId);\n }\n\n readSync(dataId: DataId):\n backend_util.BackendValues {\n const {memoryOffset, dtype, shape, stringBytes} =\n this.dataIdMap.get(dataId);\n if (dtype === 'string') {\n return stringBytes;\n }\n const bytes =\n this.wasm.HEAPU8.slice(\n memoryOffset,\n memoryOffset + util.sizeFromShape(shape) *\n util.bytesPerElement(dtype));\n return typedArrayFromBuffer(bytes.buffer, dtype);\n }\n\n /**\n * Dispose the\n memory if the dataId has\n 0 refCount. Return true if the memory\n * is released, false otherwise.\n * @param dataId\n * @oaram force\n Optional, remove the data regardless of refCount\n */\n disposeData(dataId: DataId, force = false): boolean {\n if\n (this.dataIdMap.has(dataId)) {\n const data = this.dataIdMap.get(dataId);\n data.refCount--;\n if (!force\n && data.refCount > 0) {\n return false;\n }\n\n this.wasm._free(data.memoryOffset);\n this.wasm.tfjs.disposeData(data.id);\n this.dataIdMap.delete(dataId);\n }\n return true;\n }\n\n /** Return\n refCount of a `TensorData`. */\n refCount(dataId: DataId): number {\n if (this.dataIdMap.has(dataId)) {\n const tensorData = this.dataIdMap.get(dataId);\n return tensorData.refCount;\n }\n return 0;\n }\n\n incRef(dataId: DataId) {\n const data = this.dataIdMap.get(dataId);\n if (data != null) {\n data.refCount++;\n }\n }\n\n floatPrecision(): 32 {\n return 32;\n }\n\n\n // Returns the memory offset of a tensor. Useful for debugging and unit\n // testing.\n getMemoryOffset(dataId:\n DataId): number {\n return this.dataIdMap.get(dataId).memoryOffset;\n }\n\n dispose() {\n this.wasm.tfjs.dispose();\n if ('PThread' in this.wasm) {\n this.wasm.PThread.terminateAllThreads();\n }\n\n this.wasm = null;\n }\n\n memory() {\n return {unreliable: false};\n }\n\n /**\n * Make a tensor info for the\n output of an op. If `memoryOffset` is not\n * present, this method allocates memory on the WASM heap. If\n `memoryOffset`\n * is present, the memory was allocated elsewhere (in c++) and we just record\n * the pointer\n where that memory lives.\n */\n makeOutput(shape: number[], dtype: DataType, memoryOffset?: number):\n TensorInfo {\n let dataId: {};\n if (memoryOffset == null) {\n dataId = this.write(null /* values */, shape,\n dtype);\n } else {\n const id = this.dataIdNextNumber++;\n dataId = {id};\n this.dataIdMap.set(dataId,\n {id, memoryOffset, shape, dtype, refCount: 1});\n const size = util.sizeFromShape(shape);\n this.wasm.tfjs.registerTensor(id, size, memoryOffset);\n }\n return {dataId, shape, dtype};\n }\n\n typedArrayFromHeap({shape, dtype, dataId}: TensorInfo):\n backend_util.TypedArray {\n const buffer =\n this.wasm.HEAPU8.buffer;\n const {memoryOffset} = this.dataIdMap.get(dataId);\n const size =\n util.sizeFromShape(shape);\n switch (dtype) {\n case 'float32':\n return new Float32Array(buffer,\n memoryOffset, size);\n case 'int32':\n return new Int32Array(buffer, memoryOffset, size);\n case 'bool':\n return new Uint8Array(buffer, memoryOffset, size);\n default:\n throw new Error(`Unknown dtype\n ${dtype}`);\n }\n }\n\n\n function createInstantiateWasmFunc(path: string) {\n // this will be replace by rollout\n plugin patchWechatWebAssembly in\n // miniprogram's output.\n // tslint:disable-next-line:no-any\n return (imports: any, callback: any) => {\n util.fetch(path, {credentials: 'same-origin'}).then((response) => {\n if (!response['ok']) {\n imports.env.a(`failed to load wasm binary file at '${path}'`);\n }\n\n response.arrayBuffer().then(binary => {\n WebAssembly.instantiate(binary, imports).then(output => {\n callback(output.instance, output.module);\n });\n });\n });\n return {};\n }\n\n\n /**\n * Returns the\n path of the WASM binary.\n * @param simdSupported whether SIMD is supported\n * @param threadsSupported\n whether multithreading is supported\n * @param wasmModuleFolder the directory containing the WASM\n binaries.\n */\n function getPathToWasmBinary(\n simdSupported: boolean, threadsSupported: boolean,\n wasmModuleFolder: string) {\n if (wasmPath != null) {\n // If wasmPath is defined, the user has supplied a full\n path to\n // the vanilla .wasm binary.\n return wasmPath;\n }\n\n let path: WasmBinaryName

```

```

= 'tfjs-backend-wasm.wasm';\n if (simdSupported && threadsSupported) {\n  path = 'tfjs-backend-wasm-
threaded-simd.wasm';\n } else if (simdSupported) {\n  path = 'tfjs-backend-wasm-simd.wasm';\n }\n\n if
(wasmFileMap != null) {\n  if (wasmFileMap[path] != null) {\n   return wasmFileMap[path];\n  }\n }\n\n return wasmModuleFolder + path;\n}\n\n/**\n * Initializes the wasm module and creates the js <--> wasm bridge.\n
*\n * NOTE: We wrap the wasm module in a object with property 'wasm' instead of\n * returning
Promise<BackendWasmModule> to avoid freezing Chrome (last tested\n * in Chrome 76).\n */\n\nexport async
function init(): Promise<{wasm: BackendWasmModule}> {\n  const [simdSupported, threadsSupported] = await
Promise.all([\n   env().getAsync('WASM_HAS_SIMD_SUPPORT'),\n   env().getAsync('WASM_HAS_MULTITHREAD_SUPPORT')\n  ]);\n  return new Promise((resolve, reject) =>
{\n   const factoryConfig: WasmFactoryConfig = {};\n   /**\n    * This function overrides
the Emscripten module locateFile utility.\n    * @param path The relative path to the file that needs to be loaded.\n
    * @param prefix The path to the main JavaScript file's directory.\n    */\n   factoryConfig.locateFile = (path,
prefix) => {\n    if (path.endsWith('.worker.js')) {\n     const response = wasmWorkerContents;\n     const blob
= new Blob([response], {type: 'application/javascript'});\n     return URL.createObjectURL(blob);\n    }\n    if
(path.endsWith('.wasm')) {\n     return getPathToWasmBinary(\n      simdSupported as boolean,\n      threadsSupported as boolean,\n      wasmPathPrefix != null ? wasmPathPrefix : prefix);\n    }\n    return prefix
+ path;\n   };\n   // Use the instantiateWasm override when system fetch is not available.\n   // Reference:\n   //
https://github.com/emscripten-
core/emscripten/blob/2bca083cbbd5a4133db61fbd74d04f7feecfa907/tests/manual_wasm_instantiate.html#L170\n
if (customFetch) {\n   factoryConfig.instantiateWasm =\n     createInstantiateWasmFunc(getPathToWasmBinary(\n
simdSupported as boolean, threadsSupported as boolean,\n     wasmPathPrefix != null ? wasmPathPrefix :
")));\n   }\n   let initialized = false;\n   factoryConfig.onAbort = () => {\n    if (initialized) {\n     // Emscripten
already called console.warn so no need to double log.\n     return;\n    }\n    if (initAborted) {\n     //
Emscripten calls `onAbort` twice, resulting in double error\n     // messages.\n     return;\n    }\n    initAborted
= true;\n    const rejectMsg =\n      'Make sure the server can serve the `.wasm` file relative to the ' +\n
'bundled js file. For more details see https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-
wasm/README.md#using-bundlers';\n    reject({message: rejectMsg});\n   };\n   let wasm:
Promise<BackendWasmModule>;\n   // If `wasmPath` has been defined we must initialize the
vanilla module.\n   if (threadsSupported && simdSupported && wasmPath == null) {\n   factoryConfig.mainScriptUrlOrBlob = new Blob(\n     [\n      var WasmBackendModuleThreadedSimd = ` +\n
wasmFactoryThreadedSimd.toString(),\n     {type: 'text/javascript'};\n     wasm =
wasmFactoryThreadedSimd(factoryConfig);\n   } else {\n     // The wasmFactory works for both vanilla and SIMD
binaries.\n     wasm = wasmFactory(factoryConfig);\n   }\n   // The WASM module has been successfully
created by the factory.\n   // Any error will be caught by the onAbort callback defined above.\n   wasm.then((module) => {\n    initialized = true;\n    initAborted = false;\n\n    const voidReturnType: string =
null;\n    // Using the tfjs namespace to avoid conflict with emscripten's API.\n    module.tfjs = {\n     init:
module.cwrap('init', null, []),\n     initWithThreadsCount:\n       module.cwrap('init_with_threads_count', null,
['number']),\n     getThreadsCount:
module.cwrap('get_threads_count', 'number', []),\n     registerTensor: module.cwrap(\n       'register_tensor',
null,\n       [\n        'number', // id\n        'number', // size\n        'number', // memoryOffset\n
]),\n     disposeData: module.cwrap('dispose_data', voidReturnType, ['number']),\n     dispose:
module.cwrap('dispose', voidReturnType, []),\n     resolve({wasm: module});\n   });\n   }\n   }\n   \n   function
typedArrayFromBuffer(\n    buffer: ArrayBuffer, dtype: DataType): backend_util.TypedArray {\n    switch (dtype)
{\n     case 'float32':\n      return new Float32Array(buffer);\n     case 'int32':\n      return new Int32Array(buffer);\n
     case 'bool':\n      return new Uint8Array(buffer);\n     default:\n      throw new Error(`Unknown dtype ${dtype}`);\n
    }\n   }\n   \n   const wasmBinaryNames = [\n     'tfjs-backend-wasm.wasm', 'tfjs-backend-wasm-simd.wasm',\n     'tfjs-
backend-wasm-threaded-simd.wasm'\n   ] as const ;\n   type

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WasmBinaryName = typeof wasmBinaryNames[number];\n\nlet wasmPath: string = null;\nlet wasmPathPrefix:\nstring = null;\nlet wasmFileMap: {[key in WasmBinaryName]?: string} = {};\nlet initAborted = false;\nlet\ncustomFetch = false;\n\n/**\n * @deprecated Use `setWasmPaths` instead.\n * Sets the path to the `.wasm` file\nwhich will be fetched when the wasm\n * backend is initialized. See\n *  
https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-wasm/README.md#using-bundlers\n * for more details.\n * @param path wasm file path or url\n * @param usePlatformFetch optional boolean to use platform fetch\nto download\n * the wasm file, default to false.\n * @doc {heading: 'Environment', namespace: 'wasm'}\n */\nexport function setWasmPath(path: string, usePlatformFetch = false): void {\n  deprecationWarn(\n    'setWasmPath has been deprecated in favor of setWasmPaths and '\n    'will be removed in a future release.);\n  if\n  (initAborted) {\n    throw new Error(\n      'The\n      WASM backend was already initialized. Make sure you call '\n      'setWasmPath()' before you call\n      `tf.setBackend()` or `tf.ready()`);\n  }\n  wasmPath = path;\n  customFetch = usePlatformFetch;\n}\n\n/**\n * Configures the locations of the WASM binaries.\n * @js\n * setWasmPaths({\n *   'tfjs-backend-wasm.wasm':\n   'renamed.wasm',\n *   'tfjs-backend-wasm-simd.wasm': 'renamed-simd.wasm',\n *   'tfjs-backend-wasm-threaded-simd.wasm': 'renamed-threaded-simd.wasm'\n * });\n * tf.setBackend('wasm');\n * @param\n * prefixOrFileMap This can be either a string or object:\n * - (string) The path to the directory where the WASM\nbinaries are located.\n * Note that this prefix will be used to load each binary (vanilla,\n * SIMD-enabled,\nthreading-enabled, etc.).\n * - (object) Mapping from names of WASM binaries to custom\n * full paths\nspecifying the locations of those binaries. This is useful if\n * your WASM binaries are not all located in the same\ndirectory, or\n * if your\n * WASM binaries have been renamed.\n * @param usePlatformFetch optional boolean to use platform\nfetch to download\n * the wasm file, default to false.\n * @doc {heading: 'Environment', namespace:\n'wasm'}\n */\nexport function setWasmPaths(\n  prefixOrFileMap: string|[{\nkey in WasmBinaryName]: string},\n  usePlatformFetch = false): void {\n  if (initAborted) {\n    throw new Error(\n      'The WASM backend was already\n      initialized. Make sure you call '\n      'setWasmPaths()' before you call `tf.setBackend()` or '\n      'tf.ready()`);\n  }\n  if (typeof prefixOrFileMap === 'string') {\n    wasmPathPrefix = prefixOrFileMap;\n  } else\n  {\n    wasmFileMap = prefixOrFileMap;\n    const missingPaths =\n      wasmBinaryNames.filter(name =>\n      wasmFileMap[name] == null);\n    if (missingPaths.length > 0) {\n      throw new Error(\n        `There were no\n        entries found for the following binaries: ` +\n        `${missingPaths.join(', ')}`.\n        Please either call\n        setWasmPaths with a\n        map providing a path for each binary, or with a string indicating\n        the\n        directory where all the binaries can be found.`);\n    }\n  }\n  customFetch = usePlatformFetch;\n}\n\n/**\n * Used in\nunit tests.\n */\nexport function resetWasmPath(): void {\n  wasmPath = null;\n  wasmPathPrefix = null;\n  wasmFileMap = {};\n  customFetch = false;\n  initAborted = false;\n}\n\nlet threadsCount = -1;\nlet\nactualThreadsCount = -1;\n\n/**\n * Sets the number of threads that will be used by XNNPACK to create\n * threadpool (default to the number of logical CPU cores).\n * This must be called before calling\n * `tf.setBackend('wasm')`.\n */\nexport function setThreadsCount(numThreads: number) {\n  threadsCount =\n  numThreads;\n}\n\n/**\n * Gets the actual threads count that is used by XNNPACK.\n * It is set after the\nbackend is intialized.\n */\nexport function getThreadsCount(): number {\n  if (actualThreadsCount === -1) {\n    throw new Error(\n      'WASM\n      backend not initialized.`);\n  }\n  return actualThreadsCount;\n}\n\nexport const wasmWorkerContents = 'var\nModule={};function threadPrintErr(){var text=Array.prototype.slice.call(arguments).join(\n'`\n');console.error(text)}function threadAlert(){var text=Array.prototype.slice.call(arguments).join(\n'`\n');postMessage({cmd:"alert",text:text,threadId:Module["_pthread_self"]()})}var\nerr=threadPrintErr;this.alert=threadAlert;Module["instantiateWasm"]=function(info,receiveInstance){var\ninstance=new\nWebAssembly.Instance(Module["wasmModule"],info);Module["wasmModule"]=null;receiveInstance(instance);\nreturn instance.exports};function\nmoduleLoaded(){this.onmessage=function(e){try{if(e.data.cmd==="load"){Module["wasmModule"]=e.data.wa
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smModule;Module["wasmMemory"]=e.data.wasmMemory;Module["buffer"]=Module["wasmMemory"].buffer;
Module["ENVIRONMENT_IS_PTHREAD"]=true;if(typeof
e.data.urlOrBlob==="string"){importScripts(e.data.urlOrBlob)}else{var
objectUrl=URL.createObjectURL(e.data.urlOrBlob);importScripts(objectUrl);URL.revokeObjectURL(objectUrl)}
WasmBackendModuleThreadedSimd(Module).then(function(instance){Module=instance;moduleLoaded()})else
if(e.data.cmd==="objectTransfer"){Module["PThread"].receiveObjectTransfer(e.data)}else
if(e.data.cmd==="run"){Module["__performance_now_clock_drift"]=performance.now()-
e.data.time;Module["__emscripten_thread_init"](e.data.threadInfoStruct,0,0);var max=e.data.stackBase;var
top=e.data.stackBase+e.data.stackSize;Module["establishStackSpace"](top,max);Module["_emscripten_tls_init"](
);Module["PThread"].receiveObjectTransfer(e.data);Module["PThread"].setThreadStatus(Module["_pthread_self
"](),1);try{var
result=Module["invokeEntryPoint"](e.data.start_routine,e.data.arg);if(!Module["getNoExitRuntime"]())Module["
PThread"].threadExit(result)}catch(ex){if(ex==="Canceled!"){Module["PThread"].threadCancel()}else
if(ex!="unwind"){if(ex instanceof
Module["ExitStatus"]){if(Module["getNoExitRuntime"]()){}}else{Module["PThread"].threadExit(ex.status)}}el
se{Module["PThread"].threadExit(-2);throw
ex}}}}else
if(e.data.cmd==="cancel"){if(Module["_pthread_self"]()){Module["PThread"].threadCancel()}}else
if(e.data.target==="setimmediate"){}}else
if(e.data.cmd==="processThreadQueue"){if(Module["_pthread_self"]()){Module["_emscripten_current_thread_
process_queued_calls"]()}else{err("worker.js received unknown command
"+e.data.cmd);err(e.data)}}catch(ex){err("worker.js onmessage() captured an uncaught exception:
"+ex);if(ex&&ex.stack)err(ex.stack);throw ex}};if(typeof process==="object"&&typeof
process.versions==="object"&&typeof process.versions.node==="string"){self={location:{href:__filename}}};var
onmessage=this.onmessage;var
nodeWorkerThreads=require("worker_threads");global.Worker=nodeWorkerThreads.Worker;var
parentPort=nodeWorkerThreads.parentPort;parentPort.on("message",function(data){onmessage({data:data})});var
nodeFS=require("fs");var nodeRead=function(filename){return
nodeFS.readFileSync(filename,"utf8")};function
globalEval(x){global.require=require;global.Module=Module;eval.call(null,x)}importScripts=function(f){globalEva
l(nodeRead(f));postMessage=function(msg){parentPort.postMessage(msg)};if(typeof
performance==="undefined"){performance={now:function(){return Date.now()}}};"/**\n * @license\n *
Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
"License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport './flags_wasm';\n\nimport {registerBackend} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm,
init} from './backend_wasm';\n\nexport {BackendWasm, getThreadsCount, setThreadsCount, setWasmPath,
setWasmPaths} from './backend_wasm';\n\nexport {version as version_wasm} from './version';\n\nconst
WASM_PRIORITY = 2;\n\nregisterBackend('wasm', async () => {\n\n  const {wasm} = await init();\n\n  return new
BackendWasm(wasm);\n\n}, WASM_PRIORITY);\n\n"/** @license See the LICENSE file. */\n\n// This code is
auto-generated, do not modify this file!\n\nconst version = '3.11.0';\n\nexport
{version};\n\n,"names":["CppType","FusableActivation","wasmFusedMatMul","fusedMatMulConfig","kernelNa
me","_FusedMatMul","backendName","setupFunc","backend","wasm","cwrap","kernelFunc","args","inputs","attrs
","a","b","bias","preluActivationWeights","dtype","Error","transposeA","transposeB","activation","leakyreluAlpha",

```

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mutedOutId", "getUndoAxesPermutation", "wasmDepthwiseConv2d", "depthToSpaceConfig", "DepthToSpace", "bloc
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mF,GAAuF,OAAhFxpB,EAAOypB,EAAK,gCAAgCD,EAAM,8BAAqCC,EAAK,SAASC,EAAMF,EAAMG,EAA WC,EAASzzB,EAAK0zB,GAAM,IAAIC,EAAI,CAACC,OAAAS,SAASC,GAAK,IAAIxD,EAAI,EAAE,GAAgWd ,MAAAA,GAAmC,IAANA,EAAQ,CAAC,IAAIC,EAAoB,GAAfD,EAAIvyB,QAAQ,GAAyByB,EAAaF,EAAjC xD,EAAI2D,GAAWF,GAA0BA,GAAK,OAAOzD,GAAK4D,MAAQ,SAASC,GAAK,IAAI7D,EAAI2D,GAWE, EAAI5yB,QAAoC,OAA5B6yB,GAAmBD,EAAI7D,GAAYA,IAAsJiD,EAAKF,EAASC,GAAWe,EAAM,GAO C,EAAM,EAAE,GAAGr0B,EAAM,IAAI,IAAIyD,EAAE,EAAEA,EAAEzD,EAAKsB,OAAOmC,IAAI,CAAC,IA AI6wB,EAAUX,EAAIF,EAAShwB,IAAO6wB,GAAsB,IAARD,IAAUA,EAAME,MAAYH,EAAM3wB,GAAG6 wB,EAAU0tB,EAAKyD,KAAS2wB,EAAM3wB,GAAGzD,EAAKyD,GAAK,IAAI4sB,EAAIiD,EAAKkB,MAA M,KAAKJ,GAAoE,OAA7D/D,EAArY,SAA4BA,GAAK,MAAgB,WAAbmD,EAA6BiB,EAAapE,GAAqB,YAAb mD,EAA8BkB,QAAQrE,GAAYA,EAAiQsE,CAAmBtE,GAAgB,IAARgE,GAAUO,GAAaP,GAACH,EAAI,SAA SvWb,EAAMuzB,EAAMG,EAAWC,EAASC,GAA4B,IAAIImB,GAA1BpB,EAASA,GAAU,IAA4BlwB,OAAM,S AASqP,GAAM,MAAc,WAAPA,KAAuD,MAAT,WAAb4gB,GAAqCqB,IAAcnB,EAAaN,EAASC,GAAC,WAAW ,OAAOE,EAAMF,EAAMG,EAAWC,EAASqB,YAAiB,SAASC,EAakBC,EAAKtoB,EAAIuoB,GAAyD,IAAzC,I AAIC,EAAOxoB,EAAIuoB,EAAMBpB,EAAI,KAAWnnB,GAAKwoB,IAAQ,CAAC,IAAIC,EAAGH,EAAKtoB, KAAO,IAAIyoB,EAAG,OAAOtB,EAAI,GAAQ,IAAHsB,EAAL,CAAoD,IAAIC,EAAe,GAAZJ,EAAKtoB,KAA U,GAAa,MAAN,IAAHyoB,GAAJ,CAAmE,IAAIE,EAAe,GAAZL,EAAKtoB,KAAmG,IAAvEyoB,EAAL,MAAN ,IAAHA,IAAqB,GAAHA,IAAQ,GAAGC,GAAI,EAAEC,GAAe,EAHF,IAAO,GAAGC,GAAI,GAAGC,GAAI,E AAc,GAAZL,EAAKtoB,MAAgB,MAAOmnB,GAAKyB,OAAOC,aAAaJ,OAAQ,CAAC,IAAIK,EAAGL,EAAG, MAAMtB,GAAKyB,OAAOC,aAAa,MAAMC,GAAI,GAAG,MAAS,KAAHA,SAA3Q3B,GAAKyB,OAAOC,cAA iB,GAAHJ,IAAQ,EAAEC,QAAIHvB,GAAKyB,OAAOC,aAAaJ,GAA0U,OAAOtB,EAAI,SAASY,EAAgB,EAA IR,GAAgB,OAAOQ,EAAIV,EAAkBiH,IAAmBgI,EAAIR,GAAgB,GAAG,SAASS,EAAkB7B,EAAImB,EAAKW ,EAAOC,GAAiB,KAAKA,EAAgB,GAAG,OAAO,EAA0D,IAAxD,IAAIC,EAASF,EAAWT,EAAOS,EAAOC,EA AgB,EAAUnyB,EAAE,EAAEA,EAAEowB,EAAIvyB,SAASmC,EAAE,CAAC,IAAIqyB,EAAEjC,EAAIkC,WAA WtyB,GAAoF,GAA9EqyB,GAAG,OAAOA,GAAG,QAakCA,EAAE,QAAU,KAAFA,IAAS,IAAO,KAA9CjC,EA AIkC,aAAatyB,IAAqCqyB,GAAG,IAAI,CAAC,GAAGH,GAAQT,EAAO,MAAMF,EAAKW,KAAUG,OAAO,G AAGA,GAAG,KAAK,CAAC,GAAGH,EAAO,GAAGT,EAAO,MAAMF,EAAKW,KAAU,IAAIG,GAAG,EAAEd ,EAAKW,KAAU,IAAM,GAAFG,OAAU,GAAGA,GAAG,MAAM,CAAC,GAAGH,EAAO,GAAGT,EAAO,MAA MF,EAAKW,KAAU,IAAIG,GAAG,GAAGd,EAAKW,KAAU,IAAIG,GAAG,EAAE,GAAGd,EAAKW,KAAU,IA AM,GAAFG,MAAS,CAAC,GAAGH,EAAO,GAAGT,EAAO,MAAMF,EAAKW,KAAU,IAAIG,GAAG,GAAGd, EAAKW,KAAU,IAAIG,GAAG,GAAGd,EAAKW,KAAU,IAAIG,GAAG,EAAE,GAAGd,EAAKW,KAA U,IAAM,GAAFG,GAAqB,OAafd,EAAKW,GAAQ,EAASA,EAAOE,EAAS,SAAS9B,EAAaF,EAAImC,EAAOJ, GAAiB,OAAOF,EAAkB7B,EAAIpG,IAAmBuI,EAAOJ,GAAiB,SAASK,EAAgBpC,GAAe,IAAV,IAAIC,EAAI,E AAUrwB,EAAE,EAAEA,EAAEowB,EAAIvyB,SAASmC,EAAE,CAAC,IAAIqyB,EAAEjC,EAAIkC,WAAWtyB, GAAMqyB,GAAG,OAAOA,GAAG,QAAMA,EAAE,QAAU,KAAFA,IAAS,IAAwB,KAApBjC,EAAIkC,aAAaty B,IAAWqyB,GAAG,MAAMhC,EAAoBA,GAARgC,GAAG,KAAU,EAUA,GAAG,MAAW,EAAY,EAAE,OAA OhC,EAAI,SAASK,GAAMBF,EAAM/xB,GAAQmrB,IAAmBhpB,IAAI4vB,EAAM/xB,GAAQ,SAASg0B,GAAQ 3zB,EAAE4zB,GAakD,OAArC5zB,EAAE4zB,EAAS,IAAG5zB,GAAG4zB,EAAS5zB,EAAE4zB,GAAgB5zB,E AAWE,SAASgrB,GAA2B6I,GAAKI0B,EAAOk0B,EAAIII,EAAc,MAAEV,EAAM,IAAI6I,UAAUD,GAAKII,EA Ae,OAAS,IAAIoI,WAAWF,GAAKII,EAAe,OAAEP,EAAO,IAAI1rB,WAAWm0B,GAAKII,EAAe,OAAE5O,EA AO,IAAItd,WAAWo0B,GAAKII,EAAgB,QAAU,IAAIqI,YAAYH,GAAKII,EAAgB,QAAEL,EAAQ,IAAI2I,YAA YJ,GAAKII,EAAgB,QAAU,IAAIuI,aAAaL,GAAKII,EAAgB,QAAEH,EAAQ,IAAI2I,aAAaN,GAAK,IAAu3BO, GAAn3BC,GAAe1I,EAABuB,gBAAG,SAAS,GAAGmB,EAABwB/B,EAAYW,EAAMb,WAAEhsB,EAAOgsB,EAA e,YAAO,GAAGA,EAAMb,WAAGZ,EAAYW,EAAMb,gBAAoH,MAA7GZ,EAAW,IAAIId,YAAYqK,OAAO,CA ACC,QAAUF,GAAe,MAAMG,QAAU,MAAiBC,QAAS,KAAU90B,kBAakB2qB,mBAAGz,MAA5XgG,EAAI,+ NAAkO/D,GAAqB6B,QAAQW,IAAI,qHAA2H9wB,MAAM,cAAmB8sB,IAAYprB,EAAOorB,EAAWprB,QAA O00B,GAAe10B,EAAO+0B,WAAW1J,GAA2BrrB,GAAsB,IAAIg1B,GAAa,GAAOC,GAAW,GAAOC,GAAW,G AAyBC,GAAC,GAA4I,SAASC,KAAS,IAAGjI,EAAH,CAAIc,GAAGnB,EAAe,OAA8E,IAA/C,mBAAIbA,EAAe ,SAAcA,EAAe,OAAE,CAACA,EAAe,SAASA,EAAe,OAAE5sB,QAAQi2B,GAAyRj,EAAe,OAAEsJ,SAAUC,G

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=====\n*/\n\nimport { backend_util, BatchToSpaceND, BatchToSpaceNDAttrs, BatchToSpaceNDInputs, KernelConfig,  
KernelFunc } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport  
{ reshape } from './Reshape';\nimport { slice } from './Slice';\nimport { transpose } from './Transpose';\n\nfunction  
batchToSpaceND(args: {n inputs: BatchToSpaceNDInputs,\n backend: BackendWasm,\n attrs:  
BatchToSpaceNDAttrs\n}) {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {blockShape,
```



```

crops} = attrs;\n\n const prod = blockShape.reduce((a, b) => a * b);\n\n const reshaped =
backend_util.getReshaped(x.shape, blockShape, prod);\n const permuted =
backend_util.getPermuted(reshaped.length, blockShape.length);\n const reshapedPermuted =\nbackend_util.getReshapedPermuted(x.shape, blockShape, prod);\n const sliceBeginCoords =\nbackend_util.getSliceBeginCoords(crops, blockShape.length);\n const sliceSize =\nbackend_util.getSliceSize(reshapedPermuted, crops, blockShape.length);\n\n const xReshaped = reshape({inputs:
{x}, backend, attrs: {shape: reshaped}});\n const xTransposed =\n  transpose({inputs: {x: xReshaped}, backend,
attrs: {perm: permuted}});\n const xTransposedReshaped = reshape(\n  {inputs: {x: xTransposed}, backend,
attrs: {shape: reshapedPermuted}});\n const result = slice({\n  inputs: {x: xTransposedReshaped},\n  backend,\n  attrs: {begin: sliceBeginCoords, size: sliceSize}\n });\n\n backend.disposeData(xReshaped.dataId);\n
backend.disposeData(xTransposed.dataId);\n backend.disposeData(xReshaped.dataId);\n\n return
result;\n}\n\nexport const batchToSpaceNDConfig: KernelConfig = {\n  kernelName: BatchToSpaceND,\n  backendName: 'wasm',\n  kernelFunc: batchToSpaceND as { } as KernelFunc\n};\n"}

```

Found in path(s):

```

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
wasm/dist/kernels/BatchToSpaceND.js.map

```

No license file was found, but licenses were detected in source scan.

```

{"version":3,"file":"tf-backend-
wasm.js","sources":["../src/kernels/types.ts","../src/kernels/_FusedMatMul.ts","../src/kernels/unary_kernel.ts","../src/
kernels/Abs.ts","../src/kernels/binary_kernel.ts","../src/kernels/Add.ts","../src/kernels/AddN.ts","../src/kernels/Identit
y.ts","../src/kernels/Transpose.ts","../src/kernels/kernel_utils.ts","../src/kernels/All.ts","../src/kernels/Any.ts","../src/k
ernels/ArgMax.ts","../src/kernels/AvgPool.ts","../src/kernels/Reshape.ts","../src/kernels/BatchMatMul.ts","../node_m
odules/@tensorflow/tfjs-backend-cpu/dist/kernels/Concat_impl.js","../node_modules/@tensorflow/tfjs-backend-
cpu/dist/kernels/Range_impl.js","../node_modules/@tensorflow/tfjs-backend-
cpu/dist/kernels/Slice.js","../src/kernels/Slice.ts","../src/kernels/BatchToSpaceND.ts","../src/kernels/Cast.ts","../src/k
ernels/Ceil.ts","../src/kernels/ClipByValue.ts","../src/kernels/Concat.ts","../src/kernels/Conv2D.ts","../src/kernels/Co
nv2DBackpropInput.ts","../src/kernels/Cos.ts","../src/kernels/Cosh.ts","../src/kernels/CropAndResize.ts","../src/kerne
ls/Cumsum.ts","../src/kernels/DepthToSpace.ts","../src/kernels/DepthwiseConv2dNative.ts","../src/kernels/Elu.ts","..
/src/kernels/Equal.ts","../src/kernels/Exp.ts","../src/kernels/ExpandDims.ts","../src/kernels/Fill.ts","../src/kernels/Flip
LeftRight.ts","../src/kernels/Floor.ts","../src/kernels/FloorDiv.ts","../src/kernels/FusedBatchNorm.ts","../src/kernels/
FusedConv2D.ts","../src/kernels/FusedDepthwiseConv2D.ts","../src/kernels/GatherNd.ts","../src/kernels/GatherV2.ts
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c/kernels/LessEqual.ts","../src/kernels/Log.ts","../src/kernels/LogicalAnd.ts","../src/kernels/Max.ts","../src/kernels/M
aximum.ts","../src/kernels/MaxPool.ts","../src/kernels/Mean.ts","../src/kernels/Min.ts","../src/kernels/Minimum.ts",".
../src/kernels/MirrorPad.ts","../src/kernels/Multiply.ts","../src/kernels/Neg.ts","../src/kernels/NonMaxSuppression_uti
l.ts","../src/kernels/NonMaxSuppressionV3.ts","../src/kernels/NonMaxSuppressionV4.ts","../src/kernels/NonMaxSu
ppressionV5.ts","../src/kernels/NotEqual.ts","../src/kernels/OneHot.ts","../src/kernels/OnesLike.ts","../src/kernels/Pa
ck.ts","../src/kernels/PadV2.ts","../src/kernels/Pow.ts","../src/kernels/Prelu.ts","../src/kernels/Prod.ts","../src/kernels/
Range.ts","../src/kernels/RealDiv.ts","../src/kernels/Relu.ts","../src/kernels/Relu6.ts","../src/kernels/ResizeBilinear.ts
","../src/kernels/Reverse.ts","../src/kernels/RotateWithOffset.ts","../src/kernels/Round.ts","../src/kernels/Rsqrt.ts","../
src/kernels/ScatterNd.ts","../src/kernels/Select.ts","../src/kernels/Sigmoid.ts","../src/kernels/Sin.ts","../src/kernels/Sof
tmax.ts","../src/kernels/SpaceToBatchND.ts","../src/kernels/SplitV.ts","../src/kernels/Sqrt.ts","../src/kernels/Square.ts
","../src/kernels/SquaredDifference.ts","../src/kernels/Step.ts","../src/kernels/StridedSlice.ts","../src/kernels/Sub.ts",".
../src/kernels/Sum.ts","../src/kernels/Tan.ts","../src/kernels/Tanh.ts","../src/kernels/Tile.ts","../src/kernels/TopK.ts","../
src/kernels/Transform.ts","../src/kernels/Unpack.ts","../src/kernels/ZerosLike.ts","../src/register_all_kernels.ts","../sr
c/flags_wasm.ts","../wasm-out/tfjs-backend-wasm-threaded-simd.js","../wasm-out/tfjs-backend-wasm-threaded-

```

```

simd.worker.js", "../wasm-out/tfjs-backend-
wasm.js", "../src/backend_wasm.ts", "../src/version.ts", "../src/base.ts"], "sourcesContent": ["/**\n
 * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\n// This enum must align with the enum defined in cc/backend.h.\nexport enum CppDType {\n float32 = 0,\n
int32 = 1,\n bool = 2,\n string = 3,\n complex64 = 4\n}\n\n// Must match enum in cc/fusable_activations.h.\nexport
enum FusableActivation {\n linear = 0,\n relu = 1,\n relu6 = 2,\n prelu = 3,\n leakyrelu = 4,\n sigmoid = 5,\n elu
= 6\n}\n\n/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache
License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You
may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required
by applicable law or agreed to in writing, software\n * distributed
under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF
ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n *
limitations under the License.\n *
=====
*\n\nimport { _FusedMatMul, _FusedMatMulAttrs, _FusedMatMulInputs, KernelConfig, KernelFunc } from
'@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport { FusableActivation } from
 './types';\n\nlet wasmFusedMatMul: (\n  aId: number, aShape: Uint8Array, aShapeSize: number, bId: number,\n
bShape: Uint8Array, bShapeSize: number, transposeA: boolean,\n  transposeB: boolean, activation: number,\n
biasId: number,\n  preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>\n
void;\n\nfunction setup(backend: BackendWasm) {\n  wasmFusedMatMul = backend.wasm.cwrap(_FusedMatMul,\n
null /* void */, [\n  'number',\n
  // a_id\n  'array', // a_shape\n  'number', // a_shape.length\n  'number', // b_id\n  'array', // b_shape\n
'number', // b_shape.length\n  'number', // transpose_a\n  'number', // transpose_b\n  'number', // activation\n
'number', // biasId\n  'number', // preluActivationWeightsId\n  'number', // leakyreluAlpha\n  'number' //
out_id\n  ]);\n\nfunction fusedBatchMatMul(args: {\n  inputs: _FusedMatMulInputs,\n  backend:
BackendWasm,\n  attrs: _FusedMatMulAttrs\n}) {\n  const {inputs, backend, attrs} = args;\n  const {a, b, bias,\n
preluActivationWeights} = inputs;\n\n  if (a.dtype !== 'float32' || b.dtype !== 'float32') {\n    throw new Error(\n
`_FusedMatMul for non non-float32 tensors not yet supported.`);\n  }\n\n  const {transposeA, transposeB,\n
activation, leakyreluAlpha} = attrs;\n  const aId = backend.dataIdMap.get(a.dataId).id;\n  const bId =
backend.dataIdMap.get(b.dataId).id;\n\n  let biasId = 0;\n  if (bias != null) {\n    const
biasData = backend.dataIdMap.get(bias.dataId);\n    if (biasData.shape.length !== 1) {\n      throw new Error(\n
`_FusedMatMul only supports rank-1 bias but got ` +\n      `rank ${biasData.shape.length}.`);\n    }\n    biasId =
biasData.id;\n  }\n  const preluActivationWeightsId = preluActivationWeights == null ?\n    0 : \n
backend.dataIdMap.get(preluActivationWeights.dataId).id;\n  const fusedActivation = \n
FusableActivation[activation as {}] as keyof typeof FusableActivation;\n  if (fusedActivation == null) {\n    throw
new Error(\n    `${activation} activation not yet supported for FusedConv2D ` +\n    `in the wasm backend.`);\n  }\n\n
const leftDim = transposeA ? a.shape[2] : a.shape[1];\n  const rightDim = transposeB ? b.shape[1] :
b.shape[2];\n  const batchDim = a.shape[0];\n\n  const out = backend.makeOutput([batchDim, leftDim, rightDim],
a.dtype);\n  const outId = backend.dataIdMap.get(out.dataId).id;\n  const aShapeBytes = new Uint8Array(new
Int32Array(a.shape).buffer);\n  const bShapeBytes = new Uint8Array(new Int32Array(b.shape).buffer);\n\n  wasmFusedMatMul(\n
aId, aShapeBytes, a.shape.length, bId, bShapeBytes, b.shape.length,\n  transposeA,

```

```

transposeB, fusedActivation, biasId, preluActivationWeightsId,\n    leakyreluAlpha || 0, outId);\n\n return
out;\n}\n\nexport const fusedMatMulConfig: KernelConfig = {\n kernelName: _FusedMatMul,\n backendName:
'wasm',\n setupFunc: setup,\n kernelFunc: fusedBatchMatMul as {} as KernelFunc\n};\n", "/*\n * @license\n *
Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
'License');\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an 'AS IS' BASIS,\n *
WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {DataType, KernelConfig, TensorInfo, UnaryInputs, util} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from '../backend_wasm';\n\nimport {CppType} from './types';\n\nexport function
createUnaryKernelConfig(\n kernelName: string, outType?: DataType): KernelConfig {\n let wasmFunc: (xId:
number, dtype: number, outId: number) => void;\n\n function setupFunc(backend: BackendWasm): void {\n
wasmFunc = backend.wasm.cwrap(kernelName, null /* void */, [\n 'number', // x_id\n 'number', // dtype\n
'number', // out_id\n ]);\n }\n\n function kernelFunc(args: {backend: BackendWasm, inputs: UnaryInputs}):
TensorInfo {\n const {backend, inputs: {x}} = args;\n const xId = backend.dataIdMap.get(x.dataId).id;\n
const out = backend.makeOutput(x.shape, outType || x.dtype);\n const outId =
backend.dataIdMap.get(out.dataId).id;\n\n // Short-circuit zero-sized tensors.\n if (util.sizeFromShape(out.shape)
=== 0) {\n return out;\n }\n\n wasmFunc(xId, CppDType[x.dtype], outId);\n return out;\n }\n\n return
{kernelName, backendName: 'wasm', setupFunc, kernelFunc};\n}\n", "/*\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the 'License');\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an 'AS IS' BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n
* limitations under the License.\n *
=====\n
*/\n\nimport {Abs, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'/unary_kernel';\n\nexport const absConfig: KernelConfig = createUnaryKernelConfig(Abs);\n", "/*\n * @license\n *
Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
'License');\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an 'AS IS' BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {backend_util, BinaryInputs, DataType, KernelConfig, TensorInfo, util} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {CppType} from './types';\n\nexport
function createBinaryKernelConfig(\n kernelName: string, supportsFullBroadcast: boolean,\n dtype?:
DataType): KernelConfig {\n let wasmFunc:\n (aId: number, aShape: Uint8Array, aShapeLen: number, bId:
number,\n bShape: Uint8Array, bShapeLen: number, dtype: number, outId: number) =>\n void;\n\n function
setupFunc(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(kernelName, null /*
void */, [\n 'number', // a_id,\n 'array', // a_shape\n 'number', // a_shape.length\n 'number', // b_id\n
'array', // b_shape\n 'number', // b_shape.length\n 'number', // dtype\n 'number' // out_id\n ]);\n }\n\n
function kernelFunc(args: {backend: BackendWasm, inputs: BinaryInputs}):

```

```

TensorInfo {\n  const {backend, inputs} = args;\n  const {a, b} = inputs;\n  const aId =
backend.dataIdMap.get(a.dataId).id;\n  const bId = backend.dataIdMap.get(b.dataId).id;\n\n  const outputType =
dtype != null ? dtype : a.dtype;\n  const newShape = backend_util.assertAndGetBroadcastShape(a.shape,
b.shape);\n  const out = backend.makeOutput(newShape, outputType);\n\n  // Short-circuit zero-sized tensors.\n  if (util.sizeFromShape(newShape) === 0) {\n    return out;\n  }\n\n  const aShapeBytes = new Uint8Array(new
Int32Array(a.shape).buffer);\n  const bShapeBytes = new Uint8Array(new Int32Array(b.shape).buffer);\n  const
outId = backend.dataIdMap.get(out.dataId).id;\n  const kernelFunc = () => wasmFunc(\n    aId, aShapeBytes,
a.shape.length, bId, bShapeBytes, b.shape.length,\n    CppDType[a.dtype], outId);\n\n  // Currently only some
float operations support full broadcast.\n  if (supportsFullBroadcast && a.dtype === 'float32')
{\n    kernelFunc();\n    return out;\n  }\n\n  const aBroadcastDims = backend_util.getBroadcastDims(a.shape,
newShape);\n  const bBroadcastDims = backend_util.getBroadcastDims(b.shape, newShape);\n  const
loopsOverAllOfA = aBroadcastDims.every((v, i) => v === i);\n  const loopsOverAllOfB =
bBroadcastDims.every((v, i) => v === i);\n  if (loopsOverAllOfA && loopsOverAllOfB) {\n    kernelFunc();\n
return out;\n  } else {\n    throw new Error(\n      `Broadcasting along outer dims is not yet `+\n
`supported for ${a.dtype} ${kernelName}.`);\n  }\n\n  return {kernelName, backendName: 'wasm', setupFunc,
kernelFunc};\n}\n\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * \n *
Unless required
by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\"
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {Add, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
'/binary_kernel';\n\nconst supportsFullBroadcast = true;\n\nexport const addConfig: KernelConfig =\ncreateBinaryKernelConfig(Add, supportsFullBroadcast);\n\n", "/*\n * @license\n * Copyright 2019 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {AddN, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport
{BackendWasm} from './backend_wasm';\nimport {CppType} from './types';\n\nlet wasmFunc:\n (inputIds:
Uint8Array, inputIdsLen: number, dtype: number, outId: number) =>\n void;\n\nfunction setupFunc(backend:
BackendWasm): void {\n  wasmFunc = backend.wasm.cwrap(AddN, null /* void */, [\n    'array', // input_ids\n
'number', // input_ids.length\n 'number', // dtype\n 'number', // out_id\n ]);\n}\n\nfunction addn(args: {inputs:
TensorInfo[], backend: BackendWasm}) {\n  const {inputs,
backend} = args;\n  const out = backend.makeOutput(inputs[0].shape, inputs[0].dtype);\n\n  // Short-circuit zero-
sized tensors.\n  if (util.sizeFromShape(out.shape) === 0) {\n    return out;\n  }\n\n  const inputIds = inputs.map(x
=> backend.dataIdMap.get(x.dataId).id);\n  const inputIdsBytes = new Uint8Array(new
Int32Array(inputIds).buffer);\n  const outId = backend.dataIdMap.get(out.dataId).id;\n  wasmFunc(inputIdsBytes,
inputIds.length, CCppType[out.dtype], outId);\n\n  return out;\n}\n\nexport const addNConfig: KernelConfig = {\n
kernelName: AddN,\n backendName: 'wasm',\n setupFunc,\n kernelFunc: addn as {} as KernelFunc,\n};\n\n", "/*\n *
@license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable

```

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to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```
=====\n*\n\nimport {Identity, IdentityInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\nimport\n{TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nexport function\nidentity(args: {inputs: IdentityInputs, backend: BackendWasm}):\n  TensorInfo {\n  const {inputs: {x}, backend} =\nargs;\n  const out = backend.makeOutput(x.shape, x.dtype);\n  const inVals = backend.typedArrayFromHeap(x);\n  const outVals = backend.typedArrayFromHeap(out);\n  outVals.set(inVals);\n  return out;\n}\n\nexport const\nidentityConfig: KernelConfig = {\n  kernelName: Identity,\n  backendName: 'wasm',\n  kernelFunc:\n  identity as { } as KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in\n * compliance with the License.\n * You may obtain a copy of the License at\n * \n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n *\n */\n\n=====\n\nimport {KernelConfig, KernelFunc, TensorInfo, Transpose, TransposeAttrs, TransposeInputs} from\n '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {identity} from\n './Identity';\nimport {CppType}\n from './types';\n\nlet wasmTranspose: (\n  xId: number, xShape: Uint8Array, xShapeLength: number, dtype:\n  CppDType,\n  outId: number, perm: Uint8Array, permLength: number) => void;\n\nfunction setup(backend:\n  BackendWasm) {\n  wasmTranspose = backend.wasm.cwrap(Transpose, null /* void */, [\n    'number', // xId\n    'array', // x.shape\n    'number', // x.shape.length\n    'number', // dtype\n    'number', // outId\n    'array', // perm\n    'number', // perm.length\n  ]);\n}\n\nexport function transpose(\n  args: {\n    inputs: TransposeInputs, backend:\n  BackendWasm, attrs: TransposeAttrs}): TensorInfo {\n  const {inputs, backend, attrs} = args;\n  // Reduce any\n  dimensions with size one. Lower-rank transpose kernel performs\n  // better due to simpler memory access pattern.\n  const [reducedShape, perm] = removeOneSizeDims(inputs.x.shape, attrs.perm);\n  let permIsNoOp = true;\n  for\n  (let i = 0; i < perm.length; i++) {\n    if (perm[i] !== i) {\n      permIsNoOp\n      = false;\n    }\n  }\n  const outShape = computeOutShape(inputs.x.shape, attrs.perm);\n  const x = {\n    dataId:\n  inputs.x.dataId,\n    shape: reducedShape,\n    dtype: inputs.x.dtype\n  };\n  if (permIsNoOp) {\n    const cloned =\n  identity({inputs, backend});\n    cloned.shape = outShape;\n    return cloned;\n  }\n  const out =\n  backend.makeOutput(outShape, x.dtype);\n  const xId = backend.dataIdMap.get(x.dataId).id;\n  const outId =\n  backend.dataIdMap.get(out.dataId).id;\n  const permBytes = new Uint8Array(new Int32Array(perm).buffer);\n  const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n  wasmTranspose(xId,\n  xShapeBytes, x.shape.length, CppDType[x.dtype], outId, permBytes,\n  perm.length);\n  return\n  out;\n}\n\nfunction computeOutShape(inShape: number[], perm: number[]): number[] {\n  const outShape = new\n  Array(inShape.length);\n  for (let i = 0; i < outShape.length; i++) {\n    outShape[i] = inShape[perm[i]];\n  }\n  return outShape;\n}\n\nfunction\n  removeOneSizeDims(\n  shape: number[], perm: number[]): [number[], number[]] {\n  const newShape: number[]\n  = [];\n  const newPerm: number[] = [];\n  for (let i = 0; i < shape.length; ++i) {\n    if (shape[i] !== 1) {\n      newShape.push(shape[i]);\n    }\n    if (shape[perm[i]] !== 1) {\n      newPerm.push(perm[i]);\n    }\n  }\n  for (let i =\n  0; i < newPerm.length; ++i) {\n    let minValIdx = -1;\n    for (let j = 0; j < newPerm.length; ++j) {\n      if\n      (newPerm[j] >= i && (minValIdx === -1 || newPerm[minValIdx] > newPerm[j])) {\n        minValIdx = j;\n      }\n    }\n    newPerm[minValIdx] = i;\n  }\n  return [newShape, newPerm];\n}\n\nexport const transposeConfig:\n  KernelConfig = {\n  kernelName: Transpose,\n  backendName: 'wasm',\n  kernelFunc: transpose as { } as\n  as
```

KernelFunc,\n setupFunc: setup,\n};\n", "/*\n * @license\n * Copyright 2020 Google Inc. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file\n * except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n *

```
=====\n*\n\nimport { backend_util, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from\n './backend_wasm';\nimport { transpose } from './Transpose';\n\n/*\n * Compute permutation axes and do a transpose\n * if necessary.\n * \n * Used by reduction ops.\n * \n * @param x input TensorInfo\n * @param axis reduction axes\n * @param backend wasm backend instance\n */\nexport function permuteAxesAndTranspose(\n  x: TensorInfo,\n  axis: number|number[],\n  backend: BackendWasm): {\n  transposed: TensorInfo|null,\n  axes: number[],\n  originalAxes: number[],\n  inputWasTransposed: boolean\n} {\n  const xShape = x.shape;\n  const xRank = x.shape.length;\n\n  const\n  originalAxes = util.parseAxisParam(axis, xShape);\n  let axes = originalAxes;\n  const permutedAxes =\n  backend_util.getAxesPermutation(axes, xRank);\n  let xTransposed = null;\n  let inputWasTransposed = false;\n  if\n  (permutedAxes != null) {\n    const newShape: number[] = new Array(xRank);\n    for (let i = 0; i <\n    newShape.length; i++) {\n      newShape[i] = xShape[permutedAxes[i]];\n    }\n\n    axes =\n    backend_util.getInnerMostAxes(axes.length, xRank);\n    xTransposed =\n    transpose({inputs: {x}, attrs: {perm:\n    permutedAxes}, backend});\n\n    const xId = backend.dataIdMap.get(x.dataId).id;\n    const transposedId =\n    backend.dataIdMap.get(xTransposed.dataId).id;\n    if (transposedId !== xId) {\n      inputWasTransposed = true;\n    }\n  }\n\n  return {transposed: xTransposed,\n  originalAxes, axes, inputWasTransposed};\n}\n\n
```

=====\n*\n\nimport { All, AllAttrs, AllInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util } from\n '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport\n {permuteAxesAndTranspose} from './kernel_utils';\n\nlet\n wasmAll: (xId: number, reduceSize: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm):\n void {\n wasmAll = backend.wasm.cwrap(All, null /*void*/, [number, number, number]);\n}\n\nfunction all(args:\n {backend: BackendWasm, inputs: AllInputs, attrs: AllAttrs}):\n TensorInfo {\n const {backend, inputs, attrs} =\n args;\n const {axis, keepDims} = attrs;\n const {x} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const {transposed, axes, originalAxes, inputWasTransposed} =\n permuteAxesAndTranspose(x, axis, backend);\n\n if (inputWasTransposed) {\n const transposedId =\n backend.dataIdMap.get(transposed.dataId).id;\n input = transposed;\n inputId = transposedId;\n }\n\n const\n inputRank = input.shape.length;\n backend_util.assertAxesAreInnerMostDims('all', axes, inputRank);\n const\n [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, axes);\n\n const reduceSize = util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, x.dtype);\n\n if (util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n wasmAll(inputId, reduceSize, outId);\n }\n\n if (inputWasTransposed) {\n // dispose of the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const newShape =\n backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n return

```

out;\n}\n\nexport const allConfig: KernelConfig = {\n  kernelName: All,\n  backendName: 'wasm',\n  setupFunc:
setup,\n  kernelFunc: all as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2021 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the 'License');\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n
*\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is
distributed on an 'AS IS' BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *
=====
*\n\nimport { Any, AnyAttrs, AnyInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util } from
'@tensorflow/tfjs-core';\n\nimport { BackendWasm } from './backend_wasm';\n\nimport
{ permuteAxesAndTranspose } from './kernel_utils';\n\nlet wasmAny: (xId: number, reduceSize: number, outId:
number) => void;\n\nfunction setup(backend: BackendWasm): void {\n  wasmAny = backend.wasm.cwrap(Any,
null /*void*/, ['number, number, number']);\n}\n\nfunction any(args: { backend: BackendWasm, inputs: AnyInputs,
attrs: AnyAttrs }):\n  TensorInfo {\n  const { backend, inputs,
  attrs } = args;\n  const { axis, keepDims } = attrs;\n  const { x } = inputs;\n  const xId =
backend.dataIdMap.get(x.dataId).id;\n  let inputId = xId;\n  let input = x;\n\n  const { transposed, axes, originalAxes,
inputWasTransposed } =\n    permuteAxesAndTranspose(x, axis, backend);\n\n  if (inputWasTransposed) {\n
const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n  input = transposed;\n  inputId =
transposedId;\n  }\n\n  const inputRank = input.shape.length;\n  backend_util.assertAxesAreInnerMostDims('any',
axes, inputRank);\n  const [outShape, reduceShape] =\n
backend_util.computeOutAndReduceShapes(input.shape, axes);\n  const reduceSize =
util.sizeFromShape(reduceShape);\n\n  const out = backend.makeOutput(outShape, x.dtype);\n  if
(util.sizeFromShape(input.shape) !== 0) {\n    const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmAny(inputId, reduceSize, outId);\n  }\n\n  if (inputWasTransposed) {\n    // dispose of the transposed tensor.\n
backend.disposeData(transposed.dataId);\n
  }\n\n  if (keepDims) {\n    // reshape\n    const newShape = backend_util.expandShapeToKeepDim(out.shape,
originalAxes);\n    out.shape = newShape;\n  }\n\n  return out;\n}\n\nexport const anyConfig: KernelConfig = {\n
kernelName: Any,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: any as {} as
KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the 'License');\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an 'AS IS' BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n
* =====
*\n\nimport { ArgMax, ArgMaxAttrs, ArgMaxInputs, KernelConfig, KernelFunc, util } from '@tensorflow/tfjs-
core';\n\nimport { BackendWasm } from './backend_wasm';\n\nimport { permuteAxesAndTranspose } from
 './kernel_utils';\n\nimport { CppDType } from './types';\n\nlet wasmFunc: (\n  xId: number, dtype: number, outerSize:
number, innerSize: number,\n  outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n
wasmFunc = backend.wasm.cwrap(ArgMax, null /* void */, [\n  'number', // x_id\n  'number', // dtype\n
'number', // outer_size\n  'number', // inner_size\n  'number' // out_id\n]);\n}\n\nfunction argmax(\n  args:
{ inputs: ArgMaxInputs, backend: BackendWasm, attrs: ArgMaxAttrs }) {\n  const { backend, inputs, attrs } = args;\n
const { axis } = attrs as {} as ArgMaxAttrs;\n  const { x } = inputs as {} as ArgMaxInputs;\n  const xId =
backend.dataIdMap.get(x.dataId).id;\n  let inputId

```

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= xId;\n let input = x;\n\n const {transposed, axes, inputWasTransposed} =\n  permuteAxesAndTranspose(x,\n  axis, backend);\n\n if (inputWasTransposed) {\n  const transposedId =\n  backend.dataIdMap.get(transposed.dataId).id;\n  if (transposedId !== xId) {\n    // transpose was not a no-op. We\n    will need to dispose of this\n    // once we are done.\n    input = transposed;\n    inputId = transposedId;\n  }\n}\n\n const outShape = input.shape.slice(0, -1);\n const out = backend.makeOutput(outShape, 'int32');\n const\n  outId = backend.dataIdMap.get(out.dataId).id;\n const outerSize = util.sizeFromShape(out.shape);\n const\n  innerSize = input.shape[axes[0]];\n  wasmFunc(inputId, CppDType[input.dtype], outerSize, innerSize, outId);\n\n if\n  (inputWasTransposed) {\n    // dispose of the transposed tensor.\n    backend.disposeData(transposed.dataId);\n  }\n\n return out;\n}\n\nexport const argMaxConfig: KernelConfig = {\n  kernelName: ArgMax,\n  backendName:\n  'wasm',\n  kernelFunc:\n  argmax as { } as KernelFunc,\n  setupFunc: setup\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All\n  Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this\n  file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *  

http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n  software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n  OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n  governing permissions and\n * limitations under the License.\n *\n  =====\n\n*/\n\nimport {AvgPool, AvgPoolAttrs, AvgPoolInputs, backend_util, KernelConfig, KernelFunc, Tensor4D} from\n '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmAvgPool: (\n  xId:\n  number,\n  batchSize: number, inputHeight: number, inputWidth: number,\n  filterHeight: number, filterWidth: number,\n  padTop: number, padRight: number,\n  padBottom: number, padLeft: number, strideHeight: number,\n  strideWidth: number, channels: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n  wasmAvgPool = backend.wasm.cwrap(AvgPool, null /* void */, [\n    'number', // xId\n    'number', // batchSize\n    'number', // inputHeight\n    'number', // inputWidth\n    'number', // filterHeight\n    'number', // filterWidth\n    'number', // padTop\n    'number', // padRight\n    'number', // padBottom\n    'number', // padLeft\n    'number', //\n    strideHeight\n    'number', // strideWidth\n    'number', // channels\n    'number', // outId\n  ]);\n}\n\nfunction\n  avgPool(\n  args: {inputs: AvgPoolInputs, backend: BackendWasm, attrs: AvgPoolAttrs}) {\n    const {inputs, attrs,\n    backend} = args;\n\n    const x = inputs.x as Tensor4D;\n    const xId = backend.dataIdMap.get(x.dataId).id;\n\n    const {filterSize, strides, pad, dimRoundingMode} = attrs;\n    const convInfo =\n    backend_util.computePool2DInfo(\n      x.shape, filterSize, strides, 1 /* dilations */, pad, dimRoundingMode);\n\n    const filterHeight = convInfo.filterHeight;\n    const filterWidth = convInfo.filterWidth;\n    const padTop =\n    convInfo.padInfo.top;\n    const padRight = convInfo.padInfo.right;\n    const padBottom = convInfo.padInfo.bottom;\n    const padLeft = convInfo.padInfo.left;\n    const strideHeight = convInfo.strideHeight;\n    const strideWidth =\n    convInfo.strideWidth;\n    const channels = convInfo.inChannels;\n\n    if (convInfo.dataFormat !== 'channelsLast') {\n      throw new Error(\n        `wasm backend does not support dataFormat: ` +\n        `${convInfo.dataFormat}`. Please\n        use 'channelsLast'.`);\n    }\n\n    if (convInfo.dilationWidth !== 1 || convInfo.dilationHeight !== 1) {\n      throw new\n      Error(\n        `was backend only supports average pooling with dilation = [1, 1], ` +\n        `\n        `got [${convInfo.dilationHeight}, ${convInfo.dilationWidth}].`);\n    }\n\n    const out =\n    backend.makeOutput(convInfo.outShape, 'float32');\n    const outId = backend.dataIdMap.get(out.dataId).id;\n\n    wasmAvgPool(\n      xId, x.shape[0], x.shape[1], x.shape[2], filterHeight, filterWidth,\n      padTop, padRight,\n      padBottom, padLeft, strideHeight, strideWidth, channels,\n      outId);\n\n    return out;\n  }\n}\n\nexport const\n  avgPoolConfig: KernelConfig = {\n    kernelName: AvgPool,\n    backendName: 'wasm',\n    setupFunc: setup,\n    kernelFunc: avgPool as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights\n  Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file\n  except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *  

http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,

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software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```
=====\n*\n\nimport {KernelConfig, KernelFunc, Reshape, ReshapeAttrs, ReshapeInputs, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nexport function reshape(\n  args: {inputs: ReshapeInputs, attrs: ReshapeAttrs, backend: BackendWasm}) {\n  const {inputs, attrs} = args;\n  const {x} = inputs;\n  const {shape} = attrs;\n\n  const xSize = util.sizeFromShape(x.shape);\n  const $shape = util.inferFromImplicitShape(shape, xSize);\n  util.assert(\n    xSize === util.sizeFromShape($shape),\n    () => `new shape: ${$shape}, old shape: ${x.shape}. New shape and old\n    `shape must have the same number of elements.`);\n\n  // Backend needs to track refCount for the dataId for reshape op\n  args.backend.incref(x.dataId);\n  return {dataId: x.dataId, shape: $shape, dtype: x.dtype};\n}\n\nexport const reshapeConfig: KernelConfig = {\n  kernelName: Reshape,\n  backendName: 'wasm',\n  kernelFunc: reshape as { } as KernelFunc\n};\n\n/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *\n
```

```
=====\n*\n\nimport {BatchMatMul, BatchMatMulAttrs, BatchMatMulInputs, KernelConfig, KernelFunc, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {reshape} from './Reshape';\nlet wasmBatchMatMul: (\n  aId: number, aShape: Uint8Array, aShapeSize: number, bId: number,\n  bShape: Uint8Array, bShapeSize: number, transposeA: boolean,\n  transposeB: boolean, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n  wasmBatchMatMul = backend.wasm.cwrap(BatchMatMul, null /* void */, [\n    'number', // a_id\n    'array', // a_shape\n    'number', // a_shape.length\n    'number', // b_id\n    'array', // b_shape\n    'number', // b_shape.length\n    'number', // transpose_a\n    'number', // transpose_b\n    'number' // out_id\n  ]);\n\n  function batchMatMul(args: {\n    inputs: BatchMatMulInputs,\n    backend: BackendWasm,\n    attrs: BatchMatMulAttrs\n  }) {\n    const {inputs, backend, attrs} = args;\n    const {a, b} = inputs;\n    const {transposeA, transposeB} = attrs;\n\n    if (a.dtype !== 'float32' || b.dtype !== 'float32') {\n      throw new Error(`BatchMatMul for non float32 tensors not yet supported.`);\n    }\n\n    const aRank = a.shape.length;\n    const bRank = b.shape.length;\n\n    const innerShapeA = transposeA ? a.shape[aRank - 2] : a.shape[aRank - 1];\n    const innerShapeB = transposeB ? b.shape[bRank - 1] : b.shape[bRank - 2];\n\n    const outerShapeA = transposeA ? a.shape[aRank - 1] : a.shape[aRank - 2];\n    const outerShapeB = transposeB ? b.shape[bRank - 2] : b.shape[bRank - 1];\n\n    const outerDimsA = a.shape.slice(0, -2);\n    const outerDimsB = b.shape.slice(0, -2);\n\n    const batchDimA = util.sizeFromShape(outerDimsA);\n    const batchDimB = util.sizeFromShape(outerDimsB);\n\n    const batchDimsCompatible =\n      batchDimA === batchDimB || batchDimA === 1 || batchDimB === 1;\n\n    util.assert(\n      aRank >= 2 && bRank >= 2 && batchDimsCompatible,\n      () => `Error in matMul: the input batch dimensions must either be the\n      `same or at least one input batch dimension must be 1. Got input\n      `batch dimensions of (${outerDimsA}) and (${outerDimsB}).`);\n\n    const outShapeOuterDims =\n      batchDimA > batchDimB ? a.shape.slice(0, -2) : b.shape.slice(0, -2);\n    const outShape =\n      outShapeOuterDims.concat([outerShapeA, outerShapeB]);\n\n    util.assert(\n      innerShapeA === innerShapeB,\n      () => `Error in matMul: inner shapes (${innerShapeA}) and\n      `(${innerShapeB}) of Tensors with shapes\n
```



```

{x}, backend, attrs: {shape: reshaped});\n const xTransposed =\n  transpose({inputs: {x: xReshaped}, backend,\n  attrs: {perm: permuted}});\n const xTransposedReshaped = reshape(\n  {inputs: {x: xTransposed}, backend,\n  attrs: {shape: reshapedPermuted}});\n const result = slice({\n  inputs: {x: xTransposedReshaped},\n  backend,\n  attrs: {begin: sliceBeginCoords, size: sliceSize}\n  });\n\n backend.disposeData(xReshaped.dataId);\n backend.disposeData(xTransposed.dataId);\n backend.disposeData(xReshaped.dataId);\n\n return\n result;\n}\n\nexport const batchToSpaceNDConfig: KernelConfig\n = {\n  kernelName: BatchToSpaceND,\n  backendName: 'wasm',\n  kernelFunc: batchToSpaceND as { } as\n  KernelFunc\n};\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the\n Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the\n License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n License.\n *\n *=====\n\n *\n\nimport {Cast, CastAttrs, CastInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\nimport\n {TensorInfo} from '@tensorflow/tfjs-core';\n\nimport\n {BackendWasm} from '../backend_wasm';\n\nexport function cast(\n  args: {inputs: CastInputs, attrs: CastAttrs,\n  backend: BackendWasm});\n  TensorInfo {\n  const {inputs: {x}, attrs: {dtype}, backend} = args;\n  const out =\n  backend.makeOutput(x.shape, dtype);\n  const inVals = backend.typedArrayFromHeap(x);\n  const outVals =\n  backend.typedArrayFromHeap(out);\n  outVals.set(inVals);\n  return out;\n}\n\nexport const castConfig:\n KernelConfig = {\n  kernelName: Cast,\n  backendName: 'wasm',\n  kernelFunc: cast as { } as\n  KernelFunc\n};\n"/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the\n Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the\n License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License\n for the specific language governing permissions and\n * limitations under the License.\n *\n *=====\n\n *\n\nimport {KernelConfig, Ceil} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from\n './unary_kernel';\n\nexport const ceilConfig: KernelConfig = createUnaryKernelConfig(Ceil);\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a\n copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable\n law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See\n the License for the specific language governing permissions and\n * limitations under the License.\n *\n *=====\n\n *\n\nimport {ClipByValue, ClipByValueAttrs, ClipByValueInputs, KernelConfig, KernelFunc} from\n '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmClip: (xId: number, min:\n number, max: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n  wasmClip =\n  backend.wasm.cwrap(ClipByValue, null /* void */, [\n    'number', // x_id\n    'number', // min\n    'number', //\n    max\n    'number' // out_id\n  ]);\n\n  function clip(args: {\n    inputs: ClipByValueInputs,\n    backend:\n    BackendWasm,\n    attrs: ClipByValueAttrs\n  }) {\n    const {inputs, backend, attrs} = args;\n    const {x} = inputs;\n    const {clipValueMin, clipValueMax} = attrs;\n    const xId = backend.dataIdMap.get(x.dataId).id;\n    const out =\n    backend.makeOutput(x.shape, x.dtype);\n    const outId = backend.dataIdMap.get(out.dataId).id;\n  }\n}

```

```

wasmClip(xId, clipValueMin, clipValueMax, outId);\n return out;\n}\n\nexport const clipByValueConfig:
KernelConfig = {\n kernelName: ClipByValue,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: clip
as { } as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

```

```

=====\n
*/\n\nimport
{ backend_util, Concat, ConcatAttrs, ConcatInputs, KernelConfig, KernelFunc, util } from 'tensorflow/tfjs-
core';\n\nimport { BackendWasm } from './backend_wasm';\n\nimport { concatImplCPU } from
'./kernel_utils/shared';\n\nimport { identity } from './Identity';\n\nimport { reshape } from './Reshape';\n\nexport function
concat(\n  args: { inputs: ConcatInputs, backend: BackendWasm, attrs: ConcatAttrs } ) {\n  const { inputs, backend }
= args;\n\n  const axis = util.parseAxisParam(args.attrs.axis, inputs[0].shape)[0];\n\n  let outShape =
backend_util.computeOutShape(inputs.map(t => t.shape), axis);\n\n  // Keep only non-empty tensors (ignore tensors
with 0 in their shape).\n  const $inputs = inputs.filter(t => util.sizeFromShape(t.shape) > 0);\n  if ($inputs.length ===
1) {\n    return identity({ inputs: { x: $inputs[0] }, backend });\n  }\n\n  const out = backend.makeOutput(outShape,
inputs[0].dtype);\n\n  if (util.sizeFromShape(outShape) === 0) {\n    return out;\n  }\n\n  const shapes =
$inputs.map(t
=> t.shape);\n  backend_util.assertParamsConsistent(shapes, axis);\n\n  if ($inputs[0].dtype === 'string') {\n  //
Any concat of n-dimensional tensors across any axis can be reduced to\n  // a concatenation of two-dimensional
tensors across the axis 1 by first\n  // partitioning the axes of the original tensors into those less than the\n  // axis
to be concatenated and the rest. Then reshape the tensors\n  // into a two-dimensional tensor by collapsing these
two sets of axes and\n  // concatenate the resulting matrices across the axis 1, finally reshaping\n  // the result to
have the proper shape.\n  const inputs2D = $inputs.map(t => {\n    const innerSize =
util.sizeFromShape(t.shape.slice(axis));\n    const shape = [-1, innerSize];\n    return reshape({ inputs: { x: t,
backend, attrs: { shape } }; }\n  });\n\n  const inputsValShapes = inputs2D.map(t => {\n    return { vals:
backend.readSync(t.dataId, shape: t.shape); }\n  });\n\n  // Concat 2d tensors along
axis=1.\n  outShape =\n    backend_util.computeOutShape(inputs2D.map(t => t.shape), 1 /* axis */);\n  const
simplyConcat = inputs2D[0].shape[0] === 1;\n  const outVals = concatImplCPU(\n
inputsValShapes, outShape, inputs[0].dtype,\n    simplyConcat) as string[];\n\n  const finalOutShape
=\n    backend_util.computeOutShape($inputs.map(t => t.shape), axis);\n\n  out.shape = finalOutShape;\n
const outData = backend.dataIdMap.get(out.dataId);\n  outData.stringBytes =
backend_util.fromStringArrayToUint8(outVals);\n\n  inputs2D.forEach(t => backend.disposeData(t.dataId));\n\n
return out;\n  }\n\n  const batchDim = util.sizeFromShape($inputs[0].shape.slice(0, axis));\n  let sumInnerDims =
0;\n  const innerDims = $inputs.map(input => {\n    const innerDim = util.sizeFromShape(input.shape.slice(axis));\n
sumInnerDims += innerDim;\n    return innerDim;\n  });\n  const inVals = $inputs.map(input =>
backend.typedArrayFromHeap(input));\n
const outVals = backend.typedArrayFromHeap(out);\n  for (let b = 0; b < batchDim; b++) {\n    let outOffset = b *
sumInnerDims;\n    for (let i = 0; i < inVals.length; i++) {\n      const innerDim = innerDims[i];\n      const inOffset =
b * innerDim;\n      const vals = inVals[i].subarray(inOffset, inOffset + innerDim);\n      outVals.set(vals,
outOffset);\n      outOffset += innerDim;\n    }\n  }\n  return out;\n  }\n\nexport const concatConfig: KernelConfig =
{\n  kernelName: Concat,\n  backendName: 'wasm',\n  kernelFunc: concat as { } as KernelFunc,\n};\n", "/*\n *
@license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable

```

law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```
=====\n*\n\nimport { backend_util, Conv2D, Conv2DAttrs, Conv2DInputs, KernelConfig, KernelFunc, Tensor4D } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\n\nlet wasmConv2d: (\n  xId: number, batchSize: number, inputHeight: number, inputWidth: number,\n  filterId: number, filterHeight: number, filterWidth: number, padTop: number,\n  padRight: number, padBottom: number, padLeft: number, isSamePad: number,\n  dilationHeight: number, dilationWidth: number, strideHeight: number,\n  strideWidth: number, inputChannels: number, outputChannels: number,\n  outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n  wasmConv2d = backend.wasm.cwrap(Conv2D, null\n    /* void *, [\n      'number', // xId\n      'number', // batchSize\n      'number', // inputHeight\n      'number', // inputWidth\n      'number', // filterId\n      'number', // filterHeight\n      'number', // filterWidth\n      'number', // padTop\n      'number', // padRight\n      'number', // padBottom\n      'number', // padLeft\n      'number', // isSamePad\n      'number', // dilationHeight\n      'number', // dilationWidth\n      'number', // strideHeight\n      'number', // strideWidth\n      'number', // inputChannels\n      'number', // outputChannels\n      'number', // outId\n    ]);\n  }\n\n  function conv2d(\n    args: { inputs: Conv2DInputs, backend: BackendWasm, attrs: Conv2DAttrs }) {\n    const { inputs, attrs, backend } = args;\n    const { x, filter } = inputs;\n    const xId = backend.dataIdMap.get(x.dataId).id;\n    const filterId = backend.dataIdMap.get(filter.dataId).id;\n    const { strides, dilations, pad, dimRoundingMode, dataFormat } = attrs;\n    const $dataFormat = backend_util.convertConv2DDataFormat(dataFormat);\n\n    const convInfo = backend_util.computeConv2DInfo((x as Tensor4D).shape, (filter as Tensor4D).shape,\n      strides, dilations,\n      pad, dimRoundingMode, false, $dataFormat);\n\n    const filterHeight = convInfo.filterHeight;\n    const filterWidth = convInfo.filterWidth;\n    const padTop = convInfo.padInfo.top;\n    const padRight = convInfo.padInfo.right;\n    const padBottom = convInfo.padInfo.bottom;\n    const padLeft = convInfo.padInfo.left;\n    const dilationHeight = convInfo.dilationHeight;\n    const dilationWidth = convInfo.dilationWidth;\n    const strideHeight = convInfo.strideHeight;\n    const strideWidth = convInfo.strideWidth;\n    const inputChannels = convInfo.inChannels;\n    const outputChannels = convInfo.outChannels;\n    const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;\n\n    if (convInfo.dataFormat !== 'channelsLast') {\n      throw new Error(`\n      `wasm backend Conv2D does not support dataFormat: ` +\n        `${convInfo.dataFormat}`. Please use 'channelsLast'.`);\n    }\n\n    const out = backend.makeOutput(convInfo.outShape, 'float32');\n    const outId = backend.dataIdMap.get(out.dataId).id;\n\n    wasmConv2d(\n      xId, x.shape[0], x.shape[1], x.shape[2], filterId,\n      filterHeight,\n      filterWidth, padTop, padRight, padBottom, padLeft, isSamePad,\n      dilationHeight,\n      dilationWidth, strideHeight, strideWidth, inputChannels,\n      outputChannels, outId);\n\n    return out;\n  }\n\n  export const conv2DConfig: KernelConfig = {\n    kernelName: Conv2D,\n    backendName: 'wasm',\n    setupFunc: setup,\n    kernelFunc: conv2d as { } as KernelFunc\n  }; \n  /**\n   * @license\n   * Copyright 2020 Google LLC. All Rights Reserved.\n   * Licensed under the Apache License, Version 2.0 (the \"License\");\n   * you may not use this file except in compliance with the License.\n   * You may obtain a copy of the License at\n   * \n   * http://www.apache.org/licenses/LICENSE-2.0\n   * \n   * Unless required by applicable law or agreed to in writing, software\n   * distributed under the License is distributed on an \"AS IS\" BASIS,\n   * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n   * See the License for the specific language governing permissions and\n   * limitations under the License.\n   * \n   */\n}
```

```
=====\n*\n\nimport { backend_util, Conv2DBackpropInput, Conv2DBackpropInputAttrs, Conv2DBackpropInputInputs, KernelConfig, KernelFunc, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from
```

```

'./backend_wasm';\n\nlet wasmConv2DBackpropInput: (\n  dyId: number, filterId: number, batchSize: number,
filterHeight: number,\n  filterWidth: number, inHeight: number, inWidth: number, inChannels: number,\n
outHeight: number, outWidth: number, outChannels: number,\n  strideHeight: number, strideWidth: number,
topPad: number, leftPad: number,\n  fltS0: number, fltS1: number, fltS2: number, xBatchStride: number,\n
xRowStride: number, xColStride: number, xChannelStride:
number,\n  yBatchStride: number, yRowStride: number, yColStride: number,\n  yChannelStride: number, outId:
number) => void;\n\nfunction setup(backend: BackendWasm): void {\n  wasmConv2DBackpropInput =
backend.wasm.cwrap(Conv2DBackpropInput, null, [\n    'number', // dyId\n    'number', // filterId\n    'number', //
batchSize\n    'number', // filterHeight\n    'number', // filterWidth\n    'number', // inHeight\n    'number', //
inWidth\n    'number', // inChannels\n    'number', // outHeight\n    'number', // outWidth\n    'number', //
outChannels\n    'number', // strideHeight\n    'number', // strideWidth\n    'number', // topPad\n    'number', //
leftPad\n    'number', // fltS0\n    'number', // fltS1\n    'number', // fltS2\n    'number', // xBatchStride\n
'number', // xRowStride\n    'number', // xColStride\n    'number', // xChannelStride\n    'number', // yBatchStride\n
'number', // yRowStride\n    'number', // yColStride\n    'number',
// yChannelStride\n    'number', // outId\n  ]);\n\nfunction conv2DBackpropInput(args: {\n  backend:
BackendWasm,\n  inputs: Conv2DBackpropInputInputs,\n  attrs: Conv2DBackpropInputAttrs\n}): TensorInfo {\n
const {backend, inputs, attrs} = args;\n  const {dy, filter} = inputs;\n  const {strides, pad, dataFormat,
dimRoundingMode, inputShape} = attrs;\n\n  const dilations = 1;\n\n  const $dataFormat =
backend_util.convertConv2DDataFormat(dataFormat);\n  const convInfo = backend_util.computeConv2DInfo(\n
inputShape, filter.shape as [number, number, number, number], strides,\n  dilations, pad, dimRoundingMode,
false /* depthwise */, $dataFormat);\n  const {\n    batchSize,\n    filterHeight,\n    filterWidth,\n    inChannels,\n
inHeight,\n    inWidth,\n    outChannels,\n    outHeight,\n    outWidth,\n    strideHeight,\n    strideWidth\n  } =
convInfo;\n\n  const topPad = filterHeight - 1 - convInfo.padInfo.top;\n  const leftPad = filterWidth - 1 -
convInfo.padInfo.left;\n\n  const isChannelsLast = convInfo.dataFormat === 'channelsLast';\n  const dxStrides =
util.computeStrides(convInfo.inShape);\n  const dyStrides = util.computeStrides(dy.shape);\n  const [fltS0, fltS1,
fltS2] = util.computeStrides(filter.shape);\n  const xBatchStride = dxStrides[0];\n  const xRowStride =
isChannelsLast ? dxStrides[1] : dxStrides[2];\n  const xColStride = isChannelsLast ? dxStrides[2] : 1;\n  const
xChannelStride = isChannelsLast ? 1 : dxStrides[1];\n  const yBatchStride = dyStrides[0];\n  const yRowStride =
isChannelsLast ? dyStrides[1] : dyStrides[2];\n  const yColStride = isChannelsLast ? dyStrides[2] : 1;\n  const
yChannelStride = isChannelsLast ? 1 : dyStrides[1];\n\n  const out = backend.makeOutput(convInfo.inShape,
'float32');\n  const outId = backend.dataIdMap.get(out.dataId).id;\n  const dyId =
backend.dataIdMap.get(dy.dataId).id;\n  const filterId = backend.dataIdMap.get(filter.dataId).id;\n\n
wasmConv2DBackpropInput(\n  dyId, filterId, batchSize, filterHeight,
filterWidth, inHeight, inWidth,\n  inChannels, outHeight, outWidth, outChannels, strideHeight, strideWidth,\n
topPad, leftPad, fltS0, fltS1, fltS2, xBatchStride, xRowStride,\n  xColStride, xChannelStride, yBatchStride,
yRowStride, yColStride,\n  yChannelStride, outId);\n  return out;\n}\n\nexport const
conv2DBackpropInputConfig: KernelConfig = {\n  kernelName: Conv2DBackpropInput,\n  backendName:
'wasm',\n  setupFunc: setup,\n  kernelFunc: conv2DBackpropInput as {} as KernelFunc\n};\n\n"/**\n * @license\n *
Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS
OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions
and\n * limitations under the License.\n *
=====\n
*/\n\nimport {Cos, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from

```

```
./unary_kernel';\n\nexport const cosConfig: KernelConfig = createUnaryKernelConfig(Cos);\n"/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an\n * "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific
```

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language governing permissions and\n * limitations under the License.\n *
```

```
=====\n\n*/\nimport { Cosh, KernelConfig } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from\n./unary_kernel';\n\nexport const coshConfig: KernelConfig = createUnaryKernelConfig(Cosh);\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n * 2.0 (the\n * License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a\n * copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable\n * law or agreed to in writing, software\n * distributed under the License is distributed on an\n * "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n\n*/\nimport { CropAndResize, CropAndResizeAttrs, CropAndResizeInputs, KernelConfig, KernelFunc,\nTensorInfo } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport { cast }\nfrom './Cast';\n\n// Must match enum in CropAndResize.cc\nenum InterpolationMethod {\n  bilinear = 0,\n  nearest = 1\n}\n\nlet wasmCropAndResize: (\n  imagesId: number, boxesId: number, boxIndId: number, numBoxes:\n  number,\n  imagesShape: Uint8Array, cropHeight: number, cropWidth: number,\n  method: number,\n  extrapolationValue: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n  wasmCropAndResize = backend.wasm.cwrap(CropAndResize, null /*void*/, [\n    'number', // imagesId\n    'number', // boxesId\n    'number', // boxIndId\n    'number', // numBoxes\n    'array', // images shape\n    'number', // cropHeight\n    'number', // cropWidth\n    'number', // method\n    'number', // extrapolation value\n    'number' // out id\n  ]);\n\n  function cropAndResize(args: {\n    backend: BackendWasm,\n    inputs: CropAndResizeInputs,\n    attrs: CropAndResizeAttrs\n  }): TensorInfo {\n    const { backend, inputs, attrs } = args;\n    const { method, extrapolationValue, cropSize } = attrs;\n    const { image, boxes, boxInd } = inputs;\n    const numBoxes = boxes.shape[0];\n    const [cropHeight, cropWidth] = cropSize as [number, number];\n    const outShape = [numBoxes, cropHeight, cropWidth, image.shape[3]];\n    let imagesData = backend.dataIdMap.get(image.dataId);\n    let castedData;\n    if (image.dtype !== 'float32') {\n      castedData = cast({ backend, inputs: { x: image }, attrs: { dtype: 'float32' }});\n      imagesData = backend.dataIdMap.get(castedData.dataId);\n    }\n    const imagesId = imagesData.id;\n    const boxesId = backend.dataIdMap.get(boxes.dataId).id;\n    const boxIndId = backend.dataIdMap.get(boxInd.dataId).id;\n    const out = backend.makeOutput(outShape, 'float32');\n\n    const outId = backend.dataIdMap.get(out.dataId).id;\n    const imagesShapeBytes = new Uint8Array(new Int32Array(image.shape).buffer);\n    wasmCropAndResize(\n      imagesId, boxesId, boxIndId, numBoxes, imagesShapeBytes, cropHeight,\n      cropWidth, InterpolationMethod[method as {}] as keyof typeof InterpolationMethod,\n      extrapolationValue, outId);\n\n    if (castedData !== null) {\n      backend.disposeData(castedData.dataId);\n    }\n\n    return out;\n  }\n\n  export const cropAndResizeConfig:\n  KernelConfig = {\n    kernelName: CropAndResize,\n    backendName: 'wasm',\n    setupFunc: setup,\n    kernelFunc: cropAndResize as {} as KernelFunc\n  };\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * License\");\n * you may not use this file\n * except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law
```

or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```
=====\n*\n\nimport {backend_util, KernelConfig, KernelFunc, Cumsum, CumsumAttrs, CumsumInputs, TensorInfo, util}\nfrom '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {CppType} from './types';\nimport {transpose} from './Transpose';\n\nlet wasmCumsum: (xId: number, exclusive: number, reverse: number,\n      finalDim: number, outId: number, dtype: CppDType) => void;\n\nfunction setup(backend: BackendWasm) {\n  wasmCumsum = backend.wasm.cwrap(Cumsum, null /* void */, [\n    'number', // x_id\n    'number', // exclusive\n    'number', // reverse\n    'number', // final_dim\n    'number', // out_id\n    'number' // dtype\n  ]);\n}\n\nexport function cumsum(\n  args: {inputs: CumsumInputs, backend: BackendWasm, attrs: CumsumAttrs}): TensorInfo {\n  const {inputs, backend, attrs} = args;\n  const {x} = inputs;\n  const {axis, exclusive, reverse} = attrs;\n  const xRank = x.shape.length;\n  util.assert(x.dtype === 'float32' || x.dtype === 'int32',\n    () => `cumsum does not support ${x.dtype} tensors in the WASM backend`);\n  // permute required axis to inner most axis\n  const permutation = backend_util.getAxesPermutation([axis], xRank);\n  let permutedX = x;\n  if (permutation !== null) {\n    permutedX = transpose({inputs: {x}, attrs: {perm: permutation}, backend});\n  }\n  const permutedAxis = backend_util.getInnerMostAxes(1, xRank)[0];\n  backend_util.assertAxesAreInnerMostDims('cumsum', [permutedAxis], xRank);\n  const permutedOut = backend.makeOutput(permutedX.shape, permutedX.dtype);\n  const finalDim = permutedX.shape[permutedAxis];\n  const permutedXId\n    = backend.dataIdMap.get(permutedX.dataId).id;\n  const permutedOutId =\n    backend.dataIdMap.get(permutedOut.dataId).id;\n  wasmCumsum(permutedXId, exclusive ? 1 : 0, reverse ? 1 : 0,\n    finalDim, permutedOutId, CppDType[x.dtype]);\n  // transpose data back if permuted\n  let out = permutedOut;\n  if (permutation !== null) {\n    const undoPermutation =\n      backend_util.getUndoAxesPermutation(permutation);\n    out = transpose(\n      {inputs: {x: permutedOut}, attrs: {perm: undoPermutation}, backend});\n    backend.disposeData(permutedX.dataId);\n    backend.disposeData(permutedOut.dataId);\n  }\n  return out;\n}\n\nexport const cumsumConfig: KernelConfig =\n  {\n    kernelName: Cumsum,\n    backendName: 'wasm',\n    setupFunc: setup,\n    kernelFunc: cumsum as {\n      KernelFunc\n    };,\n  },\n  /**\n  * @license\n  * Copyright 2019 Google LLC. All Rights Reserved.\n  * Licensed under the Apache License, Version 2.0 (the \"License\");\n  * you may not use this file except in compliance with the License.\n  *\n  * You may obtain a copy of the License at\n  * http://www.apache.org/licenses/LICENSE-2.0\n  * Unless required by applicable law or agreed to in writing, software\n  * distributed under the License is distributed on an \"AS IS\" BASIS,\n  * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n  * See the License for the specific language governing permissions and\n  * limitations under the License.\n  *\n  */\n  };\n\n=====\n*\n\nimport {DepthToSpace, DepthToSpaceAttrs, DepthToSpaceInputs, KernelConfig, KernelFunc, TensorInfo, util}\nfrom '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmDepthToSpace: (\n  xId: number, blockSize: number, channelsLast: number, xStrides: Uint8Array,\n  xStridesLength: number, outputShape: Uint8Array, outputStrides: Uint8Array,\n  outSize: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n  wasmDepthToSpace\n    = backend.wasm.cwrap(DepthToSpace, null /*void*/, [\n      'number', // xId\n      'number', // blockSize\n      'number', // channelsLast\n      'array', // xStrides\n      'number', // xStridesLength\n      'array', // outputShape\n      'array', // outputStrides\n      'number', // outSize\n      'number', // outId\n    ]);\n}\n\nexport function depthToSpace(args: {\n  backend: BackendWasm,\n  inputs: DepthToSpaceInputs,\n  attrs: DepthToSpaceAttrs\n}): TensorInfo {\n  const {backend, inputs, attrs} = args;\n  const {x} = inputs;\n  const {blockSize, dataFormat} = attrs;\n  const batchSize = x.shape[0];\n  const inputHeight = (dataFormat === 'NHWC') ? x.shape[1] : x.shape[2];\n  const inputWidth = (dataFormat === 'NHWC') ? x.shape[2] : x.shape[3];\n  const inputDepth = (dataFormat === 'NHWC') ? x.shape[3]
```

```
: x.shape[1];\n\n const outputHeight = inputHeight * blockSize;\n const outputWidth = inputWidth * blockSize;\n const outputDepth = inputDepth / (blockSize * blockSize);\n\n const outputShape = (dataFormat === 'NHWC') ?\n   [batchSize, outputHeight, outputWidth, outputDepth] :\n   [batchSize, outputDepth, outputHeight, outputWidth];\n\n const out = backend.makeOutput(outputShape,\n 'float32');\n\n const xData = backend.dataIdMap.get(x.dataId);\n const xId = xData.id;\n const xStridesBytes =\n new Uint8Array(new Int32Array(util.computeStrides(x.shape)).buffer);\n\n const outputShapeBytes = new\n Uint8Array(new Int32Array(outputShape).buffer);\n\n const outStridesBytes =\n   new Uint8Array(new\n Int32Array(util.computeStrides(outputShape)).buffer);\n\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const channelsLast = dataFormat === 'NHWC' ? 1 : 0;\n\n   wasmDepthToSpace(\n     xId, blockSize, channelsLast,\n     xStridesBytes, x.shape.length - 1,\n     outputShapeBytes, outStridesBytes, outputShape.length, outId);\n\n return out;\n}\n\n\nexport const depthToSpaceConfig: KernelConfig = {\n  kernelName: 'DepthToSpace',\n  backendName: 'wasm',\n\n  setupFunc: setup,\n  kernelFunc: depthToSpace as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019\n * Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you\n * may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS"\n * BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n *\n *=====\n *\n *\\\nimport {backend_util, DepthwiseConv2dNative, DepthwiseConv2dNativeAttrs,\n DepthwiseConv2dNativeInputs, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';\n\\\nimport {BackendWasm} from '../backend_wasm';\n\\\nlet\nwasmDepthwiseConv2d: (\n  xId: number, batchSize: number, inputHeight: number, inputWidth: number,\n  filterId: number, filterHeight: number, filterWidth: number, padTop: number,\n   padRight: number, padBottom: number, padLeft: number, isSamePad: number,\n   dilationHeight: number, dilationWidth: number, strideHeight:\n number,\n   strideWidth: number, inputChannels: number, outputChannels: number,\n   outId: number) =>\n void;\n\\\nfunction setup(backend: BackendWasm) {\n  wasmDepthwiseConv2d =\n  backend.wasm.cwrap(DepthwiseConv2dNative, null /* void */, [\n    'number', // xId\n    'number', //\n  batchSize\n    'number', // inputHeight\n    'number', // inputWidth\n    'number', // filterId\n    'number', //\n  filterHeight\n    'number', // filterWidth\n    'number', // padTop\n    'number', // padRight\n    'number', //\n  padBottom\n    'number', // padLeft\n    'number', // isSamePad\n    'number',\n    // dilationHeight\n    'number', // dilationWidth\n    'number', // strideHeight\n    'number', // strideWidth\n    'number', // inputChannels\n    'number', // outputChannels\n    'number', // outId\n  ]);\n\\\n\\\nfunction\n  depthwiseConv2d(args: {\n    inputs: DepthwiseConv2dNativeInputs,\n    backend: BackendWasm,\n    attrs:\n  DepthwiseConv2dNativeAttrs\n  }) {\n    const {inputs, attrs, backend} = args;\n\n    const {x, filter} = inputs;\n    const\n  xId = backend.dataIdMap.get(x.dataId).id;\n    const\n  filterId = backend.dataIdMap.get(filter.dataId).id;\n\n    const\n  {strides, dilations, pad, dimRoundingMode} = attrs;\n\n    const $dilations = dilations == null ? [1, 1] : dilations;\n\n    const\n  convInfo = backend_util.computeConv2DInfo(\n      (x as Tensor4D).shape, (filter as Tensor4D).shape,\n      strides,\n      ($dilations as number | [number, number]), pad, dimRoundingMode,\n      true /* depthwise */);\n\n    const\n  filterHeight = convInfo.filterHeight;\n    const\n  filterWidth\n  = convInfo.filterWidth;\n    const\n  padTop = convInfo.padInfo.top;\n    const\n  padRight = convInfo.padInfo.right;\n    const\n  padBottom = convInfo.padInfo.bottom;\n    const\n  padLeft = convInfo.padInfo.left;\n    const\n  dilationHeight =\n  convInfo.dilationHeight;\n    const\n  dilationWidth = convInfo.dilationWidth;\n    const\n  strideHeight =\n  convInfo.strideHeight;\n    const\n  strideWidth = convInfo.strideWidth;\n    const\n  inputChannels =\n  convInfo.inChannels;\n    const\n  outputChannels = convInfo.outChannels;\n    const\n  isSamePad = convInfo.padInfo.type\n  === 'SAME' ? 1 : 0;\n\n    if (convInfo.dataFormat !== 'channelsLast') {\n      throw new Error(`\n      `wasm backend\n  DepthwiseConv2dNative does not support dataFormat:`\n      +\n      `${convInfo.dataFormat}`.\n      Please use`
```

```

'channelsLast'.');\n } \n\n const out = backend.makeOutput(convInfo.outShape, 'float32');\n const outId =
backend.dataIdMap.get(out.dataId).id;\n wasmDepthwiseConv2d(\n   xId, x.shape[0], x.shape[1], x.shape[2],
filterId, filterHeight,\n   filterWidth,
padTop, padRight, padBottom, padLeft, isSamePad,\n   dilationHeight, dilationWidth, strideHeight, strideWidth,
inputChannels,\n   outputChannels, outId);\n return out;\n}\n\nexport const depthwiseConv2dNativeConfig:
KernelConfig = {\n kernelName: DepthwiseConv2dNative,\n backendName: 'wasm',\n setupFunc: setup,\n
kernelFunc: depthwiseConv2d as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2021 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations
under the License.\n *
=====\n
*\nimport {Elu, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'./unary_kernel';\n\nexport const eluConfig: KernelConfig = createUnaryKernelConfig(Elu);\n", "/*\n * @license\n
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
=====\n
*\nimport {Equal, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from
'./binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const equalConfig: KernelConfig =\ncreateBinaryKernelConfig(Equal, supportsFullBroadcast, 'bool');\n", "/*\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
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http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*\nimport {Exp, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'./unary_kernel';\n\nexport const expConfig: KernelConfig = createUnaryKernelConfig(Exp, 'float32');\n", "/*\n *
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {ExpandDims, ExpandDimsAttrs, ExpandDimsInputs,
KernelConfig, KernelFunc, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from
'./backend_wasm';\n\nimport {reshape} from './Reshape';\n\nexport function expandDims(args: {\n inputs:
ExpandDimsInputs,\n attrs: ExpandDimsAttrs,\n backend: BackendWasm\n}) {\n const {inputs, attrs, backend} =
args;\n const {input} = inputs;\n const {dim} = attrs;\n\n const inputRank = input.shape.length;\n const newShape

```



```

= input.shape.slice();
let $dim = dim;
if (dim < 0) {
  // Negative value is counted from the tail of rank.
  util.assert(
    -(inputRank + 1) <= dim,
    () => `Axis must be in the interval [${-(inputRank + 1)}, ${inputRank}]`);
  $dim = inputRank + dim + 1;
}
newShape.splice($dim, 0, 1);
return reshape({inputs:
{x: input}, backend, attrs: {shape: newShape}});
}
export const expandDimsConfig: KernelConfig = {
  kernelName: ExpandDims,
  backendName: 'wasm',
  kernelFunc: expandDims as {} as KernelFunc;
},"/**\n
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 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n
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 * limitations under the License.\n
 */
=====
*/

import {KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';
import {Fill, FillAttrs} from '@tensorflow/tfjs-core';
import {BackendWasm} from '../backend_wasm';
export function fill(args: {attrs: FillAttrs, backend: BackendWasm}) {
  const {attrs: {shape, value, dtype}, backend} = args;
  const out = backend.makeOutput(shape, dtype);
  const outVals = backend TypedArrayFromHeap(out);
  outVals.fill(value as number);
  return out;
}
export const fillConfig: KernelConfig = {
  kernelName: Fill,
  backendName: 'wasm',
  kernelFunc: fill as {} as KernelFunc;
},"/**\n
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 * limitations under the License.\n
 */
=====

import {FlipLeftRight, FlipLeftRightInputs, KernelConfig, KernelFunc, TensorInfo} from '@tensorflow/tfjs-core';
import {BackendWasm} from '../backend_wasm';
let wasmFlipLeftRight: (\n  xId: number, batch: number, imageHeight: number, imageWidth: number, numChannels: number, outId: number) => void;
function setup(backend: BackendWasm) {
  wasmFlipLeftRight = backend.wasm.cwrap(FlipLeftRight, null /* void */, [\n  'number', // xId\n  'number', // batch\n  'number', // imageHeight\n  'number', // imageWidth\n  'number', // numChannels\n  'number', // outId\n ]);
}
export function flipLeftRight(\n  args: {inputs: FlipLeftRightInputs, backend: BackendWasm}): TensorInfo {
  const {inputs, backend} = args;
  const {image} = inputs;
  const out = backend.makeOutput(image.shape, image.dtype);
  const imageId = backend.dataIdMap.get(image.dataId).id;
  const outId = backend.dataIdMap.get(out.dataId).id;
  const [batch, imageHeight, imageWidth, numChannels] = image.shape;
  wasmFlipLeftRight(\n  imageId, batch, imageHeight, imageWidth, numChannels, outId);
  return out;
}
export const flipLeftRightConfig: KernelConfig = {
  kernelName: FlipLeftRight,
  backendName: 'wasm',
  kernelFunc: flipLeftRight as {} as KernelFunc,
  setupFunc: setup;
},"/**\n
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 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n
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 * limitations under the License.\n
 */
=====

import {Floor, KernelConfig} from '@tensorflow/tfjs-core';
import {createUnaryKernelConfig} from './unary_kernel';
export const floorConfig: KernelConfig = createUnaryKernelConfig(Floor);
*/

```

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```
=====\n*/\n\nimport {FloorDiv, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from './binary_kernel';\n\nconst supportsFullBroadcast = false;\nexport const floorDivConfig: KernelConfig =\n  createBinaryKernelConfig(FloorDiv, supportsFullBroadcast);\n\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*/\n\nimport {FusedBatchNorm, FusedBatchNormAttrs, FusedBatchNormInputs, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmBatchNorm: (\n  xId: number, meanId: number, varianceId: number, offsetId: number,\n  scaleId: number, varianceEpsilon: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n  wasmBatchNorm = backend.wasm.cwrap(\n    FusedBatchNorm, null /* void */,\n    ['number', 'number', 'number', 'number', 'number', 'number']);\n}\n\nfunction fusedBatchNorm(args: {\n  backend: BackendWasm,\n  inputs: FusedBatchNormInputs,\n  attrs: FusedBatchNormAttrs\n}): TensorInfo {\n  const {backend, inputs, attrs} = args;\n  const {varianceEpsilon} = attrs;\n  const {x, mean, variance, offset, scale} = inputs;\n  const xId = backend.dataIdMap.get(x.dataId).id;\n  const meanId = backend.dataIdMap.get(mean.dataId).id;\n  const varianceId = backend.dataIdMap.get(variance.dataId).id;\n  const offsetId = offset != null ? backend.dataIdMap.get(offset.dataId).id : 0;\n  const scaleId = scale != null ? backend.dataIdMap.get(scale.dataId).id : 0;\n\n  const out = backend.makeOutput(x.shape, x.dtype);\n  // Short-circuit zero-sized tensors.\n  if (util.sizeFromShape(x.shape) === 0) {\n    return out;\n  }\n\n  const outId = backend.dataIdMap.get(out.dataId).id;\n\n  wasmBatchNorm(xId, meanId, varianceId, offsetId, scaleId, varianceEpsilon, outId);\n  return out;\n}\n\nexport const fusedBatchNormConfig: KernelConfig = {\n  kernelName: FusedBatchNorm,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: fusedBatchNorm as {\n    KernelFunc\n  };,\n  "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*/\n\nimport {backend_util, FusedConv2D, FusedConv2DAttrs, FusedConv2DInputs, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {FusableActivation} from './types';\n\nlet wasmFusedConv2d: (\n  xId: number, batchSize: number, inputHeight: number, inputWidth: number,\n  filterId: number, filterHeight: number, filterWidth: number,\n  biasId: number, padTop: number, padRight: number, padBottom: number,\n  padLeft: number, isSamePad: number, dilationHeight: number,\n  dilationWidth: number,
```

```

strideHeight: number, strideWidth: number,\n  inputChannels: number, outputChannels: number, activation:
number,\n  preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>\n
void;\n\nfunction setup(backend: BackendWasm) {\n  wasmFusedConv2d = backend.wasm.cwrap(FusedConv2D,
null /* void */, [\n  'number', // xId\n  'number', // batchSize\n  'number', // inputHeight\n  'number', //
inputWidth\n  'number', // filterId\n  'number', // filterHeight\n  'number', // filterWidth\n  'number', // biasId\n
'number', // padTop\n  'number', // padRight\n  'number', // padBottom\n  'number', // padLeft\n  'number', //
isSamePad\n  'number', // dilationHeight\n  'number', // dilationWidth\n  'number', // strideHeight\n  'number',
// strideWidth\n  'number', // inputChannels\n  'number', // outputChannels\n  'number', // activation\n
'number', // preluActivationWeightsId\n  'number', // leakyreluAlpha\n
'number', // outId\n  ]);\n}\n\nfunction fusedConv2d(args: {\n  inputs: FusedConv2DInputs,\n  backend:
BackendWasm,\n  attrs: FusedConv2DAttrs\n}) {\n  const {inputs, attrs, backend} = args;\n  const {x, filter, bias,
preluActivationWeights} = inputs;\n  const {\n    strides,\n    pad,\n    dilations,\n    dataFormat,\n    dimRoundingMode,\n    activation,\n    leakyreluAlpha\n  } = attrs;\n  const convInfo =
backend_util.computeConv2DInfo(\n    (x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations,\n    pad, dimRoundingMode);\n  const fusedActivation =\n    FusableActivation[activation as {}] as keyof typeof
FusableActivation;\n  if (fusedActivation == null) {\n    throw new Error(\n      ` ${activation} activation not yet
supported for FusedConv2D ` +\n      `in the wasm backend.`);\n  }\n  const xId =
backend.dataIdMap.get(x.dataId).id;\n  const filterId = backend.dataIdMap.get(filter.dataId).id;\n  const
outputChannels = convInfo.outChannels;\n\n  let biasId = 0;\n  if (bias != null) {\n    const biasData = backend.dataIdMap.get(bias.dataId);\n    if
(biasData.shape.length !== 1) {\n      throw new Error(\n        `FusedConv2D only supports rank-1 bias but got `
+\n        `rank ${biasData.shape.length}.`);\n    }\n    if (biasData.shape[0] !== outputChannels) {\n      throw new
Error(\n        `FusedConv2D bias shape (${biasData.shape}) does not ` +\n        `match the number of output
channels (${outputChannels})`);\n    }\n    biasId = biasData.id;\n  }\n  const filterHeight =
convInfo.filterHeight;\n  const filterWidth = convInfo.filterWidth;\n  const padTop = convInfo.padInfo.top;\n  const
padRight = convInfo.padInfo.right;\n  const padBottom = convInfo.padInfo.bottom;\n  const padLeft =
convInfo.padInfo.left;\n  const dilationHeight = convInfo.dilationHeight;\n  const dilationWidth =
convInfo.dilationWidth;\n  const strideHeight = convInfo.strideHeight;\n  const strideWidth =
convInfo.strideWidth;\n\n  const inputChannels = convInfo.inChannels;\n  const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;\n
const batchSize = convInfo.batchSize;\n  const inHeight = convInfo.inHeight;\n  const inWidth =
convInfo.inWidth;\n  if (dataFormat !== 'NHWC') {\n    throw new Error(\n      `wasm backend FusedConv2D
does not support dataFormat:` +\n      ` ${dataFormat}. Please use 'NHWC'.`);\n  }\n  const out =
backend.makeOutput(convInfo.outShape, 'float32');\n  const outId = backend.dataIdMap.get(out.dataId).id;\n  const
preluActivationWeightsId = preluActivationWeights == null ?\n    0 :\n  backend.dataIdMap.get(preluActivationWeights.dataId).id;\n  wasmFusedConv2d(\n    xId, batchSize, inHeight,
inWidth, filterId, filterHeight, filterWidth,\n    biasId, padTop, padRight, padBottom, padLeft, isSamePad,
dilationHeight,\n    dilationWidth, strideHeight, strideWidth, inputChannels, outputChannels,\n    fusedActivation,
preluActivationWeightsId, leakyreluAlpha || 0, outId);\n\n  return out;\n}\n\nexport const fusedConv2DConfig: KernelConfig = {\n  kernelName: FusedConv2D,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: fusedConv2d as {} as KernelFunc\n};\n\n"/**\n *
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====

```

```

*/\n\nimport {backend_util, FusedDepthwiseConv2D, FusedDepthwiseConv2DAttrs,
FusedDepthwiseConv2DInputs, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from './backend_wasm';\n\nimport {FusableActivation} from './types';\n\nlet
wasmFusedDepthwiseConv2d:\n  (xId: number, batchSize: number, inputHeight: number, inputWidth: number,\n  filterId: number, filterHeight: number, filterWidth: number,\n  biasId: number, padTop: number, padRight:
number, padBottom: number,\n  padLeft: number, isSamePad: number, dilationHeight: number,\n
dilationWidth: number, strideHeight: number, strideWidth: number,\n  inputChannels: number, outputChannels:
number, activation: number,\n  preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>\n
  void;\n\nfunction setup(backend: BackendWasm) {\n  wasmFusedDepthwiseConv2d =\n  backend.wasm.cwrap(FusedDepthwiseConv2D, null /* void */, [\n    'number', // xId\n    'number', //
batchSize\n    'number', // inputHeight\n    'number', // inputWidth\n    'number', // filterId\n    'number', // filterHeight\n    'number', // filterWidth\n
'number', // biasId\n    'number', // padTop\n    'number', // padRight\n    'number', // padBottom\n
'number', // padLeft\n    'number', // isSamePad\n    'number', // dilationHeight\n    'number', //
dilationWidth\n    'number', // strideHeight\n    'number', // strideWidth\n    'number', // inputChannels\n
'number', // outputChannels\n    'number', // activation\n    'number', // preluActivationWeightsId\n
'number', // leakyreluAlpha\n    'number', // outId\n  ]);\n\n  function fusedDepthwiseConv2d(args: {\n
inputs: FusedDepthwiseConv2DInputs,\n  backend: BackendWasm,\n  attrs: FusedDepthwiseConv2DAttrs\n}) {\n
const {inputs, attrs, backend} = args;\n  const {x, filter, bias, preluActivationWeights} = inputs;\n  const {\n
strides,\n  pad,\n  dilations,\n
  dataFormat,\n  dimRoundingMode,\n  activation,\n  leakyreluAlpha\n  } = attrs;\n\n  const convInfo =
backend_util.computeConv2DInfo(\n    (x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations,\n
pad, dimRoundingMode, true /* depthwise */);\n\n  const fusedActivation =\n    FusableActivation[activation as keyof typeof FusableActivation];\n  if (fusedActivation == null) {\n    throw new Error(\n      `${activation}
activation not yet supported for FusedDepthwiseConv2D` +\n      `in the wasm backend.`);\n  }\n\n  const xId =
backend.dataIdMap.get(x.dataId).id;\n  const filterId = backend.dataIdMap.get(filter.dataId).id;\n  const
outputChannels = convInfo.outChannels;\n\n  let biasId = 0;\n  if (bias != null) {\n    const biasData =
backend.dataIdMap.get(bias.dataId);\n    if (biasData.shape.length !== 1) {\n      throw new Error(\n
`FusedDepthwiseConv2D only supports rank-1 bias but got ` +\n        `rank ${biasData.shape.length}.`);\n
    }\n    if (biasData.shape[0] !== outputChannels) {\n      throw new Error(\n        `FusedDepthwiseConv2D bias
shape (${biasData.shape}) does not ` +\n        `match the number of output channels (${outputChannels})`);\n
    }\n    biasId = biasData.id;\n  }\n\n  const filterHeight = convInfo.filterHeight;\n  const filterWidth =
convInfo.filterWidth;\n  const padTop = convInfo.padInfo.top;\n  const padRight = convInfo.padInfo.right;\n  const
padBottom = convInfo.padInfo.bottom;\n  const padLeft = convInfo.padInfo.left;\n  const dilationHeight =
convInfo.dilationHeight;\n  const dilationWidth = convInfo.dilationWidth;\n  const strideHeight =
convInfo.strideHeight;\n  const strideWidth = convInfo.strideWidth;\n  const inputChannels =
convInfo.inChannels;\n  const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;\n  const batchSize =
convInfo.batchSize;\n  const inHeight = convInfo.inHeight;\n  const inWidth = convInfo.inWidth;\n\n  if
(dataFormat !== 'NHWC') {\n    throw new
Error(\n      `wasm backend FusedDepthwiseConv2D does not support dataFormat:` +\n      `${dataFormat}`.
Please use 'NHWC'.`);\n  }\n\n  const out = backend.makeOutput(convInfo.outShape, 'float32');\n  const outId =
backend.dataIdMap.get(out.dataId).id;\n  const preluActivationWeightsId = preluActivationWeights == null ?\n  0
:\n  backend.dataIdMap.get(preluActivationWeights.dataId).id;\n\n  wasmFusedDepthwiseConv2d(\n    xId,
batchSize, inHeight, inWidth, filterId, filterHeight, filterWidth,\n    biasId, padTop, padRight, padBottom, padLeft,
isSamePad, dilationHeight,\n    dilationWidth, strideHeight, strideWidth, inputChannels, outputChannels,\n
fusedActivation, preluActivationWeightsId, leakyreluAlpha || 0, outId);\n\n  return out;\n}\n\nexport const
fusedDepthwiseConv2DConfig: KernelConfig = {\n  kernelName: FusedDepthwiseConv2D,\n  backendName:
'wasm',\n  setupFunc: setup,\n  kernelFunc: fusedDepthwiseConv2d as KernelFunc\n};\n"/**\n * @license\n

```

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agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *

```
=====\n*\n\nimport {gather_util, GatherNd, GatherNdInputs, KernelConfig, TensorInfo} from '@tensorflow/tfjs-  
core';\nimport {BackendWasm} from './backend_wasm';\nimport {CppType} from './types';\n\nlet wasmGatherNd: (\n  xId: number, dtype: CppDType, indicesId: number, numSlices: number,\n  sliceRank: number, sliceSize: number, strides: Uint8Array, outId: number) =>\n  void;\n\nfunction setup(backend: BackendWasm): void {\n  wasmGatherNd = backend.wasm.cwrap(GatherNd, null /*void*/, [\n    'number', // xId\n    'number', // dtype\n    'number', // indicesId\n    'number', // numSlices\n    'number', // sliceRank\n    'number', // sliceSize\n    'array', // strides\n    'number' // outId\n  ]);\n\n  function gatherNd(args: {backend: BackendWasm, inputs: GatherNdInputs}):  
    TensorInfo {\n    const {backend, inputs} = args;\n    const {params, indices} = inputs;\n\n    const [resultShape, numSlices, sliceSize, strides] =\n      gather_util.prepareAndValidate(params, indices);\n\n    const out = backend.makeOutput(resultShape, params.dtype);\n    if (numSlices === 0) {\n      return out;\n    }\n\n    const indicesShape = indices.shape;\n    const sliceRank = indicesShape[indicesShape.length - 1];\n\n    const xData = backend.dataIdMap.get(params.dataId);\n    const xId = xData.id;\n\n    const indicesData = backend.dataIdMap.get(indices.dataId);\n    const indicesId = indicesData.id;\n\n    const stridesBytes = new Uint8Array(new Int32Array(strides).buffer);\n    const outId = backend.dataIdMap.get(out.dataId).id;\n\n    wasmGatherNd(\n      xId, CppDType[params.dtype], indicesId, numSlices, sliceRank, sliceSize,\n      stridesBytes, outId);\n\n    return out;\n  }\n\n  export const gatherNdConfig: KernelConfig = {\n    kernelName: GatherNd,\n    backendName: 'wasm',\n    setupFunc: setup,\n    kernelFunc: gatherNd\n  };  
}\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n*\n\nimport {backend_util, GatherV2, GatherV2Attrs, GatherV2Inputs, KernelConfig, KernelFunc, Tensor,  
TensorInfo, TypedArray, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {reshape} from './Reshape';\nimport {CppType} from './types';\n\nlet wasmGather: (\n  xId: number, dtype: CppDType, xStrides: Uint8Array, stridesSize: number,\n  indicesId: number, batchSize: number, outStrides: Uint8Array,\n  outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n  wasmGather = backend.wasm.cwrap('Gather', null /*void*/, [\n    'number', // xId\n    'number', // dtype\n    'array', // xStrides\n    'number', // stridesSize\n    'number', // indicesId\n    'number', // batchSize\n    'array', // outStrides\n    'number' // outId\n  ]);\n\n  function gatherV2(\n    args: {backend: BackendWasm, inputs: GatherV2Inputs, attrs: GatherV2Attrs}):  
    TensorInfo {\n    const {backend, inputs, attrs} = args;\n    const {x, indices} = inputs;\n    const {axis, batchDims} = attrs;\n\n    // Throw error when any index is out of bound.\n    const parsedAxis = util.parseAxisParam(axis, x.shape)[0];\n    const indicesVals = backend.readSync(indices.dataId) as TypedArray;\n    const axisDim = x.shape[parsedAxis];\n    for (let i = 0; i < indicesVals.length; ++i) {\n      const index = indicesVals[i];\n      util.assert(\n        index <= axisDim - 1 && index >= 0,\n        () => `GatherV2: the index value ${index} is not in [0, ${axisDim - 1}]`);\n    }\n\n    const shapeInfo = backend_util.segment_util.collectGatherOpShapeInfo(\n      x as Tensor, indices as Tensor, parsedAxis, batchDims);\n\n    const flattenX = reshape({\n      inputs: {x},\n      attrs: {\n        shape: [\n          shapeInfo.batchSize,
```

```

    shapeInfo.outerSize, shapeInfo.dimSize,\n    shapeInfo.sliceSize\n    ]\n    },\n    backend\n    });\n    const
indicesSize = util.sizeFromShape(indices.shape);\n    const flattenIndex = reshape({\n    inputs: {x: indices},\n    attrs:
{shape: [shapeInfo.batchSize, indicesSize / shapeInfo.batchSize]},\n    backend\n    });\n    const flattenOutputShape =
[\n    shapeInfo.batchSize, shapeInfo.outerSize, indicesSize / shapeInfo.batchSize,\n    shapeInfo.sliceSize\n    ];\n    const out = backend.makeOutput(flattenOutputShape, x.dtype);\n    if (util.sizeFromShape(x.shape) === 0) {\n
return out;\n    }\n    const stridesSize = flattenX.shape.length - 1;\n    const xData =
backend.dataIdMap.get(flattenX.dataId);\n    const xId = xData.id;\n\n    const indicesData =
backend.dataIdMap.get(flattenIndex.dataId);\n    const indicesId = indicesData.id;\n\n    const outId =
backend.dataIdMap.get(out.dataId).id;\n\n    const xStridesBytes = new Uint8Array(\n    new
Int32Array(util.computeStrides(flattenX.shape)).buffer);\n
    const outStridesBytes = new Uint8Array(\n    new
Int32Array(util.computeStrides(flattenOutputShape)).buffer);\n\n    wasmGather(\n    xId, CppDType[x.dtype],
xStridesBytes, stridesSize, indicesId,\n    shapeInfo.batchSize, outStridesBytes, outId);\n\n    backend.disposeData(flattenX.dataId);\n    backend.disposeData(flattenIndex.dataId);\n\n    // reshape\n    out.shape =
shapeInfo.outputShape;\n    return out;\n    }\n\n    export const gatherV2Config: KernelConfig = {\n    kernelName:
GatherV2,\n    backendName: 'wasm',\n    setupFunc: setup,\n    kernelFunc: gatherV2 as { } as KernelFunc\n    };
\n    /**\n
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    * Unless required by applicable
    law or agreed to in writing, software\n
    * distributed
    under the License is distributed on an "AS IS" BASIS,\n
    * WITHOUT WARRANTIES OR CONDITIONS OF
    ANY KIND, either express or implied.\n
    * See the License for the specific language governing permissions and\n
    * limitations under the License.\n
    */
\n    =====\n
    *\n
    import {Greater, KernelConfig} from '@tensorflow/tfjs-core';\n
    import {createBinaryKernelConfig} from
    './binary_kernel';\n
    const supportsFullBroadcast = false;\n
    export const greaterConfig: KernelConfig =\n
    createBinaryKernelConfig(Greater, supportsFullBroadcast, 'bool');\n
    /**\n
    * @license\n
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    * you may not
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    software\n
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    * WITHOUT WARRANTIES OR CONDITIONS OF
    ANY KIND, either express or implied.\n
    * See the License for the specific language governing permissions and\n
    * limitations under the License.\n
    */
\n    =====\n
    *\n
    import {GreaterEqual, KernelConfig} from '@tensorflow/tfjs-core';\n
    import {createBinaryKernelConfig}
    from './binary_kernel';\n
    const supportsFullBroadcast = false;\n
    export const greaterEqualConfig: KernelConfig =\n
    createBinaryKernelConfig(GreaterEqual, supportsFullBroadcast, 'bool');\n
    /**\n
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    * WITHOUT WARRANTIES
    OR CONDITIONS OF ANY KIND, either express or implied.\n
    * See the License for the specific language
    governing permissions and\n
    * limitations under the License.\n
    */
\n    =====\n
    *\n
    import {KernelConfig, KernelFunc, LeakyRelu, LeakyReluAttrs, LeakyReluInputs, TensorInfo, util} from
    '@tensorflow/tfjs-core';\n
    import {BackendWasm} from './backend_wasm';\n
    import {CppType} from
    './types';\n
    let wasmFunc: (\n    xId: number, dtype: number, leakyreluAlpha: number, outId: number) =>

```

```
void;\n\nfunction setupFunc(backend: BackendWasm): void {\n  wasmFunc = backend.wasm.cwrap(LeakyRelu,\n  null /* void */, [\n    'number', // x_id\n    'number', // dtype\n    'number', // leakyrelu_alpha\n    'number', //\n    out_id\n  ]);\n}\n\nexport function leakyRelu(\n  args: {\n    inputs: LeakyReluInputs, attrs: LeakyReluAttrs,\n    backend: BackendWasm});\n  TensorInfo {\n    const {inputs: [x], attrs: {alpha}, backend} = args;\n\n    const xId =\n    backend.dataIdMap.get(x.dataId).id;\n    // According to TF API, LeakyRelu returns float32 when input is either\n    float32\n    // or int32.\n    const out = backend.makeOutput(x.shape, 'float32');\n\n    if (util.sizeFromShape(x.shape)\n    !== 0) {\n      const outId = backend.dataIdMap.get(out.dataId).id;\n      wasmFunc(xId, CppDType[x.dtype], alpha,\n      outId);\n    }\n\n    return out;\n  }\n}\n\nexport const leakyReluConfig: KernelConfig = {\n  kernelName: LeakyRelu,\n  backendName: 'wasm',\n  setupFunc,\n  kernelFunc: leakyRelu as {} as KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law\n * or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n\n*/\nimport {KernelConfig, Less} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from\n './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const lessConfig: KernelConfig =\n createBinaryKernelConfig(Less, supportsFullBroadcast, 'bool');\n\n"/**\n * @license\n * Copyright 2019 Google\n * LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not\n * use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed\n * to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT\n * WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific\n * language governing permissions and\n * limitations under the License.\n */
```

```
=====\n\n*/\nimport {KernelConfig, LessEqual} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from\n './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const lessEqualConfig: KernelConfig =\n createBinaryKernelConfig(LessEqual, supportsFullBroadcast, 'bool');\n\n"/**\n * @license\n * Copyright 2019\n * Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you\n * may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable\n * law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT\n * WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n\n*/\nimport {KernelConfig, Log} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from\n './unary_kernel';\nexport const logConfig: KernelConfig = createUnaryKernelConfig(Log);\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed\n * on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n * implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n * License.\n */
```

```
=====\n\n*/\nimport {KernelConfig, LogicalAnd} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from\n './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const logicalAndConfig: KernelConfig =\n
```

createBinaryKernelConfig(LogicalAnd, supportsFullBroadcast, 'bool');\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is

distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```
=====\n*\n\nimport { backend_util, KernelConfig, KernelFunc, Max, MaxAttrs, MaxInputs, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport { permuteAxesAndTranspose } from './kernel_utils';\nimport { CppDType } from './types';\n\nlet wasmMax: (xId: number, dtype: number, reduceSize: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n  wasmMax = backend.wasm.cwrap(Max, null /*void*/, [\n    'number', // x_id\n    'number', // dtype\n    'number', // reduce_size\n    'number', // out_id\n  ]);\n\n  function max(args: { backend: BackendWasm, inputs: MaxInputs, attrs: MaxAttrs }): TensorInfo {\n    const { backend, inputs, attrs } = args;\n    const { reductionIndices: axis, keepDims } = attrs;\n    const x = inputs;\n    const xId = backend.dataIdMap.get(x.dataId).id;\n    let inputId = xId;\n    let input = x;\n\n    const { transposed, axes, originalAxes, inputWasTransposed } =\n      permuteAxesAndTranspose(x, axis, backend);\n\n    if (inputWasTransposed) {\n      const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n      input = transposed;\n      inputId = transposedId;\n    }\n\n    const inputRank = input.shape.length;\n    backend_util.assertAxesAreInnerMostDims('max', axes, inputRank);\n\n    const [outShape, reduceShape] =\n      backend_util.computeOutAndReduceShapes(input.shape, axes);\n\n    const reduceSize = util.sizeFromShape(reduceShape);\n\n    const out = backend.makeOutput(outShape, x.dtype);\n\n    if (util.sizeFromShape(input.shape) !== 0) {\n      const outId = backend.dataIdMap.get(out.dataId).id;\n      wasmMax(inputId, CppDType[x.dtype], reduceSize, outId);\n    }\n\n    if (inputWasTransposed) {\n      // dispose of the transposed tensor.\n      backend.disposeData(transposed.dataId);\n    }\n\n    if (keepDims) {\n      // reshape\n      const newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n      out.shape = newShape;\n    }\n\n    return out;\n  }\n\n  export const maxConfig: KernelConfig = {\n    kernelName: Max,\n    backendName: 'wasm',\n    setupFunc: setup,\n    kernelFunc: max as {} as KernelFunc\n  };\n\n  /*\n  * @license\n  * Copyright 2019 Google LLC. All Rights Reserved.\n  * Licensed under the Apache License, Version 2.0 (the \"License\");\n  * you may not use this file except in compliance with the License.\n  * You may obtain a copy of the License at\n  * http://www.apache.org/licenses/LICENSE-2.0\n  * Unless required by applicable law or agreed to in writing, software\n  * distributed under the License is distributed on an \"AS IS\" BASIS,\n  * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n  * See the License for the specific language governing\n  * permissions and\n  * limitations under the License.\n  */\n}
```

```
=====\n*\n\nimport { KernelConfig, Maximum } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from './binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const maximumConfig: KernelConfig =\n  createBinaryKernelConfig(Maximum, supportsFullBroadcast);\n\n/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions
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and\n * limitations under the License.\n *

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=====\n
*\n\nimport {backend_util, KernelConfig, KernelFunc, MaxPool, MaxPoolAttrs, MaxPoolInputs, Tensor4D, util}
from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nlet wasmMaxPool: (\n  xId:
number, batchSize: number, inputHeight: number, inputWidth: number,\n  filterHeight: number, filterWidth:
number, padTop: number, padRight: number,\n  padBottom: number, padLeft: number, dilationHeight: number,\n  dilationWidth: number, strideHeight: number, strideWidth: number,\n  inputChannels: number, outputChannels:
number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n  wasmMaxPool =
backend.wasm.cwrap(MaxPool, null /* void */, [\n  'number', // xId\n  'number', // batchSize\n  'number', //
inputHeight\n  'number', // inputWidth\n  'number', // filterHeight\n  'number', // filterWidth\n  'number',
// padTop\n  'number', // padRight\n  'number', // padBottom\n  'number', // padLeft\n  'number', //
dilationHeight\n  'number', // dilationWidth\n  'number', // strideHeight\n  'number', // strideWidth\n  'number',
// inputChannels\n  'number', // outputChannels\n  'number', // outId\n  ]);\n}\n\nfunction maxPool(\n  args:
{inputs: MaxPoolInputs, backend: BackendWasm, attrs: MaxPoolAttrs}) {\n  const {inputs, attrs, backend} =
args;\n\n  const x = inputs.x as Tensor4D;\n  const xId = backend.dataIdMap.get(x.dataId).id;\n\n  // TF API
supports int32 input. CPU and WebGL backend also support int32\n  // input. WASM backend doesn't support it
because it uses xnpack which only\n  // supports float32.\n  // Add the following assert only for the WASM
backend instead of at core op\n  // level.\n  // TODO: add support for int32 input.\n  util.assert(\n    x.dtype
=== 'float32',\n    () =>\n      `Error in MaxPool: only float32 input
is supported. Got ${x.dtype}.`);\n\n  const {filterSize, strides, pad, dimRoundingMode} = attrs;\n  const convInfo =
backend_util.computePool2DInfo(\n    x.shape, filterSize, strides, 1 /* dilations */, pad, dimRoundingMode);\n\n  const filterHeight = convInfo.filterHeight;\n  const filterWidth = convInfo.filterWidth;\n  const padTop =
convInfo.padInfo.top;\n  const padRight = convInfo.padInfo.right;\n  const padBottom = convInfo.padInfo.bottom;\n  const padLeft = convInfo.padInfo.left;\n  const dilationHeight = convInfo.dilationHeight;\n  const dilationWidth =
convInfo.dilationWidth;\n  const strideHeight = convInfo.strideHeight;\n  const strideWidth =
convInfo.strideWidth;\n  const inputChannels = convInfo.inChannels;\n  const outputChannels =
convInfo.outChannels;\n\n  if (convInfo.dataFormat !== 'channelsLast') {\n    throw new Error(\n      `wasm
backend does not support dataFormat:` +\n      `${convInfo.dataFormat}'. Please use 'channelsLast'.`);\n  }\n\n  const out = backend.makeOutput(convInfo.outShape,
'float32');\n  const outId = backend.dataIdMap.get(out.dataId).id;\n\n  wasmMaxPool(\n    xId, x.shape[0],
x.shape[1], x.shape[2], filterHeight, filterWidth,\n    padTop, padRight, padBottom, padLeft, dilationHeight,
dilationWidth,\n    strideHeight, strideWidth, inputChannels, outputChannels, outId);\n  return out;\n}\n\nexport
const maxPoolConfig: KernelConfig = {\n  kernelName: MaxPool,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: maxPool as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
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=====\n
*\n\nimport {backend_util, KernelConfig, KernelFunc, Mean, MeanAttrs, MeanInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {cast} from './Cast';\n\nimport
{permuteAxesAndTranspose} from './kernel_utils';\n\nlet wasmMean: (xId: number, reduceSize: number, outId:
number) => void;\n\nfunction setup(backend: BackendWasm): void {\n  wasmMean =\n  backend.wasm.cwrap(Mean, null /*void*/, ['number, number, number']);\n}\n\nexport function mean(\n  args:
{backend: BackendWasm, inputs: MeanInputs, attrs: MeanAttrs}):\n  TensorInfo {\n  const {backend, inputs,
attrs} = args;\n  const {axis, keepDims} = attrs;\n  const {x} = inputs;\n  const xId =
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backend.dataIdMap.get(x.dataId).id;\n
  let inputId = xId;\n  let input = x;\n\n  const {transposed, axes, originalAxes, inputWasTransposed} =\n  permuteAxesAndTranspose(x, axis, backend);\n\n  let reductionAxes = axes;\n  if (inputWasTransposed) {\n    const\n    transposedId = backend.dataIdMap.get(transposed.dataId).id;\n    if (transposedId !== xId) {\n      // transpose was\n      not a no-op. We will need to dispose of this\n      // once we are done.\n      input = transposed;\n      inputId =\n      transposedId;\n      reductionAxes = backend_util.getInnerMostAxes(\n        reductionAxes.length,\n        input.shape.length);\n    }\n  }\n\n  backend_util.assertAxesAreInnerMostDims(\n    'mean', reductionAxes,\n    input.shape.length);\n  const [outShape, reduceShape] =\n  backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n  const reduceSize =\n  util.sizeFromShape(reduceShape);\n  let castedInput = input;\n  if (input.dtype !== 'float32') {\n    castedInput =\n    cast({backend, inputs: {x: input}, attrs: {dtype: 'float32'}});\n\n    inputId = backend.dataIdMap.get(castedInput.dataId).id;\n  }\n\n  const out = backend.makeOutput(outShape,\n  'float32');\n  if (util.sizeFromShape(input.shape) !== 0) {\n    const outId = backend.dataIdMap.get(out.dataId).id;\n    wasmMean(inputId, reduceSize, outId);\n  }\n\n  if (inputWasTransposed) {\n    // dispose of the transposed\n    tensor.\n    backend.disposeData(transposed.dataId);\n  }\n\n  if (keepDims) {\n    // reshape\n    const newShape =\n    backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n    out.shape = newShape;\n  }\n\n  if (input.dtype\n  !== 'float32') {\n    backend.disposeData(castedInput.dataId);\n  }\n\n  return out;\n}\n\nexport const meanConfig:\n  KernelConfig = {\n  kernelName: Mean,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: mean as {\n  as KernelFunc\n};\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under\n  the Apache License, Version 2.0 (the "License");\n * you may not use this file\n  except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *  

http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n  software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n  OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n  governing permissions and\n * limitations under the License.\n *\n  =====\n\n  *\n  \nimport {backend_util, KernelConfig, KernelFunc, Min, MinAttrs, MinInputs, TensorInfo, util} from\n  '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport\n  {permuteAxesAndTranspose} from './kernel_utils';\nimport {CppType} from './types';\n\nlet wasmMin: (xId:\n  number, dtype: number, reduceSize: number, outId: number) =>\n  void;\n\nfunction setup(backend:\n  BackendWasm): void {\n  wasmMin = backend.wasm.cwrap(Min,\n    null /*void*/, [\n      'number', // x_id\n      'number', // dtype\n      'number', // reduce_size\n      'number', // out_id\n    ]);\n\n  function min(args: {backend: BackendWasm, inputs: MinInputs, attrs: MinAttrs}):\n    TensorInfo {\n    const {backend, inputs, attrs} = args;\n    const {axis, keepDims} = attrs;\n    const {x} = inputs;\n    const xId =\n    backend.dataIdMap.get(x.dataId).id;\n    let inputId = xId;\n    let input = x;\n\n    const {transposed, axes, originalAxes,\n    inputWasTransposed} =\n    permuteAxesAndTranspose(x, axis, backend);\n\n    if (inputWasTransposed) {\n      const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n      if (transposedId !== xId) {\n        // transpose\n        was not a no-op. We will need to dispose of this\n        // once we are done.\n        input = transposed;\n        inputId =\n        transposedId;\n      }\n    }\n\n    const inputRank = input.shape.length;\n\n    backend_util.assertAxesAreInnerMostDims('min', axes, inputRank);\n    const [outShape, reduceShape] =\n    backend_util.computeOutAndReduceShapes(input.shape,\n    axes);\n    const reduceSize = util.sizeFromShape(reduceShape);\n\n    const out = backend.makeOutput(outShape,\n    input.dtype);\n    if (util.sizeFromShape(input.shape) !== 0) {\n      const outId =\n      backend.dataIdMap.get(out.dataId).id;\n      wasmMin(inputId, CCppType[x.dtype], reduceSize, outId);\n    }\n\n    if (inputWasTransposed) {\n      // dispose of the transposed tensor.\n      backend.disposeData(transposed.dataId);\n    }\n\n    if (keepDims) {\n      // reshape\n      const newShape = backend_util.expandShapeToKeepDim(out.shape,\n      originalAxes);\n      out.shape = newShape;\n    }\n\n    return out;\n  }\n\n  export const minConfig: KernelConfig = {\n    kernelName: Min,\n    backendName: 'wasm',\n    setupFunc: setup,\n    kernelFunc: min as {\n  as

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KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n

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```
=====\n*\nimport {KernelConfig, Minimum} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const minimumConfig: KernelConfig =\ncreateBinaryKernelConfig(Minimum, supportsFullBroadcast);\n", "/*\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You
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may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```
=====\n*\nimport {KernelConfig, KernelFunc, MirrorPad, MirrorPadAttrs, MirrorPadInputs} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {CppType} from './types';\n// Must match enum in MirrorPad.cc\nenum MirrorPaddingMode {\n  reflect = 0,\n  symmetric = 1\n}\nlet wasmMirrorPad: (\n  xId: number, xShapeBytes: Uint8Array, xShapeLength: number, xDtype: number,\n  prePaddingsBytes: Uint8Array, postPaddingsBytes: Uint8Array, mode: number,\n  outId: number) => void;\nfunction setup(backend: BackendWasm) {\n  wasmMirrorPad =\n    backend.wasm.cwrap(MirrorPad, null /* void */, [\n      'number', // xId\n      'array', // x.shape\n      'number', // x.shape.length\n      'number', // x.dtype\n      'array', // pre-paddings\n      'array', // post-paddings\n      'number', // mode\n      'number', // outId\n    ]);\n  function mirrorPad(args: {\n    inputs: MirrorPadInputs,\n    backend: BackendWasm,\n    attrs: MirrorPadAttrs\n  }) {\n    const {inputs: {x}, backend, attrs: {paddings, mode}} = args;\n    const outShape = paddings.map(\n      (p, i) => p[0] /* beforePad */ + x.shape[i] + p[1] /* afterPad */);\n    const xId = backend.dataIdMap.get(x.dataId).id;\n    const out = backend.makeOutput(outShape, x.dtype);\n    const outId = backend.dataIdMap.get(out.dataId).id;\n    const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n    const prePaddingsFlat = paddings.map(padTuple => padTuple[0]);\n    const postPaddingsFlat = paddings.map(padTuple => padTuple[1]);\n    const prePaddingsBytes =\n      new Uint8Array(new Int32Array(prePaddingsFlat).buffer);\n    const postPaddingsBytes =\n      new Uint8Array(new Int32Array(postPaddingsFlat).buffer);\n    wasmMirrorPad(\n      xId, xShapeBytes, x.shape.length, CCppType[x.dtype], prePaddingsBytes,\n      postPaddingsBytes, MirrorPaddingMode[mode], outId);\n    return out;\n  }\n  export const mirrorPadConfig:\n    KernelConfig = {\n      kernelName: MirrorPad,\n      backendName: 'wasm',\n      kernelFunc: mirrorPad as { } as KernelFunc,\n      setupFunc: setup\n    };\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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=====\n*\nimport {KernelConfig, Multiply} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from './binary_kernel';\nconst supportsFullBroadcast = true;\nexport const multiplyConfig: KernelConfig =\n

createBinaryKernelConfig(Multiply, supportsFullBroadcast);\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```
=====\n*\nimport {KernelConfig, Neg} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from './unary_kernel';\nexport const negConfig: KernelConfig = createUnaryKernelConfig(Neg);\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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=====\n*\nimport {BackendWasm} from './backend_wasm';\n\n// Analogous to `struct Result` in `non_max_suppression_impl.h`\ninterface Result {\n  pSelectedIndices: number;\n  selectedSize: number;\n  pSelectedScores: number;\n  pValidOutputs: number;\n}\n\n/*\n * Parse the result of the c++ method, which has the shape equivalent to\n * `Result`\n */\nexport function parseResultStruct(\n  backend: BackendWasm, resOffset: number): Result {\n  const result = new Int32Array(backend.wasm.HEAPU8.buffer, resOffset, 4);\n  const pSelectedIndices = result[0];\n  const selectedSize = result[1];\n  const pSelectedScores = result[2];\n  const pValidOutputs = result[3];\n  // Since the result was allocated on the heap, we have to delete it.\n  backend.wasm._free(resOffset);\n  return {pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs};\n}\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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=====\n*\nimport {KernelConfig, KernelFunc, NonMaxSuppressionV3, NonMaxSuppressionV3Attrs, NonMaxSuppressionV3Inputs, TensorInfo} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {parseResultStruct} from './NonMaxSuppression_util';\n\nlet\n  wasmFunc: (\n    boxesId: number, scoresId: number, maxOutputSize: number,\n    iouThreshold: number, scoreThreshold: number) => number;\n\nfunction setup(backend: BackendWasm): void {\n  wasmFunc = backend.wasm.cwrap(\n    NonMaxSuppressionV3, 'number', // Result*\n    [\n      'number', // boxesId\n      'number', // scoresId\n      'number', // maxOutputSize\n      'number', // iouThreshold\n      'number', // scoreThreshold\n    ],\n  );\n\n  function kernelFunc(args: {\n    backend: BackendWasm,\n    inputs: NonMaxSuppressionV3Inputs,\n    attrs: NonMaxSuppressionV3Attrs\n  }): TensorInfo {\n    const {backend, inputs, attrs} = args;\n    const {iouThreshold, maxOutputSize, scoreThreshold} = attrs;\n    const {boxes, scores} = inputs;\n    const boxesId = backend.dataIdMap.get(boxes.dataId).id;\n    const scoresId = backend.dataIdMap.get(scores.dataId).id;\n    const resOffset =\n      wasmFunc(boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold);\n    const {pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs} =\n      parseResultStruct(backend, resOffset);\n    // Since we are not using scores for V3, we have to delete it from the
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heap.\n backend.wasm._free(pSelectedScores);\n backend.wasm._free(pValidOutputs);\n\n const\n selectedIndicesTensor =\n   backend.makeOutput([selectedSize], 'int32', pSelectedIndices);\n\n return\n selectedIndicesTensor;\n\n\nexport const nonMaxSuppressionV3Config: KernelConfig = {\n kernelName:\n NonMaxSuppressionV3,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: kernelFunc as {} as\n KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the\n Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the\n License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in\n writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT\n WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific\n language governing permissions and\n * limitations under the License.\n *
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=====\n\n*/\n\nimport { KernelConfig, KernelFunc, NonMaxSuppressionV4, NonMaxSuppressionV4Attrs,\n NonMaxSuppressionV4Inputs, TensorInfo } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from\n './backend_wasm';\nimport { parseResultStruct } from './NonMaxSuppression_util';\n\nlet wasmFunc: (\n boxesId: number, scoresId: number, maxOutputSize: number,\n iouThreshold: number, scoreThreshold: number,\n padToMaxOutputSize: boolean) => number;\n\nfunction setup(backend: BackendWasm): void {\n wasmFunc =\n backend.wasm.cwrap(\n NonMaxSuppressionV4,\n 'number', // Result*\n [\n 'number', // boxesId\n 'number',\n // scoresId\n 'number', // maxOutputSize\n 'number', // iouThreshold\n 'number', // scoreThreshold\n 'bool', // padToMaxOutputSize\n ]);\n\nfunction nonMaxSuppressionV4(args: {\n backend:\n BackendWasm,\n inputs: NonMaxSuppressionV4Inputs,\n attrs: NonMaxSuppressionV4Attrs\n}): TensorInfo[]\n {\n const { backend, inputs, attrs } = args;\n const { iouThreshold, maxOutputSize, scoreThreshold,\n padToMaxOutputSize } =\n attrs;\n const { boxes, scores } = inputs;\n\n const boxesId =\n backend.dataIdMap.get(boxes.dataId).id;\n const scoresId = backend.dataIdMap.get(scores.dataId).id;\n\n const\n resOffset = wasmFunc(\n boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold,\n padToMaxOutputSize);\n\n const { pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs } =\n parseResultStruct(backend, resOffset);\n\n // Since we are not using scores for V4, we have to delete it from the\n heap.\n backend.wasm._free(pSelectedScores);\n\n
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const selectedIndicesTensor =\n backend.makeOutput([selectedSize], 'int32', pSelectedIndices);\n\n const\n validOutputsTensor = backend.makeOutput([], 'int32', pValidOutputs);\n\n return [selectedIndicesTensor,\n validOutputsTensor];\n\n\nexport const nonMaxSuppressionV4Config: KernelConfig = {\n kernelName:\n NonMaxSuppressionV4,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: nonMaxSuppressionV4 as {} as\n KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the\n Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the\n License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n implied.\n * See the License
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for the specific language governing permissions and\n * limitations under the License.\n *
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```
=====\n\n*/\n\nimport { KernelConfig, KernelFunc, NonMaxSuppressionV5, NonMaxSuppressionV5Attrs,\n NonMaxSuppressionV5Inputs, TensorInfo } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from\n './backend_wasm';\nimport { parseResultStruct } from './NonMaxSuppression_util';\n\nlet wasmFunc:\n (\n boxesId: number, scoresId: number, maxOutputSize: number,\n iouThreshold: number, scoreThreshold: number,\n softNmsSigma: number) =>\n number;\n\nfunction setup(backend: BackendWasm): void {\n wasmFunc =\n backend.wasm.cwrap(\n NonMaxSuppressionV5,\n 'number', // Result*\n [\n 'number', // boxesId\n 'number', // scoresId\n 'number', // maxOutputSize\n 'number', // iouThreshold\n 'number', //
```

```

scoreThreshold\n      'number', // softNmsSigma\n      ]);\n}\n\nfunction
kernelFunc(args: {\n backend: BackendWasm,\n inputs: NonMaxSuppressionV5Inputs,\n attrs:
NonMaxSuppressionV5Attrs\n}): TensorInfo[] {\n const {backend, inputs, attrs} = args;\n const {iouThreshold,
maxOutputSize, scoreThreshold, softNmsSigma} = attrs;\n const {boxes, scores} = inputs;\n\n const boxesId =
backend.dataIdMap.get(boxes.dataId).id;\n const scoresId = backend.dataIdMap.get(scores.dataId).id;\n\n const
resOffset = wasmFunc(\n boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold,\n
softNmsSigma);\n\n const {pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs} =\n
parseResultStruct(backend, resOffset);\n\n // Since we are not using validOutputs for V5, we have to delete it from
the\n // heap.\n backend.wasm._free(pValidOutputs);\n\n const selectedIndicesTensor =\n
backend.makeOutput([selectedSize], 'int32', pSelectedIndices);\n const selectedScoresTensor =\n
backend.makeOutput([selectedSize], 'float32', pSelectedScores);\n\n
return [selectedIndicesTensor, selectedScoresTensor];\n}\n\nexport const nonMaxSuppressionV5Config:
KernelConfig = {\n kernelName: NonMaxSuppressionV5,\n backendName: 'wasm',\n setupFunc: setup,\n
kernelFunc: kernelFunc as {} as KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\nimport {KernelConfig,
NotEqual} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from './binary_kernel';\nconst
supportsFullBroadcast = false;\nexport const notEqualConfig: KernelConfig =\n
createBinaryKernelConfig(NotEqual, supportsFullBroadcast, 'bool');\n\n"/**\n * @license\n * Copyright 2020
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport
{KernelConfig, KernelFunc, OneHot, OneHotAttrs, OneHotInputs} from '@tensorflow/tfjs-core';\nimport
{BackendWasm} from './backend_wasm';\n\nlet wasmOneHot: (\n indicesId: number, depth: number, onValue:
number, offValue: number,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n
wasmOneHot = backend.wasm.cwrap(OneHot, null /* void */, [\n 'number', // indices_id\n 'number', // depth,\n
'number', // onValue\n 'number', // offValue\n 'number' // out_id\n ]);\n\nfunction oneHot(\n args:
{inputs: OneHotInputs, attrs: OneHotAttrs, backend: BackendWasm}) {\n const {inputs, backend, attrs} = args;\n
const {indices} = inputs;\n const {depth, onValue, offValue} = attrs;\n\n const out =
backend.makeOutput([...indices.shape, depth], 'int32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n
const indicesData = backend.dataIdMap.get(indices.dataId);\n const indicesId = indicesData.id;\n\n
wasmOneHot(indicesId, depth, onValue,
offValue, outId);\n\n return out;\n}\n\nexport const oneHotConfig: KernelConfig = {\n kernelName: OneHot,\n
backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: oneHot as {} as KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
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```
=====\n*\n\nimport {KernelConfig, KernelFunc, OnesLike, OnesLikeInputs} from '@tensorflow/tfjs-core';\nimport\n{BackendWasm} from '../backend_wasm';\n\nfunction onesLike(args: {inputs: OnesLikeInputs, backend:\nBackendWasm}) {\n  const {inputs: {x}, backend} = args;\n  const out = backend.makeOutput(x.shape, x.dtype);\n  const outVals = backend.toArrayFromHeap(out);\n  outVals.fill(1);\n  return out;\n}\n\nexport const\nonesLikeConfig: KernelConfig = {\n  kernelName: OnesLike,\n  backendName: 'wasm',\n  kernelFunc: onesLike as\n  {} as KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed\n * under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the\n * License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless\n * required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n * on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n * implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n * License.\n *
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=====\n*\n\nimport {KernelConfig, KernelFunc, Pack, PackAttrs, PackInputs, TensorInfo, util} from '@tensorflow/tfjs-\ncore';\nimport {BackendWasm} from '../backend_wasm';\nimport {concat} from './Concat';\nimport\n{expandDims} from './ExpandDims';\n\nexport function pack(\n  args: {inputs: PackInputs, backend:\n  BackendWasm, attrs: PackAttrs});\n  TensorInfo {\n    const {inputs, backend, attrs} = args;\n    const {axis} =\n    attrs;\n\n    if (inputs.length === 1) {\n      return expandDims(\n        {inputs: {input: inputs[0]}, backend, attrs: {dim:\n        axis}});\n    }\n\n    const shape = inputs[0].shape;\n    const dtype = inputs[0].dtype;\n\n    inputs.forEach(t => {\n      util.assertShapesMatch(\n        shape, t.shape,\n        'All tensors passed to stack must have matching shapes');\n      util.assert(\n        dtype === t.dtype,\n        () => 'All tensors passed to stack must have matching dtypes');\n    });\n\n    const\n    intermediateTensorInfos: TensorInfo[] = [];\n    const expandedTensors = inputs.map(t => {\n      const expandedT =\n      expandDims({inputs: {input: t}, backend, attrs: {dim: axis}});\n      intermediateTensorInfos.push(expandedT);\n    });\n\n    return expandedT;\n  });\n\n  const result = concat({inputs: expandedTensors, backend, attrs: {axis}});\n\n  intermediateTensorInfos.forEach(t => backend.disposeData(t.dataId));\n\n  return result;\n}\n\nexport const\npackConfig: KernelConfig = {\n  kernelName: Pack,\n  backendName: 'wasm',\n  kernelFunc: pack as {} as\n  KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the\n * Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the\n * License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless
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```
=====\n*\n\nimport {KernelConfig, KernelFunc, PadV2, PadV2Attrs, PadV2Inputs, util} from '@tensorflow/tfjs-\ncore';\nimport {BackendWasm} from '../backend_wasm';\nimport {fill} from './Fill';\nimport {CppType}\nfrom './types';\n\nlet wasmPadV2: (\n  xId: number, xShapeBytes: Uint8Array, xShapeLength: number, xDtype:\n  number,\n  prePaddingsBytes: Uint8Array, postPaddingsBytes: Uint8Array,\n  constantValue: number, outId:\n  number) => void;\n\nfunction setup(backend: BackendWasm) {\n  wasmPadV2 = backend.wasm.cwrap(PadV2, null\n  /* void */, [\n    'number', // xId\n    'array', // x.shape\n    'number', // x.shape.length\n    'number', // x.dtype\n    'array', // pre-paddings\n    'array', // post-paddings\n    'number', // constantValue\n    'number', // outId\n  ]);\n}\n\nfunction pad(\n  args: {inputs: PadV2Inputs, backend:\n  BackendWasm, attrs: PadV2Attrs}) {\n  const {inputs: {x}, backend, attrs: {paddings, constantValue}} = args;\n}
```

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const outShape = paddings.map(\n    (p, i) => p[0] /* beforePad */ + x.shape[i] + p[1] /* afterPad */);\n\n if
(util.sizeFromShape(x.shape) === 0) {\n    // Short-circuit the computation, since x doesn't have value, only\n    //
the shape is used to compute output shape to pad.\n    return fill({\n        backend,\n        attrs: {shape: outShape, value:
constantValue, dtype: x.dtype}\n    });\n };\n\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out =
backend.makeOutput(outShape, x.dtype);\n const outTensorData = backend.dataIdMap.get(out.dataId);\n const
outId = outTensorData.id;\n\n const xShapeBytes = new
  Uint8Array(new Int32Array(x.shape).buffer);\n\n const prePaddingsFlat = paddings.map(padTuple =>
  padTuple[0]);\n const postPaddingsFlat = paddings.map(padTuple => padTuple[1]);\n const prePaddingsBytes =\n
  new Uint8Array(new Int32Array(prePaddingsFlat).buffer);\n const postPaddingsBytes =\n
  new Uint8Array(new Int32Array(postPaddingsFlat).buffer);\n\n wasmPadV2(\n    xId, xShapeBytes, x.shape.length,
  CppDType[x.dtype], prePaddingsBytes,\n    postPaddingsBytes, constantValue, outId);\n return out;\n}\n\nexport
const padV2Config: KernelConfig = {\n  kernelName: PadV2,\n  backendName: 'wasm',\n  kernelFunc: pad as {} as
  KernelFunc,\n  setupFunc: setup\n};\n\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n
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  "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License
  for the specific language governing permissions and\n * limitations under the License.\n *
  =====\n
  *\nimport {KernelConfig, Pow} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
  './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const powConfig: KernelConfig =\n  createBinaryKernelConfig(Pow, supportsFullBroadcast);\n\n", "/*\n * @license\n * Copyright 2019 Google LLC. All
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  the specific language governing permissions and\n * limitations under the License.\n *
  =====\n
  *\nimport {KernelConfig, KernelFunc, Prelu, PreluInputs} from '@tensorflow/tfjs-core';\nimport
  {BackendWasm} from './backend_wasm';\nimport {cast} from './Cast';\n\nlet wasmPrelu: (xId: number,
  weightsId: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n  wasmPrelu =
  backend.wasm.cwrap(Prelu, null /* void */, [\n    'number', // x_id\n    'number', // weights_id\n    'number' //
  out_id\n  ]);\n}\n\nfunction prelu(args: {inputs: PreluInputs, backend: BackendWasm}) {\n  const {inputs, backend}
  = args;\n  const {x, alpha} = inputs;\n  const xId = backend.dataIdMap.get(x.dataId).id;\n
  const weightsId = backend.dataIdMap.get(alpha.dataId).id;\n\n  let inputId = xId;\n  const input = x;\n  let
  castedInput = input;\n  if (input.dtype !== 'float32') {\n    castedInput = cast({backend, inputs: {x}, attrs: {dtype:
  'float32'}});\n    inputId = backend.dataIdMap.get(castedInput.dataId).id;\n  }\n\n  const out =
  backend.makeOutput(x.shape, 'float32');\n  const outId = backend.dataIdMap.get(out.dataId).id;\n
  wasmPrelu(inputId, weightsId, outId);\n\n  if (input.dtype !== 'float32') {\n
  backend.disposeData(castedInput.dataId);\n  }\n\n  return out;\n}\n\nexport const preluConfig: KernelConfig = {\n
  kernelName: Prelu,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: prelu as {} as
  KernelFunc\n};\n\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
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```
=====\n*\n\nimport { backend_util, KernelConfig, KernelFunc, Prod, ProdAttrs, ProdInputs, TensorInfo, util } from\n '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport\n {permuteAxesAndTranspose} from './kernel_utils';\nimport { CppDType } from './types';\nlet wasmProd: (\n xId: number, reduceSize: number,\n dtype: number, outId: number) => void;\nfunction setup(backend:\n BackendWasm): void {\n wasmProd = backend.wasm.cwrap(Prod, null /*void*/, [\n 'number',\n 'number',\n 'number',\n 'number'\n ]);\n}\nfunction prod(args: {\n backend: BackendWasm,\n inputs: ProdInputs,\n attrs: ProdAttrs\n }):\n TensorInfo {\n const { backend, inputs, attrs } = args;\n const { axis, keepDims } = attrs;\n const { x } = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const { transposed, axes,\n originalAxes, inputWasTransposed } =\n permuteAxesAndTranspose(x, axis, backend);\n\n let reductionAxes =\n axes;\n if (inputWasTransposed) {\n const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n if\n (transposedId !== xId) {\n // transpose was not a no-op. We will need to dispose of this\n // once we are\n done.\n input = transposed;\n inputId = transposedId;\n reductionAxes =\n backend_util.getInnerMostAxes(\n reductionAxes.length, input.shape.length);\n }\n }\n\n backend_util.assertAxesAreInnerMostDims(\n 'prod', reductionAxes, input.shape.length);\n const [outShape,\n reduceShape] =\n\n backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n const reduceSize =\n util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, input.dtype);\n if\n (util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmProd(inputId, reduceSize, CppDType[out.dtype], outId);\n }\n\n if (inputWasTransposed) {\n // dispose of\n the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const\n newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n return out;\n }\n\nexport const prodConfig: KernelConfig = {\n kernelName: Prod,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: prod as { } as KernelFunc\n};\n", "**\n * @license\n * Copyright 2020 Google\n LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not\n use this file except in compliance\n with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-\n 2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is\n distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either\n express or implied.\n * See the License for the specific language governing permissions and\n * limitations under\n the License.\n *
```

```
=====\n*\n\nimport { KernelConfig, KernelFunc, Range, RangeAttrs, TensorInfo } from '@tensorflow/tfjs-core';\nimport\n {BackendWasm} from './backend_wasm';\nimport {rangeImplCPU} from './kernel_utils/shared';\n\nexport const\n range = (\n args: {backend: BackendWasm, attrs: RangeAttrs}): TensorInfo => {\n const { backend, attrs } =\n args;\n const { start, stop, step, dtype } = attrs;\n const values = rangeImplCPU(start, stop, step, dtype);\n\n const out\n = backend.makeOutput([values.length], dtype);\n const outVals = backend.typedArrayFromHeap(out);\n outVals.set(values);\n return out;\n };\n\nexport const rangeConfig: KernelConfig = {\n kernelName: Range,\n backendName: 'wasm',\n kernelFunc: range as { } as KernelFunc\n};\n", "**\n * @license\n * Copyright 2019\n Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not\n use this file except in compliance\n with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is\n distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either\n express or implied.\n * See the License for the specific language
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=====
*\n\nimport {KernelConfig, RealDiv} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from
'/binary_kernel';\n\nconst supportsFullBroadcast = true;\n\nexport const realDivConfig: KernelConfig =\ncreateBinaryKernelConfig(RealDiv, supportsFullBroadcast);\n\n"/**\n * @license\n * Copyright 2019 Google LLC.
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http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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=====
*\n\nimport {KernelConfig, Relu} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'/unary_kernel';\n\nexport const reluConfig: KernelConfig = createUnaryKernelConfig(Relu);\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
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=====
*\n\nimport {KernelConfig, Relu6} from '@tensorflow/tfjs-core';\n\nimport
{createUnaryKernelConfig} from '/unary_kernel';\n\nexport const relu6Config: KernelConfig =
createUnaryKernelConfig(Relu6);\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n *
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http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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=====
*\n\nimport {KernelConfig, KernelFunc, ResizeBilinear, ResizeBilinearAttrs, ResizeBilinearInputs, TensorInfo,
util} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from '../backend_wasm';\n\nimport {cast} from './Cast';\n\nlet wasmResizeBilinear: (\n  xId:
number, batch: number, oldHeight: number, oldWidth: number,\n  numChannels: number, newHeight: number,
newWidth: number,\n  alignCorners: number, halfPixelCenters: number, outId: number) => void;\n\nfunction
setup(backend: BackendWasm): void {\n  wasmResizeBilinear = backend.wasm.cwrap(ResizeBilinear, null
/*void*/, [\n    'number', // xId\n    'number', // batch\n    'number', // oldHeight\n    'number', // oldWidth\n
'number', // numChannels\n    'number', // newHeight\n    'number', // newWidth\n    'number', // alignCorners\n
'number', // halfPixelCenters\n    'number' // outId\n  ]);\n\n  function resizeBilinear(args: {\n    backend:
BackendWasm,\n    inputs: ResizeBilinearInputs,\n    attrs: ResizeBilinearAttrs\n  }): TensorInfo {\n    const {backend,
inputs, attrs} = args;\n\n    const {images} = inputs;\n    const {alignCorners, halfPixelCenters, size} =
attrs;\n    const [newHeight, newWidth] = size;\n\n    const [batch, oldHeight, oldWidth, numChannels] =
images.shape;\n    const outShape = [batch, newHeight, newWidth, numChannels];\n\n    let xData =
backend.dataIdMap.get(images.dataId);\n    let castedData;\n    if (xData.dtype !== 'float32') {\n      castedData =\n        cast({backend, inputs: {x: images}, attrs: {dtype: 'float32'}});\n      xData =
backend.dataIdMap.get(castedData.dataId);\n    }\n\n    const xId = xData.id;\n\n    const out =
backend.makeOutput(outShape, 'float32');\n    if (util.sizeFromShape(images.shape) === 0) {\n      return out;\n    }\n

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const outId = backend.dataIdMap.get(out.dataId).id;\n\n wasmResizeBilinear(\n  xId, batch, oldHeight,
oldWidth, numChannels, newHeight, newWidth,\n  alignCorners ? 1 : 0, halfPixelCenters ? 1 : 0, outId);\n\n if
(castedData != null) {\n  backend.disposeData(castedData.dataId);\n };\n\n return out;\n}\n\nexport const
resizeBilinearConfig: KernelConfig = {\n  kernelName: ResizeBilinear,\n
  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: resizeBilinear as {} as KernelFunc\n};\n\n"/**\n *
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport { KernelConfig, KernelFunc, Reverse, ReverseAttrs, ReverseInputs, TensorInfo, util } from
'@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport
{ identity } from './Identity';\n\nimport { reshape } from './Reshape';\n\nlet wasmReverse: (\n  xId: number, axes:
Uint8Array, axesLength: number, outShape: Uint8Array,\n  outShapeLength: number, outId: number) =>
void;\n\nfunction setup(backend: BackendWasm) {\n  wasmReverse = backend.wasm.cwrap(Reverse, null, [\n
'number', // x_id\n 'array', // axes\n 'number', // axes_length\n 'array', // out_shape\n 'number', //
out_shape_length\n 'number' // out_id\n ]);\n}\n\nexport function reverse(\n  args: {inputs: ReverseInputs,
backend: BackendWasm, attrs: ReverseAttrs});\n  TensorInfo {\n  const {inputs, backend, attrs} = args;\n  const
{x} = inputs;\n  const {dims} = attrs;\n\n  const axes = util.parseAxisParam(dims, x.shape);\n\n  if (x.shape.length
=== 0) {\n  return identity({inputs: {x}, backend});\n }\n\n  const out = backend.makeOutput(x.shape, x.dtype);\n
const xId = backend.dataIdMap.get(x.dataId).id;\n  const outId = backend.dataIdMap.get(out.dataId).id;\n\n
const axesBytes = new Uint8Array(new Int32Array(axes).buffer);\n  const outShapeBytes = new Uint8Array(new
Int32Array(x.shape).buffer);\n\n  wasmReverse(\n  xId, axesBytes, axes.length, outShapeBytes, x.shape.length,
outId);\n\n  const reshaped =\n  reshape({inputs: {x: out}, attrs: {shape: x.shape}, backend});\n\n
backend.disposeData(out.dataId);\n  return reshaped;\n}\n\nexport const reverseConfig: KernelConfig = {\n
kernelName: Reverse,\n  backendName: 'wasm',\n  kernelFunc: reverse as {} as KernelFunc,\n  setupFunc:
setup\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
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"AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n *
See the License for the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport { KernelConfig, KernelFunc, RotateWithOffset, RotateWithOffsetAttrs, RotateWithOffsetInputs,
TensorInfo } from '@tensorflow/tfjs-core';\n\nimport { backend_util } from '@tensorflow/tfjs-core';\n\nimport
{ BackendWasm } from '../backend_wasm';\n\nlet wasmRotate: (\n  xId: number, batch: number, imageHeight:
number, imageWidth: number,\n  numChannels: number, radians: number, centerX: number, centerY: number,\n
fillBytes: Uint8Array, fillLength: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n
wasmRotate = backend.wasm.cwrap(RotateWithOffset, null /* void */, [\n 'number', // xId\n 'number', //
batch\n 'number', // imageHeight\n 'number', // imageWidth\n
'number', // numChannels\n 'number', // radians\n 'number', // centerX\n 'number', // centerY\n 'array', //
fillBytes\n 'number', // fillLength\n 'number', // outId\n ]);\n}\n\nexport function rotateWithOffset(args: {\n
inputs: RotateWithOffsetInputs,\n  backend: BackendWasm,\n  attrs: RotateWithOffsetAttrs\n}): TensorInfo {\n
const {inputs, backend, attrs} = args;\n  const {image} = inputs;\n  const {radians, fillValue, center} = attrs;\n\n
const out = backend.makeOutput(image.shape, image.dtype);\n  const imageId =

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backend.dataIdMap.get(image.dataId).id;\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const [batch,
imageHeight, imageWidth, numChannels] = image.shape;\n\n const [centerX, centerY] =\n
backend_util.getImageCenter(center, imageHeight, imageWidth);\n\n const fillIsBlack = fillValue === 0;\n const
fullOpacityValue = 255;\n\n const fillValues = typeof fillValue === 'number' ?\n [fillValue, fillValue, fillValue,
fillIsBlack ? 0 : fullOpacityValue] :\n [...fillValue, fullOpacityValue];\n const fillBytes = new Uint8Array(new
Int32Array(fillValues).buffer);\n\n wasmRotate(\n imageId, batch, imageHeight, imageWidth, numChannels,
radians, centerX,\n centerY, fillBytes, fillValues.length, outId);\n return out;\n}\n\nexport const
rotateWithOffsetConfig: KernelConfig = {\n kernelName: RotateWithOffset,\n backendName: 'wasm',\n
kernelFunc: rotateWithOffset as {} as KernelFunc,\n setupFunc: setup\n};\n", "/*\n * @license\n * Copyright 2021
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OR CONDITIONS
OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions
and\n * limitations under the License.\n *
=====\n
*\nimport {KernelConfig, Round} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'/unary_kernel';\n\nexport const roundConfig: KernelConfig = createUnaryKernelConfig(Round);\n", "/*\n *
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
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language governing permissions and\n * limitations under the License.\n *
=====\n
*\nimport {KernelConfig, Rsqrt} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'/unary_kernel';\n\nexport const rsqrtConfig: KernelConfig = createUnaryKernelConfig(Rsqrt);\n", "/*\n *
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
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=====\n
*\n\nimport {KernelConfig, KernelFunc, scatter_util, ScatterNd, ScatterNdAttrs, ScatterNdInputs, TensorInfo,
util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {CppType}
from './types';\n\nlet wasmScatterNd: (\n indicesId: number, updatesId: number, dtype: CppDType, sliceRank:
number,\n numUpdates: number, sliceSize: number, strides: Uint8Array,\n outputSize: number, outId: number)
=> void;\n\nfunction setup(backend: BackendWasm): void {\n wasmScatterNd = backend.wasm.cwrap(ScatterNd,
null /*void*/, [\n 'number', // indicesId\n 'number', // updatesId\n 'number', // dtype\n 'number', //
sliceRank\n 'number', // numUpdates\n 'number', // sliceSize\n 'array', // strides\n 'number', // outputSize\n
'number' // outId\n ]);\n\nfunction scatterNd(\n args:\n {backend: BackendWasm, inputs:
ScatterNdInputs, attrs: ScatterNdAttrs});\n
TensorInfo {\n const {backend, inputs, attrs} = args;\n const {indices, updates} = inputs;\n const {shape} =
attrs;\n\n const out = backend.makeOutput(shape, updates.dtype);\n if (util.sizeFromShape(shape) === 0) {\n
return out;\n }\n\n const {sliceRank, numUpdates, sliceSize, strides, outputSize} =\n

```

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scatter_util.calculateShapes(updates, indices, shape);\n\n const indicesData =
backend.dataIdMap.get(indices.dataId);\n const indicesId = indicesData.id;\n\n const updatesData =
backend.dataIdMap.get(updates.dataId);\n const updatesId = updatesData.id;\n\n const stridesBytes = new
Uint8Array(new Int32Array(strides).buffer);\n\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmScatterNd(\n  indicesId, updatesId, CppDType[updates.dtype], sliceRank, numUpdates,\n  sliceSize,
stridesBytes, outputSize, outId);\n\n return out;\n}\n\nexport const scatterNdConfig: KernelConfig = {\n
kernelName: ScatterNd,\n backendName: 'wasm',\n setupFunc:
  setup,\n kernelFunc: scatterNd as { } as KernelFunc\n};\n\n", "/*\n * @license\n * Copyright 2020 Google LLC. All
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software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport { KernelConfig, KernelFunc, Select, SelectInputs, util } from '@tensorflow/tfjs-core';\n\nimport
{ BackendWasm } from '../backend_wasm';\n\nlet wasmSelect: (\n  conditionId: number, tId: number, eId: number,
offset: number,\n  outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n  wasmSelect =
backend.wasm.cwrap('SelectV2', null, [\n    'number', // conditionId\n    'number', // tId\n    'number', // eId\n    'number', // offset\n    'number', // outId\n  ]);\n}\n\nfunction select(args: { inputs: SelectInputs, backend:
BackendWasm }) {\n  const { inputs, backend } = args;\n  const { condition, t, e } = inputs;\n  const conditionId =
backend.dataIdMap.get(condition.dataId).id;\n  const tId = backend.dataIdMap.get(t.dataId).id;\n  const eId =
backend.dataIdMap.get(e.dataId).id;\n  const out = backend.makeOutput(t.shape, t.dtype);\n  const outId =
backend.dataIdMap.get(out.dataId).id;\n  const cRank = condition.shape.length;\n  const tRank =
t.shape.length;\n  const offset = cRank === 0 || cRank > 1 || tRank === 1 ?\n    1:\n  util.sizeFromShape(t.shape.slice(1));\n  wasmSelect(conditionId, tId, eId, offset, outId);\n  return out;\n}\n\nexport
const selectConfig:
  KernelConfig = {\n    kernelName: Select,\n    backendName: 'wasm',\n    kernelFunc: select as { } as KernelFunc,\n    setupFunc: setup\n};\n\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed
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on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====\n
*/\n\nimport { KernelConfig, KernelFunc, Sigmoid, SigmoidInputs, TensorInfo, util } from '@tensorflow/tfjs-
core';\n\nimport { BackendWasm } from
  '../backend_wasm';\n\nlet wasmFunc: (xId: number, outId: number) => void;\n\nfunction setup(backend:
BackendWasm): void {\n  wasmFunc = backend.wasm.cwrap(Sigmoid, null /* void */, ['number',
'number']);\n}\n\nfunction sigmoid(args: { backend: BackendWasm, inputs: SigmoidInputs }):\n  TensorInfo {\n  const { backend, inputs: { x } } = args;\n  const xId = backend.dataIdMap.get(x.dataId).id;\n  const out =
backend.makeOutput(x.shape, x.dtype);\n  const outId = backend.dataIdMap.get(out.dataId).id;\n  // Short-circuit
zero-sized tensors.\n  if (util.sizeFromShape(out.shape) === 0) {\n    return out;\n  }\n  wasmFunc(xId, outId);\n  return out;\n}\n\nexport const sigmoidConfig: KernelConfig = {\n  kernelName: 'Sigmoid',\n  backendName:
'wasm',\n  setupFunc: setup,\n  kernelFunc: sigmoid as { } as KernelFunc\n};\n\n", "/*\n * @license\n * Copyright
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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=====
*\nimport {KernelConfig, Sin} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'./unary_kernel';\nexport const sinConfig: KernelConfig = createUnaryKernelConfig(Sin);\n",/**\n * @license\n *
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distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *
=====
*\n\nimport {KernelConfig, KernelFunc, Softmax, SoftmaxAttrs, SoftmaxInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmFunc: (xId: number, outId:
number, channels: number, batch: number) =>\n  void;\n\nfunction setup(backend: BackendWasm): void {\n
wasmFunc = backend.wasm.cwrap(Softmax, null /* void */, [\n  'number', // xId\n  'number', // outId\n
'number', // channels\n  'number' // batch\n ]);\n\nfunction softmax(\n  args: {backend: BackendWasm,
inputs:
SoftmaxInputs, attrs: SoftmaxAttrs});\n  TensorInfo {\n    const {backend, inputs: {logits}, attrs: {dim}} = args;\n
const xId = backend.dataIdMap.get(logits.dataId).id;\n    const out = backend.makeOutput(logits.shape,
logits.dtype);\n    const outId = backend.dataIdMap.get(out.dataId).id;\n\n    const channels = logits.shape[dim];\n
const batch = util.sizeFromShape(logits.shape) / channels;\n\n    // Short-circuit zero-sized tensors.\n    if
(util.sizeFromShape(out.shape) === 0) {\n      return out;\n    }\n\n    wasmFunc(xId, outId, channels, batch);\n
return out;\n  }\n\nexport const softmaxConfig: KernelConfig = {\n  kernelName: Softmax,\n  backendName: 'wasm',\n
setupFunc: setup,\n  kernelFunc: softmax as {} as KernelFunc\n};\n",/**\n * @license\n * Copyright 2021 Google
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distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
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the License.\n *
=====
*\n\nimport {backend_util, KernelConfig, KernelFunc, ReshapeAttrs, ReshapeInputs, SpaceToBatchND,
SpaceToBatchNDAttrs, SpaceToBatchNDInputs, TensorInfo, TransposeAttrs, TransposeInputs, util} from
'@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {padV2Config} from
'./PadV2';\nimport {reshape} from './Reshape';\nimport {transpose} from './Transpose';\n\nfunction
spaceToBatchND(args: {\n  inputs: SpaceToBatchNDInputs,\n  backend: BackendWasm,\n  attrs:
SpaceToBatchNDAttrs\n}) {\n  const {inputs, backend, attrs}
= args;\n  const {x} = inputs;\n  const {blockShape, paddings} = attrs;\n\n  const prod =
util.sizeFromShape(blockShape);\n\n  const completePaddings: Array<[number, number]> = [[0, 0]];\n
completePaddings.push(...(paddings as Array<[number, number]>));\n\n  for (let i = 1 + blockShape.length; i <
x.shape.length; ++i) {\n    completePaddings.push([0, 0]);\n  }\n\n  const paddedX = padV2Config.kernelFunc({\n
inputs: {x},\n  backend,\n  attrs: {paddings: completePaddings, constantValue: 0}\n}) as TensorInfo;\n\n  const

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reshapedPaddedShape =\n    backend_util.getReshaped(paddedX.shape, blockShape, prod, false);\n\n const
permutedReshapedPaddedPermutation = backend_util.getPermuted(\n    reshapedPaddedShape.length,
blockShape.length, false);\n\n const flattenShape =\n    backend_util.getReshapedPermuted(paddedX.shape,
blockShape, prod, false);\n\n const reshapeInputs: ReshapeInputs = {x: paddedX};\n const reshapeAttrs:
ReshapeAttrs = {shape: reshapedPaddedShape};\n
const paddedXReshaped =\n    reshape({inputs: reshapeInputs, backend, attrs: reshapeAttrs});\n\n const
transposeInputs: TransposeInputs = {x: paddedXReshaped};\n const transposeAttrs:\n    TransposeAttrs = {perm:
permutedReshapedPaddedPermutation};\n const paddedXT =\n    transpose({inputs: transposeInputs, backend,
attrs: transposeAttrs});\n\n const resultReshapeInputs: ReshapeInputs = {x: paddedXT};\n const
resultReshapeAttrs: ReshapeAttrs = {shape: flattenShape};\n const result = reshape(\n    {inputs:
resultReshapeInputs, backend, attrs: resultReshapeAttrs});\n\n backend.disposeData(paddedX.dataId);\n
backend.disposeData(paddedXReshaped.dataId);\n backend.disposeData(paddedXT.dataId);\n\n return
result;\n}\n\nexport const spaceToBatchNDConfig: KernelConfig = {\n kernelName: SpaceToBatchND,\n
backendName: 'wasm',\n kernelFunc: spaceToBatchND as { } as KernelFunc\n};\n"/**\n * @license\n *
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License.\n *
=====
*\n\nimport {KernelConfig, KernelFunc, SplitV, SplitVAttrs, SplitVInputs, util} from '@tensorflow/tfjs-
core';\nimport {backend_util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from
'./backend_wasm';\n\nimport {slice} from './Slice';\n\nexport function splitV(\n    args: {inputs: SplitVInputs, attrs:
SplitVAttrs, backend: BackendWasm}) {\n    const {inputs, attrs,
backend} = args;\n    const {x} = inputs;\n    const {numOrSizeSplits, axis} = attrs;\n\n    const $axis =
util.parseAxisParam(axis, x.shape)[0];\n\n    const splitSizes = backend_util.prepareSplitSize(x, numOrSizeSplits,
$axis);\n    const begin = new Array(x.shape.length).fill(0);\n    const size = x.shape.slice();\n    return splitSizes.map(s
=> {\n        const xSliceSize = [...size];\n        xSliceSize[$axis] = s;\n        const xSlice =\n            slice({inputs: {x}, attrs:
{begin, size: xSliceSize}, backend});\n        begin[$axis] += s;\n        return xSlice;\n    });\n}\n\nexport const
splitVConfig: KernelConfig = {\n kernelName: SplitV,\n backendName: 'wasm',\n kernelFunc: splitV as { } as
KernelFunc\n};\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
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the License.\n *
=====
*\n\nimport {KernelConfig, Sqrt} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'./unary_kernel';\n\nexport const sqrtConfig: KernelConfig = createUnaryKernelConfig(Sqrt);\n"/**\n * @license\n *
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```
=====\n\n*\nimport {KernelConfig, Square} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from\n './unary_kernel';\nexport const squareConfig: KernelConfig = createUnaryKernelConfig(Square);\n", "/*\n *\n @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a\n copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable\n law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT
```

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```
=====\n\n*\nimport {KernelConfig, SquaredDifference} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig}\n from './binary_kernel';\nconst supportsFullBroadcast = true;\nexport const squaredDifferenceConfig: KernelConfig\n =\n createBinaryKernelConfig(SquaredDifference, supportsFullBroadcast);\n", "/*\n *\n @license\n * Copyright\n 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an "AS IS"
```

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```
=====\n\n*\nimport {KernelConfig, KernelFunc, Step, StepAttrs, StepInputs, TensorInfo}\n from '@tensorflow/tfjs-\ncore';\nimport {BackendWasm} from '../backend_wasm';\nimport {CppType} from './types';\nlet wasmStep:\n (xId: number, alpha: number, dtype: number, outId: number) =>\n void;\nfunction setup(backend:\n BackendWasm): void {\n wasmStep = backend.wasm.cwrap(Step, null /*void*/, [\n 'number', // x_id\n 'number', // alpha\n 'number', // dtype\n 'number', // out_id\n ]);\n}\nfunction step(\n args: {\n backend:\n BackendWasm, inputs: StepInputs, attrs: StepAttrs});\n TensorInfo {\n const {backend, inputs, attrs} = args;\n const {alpha} = attrs;\n const {x} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out = backend.makeOutput(x.shape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmStep(xId, alpha, CCppType[x.dtype], outId);\n return out;\n}\nexport const stepConfig: KernelConfig = {\n kernelName: Step,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: step as { } as
```

KernelFunc\n};\n", "/*\n *\n @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the\n Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the\n License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n License.\n\n

```
*\n=====\n\n*\nimport {KernelConfig, KernelFunc, slice_util, StridedSlice, StridedSliceAttrs, StridedSliceInputs, TensorInfo,\n util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {reshape} from\n './Reshape';\nimport {slice} from './Slice';\nlet wasmStridedSlice: (\n xId: number, xStridesBytes: Uint8Array,\n xRank: number,\n beginBytes: Uint8Array, endBytes: Uint8Array, stridesBytes: Uint8Array,\n outShapeBytes:\n Uint8Array, outStridesBytes: Uint8Array,\n outShapeLength: number, outId: number) => void;\nfunction\n setup(backend: BackendWasm): void {\n wasmStridedSlice = backend.wasm.cwrap(StridedSlice, null /*void*/, [\n 'number', // xId\n 'array', // xStrides\n 'number', // xRank\n 'array', // beginBytes\n 'array', // endBytes\n 'array', // stridesBytes\n 'array', // outShapeBytes\n 'array', // outStridesBytes\n 'number',
```



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// outShapeLength\n 'number', // outId\n ]);\n\n\nexport function stridedSlice(args: {\n backend:
BackendWasm,\n inputs: StridedSliceInputs,\n attrs: StridedSliceAttrs\n}): TensorInfo {\n const {backend, inputs,
attrs} = args;\n const {x} = inputs;\n\n const {\n begin,\n end,\n strides,\n beginMask,\n endMask,\n
ellipsisMask,\n newAxisMask,\n shrinkAxisMask\n } = attrs;\n\n const {\n finalShapeSparse,\n
finalShape,\n isIdentity,\n sliceDim0,\n isSimpleSlice,\n begin: $begin,\n end: $end,\n strides: $strides\n
} =\n slice_util.sliceInfo(\n x.shape, begin, end, strides, beginMask, endMask, ellipsisMask,\n
newAxisMask, shrinkAxisMask);\n\n let result;\n\n if (isIdentity) {\n // Optimization #1, slice is a no-op plus
reshape\n result = reshape({inputs: {x}, backend, attrs: {shape: finalShape}});\n } else if (sliceDim0 ||
isSimpleSlice) {\n // Optimization #2, slice is memory contiguous (only
occurs in dim 0)\n util.assert(\n x.shape.length >= 1,\n () => `Input must have rank at least 1, got:
${x.shape.length}`);\n\n const size = slice_util.computeOutShape($begin, $end, $strides);\n // To tolerate
begin[0] > end[0] (a 0-output slice), we min(begin, end).\n const sliced = slice({inputs: {x}, backend, attrs:
{begin: $begin, size}});\n result =\n reshape({inputs: {x: sliced}, backend, attrs: {shape: finalShape}});\n
backend.disposeData(sliced.dataId);\n } else {\n const out = backend.makeOutput(finalShapeSparse,
'float32');\n\n const xId = backend.dataIdMap.get(x.dataId).id;\n const xStridesBytes =\n new
Uint8Array(new Int32Array(util.computeStrides(x.shape)).buffer);\n const beginBytes = new Uint8Array(new
Int32Array($begin).buffer);\n const endBytes = new Uint8Array(new Int32Array($end).buffer);\n const
stridesBytes = new Uint8Array(new Int32Array($strides).buffer);\n\n const outputShapeBytes =\n
new Uint8Array(new Int32Array(finalShapeSparse).buffer);\n const outStridesBytes = new Uint8Array(\n
new Int32Array(util.computeStrides(finalShapeSparse)).buffer);\n const outId =
backend.dataIdMap.get(out.dataId).id;\n\n wasmStridedSlice(\n xId, xStridesBytes, x.shape.length,
beginBytes, endBytes, stridesBytes,\n outputShapeBytes, outStridesBytes, finalShapeSparse.length, outId);\n\n
result = reshape({inputs: {x: out}, backend, attrs: {shape: finalShape}});\n\n backend.disposeData(out.dataId);\n
}\n\n return result;\n}\n\n\nexport const stridedSliceConfig: KernelConfig = {\n kernelName: StridedSlice,\n
backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: stridedSlice as { } as KernelFunc\n};\n\n"/**\n *
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WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
=====\n
*\nimport {KernelConfig, Sub} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
'./binary_kernel';\nconst supportsFullBroadcast = true;\nexport const subConfig: KernelConfig =\ncreateBinaryKernelConfig(Sub, supportsFullBroadcast);\n"/**\n * @license\n * Copyright 2019 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
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distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *
=====\n
*\n\nimport {backend_util, KernelConfig, KernelFunc, Sum, SumAttrs, SumInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport
{permuteAxesAndTranspose} from './kernel_utils';\nimport {CppType} from './types';\n\nlet wasmSum: (xId:
number, reduceSize: number, dtype: number, outId: number) =>\n void;\n\nfunction setup(backend:

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BackendWasm): void {\n  wasmSum = backend.wasm.cwrap(Sum, null /*void*/, [\n   'number', // input_id\n 'number', // reduce_size\n 'number', // dtype\n 'number', // out_id\n ]);\n\nfunction sum(args: {backend: BackendWasm, inputs: SumInputs, attrs: SumAttrs}): \n  TensorInfo {\n    const {backend, inputs, attrs} = args;\n    const {axis, keepDims} = attrs;\n    const {x} = inputs;\n    const xId = backend.dataIdMap.get(x.dataId).id;\n    let inputId = xId;\n    let input = x;\n\n    const {transposed, axes, originalAxes, inputWasTransposed} =\n      permuteAxesAndTranspose(x, axis, backend);\n\n    let reductionAxes = axes;\n    if (inputWasTransposed) {\n      const transposedId =\n        backend.dataIdMap.get(transposed.dataId).id;\n      if (transposedId !== xId) {\n        // transpose was not a no-op. We\n        // will need to dispose of this\n        // once we are done.\n        input = transposed;\n        inputId = transposedId;\n        reductionAxes = backend_util.getInnerMostAxes(\n          reductionAxes.length, input.shape.length);\n      }\n    }\n\n    backend_util.assertAxesAreInnerMostDims(\n      'sum', reductionAxes, input.shape.length);\n    const [outShape, reduceShape]\n      =\n        backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n    const reduceSize =\n      util.sizeFromShape(reduceShape);\n\n    const out = backend.makeOutput(outShape, input.dtype);\n    if\n      (util.sizeFromShape(input.shape) !== 0) {\n      const outId = backend.dataIdMap.get(out.dataId).id;\n      wasmSum(inputId, reduceSize, CppDType[out.dtype], outId);\n    }\n\n    if (inputWasTransposed) {\n      // dispose of\n      // the transposed tensor.\n      backend.disposeData(transposed.dataId);\n    }\n\n    if (keepDims) {\n      // reshape\n      const\n        newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n      out.shape = newShape;\n    }\n\n    return out;\n  }\n\nexport const sumConfig: KernelConfig = {\n  kernelName: Sum,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: sum as {} as KernelFunc\n};\n\n", "/*\n * @license\n * Copyright 2021 Google\n * LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not\n * use this file except in\n * compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n *\n *=====\n *\nimport {KernelConfig, Tan} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from\n './unary_kernel';\nexport const tanConfig: KernelConfig = createUnaryKernelConfig(Tan);\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is\n * distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either\n * express or implied.\n * See the License for the specific language governing permissions and\n * limitations under\n * the License.\n *\n *=====\n *\nimport {KernelConfig, Tanh} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from\n './unary_kernel';\nexport const tanhConfig: KernelConfig = createUnaryKernelConfig(Tanh);\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or\n * agreed\n * to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT\n * WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific\n * language governing permissions and\n * limitations under the License.\n *\n *=====\n\n

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*\n\nimport {KernelConfig, KernelFunc, Tile, TileAttrs, TileInputs} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from './backend_wasm';\n\nimport {CppType} from './types';\n\nlet wasmTile: (\n  xId:
number, xShape: Uint8Array, xShapeSize: number, newShape: Uint8Array,\n  newShapeSize: number, dtype:
number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n  wasmTile =
backend.wasm.cwrap(Tile, null /* void */, [\n  'number', // x_id\n  'array', // x_shape\n  'number', //
x_shape.length\n  'array', // new_shape\n  'number', // new_shape.length\n  'number' // out_id\n
]);\n\nfunction
tile(\n  args: {inputs: TileInputs, backend: BackendWasm, attrs: TileAttrs}) {\n  const {inputs, backend, attrs} =
args;\n  const {x} = inputs;\n  const xId = backend.dataIdMap.get(x.dataId).id;\n  const {reps} = attrs;\n\n  const
newShape: number[] = new Array(x.shape.length);\n  for (let i = 0; i < newShape.length; i++) {\n  newShape[i] =
x.shape[i] * reps[i];\n  }\n  const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n  const
newShapeBytes = new Uint8Array(new Int32Array(newShape).buffer);\n\n  const out =
backend.makeOutput(newShape, x.dtype);\n  const outId = backend.dataIdMap.get(out.dataId).id;\n  wasmTile(\n
xId, xShapeBytes, x.shape.length, newShapeBytes, newShape.length,\n  CppDType[out.dtype], outId);\n  return
out;\n\n}\n\nexport const tileConfig: KernelConfig = {\n  kernelName: Tile,\n  backendName: 'wasm',\n  setupFunc:
setup,\n  kernelFunc: tile as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights
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http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n\n
*\n\nimport {KernelConfig, KernelFunc, TensorInfo, TopK, TopKAttrs, TopKInputs} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {CppType} from './types';\n\nlet wasmTopK:
(\n  xId: number, xShapeBytes: Uint8Array, xShapeLength: number,\n  xDtype: CppDType, k: number, sorted:
boolean, outValuesId:
number,\n  outIndicesId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n  wasmTopK =
backend.wasm.cwrap(TopK, null /* void */, [\n  'number', // xId\n  'array', // x_shape\n  'number', //
x_shape.length\n  'number', // x_dtype\n  'number', // k\n  'bool', // sorted\n  'number', // outValuesId\n
'number', // outIndicesId\n  ]);\n\n}\n\nexport const topk:\n  (args: {inputs: TopKInputs, backend: BackendWasm,
attrs: TopKAttrs}) =>\n  TensorInfo[] | TensorInfo = ({inputs, backend, attrs}) => {\n  const {x} = inputs;\n
const {k, sorted} = attrs;\n\n  const xId = backend.dataIdMap.get(x.dataId).id;\n  const xShapeBytes
= new Uint8Array(new Int32Array(x.shape).buffer);\n  const outputShape = x.shape.slice();\n
outputShape[outputShape.length - 1] = k;\n  const outValues = backend.makeOutput(outputShape, x.dtype);\n
const outValuesId = backend.dataIdMap.get(outValues.dataId).id;\n
const outIndices = backend.makeOutput(outputShape, 'int32');\n  const outIndicesId =
backend.dataIdMap.get(outIndices.dataId).id;\n\n  wasmTopK(\n    xId, xShapeBytes, x.shape.length,
CppType[x.dtype], k, sorted,\n    outValuesId, outIndicesId);\n  return [outValues, outIndices];\n
};\n\nexport const topKConfig: KernelConfig = {\n  kernelName: TopK,\n  backendName: 'wasm',\n  setupFunc:
setup,\n  kernelFunc: topk as {} as KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2021 Google LLC. All
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OR CONDITIONS
OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions
and\n * limitations under the License.\n *

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=====
*\n\nimport {KernelConfig, KernelFunc, TensorInfo, Transform, TransformAttrs, TransformInputs, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nlet wasmTransform: (\n  imageId:
number, transformsId: number, isBatchTransform: boolean,\n  batch: number, outHeight: number, outWidth:
number, numChannels: number,\n  imageWidth: number, imageHeight: number, strides: Uint8Array,\n  stridesLength: number, interpolationModeId: number, fillModeId: number,\n  fillValue: number, outId: number)
=> void;\n\nfunction setup(backend: BackendWasm): void {\n  wasmTransform = backend.wasm.cwrap(Transform,
null /*void*/, [\n    'number', // imageId\n    'number', // transformsId\n    'bool', // isBatchTransform\n    'number',
// batch\n    'number', // outHeight\n    'number', // outWidth\n    'number', // numChannels\n    'number', //
imageWidth\n    'number', // imageHeight\n    'array', // strides\n    'number', // stridesLength\n    'number', //
interpolationModeId\n    'number', // fillModeId\n    'number', // fillValue\n    'number' // outId\n
]);\n}\n\nfunction transform(\n  args: \n    {backend: BackendWasm, inputs: TransformInputs, attrs:
TransformAttrs});\n  TensorInfo {\n    const {backend, inputs, attrs} = args;\n    const {image, transforms} = inputs;\n
const {interpolation, fillMode, fillValue, outputShape} = attrs;\n    const [batch, imageHeight, imageWidth,
numChannels] = image.shape;\n    const [outHeight, outWidth] =\n      outputShape != null ? outputShape :
[imageHeight, imageWidth];\n    const outShape =\n      [batch, outHeight, outWidth,\n        numChannels] as
[number, number, number, number];\n    const strides =\n      new Uint8Array(new
Int32Array(util.computeStrides(image.shape)).buffer);\n    \n    const out = backend.makeOutput(outShape, image.dtype);\n    const outId =
backend.dataIdMap.get(out.dataId).id;\n    \n    const imageData = backend.dataIdMap.get(image.dataId);\n    const
imageId = imageData.id;\n    \n    const transformsData = backend.dataIdMap.get(transforms.dataId);\n    const
transformsId = transformsData.id;\n    \n    const interpolationModeId = interpolation === 'nearest' ? 1 : 2;\n    let
fillModeId;\n    switch (fillMode) {\n      case 'constant':\n        fillModeId = 1;\n        break;\n      case 'reflect':\n
fillModeId = 2;\n        break;\n      case 'wrap':\n        fillModeId = 3;\n        break;\n      case 'nearest':\n
fillModeId = 4;\n        break;\n      default:\n        fillModeId = 1;\n        break;\n    }\n    \n    wasmTransform(\n      imageId, transformsId,
(transforms.shape[0] > 1), batch, outHeight,\n      outWidth, numChannels, imageWidth, imageHeight, strides,\n
image.shape.length - 1, interpolationModeId, fillModeId, fillValue,\n      outId);\n    \n    return out;\n  }\n}\n\nexport const transformConfig: KernelConfig = {\n  kernelName: Transform,\n  backendName:
'wasm',\n  setupFunc: setup,\n  kernelFunc: transform as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright
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you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n
* http://www.apache.org/licenses/LICENSE-2.0\n * \n
* Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {KernelConfig, KernelFunc, TensorInfo, Unpack, UnpackAttrs, UnpackInputs} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {slice} from
'./Slice';\n\nfunction unpack(\n  args: {inputs: UnpackInputs, backend: BackendWasm, attrs: UnpackAttrs});\n
TensorInfo[] {\n  const {inputs, backend, attrs} = args;\n  const {value} = inputs;\n  let {axis} = attrs;\n  \n  if (axis <
0) {\n    axis += value.shape.length;\n  }\n  \n  const numOutputs = value.shape[axis];\n  const rank =
value.shape.length;\n  const outShape: number[] = new Array(rank - 1);\n  let outIndex = 0;\n  for (let i = 0; i < rank;\n  i++) {\n    if (i !== axis) {\n      outShape[outIndex++] = value.shape[i];\n    }\n  }\n  const outs: TensorInfo[] = new
Array(numOutputs);\n  const begin = new Array(rank).fill(0);\n  const size = value.shape.slice();\n  size[axis] = 1;\n  for (let i = 0; i < outs.length; i++) {\n    begin[axis] = i;\n    outs[i] = slice({inputs: {x: value}, attrs: {begin, size},
backend});\n  }\n  return outs.map(({dataId, dtype}) => ({dataId, dtype, shape:
outShape}));\n}\n\nexport const unpackConfig: KernelConfig = {\n  kernelName: Unpack,\n  backendName:
'wasm',\n  kernelFunc: unpack as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All

```

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```
=====\n*\n\nimport { KernelConfig, KernelFunc, ZerosLike, ZerosLikeInputs } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nfunction zerosLike(args: { inputs: ZerosLikeInputs, backend: BackendWasm }) {\n  const { inputs: { x }, backend } = args;\n  const out = backend.makeOutput(x.shape, x.dtype);\n  const outVals = backend.typedArrayFromHeap(out);\n  outVals.fill(0);\n  return out;\n}\n\nexport const zerosLikeConfig: KernelConfig = {\n  kernelName: ZerosLike,\n  backendName: 'wasm',\n  kernelFunc: zerosLike as { } as KernelFunc,\n};\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n//\n\nWe explicitly import the modular kernels so they get registered in the\n// global registry when we compile the library. A modular build would replace\n// the contents of this file and import only the kernels that are needed.\nimport { KernelConfig, registerKernel } from '@tensorflow/tfjs-core';\nimport { fusedMatMulConfig } from './kernels/_FusedMatMul';\nimport { absConfig } from './kernels/Abs';\nimport { addConfig } from './kernels/Add';\nimport { addNConfig } from './kernels/AddN';\nimport { allConfig } from './kernels/All';\nimport { anyConfig } from './kernels/Any';\nimport { argMaxConfig } from './kernels/ArgMax';\nimport { avgPoolConfig } from './kernels/AvgPool';\nimport { batchMatMulConfig } from './kernels/BatchMatMul';\nimport { batchToSpaceNDConfig } from './kernels/BatchToSpaceND';\nimport { castConfig } from './kernels/Cast';\nimport { ceilConfig } from './kernels/Ceil';\nimport { clipByValueConfig } from './kernels/ClipByValue';\nimport { concatConfig } from './kernels/Concat';\nimport { conv2DConfig } from './kernels/Conv2D';\nimport { conv2DBackpropInputConfig } from './kernels/Conv2DBackpropInput';\nimport { cosConfig } from './kernels/Cos';\nimport { coshConfig } from './kernels/Cosh';\nimport { cropAndResizeConfig } from './kernels/CropAndResize';\nimport { cumsumConfig } from './kernels/Cumsum';\nimport { depthToSpaceConfig } from './kernels/DepthToSpace';\nimport { depthwiseConv2dNativeConfig } from './kernels/DepthwiseConv2dNative';\nimport { eluConfig } from './kernels/Elu';\nimport { equalConfig } from './kernels/Equal';\nimport { expConfig } from './kernels/Exp';\nimport { expandDimsConfig } from './kernels/ExpandDims';\nimport { fillConfig } from './kernels/Fill';\nimport { flipLeftRightConfig } from './kernels/FlipLeftRight';\nimport { floorConfig } from './kernels/Floor';\nimport { floorDivConfig } from './kernels/FloorDiv';\nimport { fusedBatchNormConfig } from './kernels/FusedBatchNorm';\nimport { fusedConv2DConfig } from './kernels/FusedConv2D';\nimport { fusedDepthwiseConv2DConfig } from './kernels/FusedDepthwiseConv2D';\nimport { gatherNdConfig } from './kernels/GatherNd';\nimport { gatherV2Config } from './kernels/GatherV2';\nimport { greaterConfig } from './kernels/Greater';\nimport { greaterEqualConfig } from './kernels/GreaterEqual';\nimport { identityConfig } from './kernels/Identity';\nimport { leakyReluConfig } from './kernels/LeakyRelu';\nimport { lessConfig } from './kernels/Less';\nimport { lessEqualConfig } from './kernels/LessEqual';\nimport { logConfig } from './kernels/Log';\nimport { logicalAndConfig } from './kernels/LogicalAnd';\nimport { maxConfig } from './kernels/Max';\nimport
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{maximumConfig} from './kernels/Maximum';\nimport {maxPoolConfig} from './kernels/MaxPool';\nimport
{meanConfig} from './kernels/Mean';\nimport {minConfig} from './kernels/Min';\nimport {minimumConfig} from
 './kernels/Minimum';\nimport {mirrorPadConfig}
from './kernels/MirrorPad';\nimport {multiplyConfig} from './kernels/Multiply';\nimport {negConfig} from
 './kernels/Neg';\nimport {nonMaxSuppressionV3Config} from './kernels/NonMaxSuppressionV3';\nimport
{nonMaxSuppressionV4Config} from './kernels/NonMaxSuppressionV4';\nimport {nonMaxSuppressionV5Config}
from './kernels/NonMaxSuppressionV5';\nimport {notEqualConfig} from './kernels/NotEqual';\nimport
{oneHotConfig} from './kernels/OneHot';\nimport {onesLikeConfig} from './kernels/OnesLike';\nimport
{packConfig} from './kernels/Pack';\nimport {padV2Config} from './kernels/PadV2';\nimport {powConfig} from
 './kernels/Pow';\nimport {preluConfig} from './kernels/Prelu';\nimport {prodConfig} from './kernels/Prod';\nimport
{rangeConfig} from './kernels/Range';\nimport {realDivConfig} from './kernels/RealDiv';\nimport {reluConfig}
from './kernels/Relu';\nimport {relu6Config} from './kernels/Relu6';\nimport {reshapeConfig} from
 './kernels/Reshape';\nimport {resizeBilinearConfig}
from './kernels/ResizeBilinear';\nimport {reverseConfig} from './kernels/Reverse';\nimport
{rotateWithOffsetConfig} from './kernels/RotateWithOffset';\nimport {roundConfig} from
 './kernels/Round';\nimport {rsqrtConfig} from './kernels/Rsqrt';\nimport {scatterNdConfig} from
 './kernels/ScatterNd';\nimport {selectConfig} from './kernels/Select';\nimport {sigmoidConfig} from
 './kernels/Sigmoid';\nimport {sinConfig} from './kernels/Sin';\nimport {sliceConfig} from './kernels/Slice';\nimport
{softmaxConfig} from './kernels/Softmax';\nimport {spaceToBatchNDConfig} from
 './kernels/SpaceToBatchND';\nimport {splitVConfig} from './kernels/SplitV';\nimport {sqrtConfig} from
 './kernels/Sqrt';\nimport {squareConfig} from './kernels/Square';\nimport {squaredDifferenceConfig} from
 './kernels/SquaredDifference';\nimport {stepConfig} from './kernels/Step';\nimport {stridedSliceConfig} from
 './kernels/StridedSlice';\nimport {subConfig} from './kernels/Sub';\nimport {sumConfig} from
 './kernels/Sum';\nimport
{tanConfig} from './kernels/Tan';\nimport {tanhConfig} from './kernels/Tanh';\nimport {tileConfig} from
 './kernels/Tile';\nimport {topKConfig} from './kernels/TopK';\nimport {transformConfig} from
 './kernels/Transform';\nimport {transposeConfig} from './kernels/Transpose';\nimport {unpackConfig} from
 './kernels/Unpack';\nimport {zerosLikeConfig} from './kernels/ZerosLike';\n\n// List all kernel configs here\nconst
kernelConfigs: KernelConfig[] = [\n  absConfig,\n  addConfig,\n  addNConfig,\n  allConfig,\n  anyConfig,\n  argMaxConfig,\n  avgPoolConfig,\n  batchMatMulConfig,\n  batchToSpaceNDConfig,\n  castConfig,\n  ceilConfig,\n  clipByValueConfig,\n  concatConfig,\n  conv2DConfig,\n  conv2DBackpropInputConfig,\n  cosConfig,\n  coshConfig,\n  cropAndResizeConfig,\n  cumsumConfig,\n  depthToSpaceConfig,\n  depthwiseConv2dNativeConfig,\n  eluConfig,\n  equalConfig,\n  expConfig,\n  expandDimsConfig,\n  fillConfig,\n  flipLeftRightConfig,\n  floorConfig,\n  floorDivConfig,\n  fusedMatMulConfig,\n  fusedBatchNormConfig,\n  fusedConv2DConfig,\n  fusedDepthwiseConv2DConfig,\n  gatherNdConfig,\n  gatherV2Config,\n  greaterConfig,\n  greaterEqualConfig,\n  identityConfig,\n  leakyReluConfig,\n  lessConfig,\n  lessEqualConfig,\n  logConfig,\n  logicalAndConfig,\n  maxConfig,\n  maximumConfig,\n  maxPoolConfig,\n  meanConfig,\n  minConfig,\n  minimumConfig,\n  mirrorPadConfig,\n  multiplyConfig,\n  negConfig,\n  nonMaxSuppressionV3Config,\n  nonMaxSuppressionV4Config,\n  nonMaxSuppressionV5Config,\n  notEqualConfig,\n  oneHotConfig,\n  onesLikeConfig,\n  packConfig,\n  padV2Config,\n  powConfig,\n  preluConfig,\n  prodConfig,\n  rangeConfig,\n  realDivConfig,\n  reluConfig,\n  relu6Config,\n  reshapeConfig,\n  resizeBilinearConfig,\n  reverseConfig,\n  rotateWithOffsetConfig,\n  rsqrtConfig,\n  roundConfig,\n  scatterNdConfig,\n  selectConfig,\n  sigmoidConfig,\n  sinConfig,\n  sliceConfig,\n  softmaxConfig,\n  spaceToBatchNDConfig,\n  splitVConfig,\n  sqrtConfig,\n  squareConfig,\n  squaredDifferenceConfig,\n  stepConfig,\n  stridedSliceConfig,\n  subConfig,\n  sumConfig,\n  tanConfig,\n  tanhConfig,\n  tileConfig,\n  topKConfig,\n  transformConfig,\n  transposeConfig,\n  unpackConfig,\n  zerosLikeConfig\n];\n\nfor (const kernelConfig of kernelConfigs) {\n  registerKernel(kernelConfig);\n}\n\n"/**\n *
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=====  
*  
*\n\nimport {env} from '@tensorflow/tfjs-core';  
\nconst ENV = env();  
\n**\n * True if SIMD is supported.  
\n*/  
\n// From: https://github.com/GoogleChromeLabs/wasm-feature-detect  
\nENV.registerFlag(  
  // This typed array  
  passed in to WebAssembly.validate is WebAssembly binary  
  // code. In this case it is a small program that  
  contains SIMD  
  // instructions.  
  'WASM_HAS_SIMD_SUPPORT', async () => WebAssembly.validate(new  
  Uint8Array([\n    0, 97, 115, 109, 1, 0, 0, 0, 1, 4, 1, 96, 0, 0, 3,  
    2, 1, 0, 10, 9, 1, 7, 0, 65, 0, 253, 15, 26,  
    11  
  ]));  
\n**\n * True if threads are supported.  
\n*/  
\n// From: https://github.com/GoogleChromeLabs/wasm-  
feature-detect  
\nENV.registerFlag('WASM_HAS_MULTITHREAD_SUPPORT', async () => {\n  //  
  TODO(annxingyuan): Enable node support once this is resolved.  
\n  //  
  https://github.com/tensorflow/tfjs/issues/3830  
  if (ENV.get('IS_NODE')) {\n    return false;  
  }  
\n  try {\n    //  
    Test for transferability of SABs (needed for Firefox)  
  }  
\n  //  
  https://groups.google.com/forum/#!msg/mozilla.dev.platform/IHkBZIHETpA/dwsMNchWEQAJ  
  new  
  MessageChannel().port1.postMessage(new SharedArrayBuffer(1));  
  // This typed array is a WebAssembly  
  program containing threaded  
  // instructions.  
  return WebAssembly.validate(new Uint8Array([\n    0, 97,  
    115, 109, 1, 0, 0, 0, 1, 4, 1, 96, 0, 0, 3, 2, 1, 0, 5,  
    4, 1, 3, 1, 1, 10, 11, 1, 9, 0, 65, 0, 254, 16, 2, 0, 26,  
    11  
  ]));  
} catch (e) {\n  return false;  
});  
\n", "\nvar WasmBackendModuleThreadedSimd = (function() {\n  var _scriptDir = typeof document !== 'undefined' && document.currentScript ? document.currentScript.src :  
  undefined;  
  if (typeof __filename !== 'undefined') _scriptDir = _scriptDir || __filename;  
  return  
  (\nfunction(WasmBackendModuleThreadedSimd) {\n    WasmBackendModuleThreadedSimd =  
    WasmBackendModuleThreadedSimd || {};  
  \nfunction  
  GROWABLE_HEAP_I8(){if(wasmMemory.buffer!==buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}  
  return  
  HEAP8}function  
  GROWABLE_HEAP_U8(){if(wasmMemory.buffer!==buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}  
  }return HEAPU8}function  
  GROWABLE_HEAP_I32(){if(wasmMemory.buffer!==buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}  
  }return HEAP32}function  
  GROWABLE_HEAP_U32(){if(wasmMemory.buffer!==buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}  
  }return HEAPU32}function  
  GROWABLE_HEAP_F64(){if(wasmMemory.buffer!==buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}  
  }return HEAPF64}var Module=typeof  
  WasmBackendModuleThreadedSimd!=="undefined"?WasmBackendModuleThreadedSimd: {} ;var  
  readyPromiseResolve,readyPromiseReject;Module["ready"]=new  
  Promise(function(resolve,reject){readyPromiseResolve=resolve;readyPromiseReject=reject});var  
  moduleOverrides={};var key;for(key in  
  Module){if(Module.hasOwnProperty(key)){moduleOverrides[key]=Module[key]}}var arguments_=[];var  
  thisProgram=\.\/this.program\";var quit_=function(status,toThrow){throw  
  toThrow};var ENVIRONMENT_IS_WEB=false;var ENVIRONMENT_IS_WORKER=false;var  
  ENVIRONMENT_IS_NODE=false;var ENVIRONMENT_IS_SHELL=false;ENVIRONMENT_IS_WEB=typeof  
  window==="object\";ENVIRONMENT_IS_WORKER=typeof  
  importScripts==="function\";ENVIRONMENT_IS_NODE=typeof process==="object\"&&typeof  
  process.versions==="object\"&&typeof  
  process.versions.node==="string\";ENVIRONMENT_IS_SHELL=!ENVIRONMENT_IS_WEB&&!ENVIRONM
```

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ENT_IS_NODE&&!ENVIRONMENT_IS_WORKER;var
ENVIRONMENT_IS_PTHREAD=Module[\"ENVIRONMENT_IS_PTHREAD\"]||false;if(ENVIRONMENT_IS_P
THREAD){buffer=Module[\"buffer\"]}var scriptDirectory=\\\";function
locateFile(path){if(Module[\"locateFile\"]){return Module[\"locateFile\"](path,scriptDirectory)}return
scriptDirectory+path}var read_,readAsync,readBinary,setWindowTitle;var nodeFS;var
nodePath;if(ENVIRONMENT_IS_NODE){if(ENVIRONMENT_IS_WORKER){scriptDirectory=require(\\\"path\\\").
dirname(scriptDirectory)+\\\"^\"}else{scriptDirectory=__dirname+\\\"^\"}read_=function
shell_read(filename,binary){if(!nodeFS)nodeFS=require(\\\"fs\\\");if(!nodePath)nodePath=require(\\\"path\\\");filename=n
odePath[\\\"normalize\\\"](filename);return
nodeFS[\\\"readFileSync\\\"](filename,binary?null:\\\"utf8\\\");readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret};if(process[\\\"argv\\\"].length>1){thisProgram=process[\\\"argv\\\"][[1].replace(/\\\\\\\\g,\\\"^\\\")}arguments_=process[\\\"arg
v\\\"].slice(2);process[\\\"on\\\"](\\\"uncaughtException\\\",function(ex){if(!(ex instanceof ExitStatus)){throw
ex}});process[\\\"on\\\"](\\\"unhandledRejection\\\",abort);quit_=function(status){process[\\\"exit\\\"](status)};Module[\\\"insp
ect\\\"]=function(){return\"[Emscripten Module object]\"};var
nodeWorkerThreads;try{nodeWorkerThreads=require(\\\"worker_threads\\\")}catch(e){console.error(\\\"The
\\\"worker_threads\\\" module is not supported in this node.js build - perhaps a newer version is needed?\");throw
e}global.Worker=nodeWorkerThreads.Worker}else if(ENVIRONMENT_IS_SHELL){if(typeof
read!=\\\"undefined\\\")read_=function shell_read(f){return read(f)}readBinary=function readBinary(f){var
data;if(typeof readbuffer===\\\"function\\\")return new
Uint8Array(readbuffer(f))data=read(f,\\\"binary\\\");assert(typeof data===\\\"object\\\");return data};if(typeof
scriptArgs!=\\\"undefined\\\")arguments_=scriptArgs}else if(typeof
arguments!=\\\"undefined\\\")arguments_=arguments;if(typeof
quit===\\\"function\\\")quit_=function(status){quit(status)}if(typeof print!=\\\"undefined\\\")if(typeof
console===\\\"undefined\\\")console={};console.log=print;console.warn=console.error=typeof
printErr!=\\\"undefined\\\"?printErr:print}else
if(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER){if(ENVIRONMENT_IS_WORKER){scriptDire
ctory=self.location.href}else if(typeof
document!=\\\"undefined\\\"&&document.currentScript){scriptDirectory=document.currentScript.src}if(typeof
_scriptDir !=\\\"undefined\\\" &&
_scriptDir){scriptDirectory=_scriptDir}if(scriptDirectory.indexOf(\\\"blob:\\\")!=0){scriptDirectory=scriptDirectory.s
ubstr(0,scriptDirectory.lastIndexOf(\\\"^\\")+1)}else{scriptDirectory=\\\"\"}if(ENVIRONMENT_IS_NODE){read_=fun
ction
shell_read(filename,binary){if(!nodeFS)nodeFS=require(\\\"fs\\\");if(!nodePath)nodePath=require(\\\"path\\\");filename=n
odePath[\\\"normalize\\\"](filename);return
nodeFS[\\\"readFileSync\\\"](filename,binary?null:\\\"utf8\\\");readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret}else{read_=function(url){var xhr=new XMLHttpRequest;xhr.open(\\\"GET\\\",url,false);xhr.send(null);return
xhr.responseText};if(ENVIRONMENT_IS_WORKER){readBinary=function(url){var xhr=new
XMLHttpRequest;xhr.open(\\\"GET\\\",url,false);xhr.responseType=\\\"arraybuffer\\\";xhr.send(null);return new
Uint8Array(xhr.response)}}readAsync=function(url,onload,onerror){var xhr=new
XMLHttpRequest;xhr.open(\\\"GET\\\",url,true);xhr.responseType=\\\"arraybuffer\\\";xhr.onload=function(){if(xhr.status
===200||xhr.status===0&&xhr.response){onload(xhr.response);return}onerror();}xhr.onerror=onerror;xhr.send(null)}
}setWindowTitle=function(title){document.title=title}else{if(ENVIRONMENT_IS_NODE){if(typeof
performance===\\\"undefined\\\")global.performance=require(\\\"perf_hooks\\\").performance}}var
out=Module[\\\"print\\\"]||console.log.bind(console);var err=Module[\\\"printErr\\\"]||console.warn.bind(console);for(key
in
moduleOverrides){if(moduleOverrides.hasOwnProperty(key)){Module[key]=moduleOverrides[key]}}moduleOverr

```



```

ides=null;if(Module["arguments"])arguments_=Module["arguments"];if(Module["thisProgram"])thisProgram=
Module["thisProgram"];if(Module["quit"])quit_=Module["quit"];function
warnOnce(text){if(!warnOnce.shown)warnOnce.shown={};if(!warnOnce.shown[text]){warnOnce.shown[text]=1;er
r(text)}}var Atomics_load=Atomics.load;var Atomics_store=Atomics.store;var
Atomics_compareExchange=Atomics.compareExchange;var
wasmBinary;if(Module["wasmBinary"])wasmBinary=Module["wasmBinary"];var
noExitRuntime=Module["noExitRuntime"]||true;if(typeof WebAssembly!=="object"){abort("no
native wasm support detected")}var wasmMemory;var wasmModule;var ABORT=false;var
EXITSTATUS;function assert(condition,text){if(!condition){abort("Assertion failed: "+text)}}function
getCFunc(ident){var func=Module["_"+ident];assert(func,"Cannot call unknown function "+ident+", make sure
it is exported");return func}function ccall(ident,returnType,argTypes,args,opts){var
toC={"string":function(str){var ret=0;if(str!==null&&str!==undefined&&str!==0){var
len=(str.length<<2)+1;ret=stackAlloc(len);stringToUTF8(str,ret,len)}return ret},"array":function(arr){var
ret=stackAlloc(arr.length);writeArrayToMemory(arr,ret);return ret}};function
convertReturnValue(ret){if(returnType==="string")return UTF8ToString(ret);if(returnType==="boolean")return
Boolean(ret);return ret}var func=getCFunc(ident);var cArgs=[];var stack=0;if(args){for(var
i=0;i<args.length;i++){var
converter=toC[argTypes[i]];if(converter){if(stack===0)stack=stackSave();cArgs[i]=converter(args[i])}else{cArgs[i
]=args[i]}}var
ret=func.apply(null,cArgs);ret=convertReturnValue(ret);if(stack!==0)stackRestore(stack);return ret}function
cwrap(ident,returnType,argTypes,opts){argTypes=argTypes||[];var
numericArgs=argTypes.every(function(type){return type==="number"});var
numericRet=returnType!=="string";if(numericRet&&numericArgs&&!opts){return getCFunc(ident)}return
function(){return ccall(ident,returnType,argTypes,arguments,opts)}}function
UTF8ArrayToString(heap,idx,maxBytesToRead){var endIdx=idx+maxBytesToRead;var
str="";while(!(idx>=endIdx)){var u0=heap[idx++];if(!u0)return
str;if(!(u0&128)){str+=String.fromCharCode(u0);continue}var
u1=heap[idx++]&63;if((u0&224)==192){str+=String.fromCharCode((u0&31)<<6|u1);continue}var
u2=heap[idx++]&63;if((u0&240)==224){u0=(u0&15)<<12|u1<<6|u2}else{u0=(u0&7)<<18|u1<<12|u2<<6|heap[id
x++]&63;if(u0<65536){str+=String.fromCharCode(u0)}else{var ch=u0-
65536;str+=String.fromCharCode(55296|ch>>10,56320|ch&1023)}}return str}function
UTF8ToString(ptr,maxBytesToRead){return
ptr?UTF8ArrayToString(GROWABLE_HEAP_U8(),ptr,maxBytesToRead):""}function
stringToUTF8Array(str,heap,outIdx,maxBytesToWrite){if(!(maxBytesToWrite>0))return 0;var startIdx=outIdx;var
endIdx=outIdx+maxBytesToWrite-1;for(var i=0;i<str.length;++i){var
u=str.charCodeAt(i);if(u>=55296&&u<=57343){var
u1=str.charCodeAt(++i);u=65536+((u&1023)<<10|u1&1023)}if(u<=127){if(outIdx>=endIdx)break;heap[outIdx++]
=u}else if(u<=2047){if(outIdx+1>=endIdx)break;heap[outIdx++]=192|u>>6;heap[outIdx++]=128|u&63}else
if(u<=65535){if(outIdx+2>=endIdx)break;heap[outIdx++]=224|u>>12;heap[outIdx++]=128|u>>6&63;heap[outIdx
++]=128|u&63}else{if(outIdx+3>=endIdx)break;heap[outIdx++]=240|u>>18;heap[outIdx++]=128|u>>12&63;heap[
outIdx++]=128|u>>6&63;heap[outIdx++]=128|u&63}}heap[outIdx]=0;return outIdx-startIdx}function
stringToUTF8(str,outPtr,maxBytesToWrite){return
stringToUTF8Array(str,GROWABLE_HEAP_U8(),outPtr,maxBytesToWrite)}function lengthBytesUTF8(str){var
len=0;for(var i=0;i<str.length;++i){var
u=str.charCodeAt(i);if(u>=55296&&u<=57343)u=65536+((u&1023)<<10|str.charCodeAt(++i)&1023);if(u<=127)+
+len;else if(u<=2047)len+=2;else if(u<=65535)len+=3;else len+=4}return len}function
writeArrayToMemory(array,buffer){GROWABLE_HEAP_I8().set(array,buffer)}function
alignUp(x,multiple){if(x%multiple>0){x+=multiple-x%multiple}return x}var

```

```

buffer,HEAP8,HEAPU8,HEAP16,HEAPU16,HEAP32,HEAPU32,HEAPF32,HEAPF64;function
updateGlobalBufferAndViews(buf){buffer=buf;Module["HEAP8"]=HEAP8=new
Int8Array(buf);Module["HEAP16"]=HEAP16=new Int16Array(buf);Module["HEAP32"]=HEAP32=new
Int32Array(buf);Module["HEAPU8"]=HEAPU8=new Uint8Array(buf);Module["HEAPU16"]=HEAPU16=new
Uint16Array(buf);Module["HEAPU32"]=HEAPU32=new
Uint32Array(buf);Module["HEAPF32"]=HEAPF32=new
Float32Array(buf);Module["HEAPF64"]=HEAPF64=new Float64Array(buf)}var
INITIAL_MEMORY=Module["INITIAL_MEMORY"]||16777216;if(ENVIRONMENT_IS_PTHREAD){wasmM
emory=Module["wasmMemory"];buffer=Module["buffer"]}else{if(Module["wasmMemory"]){wasmMemory=
Module["wasmMemory"]}else{wasmMemory=new
WebAssembly.Memory({"initial":INITIAL_MEMORY/65536,"maximum":2147483648/65536,"shared":true});
if(!(wasmMemory.buffer instanceof SharedArrayBuffer)){err("requested a shared WebAssembly.Memory but the
returned buffer is not a SharedArrayBuffer, indicating that while the browser has SharedArrayBuffer it does not
have WebAssembly threads support - you may need to set a
flag");if(ENVIRONMENT_IS_NODE){console.log("(on node you may need: --experimental-wasm-threads --
experimental-wasm-bulk-memory and also use a recent version)")}throw Error("bad
memory")}}if(wasmMemory){buffer=wasmMemory.buffer}INITIAL_MEMORY=buffer.byteLength;updateGlob
alBufferAndViews(buffer);var wasmTable;var __ATPRERUN__=[];var __ATINIT__=[];var __ATMAIN__=[];var
__ATEXIT__=[];var __ATPOSTRUN__=[];var runtimeInitialized=false;var
runtimeExited=false;if(!ENVIRONMENT_IS_PTHREAD)__ATINIT__.push({func:function(){__wasm_call_ctor
s()}});function
preRun(){if(ENVIRONMENT_IS_PTHREAD)return;if(Module["preRun"]){if(typeof
Module["preRun"]=="function")Module["preRun"]=[Module["preRun"]];while(Module["preRun"].length){a
ddOnPreRun(Module["preRun"].shift())}callRuntimeCallbacks(__ATPRERUN__)}function
initRuntime(){runtimeInitialized=true;if(ENVIRONMENT_IS_PTHREAD)return;callRuntimeCallbacks(__ATINIT
__)}function
preMain(){if(ENVIRONMENT_IS_PTHREAD)return;callRuntimeCallbacks(__ATMAIN__)}function
exitRuntime(){if(ENVIRONMENT_IS_PTHREAD)return;runtimeExited=true}function
postRun(){if(ENVIRONMENT_IS_PTHREAD)return;if(Module["postRun"]){if(typeof
Module["postRun"]=="function")Module["postRun"]=[Module["postRun"]];while(Module["postRun"].lengt
h){addOnPostRun(Module["postRun"].shift())}callRuntimeCallbacks(__ATPOSTRUN__)}function
addOnPreRun(cb){__ATPRERUN__.unshift(cb)}function addOnPostRun(cb){__ATPOSTRUN__.unshift(cb)}var
runDependencies=0;var runDependencyWatcher=null;var dependenciesFulfilled=null;function
addRunDependency(id){assert(!ENVIRONMENT_IS_PTHREAD,"addRunDependency
cannot be used in a pthread
worker");runDependencies++;if(Module["monitorRunDependencies"]){Module["monitorRunDependencies"]}(ru
nDependencies)}function removeRunDependency(id){runDependencies--
;if(Module["monitorRunDependencies"]){Module["monitorRunDependencies"]}(runDependencies)}if(runDepend
encies==0){if(runDependencyWatcher!=null){clearInterval(runDependencyWatcher);runDependencyWatcher=nul
l}if(dependenciesFulfilled){var
callback=dependenciesFulfilled;dependenciesFulfilled=null;callback()}}Module["preloadedImages"]={};Module
["preloadedAudios"]={};function
abort(what){if(Module["onAbort"]){Module["onAbort"]}(what)}if(ENVIRONMENT_IS_PTHREAD)console.err
or("Pthread aborting at "+(new
Error).stack);what+="\n";err(what);ABORT=true;EXITSTATUS=1;what+="abort("+what+"). Build with -s
ASSERTIONS=1 for more info.";var e=new WebAssembly.RuntimeError(what);readyPromiseReject(e);throw
e}function hasPrefix(str,prefix){return

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String.prototype.startsWith?str.startsWith(prefix):str.indexOf(prefix)===0}var
dataURIPrefix="data:application/octet-stream;base64,";function isDataURI(filename){return
hasPrefix(filename,dataURIPrefix)}var fileURIPrefix="file://";function isFileURI(filename){return
hasPrefix(filename,fileURIPrefix)}var wasmBinaryFile="tfjs-backend-wasm-threaded-
simd.wasm";if(!isDataURI(wasmBinaryFile)){wasmBinaryFile=locateFile(wasmBinaryFile)}function
getBinary(file){try{if(file===wasmBinaryFile&&wasmBinary){return new
Uint8Array(wasmBinary)}if(readBinary){return readBinary(file)}else{throw"both async and sync fetching of the
wasm failed"}}catch(err){abort(err)}}function
getBinaryPromise(){if(!wasmBinary&&(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER)){if(typeof
fetch===function"&&!isFileURI(wasmBinaryFile)){return fetch(wasmBinaryFile,{credentials:"same-
origin"}).then(function(response){if(!response["ok"]){throw"failed to load wasm binary file at
"+wasmBinaryFile+""}return
response["arrayBuffer"]()).catch(function(){return getBinary(wasmBinaryFile)})}}else{if(readAsync){return new
Promise(function(resolve,reject){readAsync(wasmBinaryFile,function(response){resolve(new
Uint8Array(response)),reject}))})}return Promise.resolve().then(function(){return
getBinary(wasmBinaryFile)})}function createWasm(){var info={"a":asmLibraryArg};function
receiveInstance(instance,module){var
exports=instance.exports;Module["asm"]=exports;wasmTable=Module["asm"]["T"];wasmModule=module;if(!E
NVIRONMENT_IS_PTHREAD){var
numWorkersToLoad=PThread.unusedWorkers.length;PThread.unusedWorkers.forEach(function(w){PThread.load
WasmModuleToWorker(w,function(){if!--numWorkersToLoad)removeRunDependency("wasm-
instantiate")})))}if(!ENVIRONMENT_IS_PTHREAD){addRunDependency("wasm-instantiate")}function
receiveInstantiatedSource(output){receiveInstance(output["instance"],output["module"])}function
instantiateArrayBuffer(receiver){return getBinaryPromise().then(function(binary){return
WebAssembly.instantiate(binary,info)}).then(receiver,function(reason){err("failed to asynchronously prepare
wasm: "+reason);abort(reason)})}function instantiateAsync(){if(!wasmBinary&&typeof
WebAssembly.instantiateStreaming===function"&&!isDataURI(wasmBinaryFile)&&!isFileURI(wasmBinaryFil
e)&&typeof fetch===function"){return fetch(wasmBinaryFile,{credentials:"same-
origin"}).then(function(response){var result=WebAssembly.instantiateStreaming(response,info);return
result.then(receiveInstantiatedSource,function(reason){err("wasm streaming compile failed: "+reason);err("falling
back to ArrayBuffer instantiation");return instantiateArrayBuffer(receiveInstantiatedSource)}))}else{return
instantiateArrayBuffer(receiveInstantiatedSource)}if(Module["instantiateWasm"]){try{var
exports=Module["instantiateWasm"](info,receiveInstance);return exports}catch(e){err("Module.instantiateWasm
callback failed with error: "+e);return false}}instantiateAsync().catch(rejectPromise);return}}var
ASM_CONSTS={10520:function(){throw"Canceled!";},10538:function($0,$1){setTimeout(function(){__emscript
en_do_dispatch_to_thread($0,$1),0});};function initPthreadsJS(){PThread.initRuntime()}function
callRuntimeCallbacks(callbacks){while(callbacks.length>0){var callback=callbacks.shift();if(typeof
callback===function"){callback(Module);continue}var func=callback.func;if(typeof
func===number){if(callback.arg===undefined){wasmTable.get(func)}else{wasmTable.get(func)(callback.arg
)}}else{func(callback.arg===undefined?null:callback.arg)}}}var
ERRNO_CODES={EPERM:63,ENOENT:44,ESRCH:71,EINTR:27,EIO:29,ENXIO:60,E2BIG:1,ENOEXEC:45,E
BADF:8,ECHILD:12,EAGAIN:6,EWOULDBLOCK:6,ENOMEM:48,EACCES:2,EFAULT:21,ENOTBLK:105,EB
USY:10,EEXIST:20,EXDEV:75,ENODEV:43,ENOTDIR:54,EISDIR:31,EINVAL:28,ENFILE:41,EMFILE:33,EN
OTTY:59,ETXTBSY:74,EFBIG:22,ENOSPC:51,ESPIPE:70,EROFS:69,EMLINK:34,EPIPE:64,EDOM:18,ERAN
GE:68,ENOMSG:49,EIDRM:24,ECHRNG:106,EL2NSYNC:156,EL3HLT:107,EL3RST:108,ELNRNG:109,EUNA
TCH:110,ENOSYS:111,EL2HLT:112,EDEADLK:16,ENOLCK:46,EBADE:113,EBADR:114,EXFULL:115,ENOA
NO:104,EBADRQC:103,EBADSLT:102,EDEADLOCK:16,EBFONT:101,ENOSTR:100,ENODATA:116,ETIME:
117,ENOSR:118,ENONET:119,ENOPKG:120,EREMOTE:121,ENOLINK:47,EADV:122,ESRMNT:123,ECOMM

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:124,EPROTO:65,EMULTIHOP:36,EDOTDOT:125,EBADMSG:9,ENOTUNIQ:126,EBADFD:127,EREMCHG:1
28,ELIBACC:129,ELIBBAD:130,ELIBSCN:131,ELIBMAX:132,ELIBEXEC:133,ENOSYS:52,ENOTEMPTY:55,
ENAMETOOLONG:37,ELOOP:32,EOPNOTSUPP:138,EPFNOSUPPORT:139,ECONNRESET:15,ENOBUFS:42,
EAFNOSUPPORT:5,EPROTOTYPE:67,ENOTSOK:57,ENOPROTOOPT:50,ESHUTDOWN:140,ECONNREFU
SED:14,EADDRINUSE:3,ECONNABORTED:13,ENETUNREACH:40,ENETDOWN:38,ETIMEDOUT:73,EHOS
TDOWN:142,EHOSTUNREACH:23,EINPROGRESS:26,EALREADY:7,EDESTADDRREQ:17,EMSGSIZE:35,E
PROTONOSUPPORT:66,ESOCKTNOSUPPORT:137,EADDRNOTAVAIL:4,ENETRESET:39,EISCONN:30,EN
OTCONN:53,ETOOMANYREFS:141,EUSERS:136,EDQUOT:19,ESTALE:72,ENOTSUP:138,ENOMEDIUM:14
8,EILSEQ:25,E_OVERFLOW:61,ECANCELED:11,ENOTRECOVERABLE:56,EOWNERDEAD:62,ESTRPIPE:13
5};function
_emsripten_futex_wake(addr,count){if(addr<=0||addr>GROWABLE_HEAP_I8().length||addr&3!=0||count<0)retu
rn-28;if(count==0)return 0;if(count>=2147483647)count=Infinity;var
mainThreadWaitAddress=Atomics.load(GROWABLE_HEAP_I32(),__emsripten_main_thread_futex>>2);var
mainThreadWoken=0;if(mainThreadWaitAddress==addr){var
loadedAddr=Atomics.compareExchange(GROWABLE_HEAP_I32(),__emsripten_main_thread_futex>>2,mainTh
readWaitAddress,0);if(loadedAddr==mainThreadWaitAddress){--count;mainThreadWoken=1;if(count<=0)return
1}}var ret=Atomics.notify(GROWABLE_HEAP_I32(),addr>>2,count);if(ret>=0)return
ret+mainThreadWoken;throw`Atomics.notify returned an unexpected value
`+ret}Module["_emsripten_futex_wake"]=_emsripten_futex_wake;function
killThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw`Internal Error! killThread() can only ever be
called from main application thread!`;if(!pthread_ptr)throw`Internal Error! Null pthread_ptr in
killThread!`;GROWABLE_HEAP_I32()[pthread_ptr+12>>2]=0;var
pthread=PThread.threads[pthread_ptr];pthread.worker.terminate();PThread.freeThreadData(pthread);PThread.runni
ngWorkers.splice(PThread.runningWorkers.indexOf(pthread.worker),1);pthread.worker pthread=undefined}functio
n cancelThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw`Internal Error! cancelThread() can only
ever be called from main application thread!`;if(!pthread_ptr)throw`Internal Error! Null pthread_ptr in
cancelThread!`;var
pthread=PThread.threads[pthread_ptr];pthread.worker.postMessage({"cmd":"cancel"})}function
cleanupThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw`Internal Error! cleanupThread() can only
ever be called from main application thread!`;if(!pthread_ptr)throw`Internal Error! Null pthread_ptr in
cleanupThread!`;var
pthread=PThread.threads[pthread_ptr];if(pthread){GROWABLE_HEAP_I32()[pthread_ptr+12>>2]=0;var
worker=pthread.worker;PThread.returnWorkerToPool(worker)}}var
PThread={unusedWorkers:[],runningWorkers:[],initMainThreadBlock:function(){var
pthreadPoolSize=8;for(var
i=0;i<pthreadPoolSize;++i){PThread.allocateUnusedWorker()}};initRuntime:function(){var
tb=_malloc(228);for(var
i=0;i<228/4;++i)GROWABLE_HEAP_U32()[tb/4+i]=0;GROWABLE_HEAP_I32()[tb+12>>2]=tb;var
headPtr=tb+152;GROWABLE_HEAP_I32()[headPtr>>2]=headPtr;var tlsMemory=_malloc(512);for(var
i=0;i<128;++i)GROWABLE_HEAP_U32()[tlsMemory/4+i]=0;Atomics.store(GROWABLE_HEAP_U32(),tb+100
>>2,tlsMemory);Atomics.store(GROWABLE_HEAP_U32(),tb+40>>2,tb);__emsripten_thread_init(tb,!ENVIRON
MENT_IS_WORKER,1);__emsripten_register_main_browser_thread_id(tb);initWorker:function(){},threads:{},t
hreadExitHandlers:[],setThreadStatus:function(){},runExitHandlers:function(){while(PThread.threadExitHandlers.l
ength>0){PThread.threadExitHandlers.pop()};if(ENVIRONMENT_IS_PTHREAD&&pthread_self())__pthread
_tsd_run_dtors(),runExitHandlersAndDeinitThread:function(tb,exitCode){Atomics.store(GROWABLE_HEAP_U
32(),tb+56>>2,1);Atomics.store(GROWABLE_HEAP_U32(),tb+60>>2,0);PThread.runExitHandlers();Atomics.stor
e(GROWABLE_HEAP_U32(),tb+4>>2,exitCode);Atomics.store(GROWABLE_HEAP_U32(),tb+0>>2,1);_emscri
pten_futex_wake(tb+0,2147483647);__emsripten_thread_init(0,0)},threadExit:function(exitCode){var

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tb=_pthread_self();if(tb){PThread.runExitHandlersAndDeinitThread(tb,exitCode);if(ENVIRONMENT_IS_PTHRE
AD){postMessage({"cmd":"exit"})}},threadCancel:function(){PThread.runExitHandlersAndDeinitThread(_pthr
ead_self(),-1);postMessage({"cmd":"cancelDone"})},terminateAllThreads:function(){for(var t in
PThread.pthreads){var
pthread=PThread.pthreads[t];if(pthread&&pthread.worker){PThread.returnWorkerToPool(pthread.worker)}PThre
ad.pthreads={};for(var i=0;i<PThread.unusedWorkers.length;++i){var
worker=PThread.unusedWorkers[i];worker.terminate()}PThread.unusedWorkers=[];for(var
i=0;i<PThread.runningWorkers.length;++i){var worker=PThread.runningWorkers[i];var
pthread=worker.pthread;PThread.freeThreadData(pthread);worker.terminate()}PThread.runningWorkers=[],freeTh
readData:function(pthread){if(!pthread)return;if(pthread.threadInfoStruct){var
tlsMemory=GROWABLE_HEAP_I32()[pthread.threadInfoStruct+100>>2];GROWABLE_HEAP_I32()[pthread.thr
eadInfoStruct+100>>2]=0;_free(tlsMemory);_free(pthread.threadInfoStruct)}pthread.threadInfoStruct=0;if(pthread.
allocatedOwnStack&&pthread.stackBase)_free(pthread.stackBase);pthread.stackBase=0;if(pthread.worker)pthread.
worker.pthread=null},returnWorkerToPool:function(worker){PThread.runWithoutMainThreadQueuedCalls(funcio
n(){delete
PThread.pthreads[worker.pthread.threadInfoStruct];PThread.unusedWorkers.push(worker);PThread.runningWorker
s.splice(PThread.runningWorkers.indexOf(worker),1);PThread.freeThreadData(worker.pthread);worker.pthread=un
defined}},runWithoutMainThreadQueuedCalls:function(func){GROWABLE_HEAP_I32()[__emscripten_allow_m
ain_runtime_queued_calls>>2]=0;try{func()}finally{GROWABLE_HEAP_I32()[__emscripten_allow_main_runti
me_queued_calls>>2]=1}},receiveObjectTransfer:function(data){},loadWasmModuleToWorker:function(worker,o
nFinishedLoading){worker.onmessage=function(e){var
d=e["data"];var
cmd=d["cmd"];if(worker.pthread)PThread.currentProxiedOperationCallerThread=worker.pthread.threadInfoStruct;
if(d["targetThread"]&&d["targetThread"]!==_pthread_self()){var
thread=PThread.pthreads[d.targetThread];if(thread){thread.worker.postMessage(e.data,d["transferList"])}}else{con
sole.error('Internal error! Worker sent a message \''+cmd+'\" to target pthread '+d["targetThread"]+', but that
thread no longer
exists!')}PThread.currentProxiedOperationCallerThread=undefined;return}if(cmd===\"processQueuedMainThread
Work\"){__emscripten_main_thread_process_queued_calls()}else
if(cmd===\"spawnThread\"){spawnThread(e.data)}else
if(cmd===\"cleanupThread\"){cleanupThread(d["thread"])}}else
if(cmd===\"killThread\"){killThread(d["thread"])}}else
if(cmd===\"cancelThread\"){cancelThread(d["thread"])}}else
if(cmd===\"loaded\"){worker.loaded=true;if(onFinishedLoading)onFinishedLoading(worker);if(worker.runPthread)
{worker.runPthread();delete
worker.runPthread}}else if(cmd===\"print\"){out(\"Thread \"+d["threadId"]+\": \"+d["text"])}}else
if(cmd===\"printErr\"){err(\"Thread \"+d["threadId"]+\": \"+d["text"])}}else if(cmd===\"alert\"){alert(\"Thread
\"+d["threadId"]+\": \"+d["text"])}}else if(cmd===\"exit\"){var
detached=worker.pthread&&Atomics.load(GROWABLE_HEAP_U32(),worker.pthread.threadInfoStruct+64>>2);if
(detached){PThread.returnWorkerToPool(worker)}}else
if(cmd===\"exitProcess\"){try{exit(d["returnCode"])}}catch(e){if(e instanceof ExitStatus)return;throw e}}else
if(cmd===\"cancelDone\"){PThread.returnWorkerToPool(worker)}else
if(cmd===\"objectTransfer\"){PThread.receiveObjectTransfer(e.data)}else
if(e.data.target===\"setimmediate\"){worker.postMessage(e.data)}else{err(\"worker sent an unknown command
'+cmd')PThread.currentProxiedOperationCallerThread=undefined};worker.onerror=function(e){err(\"pthread sent
an error! \"+e.filename+\":'+e.lineno+\":
'+e.message)};if(ENVIRONMENT_IS_NODE){worker.on(\"message\",function(data){worker.onmessage({data:d
ata})});worker.on(\"error\",function(data){worker.onerror(data)});worker.on(\"exit\",function(data){})}worker.post

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Message({"cmd":"load","urlOrBlob":Module["mainScriptUrlOrBlob"]||_scriptDir,"wasmMemory":wasmMemory,"wasmModule":wasmModule}),allocateUnusedWorker:function(){var
pthreadMainJs=locateFile("tfjs-backend-wasm-threaded-simd.worker.js");PThread.unusedWorkers.push(new
Worker(pthreadMainJs)),getNewWorker:function(){if(PThread.unusedWorkers.length==0){PThread.allocateUnus
edWorker();PThread.loadWasmModuleToWorker(PThread.unusedWorkers[0])}if(PThread.unusedWorkers.length>
0)return PThread.unusedWorkers.pop();else return null},busySpinWait:function(msecs){var
t=performance.now()+msecs;while(performance.now()<t){}};function
establishStackSpace(stackTop,stackMax){_emscripten_stack_set_limits(stackTop,stackMax);stackRestore(stackTop
)}Module["establishStackSpace"]=establishStackSpace;function getNoExitRuntime(){return
noExitRuntime}Module["getNoExitRuntime"]=getNoExitRuntime;function invokeEntryPoint(ptr,arg){return
wasmTable.get(ptr)(arg)}Module["invokeEntryPoint"]=invokeEntryPoint;function
__assert_fail(condition,filename,line,func){abort("Assertion failed: "+UTF8ToString(condition)+" at:
"+[filename?UTF8ToString(filename):"unknown filename",line,func?UTF8ToString(func):"unknown
function"])}function __call_main(argc,argv){var returnCode=_main(argc,argv)}var
_emscripten_get_now;if(ENVIRONMENT_IS_NODE){_emscripten_get_now=function(){var
t=process["hrtime"]();return t[0]*1e3+t[1]/1e6}}else
if(ENVIRONMENT_IS_PTHREAD){_emscripten_get_now=function(){return performance.now()-
Module["__performance_now_clock_drift"]}}else if(typeof
dateNow!="undefined"){_emscripten_get_now=dateNow}else _emscripten_get_now=function(){return
performance.now()};function setErrNo(value){GROWABLE_HEAP_I32()[__errno_location()>>2]=value;return
value}function _atexit(func,arg){if(ENVIRONMENT_IS_PTHREAD)return
_emscripten_proxy_to_main_thread_js(1,1,func,arg)}function
_emscripten_notify_thread_queue(targetThreadId,mainThreadId){if(targetThreadId==mainThreadId){postMessag
e({"cmd":"processQueuedMainThreadWork"})}else
if(ENVIRONMENT_IS_PTHREAD){postMessage({"targetThread":targetThreadId,"cmd":"processThreadQueue
e"})}else{var pthread=PThread.threads[targetThreadId];var
worker=pthread&&pthread.worker;if(!worker){return}worker.postMessage({"cmd":"processThreadQueue
e"})}return 1}function _abort(){abort()}function _emscripten_asm_const_int(code,sigPtr,argbuf){var
args=readAsmConstArgs(sigPtr,argbuf);return ASM_CONSTS[code].apply(null,args)}function
_emscripten_conditional_set_current_thread_status(expectedStatus,newStatus){}function
_emscripten_futex_wait(addr,val,timeout){if(addr<=0||addr>GROWABLE_HEAP_I8().length||addr&3!=0)return-
28;if(!ENVIRONMENT_IS_WEB){var
ret=Atomics.wait(GROWABLE_HEAP_I32(),addr>>2,val,timeout);if(ret==="timed-out")return-
73;if(ret==="not-equal")return-6;if(ret==="ok")return
0;throw"Atomics.wait returned an unexpected value
"+ret}else{if(Atomics.load(GROWABLE_HEAP_I32(),addr>>2)!=val){return-6}var
tNow=performance.now();var tEnd=tNow+timeout;var
lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2,addr);while(1){tNo
w=performance.now();if(tNow>tEnd){lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emscripten_mai
n_thread_futex>>2,0);return-
73}lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2,0);if(lastAddr==
0){break}_emscripten_main_thread_process_queued_calls();if(Atomics.load(GROWABLE_HEAP_I32(),addr>>2)
==val){return-
6}lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2,addr)}return
0}}function
_emscripten_memcpy_big(dest,src,num){GROWABLE_HEAP_U8().copyWithin(dest,src,src+num)}function
_emscripten_num_logical_cores(){if(ENVIRONMENT_IS_NODE)return require("os").cpus().length;return
navigator["hardwareConcurrency"]}function _emscripten_proxy_to_main_thread_js(index,sync){var

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numCallArgs=arguments.length-2;var stack=stackSave();var serializedNumCallArgs=numCallArgs;var
args=stackAlloc(serializedNumCallArgs*8);var b=args>>3;for(var i=0;i<numCallArgs;i++){var
arg=arguments[2+i];GROWABLE_HEAP_F64()[b+i]=arg}var
ret=_emscripten_run_in_main_runtime_thread_js(index,serializedNumCallArgs,args,sync);stackRestore(stack);return
ret}var _emscripten_receive_on_main_thread_js_callArgs=[];var readAsmConstArgsArray=[];function
readAsmConstArgs(sigPtr,buf){readAsmConstArgsArray.length=0;var
ch;buf>>=2;while(ch=GROWABLE_HEAP_U8()[sigPtr++){var
double=ch<105;if(double&&buf&1)buf++;readAsmConstArgsArray.push(double?GROWABLE_HEAP_F64()[buf
++>>1]:GROWABLE_HEAP_I32()[buf]);++buf}return readAsmConstArgsArray}function
_emscripten_receive_on_main_thread_js(index,numCallArgs,args){_emscripten_receive_on_main_thread_js_callA
rgs.length=numCallArgs;var b=args>>3;for(var
i=0;i<numCallArgs;i++){_emscripten_receive_on_main_thread_js_callArgs[i]=GROWABLE_HEAP_F64()[b+i]}v
ar
isEmAsmConst=index<0;var func=!isEmAsmConst?proxiedFunctionTable[index]:ASM_CONSTS[-index-
1];return func.apply(null,_emscripten_receive_on_main_thread_js_callArgs)}function
_emscripten_get_heap_size(){return GROWABLE_HEAP_U8().length}function
emscripten_realloc_buffer(size){try{wasmmemory.grow(size-
buffer.byteLength+65535>>>16);updateGlobalBufferAndViews(wasmmemory.buffer);return
1}catch(e){}}function _emscripten_resize_heap(requestedSize){var
oldSize=_emscripten_get_heap_size();if(requestedSize<=oldSize){return false}var
maxHeapSize=2147483648;if(requestedSize>maxHeapSize){return false}for(var
cutDown=1;cutDown<=4;cutDown*=2){var
overGrownHeapSize=oldSize*(1+.2/cutDown);overGrownHeapSize=Math.min(overGrownHeapSize,requestedSize
+100663296);var
newSize=Math.min(maxHeapSize,alignUp(Math.max(requestedSize,overGrownHeapSize),65536));var
replacement=emscripten_realloc_buffer(newSize);if(replacement){return true}}return false}var
JSEvents={inEventHandler:0,removeAllEventListeners:function(){for(var
i=JSEvents.eventHandlers.length-1;i>=0;--
i){JSEvents._removeHandler(i)}JSEvents.eventHandlers=[];JSEvents.deferredCalls=[]},registerRemoveEventListen
ers:function(){if(!JSEvents.removeEventListenersRegistered){__ATEXIT__.push(JSEvents.removeAllEventListene
rs);JSEvents.removeEventListenersRegistered=true}},deferredCalls:[],deferCall:function(targetFunction,precedence
,argsList){function arraysHaveEqualContent(arrA,arrB){if(arrA.length!=arrB.length)return false;for(var i in
arrA){if(arrA[i]!=arrB[i])return false}return true}for(var i in JSEvents.deferredCalls){var
call=JSEvents.deferredCalls[i];if(call.targetFunction==targetFunction&&arraysHaveEqualContent(call.argsList,args
List)){return}}JSEvents.deferredCalls.push({targetFunction:targetFunction,precedence:precedence,argsList:argsList
});JSEvents.deferredCalls.sort(function(x,y){return
x.precedence<y.precedence}),removeDeferredCalls:function(targetFunction){for(var
i=0;i<JSEvents.deferredCalls.length;++i){if(JSEvents.deferredCalls[i].targetFunction==targetFunction){JSEvents.d
eferredCalls.splice(i,1);--i}},canPerformEventHandlerRequests:function(){return
JSEvents.inEventHandler&&JSEvents.currentEventHandler.allowsDeferredCalls},runDeferredCalls:function(){if(!J
SEvents.canPerformEventHandlerRequests()){return}for(var i=0;i<JSEvents.deferredCalls.length;++i){var
call=JSEvents.deferredCalls[i];JSEvents.deferredCalls.splice(i,1);--
i;call.targetFunction.apply(null,call.argsList)},eventHandlers:[],removeAllHandlersOnTarget:function(target,event
TypeString){for(var
i=0;i<JSEvents.eventHandlers.length;++i){if(JSEvents.eventHandlers[i].target==target&&(!eventTypeString||event
TypeString==JSEvents.eventHandlers[i].eventTypeString)){JSEvents._removeHandler(i--
)}}},_removeHandler:function(i){var
h=JSEvents.eventHandlers[i];h.target.removeEventListener(h.eventTypeString,h.eventListenerFunc,h.useCapture);J

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SEvents.eventHandlers.splice(i,1)},registerOrRemoveHandler:function(eventHandler){ var
jsEventHandler=function
jsEventHandler(event){++JSEvents.inEventHandler;JSEvents.currentEventHandler=eventHandler;JSEvents.runDef
erredCalls();eventHandler.handlerFunc(event);JSEvents.runDeferredCalls();--
JSEvents.inEventHandler};if(eventHandler.callbackfunc){ eventHandler.eventListenerFunc=jsEventHandler;eventH
andler.target.addEventListener(eventHandler.eventTypeString,jsEventHandler,eventHandler.useCapture);JSEvents.e
ventHandlers.push(eventHandler);JSEvents.registerRemoveEventListeners()}else{for(var
i=0;i<JSEvents.eventHandlers.length;++i){if(JSEvents.eventHandlers[i].target==eventHandler.target&&JSEvents.e
ventHandlers[i].eventTypeString==eventHandler.eventTypeString){JSEvents._removeHandler(i--
)}}},queueEventHandlerOnThread_iiii:function(targetThread,eventHandlerFunc,eventTypeId,eventData,userData)
{ var stackTop=stackSave();var
varargs=stackAlloc(12);GROWABLE_HEAP_I32()[varargs>>2]=eventTypeId;GROWABLE_HEAP_I32()[varargs
+4>>2]=eventData;GROWABLE_HEAP_I32()[varargs+8>>2]=userData;__emscripten_call_on_thread(0,targetThr
ead,637534208,eventHandlerFunc,eventData,varargs);stackRestore(stackTop)},getTargetThreadForEventCallback:f
unction(targetThread){switch(targetThread){case
1:return 0;case 2:return PThread.currentProxiedOperationCallerThread;default:return
targetThread}},getNodeNameForTarget:function(target){if(!target)return\"";if(target==window)return\"#window\";
if(target==screen)return\"#screen\";return
target&&target.nodeName?target.nodeName:\"\"},fullscreenEnabled:function(){return
document.fullscreenEnabled||document.webkitFullscreenEnabled}};function stringToNewUTF8(jsString){ var
length=lengthBytesUTF8(jsString)+1;var cString=_malloc(length);stringToUTF8(jsString,cString,length);return
cString}function
_emscripten_set_offscreencanvas_size_on_target_thread_js(targetThread,targetCanvas,width,height){ var
stackTop=stackSave();var varargs=stackAlloc(12);var
targetCanvasPtr=0;if(targetCanvas){ targetCanvasPtr=stringToNewUTF8(targetCanvas);GROWABLE_HEAP_I32(
)[varargs>>2]=targetCanvasPtr;GROWABLE_HEAP_I32()[varargs+4>>2]=width;GROWABLE_HEAP_I32()[var
args+8>>2]=height;__emscripten_call_on_thread(0,targetThread,657457152,0,targetCanvasPtr,varargs);stackRestor
e(stackTop)}function
_emscripten_set_offscreencanvas_size_on_target_thread(targetThread,targetCanvas,width,height){ targetCanvas=tar
getCanvas?UTF8ToString(targetCanvas):\"\";_emscripten_set_offscreencanvas_size_on_target_thread_js(targetThr
ead,targetCanvas,width,height)}function maybeCStringToJsString(cString){ return
cString>2?UTF8ToString(cString):cString}var specialHTMLTargets=[0,typeof
document!=="undefined"?document:0,typeof window!=="undefined"?window:0];function
findEventTarget(target){ target=maybeCStringToJsString(target);var
domElement=specialHTMLTargets[target]||(typeof
document!=="undefined"?document.querySelector(target):undefined);return domElement}function
findCanvasEventTarget(target){ return findEventTarget(target)}function
_emscripten_set_canvas_element_size_calling_thread(target,width,height){ var
canvas=findCanvasEventTarget(target);if(!canvas)return-
4;if(canvas.canvasSharedPtr){ GROWABLE_HEAP_I32()[canvas.canvasSharedPtr>>2]=width;GROWABLE_HEA
P_I32()[canvas.canvasSharedPtr+4>>2]=height}if(canvas.offscreenCanvas||!canvas.controlTransferredOffscreen){ if
(canvas.offscreenCanvas)canvas=canvas.offscreenCanvas;var
autoResizeViewport=false;if(canvas.GLctxObject&&canvas.GLctxObject.GLctx){ var
prevViewport=canvas.GLctxObject.GLctx.getParameter(2978);autoResizeViewport=prevViewport[0]===0&&prev
Viewport[1]===0&&prevViewport[2]===canvas.width&&prevViewport[3]===canvas.height} canvas.width=width;
canvas.height=height;if(autoResizeViewport){ canvas.GLctxObject.GLctx.viewport(0,0,width,height)}} else
if(canvas.canvasSharedPtr){ var
targetThread=GROWABLE_HEAP_I32()[canvas.canvasSharedPtr+8>>2];_emscripten_set_offscreencanvas_size_o

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n_target_thread(targetThread,target,width,height);return 1 }else{return-4}return 0}function
_emsripten_set_canvas_element_size_main_thread(target,width,height){if(ENVIRONMENT_IS_PTHREAD)retur
n
_emsripten_proxy_to_main_thread_js(2,1,target,width,height);return
_emsripten_set_canvas_element_size_calling_thread(target,width,height)}function
_emsripten_set_canvas_element_size(target,width,height){var
canvas=findCanvasEventTarget(target);if(canvas){return
_emsripten_set_canvas_element_size_calling_thread(target,width,height)}else{return
_emsripten_set_canvas_element_size_main_thread(target,width,height)}}function
_emsripten_set_current_thread_status(newStatus){}function
_emsripten_set_thread_name(threadId,name){}function __webgl_enable_ANGLE_instanced_arrays(ctx){var
ext=ctx.getExtension("\ANGLE_instanced_arrays");if(ext){ctx["vertexAttribDivisor"]=function(index,divisor){ex
t["vertexAttribDivisorANGLE"](index,divisor)};ctx["drawArraysInstanced"]=function(mode,first,count,primcou
nt){ext["drawArraysInstancedANGLE"](mode,first,count,primcount)};ctx["drawElementsInstanced"]=function(
mode,count,type,indices,primcount){ext["drawElementsInstancedANGLE"](mode,count,type,indices,primcount)};
return
1}}function __webgl_enable_OES_vertex_array_object(ctx){var
ext=ctx.getExtension("\OES_vertex_array_object");if(ext){ctx["createVertexArray"]=function(){return
ext["createVertexArrayOES"]();};ctx["deleteVertexArray"]=function(vao){ext["deleteVertexArrayOES"](vao)};
ctx["bindVertexArray"]=function(vao){ext["bindVertexArrayOES"](vao)};ctx["isVertexArray"]=function(vao)
{return ext["isVertexArrayOES"](vao)};return 1}}function __webgl_enable_WEBGL_draw_buffers(ctx){var
ext=ctx.getExtension("\WEBGL_draw_buffers");if(ext){ctx["drawBuffers"]=function(n,bufs){ext["drawBuffers
WEBGL"](n,bufs)};return 1}}function
__webgl_enable_WEBGL_multi_draw(ctx){return!(ctx.multiDrawWebgl=ctx.getExtension("\WEBGL_multi_dra
w"))}var
GL={counter:1,buffers:[],programs:[],framebuffers:[],renderbuffers:[],textures:[],uniforms:[],shaders:[],vaos:[],cont
exts:{},offscreenCanvases:{},timerQueriesEXT:[],programInfos:{},stringCache:{},unpackAlignment:4,recordError:
function
recordError(errorCode){if(!GL.lastError){GL.lastError=errorCode}},getNewId:function(table){var
ret=GL.counter++;for(var i=table.length;i<ret;i++){table[i]=null}return
ret},getSource:function(shader,count,string,length){var source="\";for(var i=0;i<count;++)i){var
len=length?GROWABLE_HEAP_I32()[length+i*4>>2]:-
1;source+=UTF8ToString(GROWABLE_HEAP_I32()[string+i*4>>2],len<0?undefined:len)}return
source},createContext:function(canvas,webGLContextAttributes){var
ctx=canvas.getContext("\webgl",webGLContextAttributes);if(!ctx)return 0;var
handle=GL.registerContext(ctx,webGLContextAttributes);return
handle},registerContext:function(ctx,webGLContextAttributes){var
handle=_malloc(8);GROWABLE_HEAP_I32()[handle+4>>2]=_pthread_self();var
context={handle:handle,attributes:webGLContextAttributes,version:webGLContextAttributes.majorVersion,GLctx:
ctx};if(ctx.canvas)ctx.canvas.GLctxObject=context;GL.contexts[handle]=context;if(typeof
webGLContextAttributes.enableExtensionsByDefault===\undefined\||webGLContextAttributes.enableExtensions
ByDefault){GL.initExtensions(context)}return
handle},makeContextCurrent:function(contextHandle){GL.currentContext=GL.contexts[contextHandle];Module.ctx
=GLctx=GL.currentContext&&GL.currentContext.GLctx;return!(contextHandle&&!GLctx)},getContext:function(c
ontextHandle){return
GL.contexts[contextHandle]},deleteContext:function(contextHandle){if(GL.currentContext===GL.contexts[context
Handle])GL.currentContext=null;if(typeof
JSEvents===\object\")JSEvents.removeAllHandlersOnTarget(GL.contexts[contextHandle].GLctx.canvas);if(GL.co

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nctxs[contextHandle]&&GL.ctxs[contextHandle].GLctx.canvas)GL.ctxs[contextHandle].GLctx.canvas.GL
ctxObject=undefined;_free(GL.ctxs[contextHandle].handle);GL.ctxs[contextHandle]=null},initExtensions:f
unction(context){if(!context)context=GL.currentContext;if(context.initExtensionsDone)return;context.initExtension
sDone=true;var
GLctx=context.GLctx;__webgl_enable_ANGLE_instanced_arrays(GLctx);__webgl_enable_OES_vertex_array_obj
ect(GLctx);__webgl_enable_WEBGL_draw_buffers(GLctx);GLctx.disjointTimerQueryExt=GLctx.getExtension("\
EXT_disjoint_timer_query");__webgl_enable_WEBGL_multi_draw(GLctx);var
exts=GLctx.getSupportedExtensions()||[];exts.forEach(function(ext){if(ext.indexOf("lose_context")<0&&ext.inde
xOf("debug")<0){GLctx.getExtension(ext)}}),populateUniformTable:function(program){var
p=GL.programs[program];var
ptable=GL.programInfos[program]={uniforms:{},maxUniformLength:0,maxAttributeLength:-
1,maxUniformBlockNameLength:-1};var utable=ptable.uniforms;var
numUniforms=GLctx.getProgramParameter(p,35718);for(var i=0;i<numUniforms;++i){var
u=GLctx.getActiveUniform(p,i);var
name=u.name;ptable.maxUniformLength=Math.max(ptable.maxUniformLength,name.length+1);if(name.slice(-
1)!="\"){name=name.slice(0,name.lastIndexOf("\["))}var loc=GLctx.getUniformLocation(p,name);if(loc){var
id=GL.getNewId(GL.uniforms);utable[name]=[u.size,id];GL.uniforms[id]=loc;for(var
j=1;j<u.size;++j){var
n=name+"\["+j+"\]";loc=GLctx.getUniformLocation(p,n);id=GL.getNewId(GL.uniforms);GL.uniforms[id]=loc}}
};var __emscripten_webgl_power_preferences=["default","low-power","high-performance"];function
__emscripten_webgl_do_create_context(target,attributes){var a=attributes>>2;var
powerPreference=GROWABLE_HEAP_I32()[a+(24>>2)];var
contextAttributes={"alpha":!!GROWABLE_HEAP_I32()[a+(0>>2)],"depth":!!GROWABLE_HEAP_I32()[a+(4
>>2)],"stencil":!!GROWABLE_HEAP_I32()[a+(8>>2)],"antialias":!!GROWABLE_HEAP_I32()[a+(12>>2)],"p
remultipliedAlpha":!!GROWABLE_HEAP_I32()[a+(16>>2)],"preserveDrawingBuffer":!!GROWABLE_HEAP_
I32()[a+(20>>2)],"powerPreference":__emscripten_webgl_power_preferences[powerPreference],"\failIfMajorPerf
ormanceCaveat":!!GROWABLE_HEAP_I32()[a+(28>>2)],majorVersion:GROWABLE_HEAP_I32()[a+(32>>2)],
minorVersion:GROWABLE_HEAP_I32()[a+(36>>2)],enableExtensionsByDefault:GROWABLE_HEAP_I32()[a+(
40>>2)],explicitSwapControl:GROWABLE_HEAP_I32()[a+(44>>2)],proxyContextToMainThread:GROWABLE_
HEAP_I32()[a+(48>>2)],renderViaOffscreenBackBuffer:GROWABLE_HEAP_I32()[a+(52>>2)]};var
canvas=findCanvasEventTarget(target);if(!canvas){return 0}if(contextAttributes.explicitSwapControl){return
0}var contextHandle=GL.createContext(canvas,contextAttributes);return contextHandle}function
__emscripten_webgl_create_context(a0,a1){return __emscripten_webgl_do_create_context(a0,a1)}var
SYSCALLS={mappings:{},buffers:[null,[],[]],printChar:function(stream,curr){var
buffer=SYSCALLS.buffers[stream];if(curr===0||curr===10){(stream===1?out:err)(UTF8ArrayToString(buffer,0));
buffer.length=0}else{buffer.push(curr)},varargs:undefined,get:function(){SYSCALLS.varargs+=4;var
ret=GROWABLE_HEAP_I32()[SYSCALLS.varargs-4>>2];return ret},getStr:function(ptr){var
ret=UTF8ToString(ptr);return ret},get64:function(low,high){return low}};function
__fd_close(fd){if(ENVIRONMENT_IS_PTHREAD)return __emscripten_proxy_to_main_thread_js(3,1,fd);return
0}function __fd_seek(fd,offset_low,offset_high,whence,newOffset){if(ENVIRONMENT_IS_PTHREAD)return
__emscripten_proxy_to_main_thread_js(4,1,fd,offset_low,offset_high,whence,newOffset)}function
__fd_write(fd,iiov,iiovcnt,pnum){if(ENVIRONMENT_IS_PTHREAD)return
__emscripten_proxy_to_main_thread_js(5,1,fd,iiov,iiovcnt,pnum);var num=0;for(var i=0;i<iiovcnt;i++){var
ptr=GROWABLE_HEAP_I32()[iiov+i*8>>2];var len=GROWABLE_HEAP_I32()[iiov+(i*8+4)>>2];for(var
j=0;j<len;j++){SYSCALLS.printChar(fd,GROWABLE_HEAP_U8)[ptr+j]}num+=len}GROWABLE_HEAP_I32
()[pnum>>2]=num;return 0}function __pthread_cleanup_pop(execute){var
routine=PThread.threadExitHandlers.pop();if(execute)routine()}function
__pthread_cleanup_push(routine,arg){PThread.threadExitHandlers.push(function(){wasmTable.get(routine)(arg)}})f

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unction spawnThread(threadParams){if(ENVIRONMENT_IS_PTHREAD)throw\`Internal Error! spawnThread()
can only ever be called from main application thread!\`;var
worker=PThread.getNewWorker();if(worker.pthread!==undefined)throw\`Internal
error!\`;if(!threadParams.pthread_ptr)throw\`Internal
error, no pthread ptr!\`;PThread.runningWorkers.push(worker);var tlsMemory=_malloc(128*4);for(var
i=0;i<128;++i){GROWABLE_HEAP_I32()[tlsMemory+i*4>>2]=0}var
stackHigh=threadParams.stackBase+threadParams.stackSize;var
pthread=PThread.pthreads[threadParams.pthread_ptr]={ worker:worker,stackBase:threadParams.stackBase,stackSize
:threadParams.stackSize,allocatedOwnStack:threadParams.allocatedOwnStack,threadInfoStruct:threadParams.pthrea
d_ptr };var
tis=pthread.threadInfoStruct>>2;Atomics.store(GROWABLE_HEAP_U32(),tis+(64>>2),threadParams.detached);A
tomics.store(GROWABLE_HEAP_U32(),tis+(100>>2),tlsMemory);Atomics.store(GROWABLE_HEAP_U32(),tis
+(40>>2),pthread.threadInfoStruct);Atomics.store(GROWABLE_HEAP_U32(),tis+(80>>2),threadParams.stackSiz
e);Atomics.store(GROWABLE_HEAP_U32(),tis+(76>>2),stackHigh);Atomics.store(GROWABLE_HEAP_U32(),t
is+(104>>2),threadParams.stackSize);Atomics.store(GROWABLE_HEAP_U32(),tis+(104+8>>2),stackHigh);Atom
ics.store(GROWABLE_HEAP_U32(),tis+(104+12>>2),threadParams.detached);var
global_libc=_emscripten_get_global_libc();var
global_locale=global_libc+40;Atomics.store(GROWABLE_HEAP_U32(),tis+(172>>2),global_locale);worker.pthr
ead=pthread;var
msg={"cmd\`:"run\`,`start_routine\`:threadParams.startRoutine,\`arg\`:threadParams.arg,\`threadInfoStruct\`:thre
adParams.pthread_ptr,\`stackBase\`:threadParams.stackBase,\`stackSize\`:threadParams.stackSize};worker.runPthre
ad=function(){msg.time=performance.now();worker.postMessage(msg,threadParams.transferList)};if(worker.loaded
){worker.runPthread();delete worker.runPthread}}function
__pthread_create(pthread_ptr,attr,start_routine,arg){if(typeof SharedArrayBuffer===\`undefined\`){err(\`Current
environment does not support SharedArrayBuffer, pthreads are not available!\`);return
6}if(!pthread_ptr){err(\`pthread_create called with a null thread pointer!\`);return 28}var transferList=[];var
error=0;if(ENVIRONMENT_IS_PTHREAD&&(transferList.length===0||error)){return
__emscripten_sync_run_in_main_thread_4(687865856,pthread_ptr,attr,start_routine,arg)}if(error)return
error;var stackSize=0;var stackBase=0;var detached=0;if(attr&&attr!=-
1){stackSize=GROWABLE_HEAP_I32()[attr>>2];stackSize+=81920;stackBase=GROWABLE_HEAP_I32()[attr+
8>>2];detached=GROWABLE_HEAP_I32()[attr+12>>2]!==0}else{stackSize=2097152}var
allocatedOwnStack=stackBase===0;if(allocatedOwnStack){stackBase=_memalign(16,stackSize)}else{stackBase-
=stackSize;assert(stackBase>0)}var threadInfoStruct=_malloc(228);for(var
i=0;i<228>>2;++i)GROWABLE_HEAP_U32()[threadInfoStruct>>2+i]=0;GROWABLE_HEAP_I32()[pthread_p
tr>>2]=threadInfoStruct;GROWABLE_HEAP_I32()[threadInfoStruct+12>>2]=threadInfoStruct;var
headPtr=threadInfoStruct+152;GROWABLE_HEAP_I32()[headPtr>>2]=headPtr;var
threadParams={stackBase:stackBase,stackSize:stackSize,allocatedOwnStack:allocatedOwnStack,detached:detached
,startRoutine:start_routine,pthread_ptr:threadInfoStruct,arg:arg,transferList:transferList};if(ENVIRONMENT_IS_P
THREAD){threadParams.cmd=\`spawnThread\`;postMessage(threadParams,transferList)}else{spawnThread(thread
Params)}return
0}function __pthread_testcancel_js(){if(!ENVIRONMENT_IS_PTHREAD)return;var
tb=__pthread_self();if(!tb)return;var
cancelDisabled=Atomics.load(GROWABLE_HEAP_U32(),tb+56>>2);if(cancelDisabled)return;var
canceled=Atomics.load(GROWABLE_HEAP_U32(),tb+0>>2);if(canceled===2)throw\`Canceled!\`}function
__emscripten_check_blocking_allowed(){if(ENVIRONMENT_IS_NODE)return;if(ENVIRONMENT_IS_WORKE
R)return;warnOnce(\`Blocking on the main thread is very dangerous, see
https://emscripten.org/docs/porting/pthreads.html#blocking-on-the-main-browser-thread\`);}function
__emscripten_do_pthread_join(thread,status,block){if(!thread){err(\`pthread_join attempted on a null thread

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pointer!);return
ERRNO_CODES.ESRCH}if(ENVIRONMENT_IS_PTHREAD&&_pthread_self()==thread){err("\PThread
\"+thread+\" is attempting to join to itself!\");return ERRNO_CODES.EDEADLK}else
if(!ENVIRONMENT_IS_PTHREAD&&_emscripten_main_browser_thread_id()==thread){err("\Main
thread \"+thread+\" is attempting to join to itself!\");return ERRNO_CODES.EDEADLK}var
self=GROWABLE_HEAP_I32()[thread+12>>2];if(self!==thread){err("\pthread_join attempted on thread
\"+thread+\", which does not point to a valid thread, or does not exist anymore!\");return
ERRNO_CODES.ESRCH}var
detached=Atomics.load(GROWABLE_HEAP_U32(),thread+64>>2);if(detached){err("\Attempted to join thread
\"+thread+\", which was already detached!\");return
ERRNO_CODES.EINVAL}if(block){_emscripten_check_blocking_allowed()}for(;;){var
threadStatus=Atomics.load(GROWABLE_HEAP_U32(),thread+0>>2);if(threadStatus==1){var
threadExitCode=Atomics.load(GROWABLE_HEAP_U32(),thread+4>>2);if(status)GROWABLE_HEAP_I32()[sta
tus>>2]=threadExitCode;Atomics.store(GROWABLE_HEAP_U32(),thread+64>>2,1);if(!ENVIRONMENT_IS_PT
HREAD)cleanupThread(thread);else postMessage({"cmd":"cleanupThread","thread":thread});return
0}if(!block){return
ERRNO_CODES.EBUSY}}__pthread_testcancel_js();if(!ENVIRONMENT_IS_PTHREAD)_emscripten_main_thre
ad_process_queued_calls();_emscripten_futex_wait(thread+0,threadStatus,ENVIRONMENT_IS_PTHREAD?100:1
)}}function
_pthread_join(thread,status){return __emscripten_do_pthread_join(thread,status,true)}function
_sysconf(name){if(ENVIRONMENT_IS_PTHREAD)return
_emscripten_proxy_to_main_thread_js(6,1,name);switch(name){case 30:return 16384;case 85:var
maxHeapSize=2147483648;return maxHeapSize/16384;case 132:case 133:case 12:case 137:case 138:case 15:case
235:case 16:case 17:case 18:case 19:case 20:case 149:case 13:case 10:case 236:case 153:case 9:case 21:case 22:case
159:case 154:case 14:case 77:case 78:case 139:case 82:case 68:case 67:case 164:case 11:case 29:case 47:case
48:case 95:case 52:case 51:case 46:return 200809;case 27:case 246:case 127:case 128:case 23:case 24:case 160:case
161:case 181:case 182:case 242:case 183:case 184:case 243:case 244:case 245:case 165:case 178:case 179:case
49:case 50:case 168:case 169:case 175:case 170:case 171:case 172:case 97:case
76:case 32:case 173:case 35:case 80:case 81:case 79:return-1;case 176:case 177:case 7:case 155:case 8:case
157:case 125:case 126:case 92:case 93:case 129:case 130:case 131:case 94:case 91:return 1;case 74:case 60:case
69:case 70:case 4:return 1024;case 31:case 42:case 72:return 32;case 87:case 26:case 33:return 2147483647;case
34:case 1:return 47839;case 38:case 36:return 99;case 43:case 37:return 2048;case 0:return 2097152;case 3:return
65536;case 28:return 32768;case 44:return 32767;case 75:return 16384;case 39:return 1e3;case 89:return 700;case
71:return 256;case 40:return 255;case 2:return 100;case 180:return 64;case 25:return 20;case 5:return 16;case
6:return 6;case 73:return 4;case 84:{if(typeof navigator===\"object\")return
navigator[\"hardwareConcurrency\"]||1;return 1}}setErrNo(28);return-
1}if(!ENVIRONMENT_IS_PTHREAD)PThread.initMainThreadBlock();var GLctx;var
proxiedFunctionTable=[null,_atexit,_emscripten_set_canvas_element_size_main_thread,_fd_close,_fd_seek,_fd_wr
ite,_sysconf];var
asmLibraryArg={\"e\":__assert_fail,\"r\":__call_main,\"x\":_emscripten_notify_thread_queue,\"b\":_abort,\"y\":
_emscripten_asm_const_int,\"j\":_emscripten_conditional_set_current_thread_status,\"d\":_emscripten_futex_wait,\"
c\":_emscripten_futex_wake,\"f\":_emscripten_get_now,\"p\":_emscripten_memcpy_big,\"A\":_emscripten_num_l
ogical_cores,\"u\":_emscripten_receive_on_main_thread_js,\"q\":_emscripten_resize_heap,\"v\":_emscripten_set_ca
nvas_element_size,\"i\":_emscripten_set_current_thread_status,\"s\":_emscripten_set_thread_name,\"w\":_emscript
en_webgl_create_context,\"l\":_fd_close,\"n\":_fd_seek,\"g\":_fd_write,\"o\":initPthreadsJS,\"a\":wasmMemory|Mo
dule[\"wasmMemory\"],\"z\":_pthread_cleanup_pop,\"k\":_pthread_cleanup_push,\"h\":_pthread_create,\"m\":_pthr
ead_join,\"t\":_sysconf};var asm=createWasm();var
__wasm_call_ctors=Module[\"__wasm_call_ctors\"]=function(){return(__wasm_call_ctors=Module[\"__wasm

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_call_ctors"]=Module["asm"]["B").apply(null,arguments));var
_init=Module["_init"]=function(){return(_init=Module["_init"]=Module["asm"]["C").apply(null,arguments));
var
_init_with_threads_count=Module["_init_with_threads_count"]=function(){return(_init_with_threads_count=Module["_init_with_threads_count"]=Module["asm"]["D").apply(null,arguments));var
_get_threads_count=Module["_get_threads_count"]=function(){return(_get_threads_count=Module["_get_threads_count"]=Module["asm"]["E").apply(null,arguments));var
_register_tensor=Module["_register_tensor"]=function(){return(_register_tensor=Module["_register_tensor"]=Module["asm"]["F").apply(null,arguments));var
_dispose_data=Module["_dispose_data"]=function(){return(_dispose_data=Module["_dispose_data"]=Module["asm"]["G").apply(null,arguments));var
_dispose=Module["_dispose"]=function(){return(_dispose=Module["_dispose"]=Module["asm"]["H").apply(null,arguments));var
_Abs=Module["_Abs"]=function(){return(_Abs=Module["_Abs"]=Module["asm"]["J").apply(null,arguments));var
_Add=Module["_Add"]=function(){return(_Add=Module["_Add"]=Module["asm"]["K").apply(null,arguments));var
_AddN=Module["_AddN"]=function(){return(_AddN=Module["_AddN"]=Module["asm"]["L").apply(null,arguments));var
_All=Module["_All"]=function(){return(_All=Module["_All"]=Module["asm"]["M").apply(null,arguments));var
_Any=Module["_Any"]=function(){return(_Any=Module["_Any"]=Module["asm"]["N").apply(null,arguments));var
_ArgMax=Module["_ArgMax"]=function(){return(_ArgMax=Module["_ArgMax"]=Module["asm"]["O").apply(null,arguments));var
_AvgPool=Module["_AvgPool"]=function(){return(_AvgPool=Module["_AvgPool"]=Module["asm"]["P").apply(null,arguments));var
_BatchMatMul=Module["_BatchMatMul"]=function(){return(_BatchMatMul=Module["_BatchMatMul"]=Module["asm"]["Q").apply(null,arguments));var
_Ceil=Module["_Ceil"]=function(){return(_Ceil=Module["_Ceil"]=Module["asm"]["R").apply(null,arguments));var
_ClipByValue=Module["_ClipByValue"]=function(){return(_ClipByValue=Module["_ClipByValue"]=Module["asm"]["S").apply(null,arguments));var
_Conv2D=Module["_Conv2D"]=function(){return(_Conv2D=Module["_Conv2D"]=Module["asm"]["T").apply(null,arguments));var
_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=function(){return(_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=Module["asm"]["U").apply(null,arguments));var
_Cos=Module["_Cos"]=function(){return(_Cos=Module["_Cos"]=Module["asm"]["V").apply(null,arguments));var
_Cosh=Module["_Cosh"]=function(){return(_Cosh=Module["_Cosh"]=Module["asm"]["W").apply(null,arguments));var
_CropAndResize=Module["_CropAndResize"]=function(){return(_CropAndResize=Module["_CropAndResize"]=Module["asm"]["X").apply(null,arguments));var
_Cumsum=Module["_Cumsum"]=function(){return(_Cumsum=Module["_Cumsum"]=Module["asm"]["Y").apply(null,arguments));var
_DepthToSpace=Module["_DepthToSpace"]=function(){return(_DepthToSpace=Module["_DepthToSpace"]=Module["asm"]["Z").apply(null,arguments));var

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_DeepwiseConv2dNative=Module["_DeepwiseConv2dNative"]=function(){return(_DeepwiseConv2dNative=Module["_DeepwiseConv2dNative"]=Module["asm"][["_"]]).apply(null,arguments)};var
_Elu=Module["_Elu"]=function(){return(_Elu=Module["_Elu"]=Module["asm"][["$"]]).apply(null,arguments)};var
_Equal=Module["_Equal"]=function(){return(_Equal=Module["_Equal"]=Module["asm"][["aa"]]).apply(null,arguments)};var
_Exp=Module["_Exp"]=function(){return(_Exp=Module["_Exp"]=Module["asm"][["ba"]]).apply(null,arguments)};var
_FlipLeftRight=Module["_FlipLeftRight"]=function(){return(_FlipLeftRight=Module["_FlipLeftRight"]=Module["asm"][["ca"]]).apply(null,arguments)};var
_Floor=Module["_Floor"]=function(){return(_Floor=Module["_Floor"]=Module["asm"][["da"]]).apply(null,arguments)};var
_FloorDiv=Module["_FloorDiv"]=function(){return(_FloorDiv=Module["_FloorDiv"]=Module["asm"][["ea"]]).apply(null,arguments)};var
_FusedBatchNorm=Module["_FusedBatchNorm"]=function(){return(_FusedBatchNorm=Module["_FusedBatchNorm"]=Module["asm"][["fa"]]).apply(null,arguments)};var
_FusedConv2D=Module["_FusedConv2D"]=function(){return(_FusedConv2D=Module["_FusedConv2D"]=Module["asm"][["ga"]]).apply(null,arguments)};var
_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=function(){return(_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=Module["asm"][["ha"]]).apply(null,arguments)};var
_Gather=Module["_Gather"]=function(){return(_Gather=Module["_Gather"]=Module["asm"][["ia"]]).apply(null,arguments)};var
_GatherNd=Module["_GatherNd"]=function(){return(_GatherNd=Module["_GatherNd"]=Module["asm"][["ja"]]).apply(null,arguments)};var
_Greater=Module["_Greater"]=function(){return(_Greater=Module["_Greater"]=Module["asm"][["ka"]]).apply(null,arguments)};var
_GreaterEqual=Module["_GreaterEqual"]=function(){return(_GreaterEqual=Module["_GreaterEqual"]=Module["asm"][["la"]]).apply(null,arguments)};var
_LeakyRelu=Module["_LeakyRelu"]=function(){return(_LeakyRelu=Module["_LeakyRelu"]=Module["asm"][["ma"]]).apply(null,arguments)};var
_Less=Module["_Less"]=function(){return(_Less=Module["_Less"]=Module["asm"][["na"]]).apply(null,arguments)};var
_LessEqual=Module["_LessEqual"]=function(){return(_LessEqual=Module["_LessEqual"]=Module["asm"][["oa"]]).apply(null,arguments)};var
_Log=Module["_Log"]=function(){return(_Log=Module["_Log"]=Module["asm"][["pa"]]).apply(null,arguments)};var
_LogicalAnd=Module["_LogicalAnd"]=function(){return(_LogicalAnd=Module["_LogicalAnd"]=Module["asm"][["qa"]]).apply(null,arguments)};var
_Max=Module["_Max"]=function(){return(_Max=Module["_Max"]=Module["asm"][["ra"]]).apply(null,arguments)};var
_MaxPool=Module["_MaxPool"]=function(){return(_MaxPool=Module["_MaxPool"]=Module["asm"][["sa"]]).apply(null,arguments)};var
_Maximum=Module["_Maximum"]=function(){return(_Maximum=Module["_Maximum"]=Module["asm"][["ta"]]).apply(null,arguments)};var
_Mean=Module["_Mean"]=function(){return(_Mean=Module["_Mean"]=Module["asm"][["ua"]]).apply(null,arguments)};var
_Min=Module["_Min"]=function(){return(_Min=Module["_Min"]=Module["asm"][["va"]]).apply(null,arguments)};var

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_Minimum=Module["_Minimum"]=function(){return(_Minimum=Module["_Minimum"]=Module["asm"][["wa
"]).apply(null,arguments));var
_MirrorPad=Module["_MirrorPad"]=function(){return(_MirrorPad=Module["_MirrorPad"]=Module["asm"][["x
a")]).apply(null,arguments));var
_Multiply=Module["_Multiply"]=function(){return(_Multiply=Module["_Multiply"]=Module["asm"][["ya")]).a
pply(null,arguments));var
_Neg=Module["_Neg"]=function(){return(_Neg=Module["_Neg"]=Module["asm"][["za")]).apply(null,argumen
ts));var
_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=function(){return(_NonMaxSuppressionV3=Mod
ule["_NonMaxSuppressionV3"]=Module["asm"][["Aa")]).apply(null,arguments));var
_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=function(){return(_NonMaxSuppressionV4=Mod
ule["_NonMaxSuppressionV4"]=Module["asm"][["Ba")]).apply(null,arguments));var
_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=function(){return(_NonMaxSuppressionV5=Mod
ule["_NonMaxSuppressionV5"]=Module["asm"][["Ca")]).apply(null,arguments));var
_NotEqual=Module["_NotEqual"]=function(){return(_NotEqual=Module["_NotEqual"]=Module["asm"][["Da"
])).apply(null,arguments));var
_OneHot=Module["_OneHot"]=function(){return(_OneHot=Module["_OneHot"]=Module["asm"][["Ea")]).apl
y(null,arguments));var
_PadV2=Module["_PadV2"]=function(){return(_PadV2=Module["_PadV2"]=Module["asm"][["Fa")]).apply(nu
ll,arguments));var
_Pow=Module["_Pow"]=function(){return(_Pow=Module["_Pow"]=Module["asm"][["Ga")]).apply(null,argume
nts));var
_Prelu=Module["_Prelu"]=function(){return(_Prelu=Module["_Prelu"]=Module["asm"][["Ha")]).apply(null,arg
uments));var
_Prod=Module["_Prod"]=function(){return(_Prod=Module["_Prod"]=Module["asm"][["Ia")]).apply(null,argum
ents));var
_RealDiv=Module["_RealDiv"]=function(){return(_RealDiv=Module["_RealDiv"]=Module["asm"][["Ja")]).app
ly(null,arguments));var
_Relu=Module["_Relu"]=function(){return(_Relu=Module["_Relu"]=Module["asm"][["Ka")]).apply(null,argum
ents));var
_Relu6=Module["_Relu6"]=function(){return(_Relu6=Module["_Relu6"]=Module["asm"][["La")]).apply(null,a
rguments));var
_ResizeBilinear=Module["_ResizeBilinear"]=function(){return(_ResizeBilinear=Module["_ResizeBilinear"]=Mo
dule["asm"][["Ma")]).apply(null,arguments));var
_Reverse=Module["_Reverse"]=function(){return(_Reverse=Module["_Reverse"]=Module["asm"][["Na")]).app
ly(null,arguments));var
_RotateWithOffset=Module["_RotateWithOffset"]=function(){return(_RotateWithOffset=Module["_RotateWith
Offset"]=Module["asm"][["Oa")]).apply(null,arguments));var
_Round=Module["_Round"]=function(){return(_Round=Module["_Round"]=Module["asm"][["Pa")]).apply(nul
l,arguments));var
_Rsqrt=Module["_Rsqrt"]=function(){return(_Rsqrt=Module["_Rsqrt"]=Module["asm"][["Qa")]).apply(null,arg
uments));var
_ScatterNd=Module["_ScatterNd"]=function(){return(_ScatterNd=Module["_ScatterNd"]=Module["asm"][["Ra
")]).apply(null,arguments));var
_SelectV2=Module["_SelectV2"]=function(){return(_SelectV2=Module["_SelectV2"]=Module["asm"][["Sa")]).
apply(null,arguments));var
_Sigmoid=Module["_Sigmoid"]=function(){return(_Sigmoid=Module["_Sigmoid"]=Module["asm"][["Ta")]).ap
ply(null,arguments));var

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_Sin=Module["_Sin"]=function(){return(_Sin=Module["_Sin"]=Module["asm"][_"Ua"]).apply(null,arguments)
};var
_Softmax=Module["_Softmax"]=function(){return(_Softmax=Module["_Softmax"]=Module["asm"][_"Va"]).a
pply(null,arguments)};var
_Sqrt=Module["_Sqrt"]=function(){return(_Sqrt=Module["_Sqrt"]=Module["asm"][_"Wa"]).apply(null,argume
nts)};var
_Square=Module["_Square"]=function(){return(_Square=Module["_Square"]=Module["asm"][_"Xa"]).apply(n
ull,arguments)};var
_SquaredDifference=Module["_SquaredDifference"]=function(){return(_SquaredDifference=Module["_Squared
Difference"]=Module["asm"][_"Ya"]).apply(null,arguments)};var
_Step=Module["_Step"]=function(){return(_Step=Module["_Step"]=Module["asm"][_"Za"]).apply(null,argume
nts)};var
_StridedSlice=Module["_StridedSlice"]=function(){return(_StridedSlice=Module["_StridedSlice"]=Module["as
m"][_"a"]).apply(null,arguments)};var
_Sub=Module["_Sub"]=function(){return(_Sub=Module["_Sub"]=Module["asm"][_"$a"]).apply(null,argument
s)};var
_Sum=Module["_Sum"]=function(){return(_Sum=Module["_Sum"]=Module["asm"][_"ab"]).apply(null,argume
nts)};var
_Tan=Module["_Tan"]=function(){return(_Tan=Module["_Tan"]=Module["asm"][_"bb"]).apply(null,argument
s)};var
_Tanh=Module["_Tanh"]=function(){return(_Tanh=Module["_Tanh"]=Module["asm"][_"cb"]).apply(null,argu
ments)};var
_Tile=Module["_Tile"]=function(){return(_Tile=Module["_Tile"]=Module["asm"][_"db"]).apply(null,argument
s)};var
_TopK=Module["_TopK"]=function(){return(_TopK=Module["_TopK"]=Module["asm"][_"eb"]).apply(null,ar
guments)};var
_Transform=Module["_Transform"]=function(){return(_Transform=Module["_Transform"]=Module["asm"][_"f
b"]).apply(null,arguments)};var
_Transpose=Module["_Transpose"]=function(){return(_Transpose=Module["_Transpose"]=Module["asm"][_"g
b"]).apply(null,arguments)};var
__FusedMatMul=Module["__FusedMatMul"]=function(){return(__FusedMatMul=Module["__FusedMatMul"]=
Module["asm"][_"hb"]).apply(null,arguments)};var
_malloc=Module["_malloc"]=function(){return(_malloc=Module["_malloc"]=Module["asm"][_"ib"]).apply(nul
l,arguments)};var
_free=Module["_free"]=function(){return(_free=Module["_free"]=Module["asm"][_"jb"]).apply(null,arguments
)};var
__errno_location=Module["__errno_location"]=function(){return(__errno_location=Module["__errno_locati
on"]=Module["asm"][_"kb"]).apply(null,arguments)};var
_emscripten_get_global_libc=Module["_emscripten_get_global_libc"]=function(){return(_emscripten_get_global
_libc=Module["_emscripten_get_global_libc"]=Module["asm"][_"lb"]).apply(null,arguments)};var
_pthread_self=Module["_pthread_self"]=function(){return(_pthread_self=Module["_pthread_self"]=Module["as
m"][_"mb"]).apply(null,arguments)};var
__pthread_tsd_run_dtors=Module["__pthread_tsd_run_dtors"]=function(){return(__pthread_tsd_run_dtors=M
odule["__pthread_tsd_run_dtors"]=Module["asm"][_"nb"]).apply(null,arguments)};var
_emscripten_main_thread_process_queued_calls=Module["_emscripten_main_thread_process_queued_calls"]=fu
nction(){return(_emscripten_main_thread_process_queued_calls=Module["_emscripten_main_thread_process_que
ued_calls"]=Module["asm"][_"ob"]).apply(null,arguments)};var
_emscripten_current_thread_process_queued_calls=Module["_emscripten_current_thread_process_queued_calls"]

```



```

=function(){return(_emscripten_current_thread_process_queued_calls=Module[\"_emscripten_current_thread_proc
ess_queued_calls\"]=Module[\"asm\"][\"pb\"]).apply(null,arguments)};var
_emscripten_register_main_browser_thread_id=Module[\"_emscripten_register_main_browser_thread_id\"]=functi
on(){return(_emscripten_register_main_browser_thread_id=Module[\"_emscripten_register_main_browser_thread_
id\"]=Module[\"asm\"][\"qb\"]).apply(null,arguments)};var
_emscripten_main_browser_thread_id=Module[\"_emscripten_main_browser_thread_id\"]=function(){return(_ems
cripten_main_browser_thread_id=Module[\"_emscripten_main_browser_thread_id\"]=Module[\"asm\"][\"rb\"]).app
ly(null,arguments)};var
__emscripten_do_dispatch_to_thread=Module[\"__emscripten_do_dispatch_to_thread\"]=function(){return(__ems
cripten_do_dispatch_to_thread=Module[\"__emscripten_do_dispatch_to_thread\"]=Module[\"asm\"][\"sb\"]).apply(n
ull,arguments)};var
_emscripten_sync_run_in_main_thread_4=Module[\"_emscripten_sync_run_in_main_thread_4\"]=function(){retur
n(_emscripten_sync_run_in_main_thread_4=Module[\"_emscripten_sync_run_in_main_thread_4\"]=Module[\"asm\
\"][\"tb\"]).apply(null,arguments)};var
_emscripten_run_in_main_runtime_thread_js=Module[\"_emscripten_run_in_main_runtime_thread_js\"]=function(
){return(_emscripten_run_in_main_runtime_thread_js=Module[\"_emscripten_run_in_main_runtime_thread_js\"]=
Module[\"asm\"][\"ub\"]).apply(null,arguments)};var
__emscripten_call_on_thread=Module[\"__emscripten_call_on_thread\"]=function(){return(__emscripten_call_on_t
hread=Module[\"__emscripten_call_on_thread\"]=Module[\"asm\"][\"vb\"]).apply(null,arguments)};var
_emscripten_tls_init=Module[\"_emscripten_tls_init\"]=function(){return(_emscripten_tls_init=Module[\"_emscri
pten_tls_init\"]=Module[\"asm\"][\"wb\"]).apply(null,arguments)};var
__emscripten_thread_init=Module[\"__emscripten_thread_init\"]=function(){return(__emscripten_thread_init=Mod
ule[\"__emscripten_thread_init\"]=Module[\"asm\"][\"xb\"]).apply(null,arguments)};var
stackSave=Module[\"stackSave\"]=function(){return(stackSave=Module[\"stackSave\"]=Module[\"asm\"][\"yb\"]).a
pply(null,arguments)};var
stackRestore=Module[\"stackRestore\"]=function(){return(stackRestore=Module[\"stackRestore\"]=Module[\"asm\
\"][\"zb\"]).apply(null,arguments)};var
stackAlloc=Module[\"stackAlloc\"]=function(){return(stackAlloc=Module[\"stackAlloc\"]=Module[\"asm\"][\"Ab\
\"]).apply(null,arguments)};var
_emscripten_stack_set_limits=Module[\"_emscripten_stack_set_limits\"]=function(){return(_emscripten_stack_set_
limits=Module[\"_emscripten_stack_set_limits\"]=Module[\"asm\"][\"Bb\"]).apply(null,arguments)};var
_memalign=Module[\"_memalign\"]=function(){return(_memalign=Module[\"_memalign\"]=Module[\"asm\"][\"Cb
\"]).apply(null,arguments)};var
__emscripten_allow_main_runtime_queued_calls=Module[\"__emscripten_allow_main_runtime_queued_calls\"]=1
0512;var
__emscripten_main_thread_futex=Module[\"__emscripten_main_thread_futex\"]=12148;Module[\"cwrap\"]=cwrap
;Module[\"PThread\"]=PThread;Module[\"PThread\"]=PThread;Module[\"wasmMemory\"]=wasmMemory;Module
[\"ExitStatus\"]=ExitStatus;var
calledRun;function ExitStatus(status){this.name=\"ExitStatus\";this.message=\"Program terminated with
exit(\"+status+\")\";this.status=status}dependenciesFulfilled=function
runCaller(){if(!calledRun)run();if(!calledRun)dependenciesFulfilled=runCaller};function
run(args){args=args||arguments_;if(runDependencies>0){return}if(ENVIRONMENT_IS_PTHREAD){readyPromis
eResolve(Module);initRuntime();postMessage({\"cmd\": \"loaded\"});return}preRun();if(runDependencies>0){retur
n}function
doRun(){if(calledRun)return;calledRun=true;Module[\"calledRun\"]=true;if(ABORT)return;initRuntime();preMain(
);readyPromiseResolve(Module);if(Module[\"onRuntimeInitialized\"])Module[\"onRuntimeInitialized\"]();postRun(
)}if(Module[\"setStatus\"])Module[\"setStatus\"](\"Running...\");setTimeout(function(){setTimeout(function(){Mo
dule[\"setStatus\"](\" \"),1});doRun(),1)}else{doRun()}}Module[\"run\"]=run;function

```

```

exit(status,implicit){if(implicit&&noExitRuntime&&status===0){return}if(!implicit){if(ENVIRONMENT_IS_PT
HREAD){postMessage({"cmd":"exitProcess","returnCode":status});throw
new
ExitStatus(status)}else{}if(noExitRuntime){}else{PThread.terminateAllThreads();EXITSTATUS=status;exitRunti
me();if(Module["onExit"])Module["onExit"](status);ABORT=true}quit_(status,new
ExitStatus(status))}if(Module["preInit"]){if(typeof
Module["preInit"]!="function")Module["preInit"]=[Module["preInit"]];while(Module["preInit"].length>0){
Module["preInit"].pop()}if(ENVIRONMENT_IS_PTHREAD){noExitRuntime=false;PThread.initWorker()}run
();\n\n\nreturnWasmBackendModuleThreadedSimd.ready\n\n\n);nif(typeofexports==='object'&&typeof
module==='object')\nmodule.exports=WasmBackendModuleThreadedSimd;\nelseif(typeofdefine==='
'function'&&define['amd'])\ndefine([],function(){returnWasmBackendModuleThreadedSimd;});\nelseif
(typeofexports==='object')\nexports["WasmBackendModuleThreadedSimd"]
=WasmBackendModuleThreadedSimd;\n","exportconstwasmWorkerContents='varModule={};function
threadPrintErr(){vartext=Array.prototype.slice.call(arguments).join(" ");console.error(text)}function
threadAlert(){vartext=Array.prototype.slice.call(arguments).join("
");postMessage({"cmd":"alert",text:text,threadId:Module["_pthread_self"]})}}var
err=threadPrintErr;this.alert=threadAlert;Module["instantiateWasm"]=function(info,receiveInstance){var
instance=new
WebAssembly.Instance(Module["wasmModule"],info);Module["wasmModule"]=null;receiveInstance(instance);r
eturninstance.exports};function
moduleLoaded(){this.onmessage=function(e){try{if(e.data.cmd==="load"){Module["wasmModule"]=e.data.wa
smModule;Module["wasmMemory"]=e.data.wasmMemory;Module["buffer"]=Module["wasmMemory"].buffer;
Module["ENVIRONMENT_IS_PTHREAD"]=true;if(typeof
e.data.urlOrBlob==="string"){importScripts(e.data.urlOrBlob)}else{var
objectUrl=URL.createObjectURL(e.data.urlOrBlob);importScripts(objectUrl);URL.revokeObjectURL(objectUrl)}
WasmBackendModuleThreadedSimd(Module).then(function(instance){Module=instance;moduleLoaded()})}else
if(e.data.cmd==="objectTransfer"){Module["PThread"].receiveObjectTransfer(e.data)}else
if(e.data.cmd==="run"){Module["__performance_now_clock_drift"]=performance.now()-
e.data.time;Module["__emscripten_thread_init"](e.data.threadInfoStruct,0,0);varmax=e.data.stackBase;var
top=e.data.stackBase+e.data.stackSize;Module["establishStackSpace"](top,max);Module["emscripten_tls_init"](
);Module["PThread"].receiveObjectTransfer(e.data);Module["PThread"].setThreadStatus(Module["_pthread_self
"],1);try{var
result=Module["invokeEntryPoint"](e.data.start_routine,e.data.arg);if(!Module["getNoExitRuntime"]())Module["
PThread"].threadExit(result)}catch(ex){if(ex==="Canceled!"){Module["PThread"].threadCancel()}else
if(ex!="unwind"){if(exinstanceof
Module["ExitStatus"]){if(Module["getNoExitRuntime"]()){}else{Module["PThread"].threadExit(ex.status)}}el
se{Module["PThread"].threadExit(-2);throw
ex}}}}else
if(e.data.cmd==="cancel"){if(Module["_pthread_self"]){Module["PThread"].threadCancel()}else
if(e.data.target==="setimmediate"){}else
if(e.data.cmd==="processThreadQueue"){if(Module["_pthread_self"]){Module["emscripten_current_thread_
process_queued_calls"]()}else{err("worker.jsreceivedunknowncommand
"+e.data.cmd);err(e.data)}}catch(ex){err("worker.js onmessage() captured an uncaught exception:
"+ex);if(ex&&ex.stack)err(ex.stack);throwex}};if(typeofprocess==="object"&&typeof
process.versions==="object"&&typeofprocess.versions.node==="string"){self={location:{href:__filename}};var
onmessage=this.onmessage;var
nodeWorkerThreads=require("worker_threads");global.Worker=nodeWorkerThreads.Worker;var
parentPort=nodeWorkerThreads.parentPort;parentPort.on("message",function(data){onmessage({data:data})});var

```

```

nodeFS=require("\fs");var nodeRead=function(filename){return
nodeFS.readFileSync(filename,"\utf8");};function
globalEval(x){global.require=require;global.Module=Module;eval.call(null,x)}importScripts=function(f){globalEval
(nodeRead(f));postMessage=function(msg){parentPort.postMessage(msg)};if(typeof
performance===\undefined\){performance={now:function(){return Date.now()}}};"\nvar
WasmBackendModule = (function() {\n var __scriptDir = typeof document !== 'undefined' &&
document.currentScript ? document.currentScript.src : undefined;\n if (typeof __filename !== 'undefined')
__scriptDir = __scriptDir || __filename;\n return (\nfunction(WasmBackendModule) {\n WasmBackendModule =
WasmBackendModule || {};\n\nvar Module=typeof
WasmBackendModule!=="undefined"?WasmBackendModule: {} ;var
readyPromiseResolve,readyPromiseReject;Module["ready"]=new
Promise(function(resolve,reject){readyPromiseResolve=resolve;readyPromiseReject=reject});var
moduleOverrides={};var key;for(key in
Module){if(Module.hasOwnProperty(key)){moduleOverrides[key]=Module[key]}}var
arguments_=[];var thisProgram=\.this.program\.;var quit_=function(status,toThrow){throw toThrow};var
ENVIRONMENT_IS_WEB=false;var ENVIRONMENT_IS_WORKER=false;var
ENVIRONMENT_IS_NODE=false;var ENVIRONMENT_IS_SHELL=false;ENVIRONMENT_IS_WEB=typeof
window===\object\;ENVIRONMENT_IS_WORKER=typeof
importScripts===\function\;ENVIRONMENT_IS_NODE=typeof process===\object\&&typeof
process.versions===\object\&&typeof
process.versions.node===\string\;ENVIRONMENT_IS_SHELL=!ENVIRONMENT_IS_WEB&&!ENVIRONM
ENT_IS_NODE&&!ENVIRONMENT_IS_WORKER;var scriptDirectory=\.;\nfunction
locateFile(path){if(Module["locateFile"]){return Module["locateFile"](path,scriptDirectory)}return
scriptDirectory+path}var read_,readAsync,readBinary,setWindowTitle;var nodeFS;var
nodePath;if(ENVIRONMENT_IS_NODE){if(ENVIRONMENT_IS_WORKER){scriptDirectory=require("\path\").
dirname(scriptDirectory)+\^\}else{scriptDirectory=__dirname+\^\}read_=function
shell_read(filename,binary){if(!nodeFS)nodeFS=require("\fs");if(!nodePath)nodePath=require("\path");filename=n
odePath["normalize\"](filename);return
nodeFS["readFileSync\"](filename,binary?null:\utf8);};readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret};if(process["argv"].length>1){thisProgram=process["argv"][1].replace(/\\/g,\^)}arguments_=process["arg
v"].slice(2);process["on\"](\uncaughtException",function(ex){if(!(ex instanceof ExitStatus)){throw
ex}});process["on\"](\unhandledRejection",abort);quit_=function(status){process["exit\"](status)};Module["inSp
ect"]=function(){return"[Emscripten Module object]"};else if(ENVIRONMENT_IS_SHELL){if(typeof
read!=="undefined"){read_=function shell_read(f){return read(f)};readBinary=function readBinary(f){var
data;if(typeof readbuffer===\function\){return new
Uint8Array(readbuffer(f))}data=read(f,\binary");assert(typeof data===\object");return data};if(typeof
scriptArgs!="undefined"){arguments_=scriptArgs}else
if(typeof arguments!="undefined"){arguments_=arguments}if(typeof
quit===\function\){quit_=function(status){quit(status)}}if(typeof print!=="undefined"){if(typeof
console===\undefined\){console={};console.log=print;console.warn=console.error=typeof
printErr!="undefined"?printErr:print}}else
if(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER){if(ENVIRONMENT_IS_WORKER){scriptDire
ctory=self.location.href}else if(typeof
document!=="undefined"&&document.currentScript){scriptDirectory=document.currentScript.src}if(__scriptDir){s
criptDirectory=__scriptDir;if(scriptDirectory.indexOf(\blob:\")==0){scriptDirectory=scriptDirectory.substr(0,script
Directory.lastIndexOf(\^")+1)}else{scriptDirectory=\.}}read_=function(url){var xhr=new
XMLHttpRequest;xhr.open(\GET",url,false);xhr.send(null);return

```

```

xhr.responseText};if(ENVIRONMENT_IS_WORKER){readBinary=function(url){var xhr=new
XMLHttpRequest;xhr.open("\GET",url,false);xhr.responseType="arraybuffer";xhr.send(null);return
new Uint8Array(xhr.response)}}readAsync=function(url,onload,onerror){var xhr=new
XMLHttpRequest;xhr.open("\GET",url,true);xhr.responseType="arraybuffer";xhr.onload=function(){if(xhr.status
==200||xhr.status==0&&xhr.response){onload(xhr.response);return}onerror()};xhr.onerror=onerror;xhr.send(null)}
}setWindowTitle=function(title){document.title=title} }else{ }var
out=Module["print"]||console.log.bind(console);var err=Module["printErr"]||console.warn.bind(console);for(key
in
moduleOverrides){if(moduleOverrides.hasOwnProperty(key)){Module[key]=moduleOverrides[key]} }moduleOverr
ides=null;if(Module["arguments"])arguments_=Module["arguments"];if(Module["thisProgram"])thisProgram=
Module["thisProgram"];if(Module["quit"])quit_=Module["quit"];var
wasmBinary;if(Module["wasmBinary"])wasmBinary=Module["wasmBinary"];var
noExitRuntime=Module["noExitRuntime"]||true;if(typeof WebAssembly!="object"){abort("no native wasm
support detected")}var wasmMemory;var
ABORT=false;var EXITSTATUS;function assert(condition,text){if(!condition){abort("Assertion failed:
"+text)}}function getCFunc(ident){var func=Module["_"+ident];assert(func,"Cannot call unknown function
"+ident+", make sure it is exported");return func}function ccall(ident,returnType,argTypes,args,opts){var
toC={"string":function(str){var ret=0;if(str==null&&str==undefined&&str==0){var
len=(str.length<<2)+1;ret=stackAlloc(len);stringToUTF8(str,ret,len)}return ret},"array":function(arr){var
ret=stackAlloc(arr.length);writeArrayToMemory(arr,ret);return ret}};function
convertReturnValue(ret){if(returnType=="string")return UTF8ToString(ret);if(returnType=="boolean")return
Boolean(ret);return ret}var func=getCFunc(ident);var cArgs=[];var stack=0;if(args){for(var
i=0;i<args.length;i++){var
converter=toC[argTypes[i]];if(converter){if(stack==0)stack=stackSave();cArgs[i]=converter(args[i])}else{cArgs[i
]=args[i]}}var ret=func.apply(null,cArgs);ret=convertReturnValue(ret);if(stack!=0)stackRestore(stack);return
ret}function cwrap(ident,returnType,argTypes,opts){argTypes=argTypes||[];var
numericArgs=argTypes.every(function(type){return type=="number"});var
numericRet=returnType!="string";if(numericRet&&numericArgs&&!opts){return getCFunc(ident)}return
function(){return ccall(ident,returnType,argTypes,arguments,opts)} }var UTF8Decoder=typeof
TextDecoder!="undefined"?new TextDecoder("utf8"):undefined;function
UTF8ArrayToString(heap,idx,maxBytesToRead){var endIdx=idx+maxBytesToRead;var
endPtr=idx;while(heap[endPtr]&&!(endPtr>=endIdx))++endPtr;if(endPtr-
idx>16&&heap.subarray&&UTF8Decoder){return UTF8Decoder.decode(heap.subarray(idx,endPtr))}else{var
str="";while(idx<endPtr){var u0=heap[idx++];if(!(u0&128)){str+=String.fromCharCode(u0);continue}var
u1=heap[idx++]&63;if((u0&224)==192){str+=String.fromCharCode((u0&31)<<6|u1);continue}var
u2=heap[idx++]&63;if((u0&240)==224){u0=(u0&15)<<12|u1<<6|u2}else{u0=(u0&7)<<18|u1<<12|u2<<6|heap[id
x++]&63}if(u0<65536){str+=String.fromCharCode(u0)}else{var
ch=u0-65536;str+=String.fromCharCode(55296|ch>>10,56320|ch&1023)}}return str}function
UTF8ToString(ptr,maxBytesToRead){return
ptr?UTF8ArrayToString(HEAPU8,ptr,maxBytesToRead):""}function
stringToUTF8Array(str,heap,outIdx,maxBytesToWrite){if(!(maxBytesToWrite>0))return 0;var startIdx=outIdx;var
endIdx=outIdx+maxBytesToWrite-1;for(var i=0;i<str.length;++i){var
u=str.charCodeAtAt(i);if(u>=55296&&u<=57343){var
u1=str.charCodeAtAt(++i);u=65536+((u&1023)<<10|u1&1023)}if(u<=127){if(outIdx>=endIdx)break;heap[outIdx++]
=u}else if(u<=2047){if(outIdx+1>=endIdx)break;heap[outIdx++]=192|u>>6;heap[outIdx++]=128|u&63}else
if(u<=65535){if(outIdx+2>=endIdx)break;heap[outIdx++]=224|u>>12;heap[outIdx++]=128|u>>6&63;heap[outIdx
++]=128|u&63}else{if(outIdx+3>=endIdx)break;heap[outIdx++]=240|u>>18;heap[outIdx++]=128|u>>12&63;heap[
outIdx++]=128|u>>6&63;heap[outIdx++]=128|u&63}}heap[outIdx]=0;return outIdx-startIdx}function

```

```

stringToUTF8(str,outPtr,maxBytesToWrite){return
stringToUTF8Array(str,HEAPU8,outPtr,maxBytesToWrite)}function
writeArrayToMemory(array,buffer){HEAP8.set(array,buffer)}function
alignUp(x,multiple){if(x%multiple>0){x+=multiple-x%multiple}return x}var
buffer,HEAP8,HEAPU8,HEAP16,HEAPU16,HEAP32,HEAPU32,HEAPF32,HEAPF64;function
updateGlobalBufferAndViews(buf){buffer=buf;Module["HEAP8"]=HEAP8=new
Int8Array(buf);Module["HEAP16"]=HEAP16=new Int16Array(buf);Module["HEAP32"]=HEAP32=new
Int32Array(buf);Module["HEAPU8"]=HEAPU8=new Uint8Array(buf);Module["HEAPU16"]=HEAPU16=new
Uint16Array(buf);Module["HEAPU32"]=HEAPU32=new
Uint32Array(buf);Module["HEAPF32"]=HEAPF32=new
Float32Array(buf);Module["HEAPF64"]=HEAPF64=new Float64Array(buf)}var
INITIAL_MEMORY=Module["INITIAL_MEMORY"]||16777216;var wasmTable;var __ATPRERUN__=[];var
__ATINIT__=[];var __ATMAIN__=[];var __ATPOSTRUN__=[];var
runtimeInitialized=false;__ATINIT__.push({func:function(){__wasm_call_ctors()}});function
preRun(){if(Module["preRun"]){if(typeof
Module["preRun"]=="function")Module["preRun"]=[Module["preRun"]];while(Module["preRun"].length){a
ddOnPreRun(Module["preRun"].shift())}callRuntimeCallbacks(__ATPRERUN__)}function
initRuntime(){runtimeInitialized=true;callRuntimeCallbacks(__ATINIT__)}function
preMain(){callRuntimeCallbacks(__ATMAIN__)}function postRun(){if(Module["postRun"]){if(typeof
Module["postRun"]=="function")Module["postRun"]=[Module["postRun"]];while(Module["postRun"].lengt
h){addOnPostRun(Module["postRun"].shift())}callRuntimeCallbacks(__ATPOSTRUN__)}function
addOnPreRun(cb){__ATPRERUN__.unshift(cb)}function addOnPostRun(cb){__ATPOSTRUN__.unshift(cb)}var
runDependencies=0;var runDependencyWatcher=null;var dependenciesFulfilled=null;function
addRunDependency(id){runDependencies++;if(Module["monitorRunDependencies"]){Module["monitorRunDep
endencies"](runDependencies)}function removeRunDependency(id){runDependencies--
;if(Module["monitorRunDependencies"]){Module["monitorRunDependencies"](runDependencies)}if(runDepend
encies==0){if(runDependencyWatcher!=null){clearInterval(runDependencyWatcher);runDependencyWatcher=null}
if(dependenciesFulfilled){var
callback=dependenciesFulfilled;dependenciesFulfilled=null;callback()}}Module["preloadedImages"]={};Module
["preloadedAudios"]={};function
abort(what){if(Module["onAbort"]){Module["onAbort"](what)}what+="\n";err(what);ABORT=true;EXITSTAT
US=1;what="abort("+what+"). Build with -s ASSERTIONS=1 for more info.";var e=new
WebAssembly.RuntimeError(what);readyPromiseReject(e);throw e}function hasPrefix(str,prefix){return
String.prototype.startsWith?str.startsWith(prefix):str.indexOf(prefix)===0}var
dataURIPrefix="data:application/octet-stream;base64,";function isDataURI(filename){return
hasPrefix(filename,dataURIPrefix)}var fileURIPrefix="file://";function isFileURI(filename){return
hasPrefix(filename,fileURIPrefix)}var wasmBinaryFile="tfjs-backend-
wasm.wasm";if(!isDataURI(wasmBinaryFile)){wasmBinaryFile=locateFile(wasmBinaryFile)}function
getBinary(file){try{if(file==wasmBinaryFile&&wasmBinary){return new
Uint8Array(wasmBinary)}if(readBinary){return readBinary(file)}else{throw"both async and sync fetching of the
wasm failed"}}catch(err){abort(err)}function
getBinaryPromise(){if(!wasmBinary&&(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER)){if(typeof
fetch==="function"&&!isFileURI(wasmBinaryFile)){return fetch(wasmBinaryFile,{credentials:"same-
origin"}).then(function(response){if(!response["ok"]){throw"failed to load wasm binary file at
"+wasmBinaryFile+""}return response["arrayBuffer"]()).catch(function(){return
getBinary(wasmBinaryFile)})}else{if(readAsync){return new
Promise(function(resolve,reject){readAsync(wasmBinaryFile,function(response){resolve(new
Uint8Array(response))},reject)}))}}return Promise.resolve().then(function(){return

```

```

getBinary(wasmBinaryFile)})function createWasm(){ var info={"a":asmLibraryArg};function
receiveInstance(instance,module){ var
exports=instance.exports;Module["asm"]=exports;wasmMemory=Module["asm"][j];updateGlobalBufferAnd
Views(wasmMemory.buffer);wasmTable=Module["asm"][r];removeRunDependency("wasm-
instantiate")}addRunDependency("wasm-instantiate");function
receiveInstantiatedSource(output){receiveInstance(output["instance"])}function
instantiateArrayBuffer(receiver){return getBinaryPromise().then(function(binary){return
WebAssembly.instantiate(binary,info)).then(receiver,function(reason){err("failed to asynchronously prepare
wasm: "+reason);abort(reason)})}function instantiateAsync(){if(!wasmBinary&&typeof
WebAssembly.instantiateStreaming===function"&&!isDataURI(wasmBinaryFile)&&!isFileURI(wasmBinaryFil
e)&&typeof fetch===function"){return fetch(wasmBinaryFile,{credentials:"same-
origin"}).then(function(response){var result=WebAssembly.instantiateStreaming(response,info);return
result.then(receiveInstantiatedSource,function(reason){err("wasm streaming compile failed: "+reason);err("falling
back to ArrayBuffer
instantiation");return instantiateArrayBuffer(receiveInstantiatedSource)}))}else{return
instantiateArrayBuffer(receiveInstantiatedSource)}if(Module["instantiateWasm"]){try{var
exports=Module["instantiateWasm"](info,receiveInstance);return exports} catch(e){err("Module.instantiateWasm
callback failed with error: "+e);return false}}instantiateAsync().catch(rejectPromise);return{}}function
callRuntimeCallbacks(callbacks){while(callbacks.length>0){var callback=callbacks.shift();if(typeof
callback=="function"){callback(Module);continue}var func=callback.func;if(typeof
func=="number"){if(callback.arg===undefined){wasmTable.get(func)}else{wasmTable.get(func)(callback.arg)
}else{func(callback.arg===undefined?null:callback.arg)}}}function _abort(){abort()}function
_emscripten_memcpy_big(dest,src,num){HEAPU8.copyWithin(dest,src,src+num)}function
_emscripten_get_heap_size(){return HEAPU8.length}function
emscripten_realloc_buffer(size){try{wasmMemory.grow(size-
buffer.byteLength+65535>>>16);updateGlobalBufferAndViews(wasmMemory.buffer);return
1} catch(e){}}function _emscripten_resize_heap(requestedSize){var oldSize=_emscripten_get_heap_size();var
maxHeapSize=2147483648;if(requestedSize>maxHeapSize){return false}for(var
cutDown=1;cutDown<=4;cutDown*=2){var
overGrownHeapSize=oldSize*(1+.2/cutDown);overGrownHeapSize=Math.min(overGrownHeapSize,requestedSize
+100663296);var
newSize=Math.min(maxHeapSize,alignUp(Math.max(requestedSize,overGrownHeapSize),65536));var
replacement=emscripten_realloc_buffer(newSize);if(replacement){return true}}return false}var
SYSCALLS={mappings:{},buffers:[null,[],[]],printChar:function(stream,curr){var
buffer=SYSCALLS.buffers[stream];if(curr===0||curr===10){(stream===1?out:err)(UTF8ArrayToString(buffer,0));
buffer.length=0}else{buffer.push(curr)}},varargs:undefined,get:function(){SYSCALLS.varargs+=4;var
ret=HEAP32[SYSCALLS.varargs-4>>2];return ret},getStr:function(ptr){var ret=UTF8ToString(ptr);return
ret},get64:function(low,high){return
low}};function _fd_close(fd){return 0}function _fd_seek(fd,offset_low,offset_high,whence,newOffset){}function
_fd_write(fd,iov,iovcnt,pnum){var num=0;for(var i=0;i<iovcnt;i++){var ptr=HEAP32[iov+i*8>>2];var
len=HEAP32[iov+(i*8+4)>>2];for(var
j=0;j<len;j++){SYSCALLS.printChar(fd,HEAPU8[ptr+j])}num+=len}HEAP32[pnum>>2]=num;return 0}function
_thread_create(){return 6}function _pthread_join(){return 28}function
setErrNo(value){HEAP32[___errno_location()>>2]=value;return value}function
_sysconf(name){switch(name){case 30:return 16384;case 85:var maxHeapSize=2147483648;return
maxHeapSize/16384;case 132:case 133:case 12:case 137:case 138:case 15:case 235:case 16:case 17:case 18:case
19:case 20:case 149:case 13:case 10:case 236:case 153:case 9:case 21:case 22:case 159:case 154:case 14:case
77:case 78:case 139:case 82:case 68:case 67:case 164:case 11:case 29:case 47:case 48:case 95:case 52:case 51:case

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46:return 200809;case 27:case 246:case 127:case 128:case 23:case 24:case 160:case 161:case
181:case 182:case 242:case 183:case 184:case 243:case 244:case 245:case 165:case 178:case 179:case 49:case
50:case 168:case 169:case 175:case 170:case 171:case 172:case 97:case 76:case 32:case 173:case 35:case 80:case
81:case 79:return-1;case 176:case 177:case 7:case 155:case 8:case 157:case 125:case 126:case 92:case 93:case
129:case 130:case 131:case 94:case 91:return 1;case 74:case 60:case 69:case 70:case 4:return 1024;case 31:case
42:case 72:return 32;case 87:case 26:case 33:return 2147483647;case 34:case 1:return 47839;case 38:case 36:return
99;case 43:case 37:return 2048;case 0:return 2097152;case 3:return 65536;case 28:return 32768;case 44:return
32767;case 75:return 16384;case 39:return 1e3;case 89:return 700;case 71:return 256;case 40:return 255;case
2:return 100;case 180:return 64;case 25:return 20;case 5:return 16;case 6:return 6;case 73:return 4;case 84:{if(typeof
navigator===\"object\")return navigator[\"hardwareConcurrency\"]|1;return 1 } }setErrNo(28);return-1 }var
asmLibraryArg={\"a\":_abort,\"d\":_emscripten_memcpy_big,\"e\":_emscripten_resize_heap,\"f\":_fd_close,\"c\":_f
d_seek,\"b\":_fd_write,\"h\":_pthread_create,\"g\":_pthread_join,\"i\":_sysconf};var
asm=createWasm();var
__wasm_call_ctors=Module[\"__wasm_call_ctors\"]=function(){return(__wasm_call_ctors=Module[\"__wasm
_call_ctors\"]=Module[\"asm\"][\"k\"]).apply(null,arguments)};var
_init=Module[\"_init\"]=function(){return(_init=Module[\"_init\"]=Module[\"asm\"][\"l\"]).apply(null,arguments)};
var
_init_with_threads_count=Module[\"_init_with_threads_count\"]=function(){return(_init_with_threads_count=Mod
ule[\"_init_with_threads_count\"]=Module[\"asm\"][\"m\"]).apply(null,arguments)};var
_get_threads_count=Module[\"_get_threads_count\"]=function(){return(_get_threads_count=Module[\"_get_threads
_count\"]=Module[\"asm\"][\"n\"]).apply(null,arguments)};var
_register_tensor=Module[\"_register_tensor\"]=function(){return(_register_tensor=Module[\"_register_tensor\"]=M
odule[\"asm\"][\"o\"]).apply(null,arguments)};var
_dispose_data=Module[\"_dispose_data\"]=function(){return(_dispose_data=Module[\"_dispose_data\"]=Module[\"
asm\"][\"p\"]).apply(null,arguments)};var
_dispose=Module[\"_dispose\"]=function(){return(_dispose=Module[\"_dispose\"]=Module[\"asm\"][\"q\"]).apply(n
ull,arguments)};var
_Abs=Module[\"_Abs\"]=function(){return(_Abs=Module[\"_Abs\"]=Module[\"asm\"][\"s\"]).apply(null,arguments
)};var
_Add=Module[\"_Add\"]=function(){return(_Add=Module[\"_Add\"]=Module[\"asm\"][\"t\"]).apply(null,argument
s)};var
_AddN=Module[\"_AddN\"]=function(){return(_AddN=Module[\"_AddN\"]=Module[\"asm\"][\"u\"]).apply(null,ar
guments)};var
_All=Module[\"_All\"]=function(){return(_All=Module[\"_All\"]=Module[\"asm\"][\"v\"]).apply(null,arguments)};
var
_Any=Module[\"_Any\"]=function(){return(_Any=Module[\"_Any\"]=Module[\"asm\"][\"w\"]).apply(null,argumen
ts)};var
_ArgMax=Module[\"_ArgMax\"]=function(){return(_ArgMax=Module[\"_ArgMax\"]=Module[\"asm\"][\"x\"]).app
ly(null,arguments)};var
_AvgPool=Module[\"_AvgPool\"]=function(){return(_AvgPool=Module[\"_AvgPool\"]=Module[\"asm\"][\"y\"]).a
pply(null,arguments)};var
_BatchMatMul=Module[\"_BatchMatMul\"]=function(){return(_BatchMatMul=Module[\"_BatchMatMul\"]=Modu
le[\"asm\"][\"z\"]).apply(null,arguments)};var
_Ceil=Module[\"_Ceil\"]=function(){return(_Ceil=Module[\"_Ceil\"]=Module[\"asm\"][\"A\"]).apply(null,argument
s)};var
_ClipByValue=Module[\"_ClipByValue\"]=function(){return(_ClipByValue=Module[\"_ClipByValue\"]=Module[\"
asm\"][\"B\"]).apply(null,arguments)};var
_Conv2D=Module[\"_Conv2D\"]=function(){return(_Conv2D=Module[\"_Conv2D\"]=Module[\"asm\"][\"C\"]).ap

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ply(null,arguments));var
_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=function(){return(_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=Module["asm"]["D"]).apply(null,arguments)};var
_Cos=Module["_Cos"]=function(){return(_Cos=Module["_Cos"]=Module["asm"]["E"]).apply(null,arguments)};var
_Cosh=Module["_Cosh"]=function(){return(_Cosh=Module["_Cosh"]=Module["asm"]["F"]).apply(null,arguments)};var
_CropAndResize=Module["_CropAndResize"]=function(){return(_CropAndResize=Module["_CropAndResize"]=Module["asm"]["G"]).apply(null,arguments)};var
_Cumsum=Module["_Cumsum"]=function(){return(_Cumsum=Module["_Cumsum"]=Module["asm"]["H"]).apply(null,arguments)};var
_DepthToSpace=Module["_DepthToSpace"]=function(){return(_DepthToSpace=Module["_DepthToSpace"]=Module["asm"]["I"]).apply(null,arguments)};var
_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=function(){return(_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=Module["asm"]["J"]).apply(null,arguments)};var
_Elu=Module["_Elu"]=function(){return(_Elu=Module["_Elu"]=Module["asm"]["K"]).apply(null,arguments)};var
_Equal=Module["_Equal"]=function(){return(_Equal=Module["_Equal"]=Module["asm"]["L"]).apply(null,arguments)};var
_Exp=Module["_Exp"]=function(){return(_Exp=Module["_Exp"]=Module["asm"]["M"]).apply(null,arguments)};var
_FlipLeftRight=Module["_FlipLeftRight"]=function(){return(_FlipLeftRight=Module["_FlipLeftRight"]=Module["asm"]["N"]).apply(null,arguments)};var
_Floor=Module["_Floor"]=function(){return(_Floor=Module["_Floor"]=Module["asm"]["O"]).apply(null,arguments)};var
_FloorDiv=Module["_FloorDiv"]=function(){return(_FloorDiv=Module["_FloorDiv"]=Module["asm"]["P"]).apply(null,arguments)};var
_FusedBatchNorm=Module["_FusedBatchNorm"]=function(){return(_FusedBatchNorm=Module["_FusedBatchNorm"]=Module["asm"]["Q"]).apply(null,arguments)};var
_FusedConv2D=Module["_FusedConv2D"]=function(){return(_FusedConv2D=Module["_FusedConv2D"]=Module["asm"]["R"]).apply(null,arguments)};var
_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=function(){return(_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=Module["asm"]["S"]).apply(null,arguments)};var
_Gather=Module["_Gather"]=function(){return(_Gather=Module["_Gather"]=Module["asm"]["T"]).apply(null,arguments)};var
_GatherNd=Module["_GatherNd"]=function(){return(_GatherNd=Module["_GatherNd"]=Module["asm"]["U"]).apply(null,arguments)};var
_Greater=Module["_Greater"]=function(){return(_Greater=Module["_Greater"]=Module["asm"]["V"]).apply(null,arguments)};var
_GreaterEqual=Module["_GreaterEqual"]=function(){return(_GreaterEqual=Module["_GreaterEqual"]=Module["asm"]["W"]).apply(null,arguments)};var
_LeakyRelu=Module["_LeakyRelu"]=function(){return(_LeakyRelu=Module["_LeakyRelu"]=Module["asm"]["X"]).apply(null,arguments)};var
_Less=Module["_Less"]=function(){return(_Less=Module["_Less"]=Module["asm"]["Y"]).apply(null,arguments)};var
_LessEqual=Module["_LessEqual"]=function(){return(_LessEqual=Module["_LessEqual"]=Module["asm"]["Z"]).apply(null,arguments)};var
_Log=Module["_Log"]=function(){return(_Log=Module["_Log"]=Module["asm"]["_"]).apply(null,arguments)};

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});var
_LogicalAnd=Module["_LogicalAnd"]=function(){return(_LogicalAnd=Module["_LogicalAnd"]=Module["asm\"][["$"]).apply(null,arguments));var
_Max=Module["_Max"]=function(){return(_Max=Module["_Max"]=Module["asm\"][["aa"]).apply(null,arguments));var
_MaxPool=Module["_MaxPool"]=function(){return(_MaxPool=Module["_MaxPool"]=Module["asm\"][["ba"]).apply(null,arguments));var
_Maximum=Module["_Maximum"]=function(){return(_Maximum=Module["_Maximum"]=Module["asm\"][["ca"]).apply(null,arguments));var
_Mean=Module["_Mean"]=function(){return(_Mean=Module["_Mean"]=Module["asm\"][["da"]).apply(null,arguments));var
_Min=Module["_Min"]=function(){return(_Min=Module["_Min"]=Module["asm\"][["ea"]).apply(null,arguments));var
_Minimum=Module["_Minimum"]=function(){return(_Minimum=Module["_Minimum"]=Module["asm\"][["fa"]).apply(null,arguments));var
_MirrorPad=Module["_MirrorPad"]=function(){return(_MirrorPad=Module["_MirrorPad"]=Module["asm\"][["ga"]).apply(null,arguments));var
_Multiply=Module["_Multiply"]=function(){return(_Multiply=Module["_Multiply"]=Module["asm\"][["ha"]).apply(null,arguments));var
_Neg=Module["_Neg"]=function(){return(_Neg=Module["_Neg"]=Module["asm\"][["ia"]).apply(null,arguments));var
_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=function(){return(_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=Module["asm\"][["ja"]).apply(null,arguments));var
_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=function(){return(_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=Module["asm\"][["ka"]).apply(null,arguments));var
_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=function(){return(_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=Module["asm\"][["la"]).apply(null,arguments));var
_NotEqual=Module["_NotEqual"]=function(){return(_NotEqual=Module["_NotEqual"]=Module["asm\"][["ma"]).apply(null,arguments));var
_OneHot=Module["_OneHot"]=function(){return(_OneHot=Module["_OneHot"]=Module["asm\"][["na"]).apply(null,arguments));var
_PadV2=Module["_PadV2"]=function(){return(_PadV2=Module["_PadV2"]=Module["asm\"][["oa"]).apply(null,arguments));var
_Pow=Module["_Pow"]=function(){return(_Pow=Module["_Pow"]=Module["asm\"][["pa"]).apply(null,arguments));var
_Prelu=Module["_Prelu"]=function(){return(_Prelu=Module["_Prelu"]=Module["asm\"][["qa"]).apply(null,arguments));var
_Prod=Module["_Prod"]=function(){return(_Prod=Module["_Prod"]=Module["asm\"][["ra"]).apply(null,arguments));var
_RealDiv=Module["_RealDiv"]=function(){return(_RealDiv=Module["_RealDiv"]=Module["asm\"][["sa"]).apply(null,arguments));var
_RelU=Module["_Relu"]=function(){return(_Relu=Module["_Relu"]=Module["asm\"][["ta"]).apply(null,arguments));var
_RelU6=Module["_Relu6"]=function(){return(_Relu6=Module["_Relu6"]=Module["asm\"][["ua"]).apply(null,arguments));var
_ResizeBilinear=Module["_ResizeBilinear"]=function(){return(_ResizeBilinear=Module["_ResizeBilinear"]=Module["asm\"][["va"]).apply(null,arguments));var

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 Reverse=Module["_Reverse"]=function(){return(_Reverse=Module["_Reverse"]=Module["asm"][["wa"]]).apply(
 ly(null,arguments));var
 RotateWithOffset=Module["_RotateWithOffset"]=function(){return(_RotateWithOffset=Module["_RotateWith
 Offset"]=Module["asm"][["xa"]]).apply(null,arguments);var
 Round=Module["_Round"]=function(){return(_Round=Module["_Round"]=Module["asm"][["ya"]]).apply(nul
 l,arguments);var
 Rsqrt=Module["_Rsqrt"]=function(){return(_Rsqrt=Module["_Rsqrt"]=Module["asm"][["za"]]).apply(null,arg
 uments);var
 ScatterNd=Module["_ScatterNd"]=function(){return(_ScatterNd=Module["_ScatterNd"]=Module["asm"][["Aa
 \"]]).apply(null,arguments);var
 SelectV2=Module["_SelectV2"]=function(){return(_SelectV2=Module["_SelectV2"]=Module["asm"][["Ba"]])
 .apply(null,arguments);var
 Sigmoid=Module["_Sigmoid"]=function(){return(_Sigmoid=Module["_Sigmoid"]=Module["asm"][["Ca"]]).ap
 ply(null,arguments);var
 Sin=Module["_Sin"]=function(){return(_Sin=Module["_Sin"]=Module["asm"][["Da"]]).apply(null,arguments)
 };var
 Softmax=Module["_Softmax"]=function(){return(_Softmax=Module["_Softmax"]=Module["asm"][["Ea"]]).ap
 ply(null,arguments);var
 Sqrt=Module["_Sqrt"]=function(){return(_Sqrt=Module["_Sqrt"]=Module["asm"][["Fa"]]).apply(null,argumen
 ts);var
 Square=Module["_Square"]=function(){return(_Square=Module["_Square"]=Module["asm"][["Ga"]]).apply(n
 ull,arguments);var
 SquaredDifference=Module["_SquaredDifference"]=function(){return(_SquaredDifference=Module["_Squared
 Difference"]=Module["asm"][["Ha"]]).apply(null,arguments);var
 Step=Module["_Step"]=function(){return(_Step=Module["_Step"]=Module["asm"][["Ia"]]).apply(null,argume
 nts);var
 StridedSlice=Module["_StridedSlice"]=function(){return(_StridedSlice=Module["_StridedSlice"]=Module["as
 m"][["Ja"]]).apply(null,arguments);var
 Sub=Module["_Sub"]=function(){return(_Sub=Module["_Sub"]=Module["asm"][["Ka"]]).apply(null,argument
 s);var
 Sum=Module["_Sum"]=function(){return(_Sum=Module["_Sum"]=Module["asm"][["La"]]).apply(null,argum
 ents);var
 Tan=Module["_Tan"]=function(){return(_Tan=Module["_Tan"]=Module["asm"][["Ma"]]).apply(null,argumen
 ts);var
 Tanh=Module["_Tanh"]=function(){return(_Tanh=Module["_Tanh"]=Module["asm"][["Na"]]).apply(null,argu
 ments);var
 Tile=Module["_Tile"]=function(){return(_Tile=Module["_Tile"]=Module["asm"][["Oa"]]).apply(null,argumen
 ts);var
 TopK=Module["_TopK"]=function(){return(_TopK=Module["_TopK"]=Module["asm"][["Pa"]]).apply(null,ar
 guments);var
 Transform=Module["_Transform"]=function(){return(_Transform=Module["_Transform"]=Module["asm"][["
 Qa"]]).apply(null,arguments);var
 Transpose=Module["_Transpose"]=function(){return(_Transpose=Module["_Transpose"]=Module["asm"][["R
 a"]]).apply(null,arguments);var
 FusedMatMul=Module["__FusedMatMul"]=function(){return(__FusedMatMul=Module["__FusedMatMul"]=
 Module["asm"][["Sa"]]).apply(null,arguments);var
 malloc=Module["_malloc"]=function(){return(_malloc=Module["_malloc"]=Module["asm"][["Ta"]]).apply(nu
 ll,arguments);var

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_free=Module["_free"]=function(){return(_free=Module["_free"]=Module["asm"][["Ua"]]).apply(null,arguments)};var
__errno_location=Module["__errno_location"]=function(){return(__errno_location=Module["__errno_location"]=Module["asm"][["Va"]]).apply(null,arguments)};var
stackSave=Module["stackSave"]=function(){return(stackSave=Module["stackSave"]=Module["asm"][["Wa"]]).apply(null,arguments)};var
stackRestore=Module["stackRestore"]=function(){return(stackRestore=Module["stackRestore"]=Module["asm"][["Xa"]]).apply(null,arguments)};var
stackAlloc=Module["stackAlloc"]=function(){return(stackAlloc=Module["stackAlloc"]=Module["asm"][["Ya"]]).apply(null,arguments)};Module["cwrap"]=cwrap;var calledRun;function
ExitStatus(status){this.name="ExitStatus";this.message="Program terminated with
exit("+status+")";this.status=status}dependenciesFulfilled=function
runCaller(){if(!calledRun)run();if(!calledRun)dependenciesFulfilled=runCaller};function
run(args){args=args||arguments_;if(runDependencies>0){return}preRun();if(runDependencies>0){return}function
doRun(){if(calledRun)return;calledRun=true;Module["calledRun"]=true;if(ABORT)return;initRuntime();preMain(
);readyPromiseResolve(Module);if(Module["onRuntimeInitialized"])Module["onRuntimeInitialized"]();postRun(
)}if(Module["setStatus"]){Module["setStatus"]("Running...");setTimeout(function(){setTimeout(function(){Module["setStatus"](""),1});doRun()},1)}else{doRun()}}Module["run"]=run;if(Module["preInit"]){if(typeof
Module["preInit"]=="function")Module["preInit"]=Module["preInit"];while(Module["preInit"].length>0){
Module["preInit"].pop()}run();\n\n\n return WasmBackendModule.ready\n\n\n);nif (typeof exports ===
'object' && typeof module === 'object')\n module.exports = WasmBackendModule;\nelse if (typeof define ===
'function'
&& define['amd'])\n define([], function() { return WasmBackendModule; });\nelse if (typeof exports ===
'object')\n exports["WasmBackendModule"] = WasmBackendModule;\n", "/**\n * @license\n * Copyright 2019
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\nimport './flags_wasm';\n\nimport {backend_util, BackendTimingInfo, DataStorage, DataType, deprecationWarn,
engine, env, KernelBackend, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasmModule,
WasmFactoryConfig} from './wasm-out/tfjs-backend-wasm';\n\nimport {BackendWasmThreadedSimdModule} from
'./wasm-out/tfjs-backend-wasm-threaded-simd';\n\nimport wasmFactoryThreadedSimd from './wasm-out/tfjs-
backend-wasm-threaded-simd.js';\n// @ts-ignore\nimport {wasmWorkerContents} from './wasm-out/tfjs-backend-
wasm-threaded-simd.worker.js';\n\nimport wasmFactory from './wasm-out/tfjs-backend-wasm.js';\n\ninterface
TensorData {\n id: number;\n memoryOffset: number;\n shape: number[];\n dtype: DataType;\n refCount:
number;\n /** Only used for string tensors, storing encoded bytes. */\n stringBytes?: Uint8Array[];\n}\n\nexport
type DataId = object; // object instead of {} to force non-primitive.\n\nexport class BackendWasm extends
KernelBackend {\n // 0 is reserved for null data ids.\n private dataIdNextNumber = 1;\n dataIdMap:
DataStorage<TensorData>;\n\n constructor(public
wasm: BackendWasmModule|BackendWasmThreadedSimdModule) {\n super();\n
this.wasm.tfjs.initWithThreadsCount(threadsCount);\n actualThreadsCount = this.wasm.tfjs.getThreadsCount();\n
this.dataIdMap = new DataStorage(this, engine());\n }\n\n write(values: backend_util.BackendValues, shape:
number[], dtype: DataType):\n DataId {\n const dataId = {id: this.dataIdNextNumber++};\n
this.move(dataId, values, shape, dtype, 1);\n return dataId;\n }\n\n numDataIds(): number {\n return
this.dataIdMap.numDataIds();\n }\n\n async time(f: () => void): Promise<BackendTimingInfo> {\n const start =

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util.now();\n f();\n const kernelMs = util.now() - start;\n return {kernelMs};\n }\n\n move(\n  dataId:\n  DataId, values: backend_util.BackendValues, shape: number[],\n  dtype: DataType, refCount: number): void {\n  const id = this.dataIdNextNumber++;\n  if (dtype === 'string') {\n    const stringBytes = values as Uint8Array[];\n    this.dataIdMap.set(\n      dataId,\n      {id, stringBytes, shape, dtype, memoryOffset: null, refCount});\n    return;\n  }\n\n  const\n  size = util.sizeFromShape(shape);\n  const numBytes = size * util.bytesPerElement(dtype);\n  const\n  memoryOffset = this.wasm._malloc(numBytes);\n  this.dataIdMap.set(dataId, {id, memoryOffset, shape, dtype,\n  refCount});\n  this.wasm.tfjs.registerTensor(id, size, memoryOffset);\n  if (values != null) {\n    this.wasm.HEAPU8.set(\n      new Uint8Array(\n        (values as backend_util.TypedArray).buffer,\n        (values as backend_util.TypedArray).byteOffset, numBytes),\n      memoryOffset);\n  }\n\n  async\n  read(dataId: DataId): Promise<backend_util.BackendValues> {\n    return this.readSync(dataId);\n  }\n\n  readSync(dataId: DataId): backend_util.BackendValues {\n    const {memoryOffset, dtype, shape, stringBytes} =\n    this.dataIdMap.get(dataId);\n    if (dtype === 'string') {\n      return stringBytes;\n    }\n    const bytes = this.wasm.HEAPU8.slice(\n      memoryOffset,\n      memoryOffset +\n      util.sizeFromShape(shape) * util.bytesPerElement(dtype));\n    return typedArrayFromBuffer(bytes.buffer, dtype);\n  }\n\n  /**\n   * Dispose the memory if the dataId has 0 refCount. Return true if the memory\n   * is released, false\n   * otherwise.\n   * @param dataId\n   * @param force Optional, remove the data regardless of refCount\n   */\n  disposeData(dataId: DataId, force = false): boolean {\n    if (this.dataIdMap.has(dataId)) {\n      const data =\n      this.dataIdMap.get(dataId);\n      data.refCount--;\n      if (!force && data.refCount > 0) {\n        return false;\n      }\n      this.wasm._free(data.memoryOffset);\n      this.wasm.tfjs.disposeData(data.id);\n      this.dataIdMap.delete(dataId);\n    }\n    return true;\n  }\n\n  /** Return refCount of a `TensorData`. */\n  refCount(dataId: DataId): number {\n    if (this.dataIdMap.has(dataId)) {\n      const tensorData =\n      this.dataIdMap.get(dataId);\n      return tensorData.refCount;\n    }\n    return 0;\n  }\n\n  incRef(dataId: DataId) {\n    const data =\n    this.dataIdMap.get(dataId);\n    if (data != null) {\n      data.refCount++;\n    }\n  }\n\n  floatPrecision(): 32 {\n    return 32;\n  }\n\n  // Returns the memory offset of a tensor. Useful for debugging and unit\n  // testing.\n  getMemoryOffset(dataId: DataId): number {\n    return this.dataIdMap.get(dataId).memoryOffset;\n  }\n\n  dispose() {\n    this.wasm.tfjs.dispose();\n    if ('PThread' in this.wasm) {\n      this.wasm.PThread.terminateAllThreads();\n    }\n    this.wasm = null;\n  }\n\n  memory() {\n    return {unreliable:\n    false};\n  }\n\n  /**\n   * Make a tensor info for the output of an op. If `memoryOffset` is not\n   * present, this\n   * method allocates memory on the WASM heap. If `memoryOffset`\n   * is present, the memory was allocated\n   * elsewhere (in c++) and we just record\n   * the pointer where that memory lives.\n   */\n  makeOutput(shape:\n  number[], dtype: DataType, memoryOffset?: number):\n  TensorInfo {\n    let dataId: {};\n    if (memoryOffset\n    == null) {\n      dataId = this.write(null /* values */, shape, dtype);\n    } else {\n      const id =\n      this.dataIdNextNumber++;\n      dataId = {id};\n      this.dataIdMap.set(dataId, {id, memoryOffset, shape, dtype,\n      refCount: 1});\n      const size = util.sizeFromShape(shape);\n      this.wasm.tfjs.registerTensor(id, size,\n      memoryOffset);\n    }\n    return {dataId, shape, dtype};\n  }\n\n  typedArrayFromHeap({shape, dtype, dataId}:\n  TensorInfo):\n  backend_util.TypedArray {\n    const buffer = this.wasm.HEAPU8.buffer;\n    const\n    {memoryOffset} = this.dataIdMap.get(dataId);\n    const size = util.sizeFromShape(shape);\n    switch (dtype) {\n    case 'float32':\n      return new Float32Array(buffer, memoryOffset, size);\n    case 'int32':\n      return new\n      Int32Array(buffer, memoryOffset, size);\n    case 'bool':\n      return new Uint8Array(buffer, memoryOffset,\n      size);\n    default:\n      throw new Error(`Unknown dtype ${dtype}`);\n    }\n  }\n\n  function\n  createInstantiateWasmFunc(path: string) {\n    // this will be replace by rollup plugin patchWechatWebAssembly in\n    // minprogram's output.\n    // tslint:disable-next-line:no-any\n    return (imports: any, callback: any) => {\n      util.fetch(path, {credentials: 'same-origin'}).then((response) => {\n        if (!response['ok']) {\n          imports.env.a(`failed to load wasm binary file at '${path}'`);\n        }\n        response.arrayBuffer().then(binary => {\n          WebAssembly.instantiate(binary, imports).then(output => {\n            callback(output.instance, output.module);\n          });\n        });\n      });\n      return {};\n    };\n  }\n\n  /**\n   * Returns the path of the WASM binary.\n   * @param

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simdSupported whether SIMD is supported\n * @param threadsSupported whether multithreading is supported\n *
@param wasmModuleFolder the directory containing the WASM binaries.\n */\nfunction getPathToWasmBinary(\n  simdSupported: boolean, threadsSupported: boolean,\n  wasmModuleFolder: string) {\n  if (wasmPath != null)\n  {\n    // If wasmPath is defined, the user has supplied a full path to\n    // the vanilla .wasm binary.\n    return\n    wasmPath;\n  }\n  let path: WasmBinaryName = 'tfjs-backend-wasm.wasm';\n  if (simdSupported &&\n  threadsSupported) {\n    path = 'tfjs-backend-wasm-threaded-simd.wasm';\n  } else if (simdSupported) {\n    path =\n    'tfjs-backend-wasm-simd.wasm';\n  }\n  if (wasmFileMap != null) {\n    if (wasmFileMap[path] != null) {\n      return\n      wasmFileMap[path];\n    }\n  }\n  return\n  wasmModuleFolder + path;\n}\n\n/**\n * Initializes the wasm\n module and creates the js <--> wasm bridge.\n *\n * NOTE: We wrap the wasm module in a object with property\n 'wasm' instead of\n * returning Promise<BackendWasmModule> to avoid freezing Chrome (last tested\n * in\n Chrome 76).\n */\nexport async function init(): Promise<{ wasm: BackendWasmModule}> {\n  const\n  [simdSupported, threadsSupported]\n  = await Promise.all([\n    env().getAsync('WASM_HAS_SIMD_SUPPORT'),\n    env().getAsync('WASM_HAS_MULTITHREAD_SUPPORT')\n  ]);\n  return\n  new Promise((resolve, reject) => {\n    const\n    factoryConfig: WasmFactoryConfig = {};\n\n    /**\n     * This function overrides the Emscripten\n     module locateFile utility.\n     *\n     * @param path The relative path to the file that needs to be loaded.\n     *\n     * @param\n     prefix The path to the main JavaScript file's directory.\n     *\n     */\n    factoryConfig.locateFile = (path, prefix) => {\n      if\n      (path.endsWith('.worker.js')) {\n        const\n        response = wasmWorkerContents;\n        const\n        blob = new\n        Blob([response], {type: 'application/javascript'});\n        return\n        URL.createObjectURL(blob);\n      }\n      if\n      (path.endsWith('.wasm')) {\n        return\n        getPathToWasmBinary(\n          simdSupported as boolean,\n          threadsSupported as boolean,\n          wasmPathPrefix != null ? wasmPathPrefix : prefix);\n      }\n      return\n      prefix\n      + path;\n    };\n\n    // Use the instantiateWasm override when system fetch is not available.\n    // Reference:\n    //\n    // https://github.com/emscripten-core/emscripten/blob/2bca083cbbd5a4133db61fbd74d04f7feecfa907/tests/manual_wasm_instantiate.html#L170\n    if\n    (customFetch) {\n      factoryConfig.instantiateWasm =\n      createInstantiateWasmFunc(getPathToWasmBinary(\n        simdSupported as boolean, threadsSupported as\n        boolean,\n        wasmPathPrefix != null ? wasmPathPrefix :\n        ''));\n    }\n\n    let\n    initialized = false;\n\n    factoryConfig.onAbort = () => {\n      if\n      (initialized) {\n        // Emscripten already called console.warn so no need to\n        double\n        log.\n        return;\n      }\n      if\n      (initAborted) {\n        // Emscripten calls `onAbort` twice, resulting in double\n        error\n        // messages.\n        return;\n      }\n      initAborted = true;\n      const\n      rejectMsg =\n      'Make sure the\n      server can serve the `.wasm` file relative to the '+\n      '\n      'bundled js\n      file. For more details see\n      https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-wasm/README.md#using-bundlers';\n      reject\n      ({message: rejectMsg});\n    };\n\n    let\n    wasm: Promise<BackendWasmModule>;\n\n    // If\n    `wasmPath` has been defined we must initialize the vanilla module.\n    if\n    (threadsSupported && simdSupported && wasmPath == null) {\n      factoryConfig.mainScriptUrlOrBlob = new\n      Blob([\n        `var\n        WasmBackendModuleThreadedSimd = `\n        +\n        wasmFactoryThreadedSimd.toString(),\n        {\n          type:\n          'text/javascript'\n        }];\n      wasm =\n      wasmFactoryThreadedSimd(factoryConfig);\n    } else {\n      // The\n      wasmFactory works for both vanilla and SIMD binaries.\n      wasm =\n      wasmFactory(factoryConfig);\n    }\n\n    // The\n    WASM module has been successfully created by the factory.\n    // Any\n    error will be caught by the onAbort callback defined above.\n    wasm.then\n    ((module) => {\n      initialized = true;\n      initAborted = false;\n\n      const\n      voidReturnType:\n      string\n      = null;\n\n      // Using\n      the tfjs namespace to avoid conflict with emscripten's API.\n      module.tfjs = {\n        init:\n        module.cwrap('init', null, []),\n        initWithThreadCount:\n        module.cwrap('init_with_threads_count', null,\n        ['number']),\n        getThreadCount:\n        module.cwrap('get_threads_count', 'number', []),\n        registerTensor:\n        module.cwrap(\n          'register_tensor', null,\n          [\n            'number', // id\n            'number', // size\n            'number', // memoryOffset\n          ]),\n        disposeData:\n        module.cwrap('dispose_data', voidReturnType,\n        ['number']),\n        dispose:\n        module.cwrap('dispose', voidReturnType, []),\n      };\n\n      resolve\n      ({wasm: module});\n    });\n  });\n}

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});\n });\n\nfunction typedArrayFromBuffer(\n  buffer: ArrayBuffer, dtype: DataType):
backend_util.TypedArray {\n switch (dtype) {\n case 'float32':\n return new Float32Array(buffer);\n case
'int32':\n return new Int32Array(buffer);\n
case 'bool':\n return new Uint8Array(buffer);\n default:\n throw new Error(`Unknown dtype ${dtype}`);\n
}\n}\n\nconst wasmBinaryNames = [\n 'tfjs-backend-wasm.wasm', 'tfjs-backend-wasm-simd.wasm',\n 'tfjs-
backend-wasm-threaded-simd.wasm'\n] as const ;\ntype WasmBinaryName = typeof
wasmBinaryNames[number];\n\nlet wasmPath: string = null;\nlet wasmPathPrefix: string = null;\nlet wasmFileMap:
{[key in WasmBinaryName]?: string} = {};\nlet initAborted = false;\nlet customFetch = false;\n\n/**\n *
@deprecated Use `setWasmPaths` instead.\n * Sets the path to the `.wasm` file which will be fetched when the
wasm\n * backend is initialized. See\n * https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-
wasm/README.md#using-bundlers\n * for more details.\n * @param path wasm file path or url\n * @param
usePlatformFetch optional boolean to use platform fetch to download\n * the wasm file, default to false.\n *\n *
@doc {heading: 'Environment', namespace: 'wasm'}\n */\nexport
function setWasmPath(path: string, usePlatformFetch = false): void {\n deprecationWarn(\n 'setWasmPath has
been deprecated in favor of setWasmPaths and ' +\n ' will be removed in a future release.);\n if (initAborted) {\n
throw new Error(\n 'The WASM backend was already initialized. Make sure you call ' +\n ' `setWasmPath()`
before you call `tf.setBackend()` or `tf.ready()`);\n }\n\n wasmPath = path;\n customFetch =
usePlatformFetch;\n}\n\n/**\n * Configures the locations of the WASM binaries.\n *\n * `js` setWasmPaths({\n *
'tfjs-backend-wasm.wasm': 'renamed.wasm',\n * 'tfjs-backend-wasm-simd.wasm': 'renamed-simd.wasm',\n *
'tfjs-backend-wasm-threaded-simd.wasm': 'renamed-threaded-simd.wasm'\n * });\n * tf.setBackend('wasm');\n *
```\n *\n * @param prefixOrFileMap This can be either a string or object:\n * - (string) The path to the directory
where the WASM binaries are located.\n * Note that this prefix will be used to load each binary
(vanilla,\n * SIMD-enabled, threading-enabled, etc.).\n * - (object) Mapping from names of WASM binaries to
custom\n * full paths specifying the locations of those binaries. This is useful if\n * your WASM binaries are
not all located in the same directory, or if your\n * WASM binaries have been renamed.\n * @param
usePlatformFetch optional boolean to use platform fetch to download\n * the wasm file, default to false.\n *\n *
@doc {heading: 'Environment', namespace: 'wasm'}\n */\nexport function setWasmPaths(\n prefixOrFileMap:
string|{[key in WasmBinaryName]?: string},\n usePlatformFetch = false): void {\n if (initAborted) {\n
throw new Error(\n 'The WASM backend was already initialized. Make sure you call ' +\n ' `setWasmPaths()`
before you call `tf.setBackend()` or ' +\n ' `tf.ready()`);\n }\n\n if (typeof prefixOrFileMap === 'string') {\n
wasmPathPrefix = prefixOrFileMap;\n } else {\n wasmFileMap = prefixOrFileMap;\n const
missingPaths =\n wasmBinaryNames.filter(name => wasmFileMap[name] == null);\n if (missingPaths.length
> 0) {\n throw new Error(\n `There were no entries found for the following binaries: ` +\n
`${missingPaths.join(',')}. Please either call setWasmPaths with a ` +\n `map providing a path for each binary,
or with a string indicating ` +\n `the directory where all the binaries can be found.`);\n }\n }\n\n
customFetch = usePlatformFetch;\n}\n\n/** Used in unit tests. */\nexport function resetWasmPath(): void {\n
wasmPath = null;\n wasmPathPrefix = null;\n wasmFileMap = {};\n customFetch = false;\n initAborted =
false;\n}\n\nlet threadsCount = -1;\nlet actualThreadsCount = -1;\n\n/**\n * Sets the number of threads that will be
used by XNNPACK to create\n * threadpool (default to the number of logical CPU cores).\n *\n * This must be
called before calling `tf.setBackend('wasm')`.\n */\nexport function setThreadsCount(numThreads:
number) {\n threadsCount = numThreads;\n}\n\n/**\n * Gets the actual threads count that is used by
XNNPACK.\n *\n * It is set after the backend is initialized.\n */\nexport function getThreadsCount(): number {\n
if (actualThreadsCount === -1) {\n throw new Error(`WASM backend not initialized.`);\n }\n return
actualThreadsCount;\n}\n\n"/** @license See the LICENSE file. */\n\n// This code is auto-generated, do not modify
this file!\nconst version = '3.11.0';\nexport {version};\n"/**\n * @license\n * Copyright 2020 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,

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software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\n\nimport './flags_wasm';\nimport {registerBackend} from '@tensorflow/tfjs-core';\nimport {BackendWasm, init} from './backend_wasm';\nexport {BackendWasm, getThreadsCount, setThreadsCount, setWasmPath, setWasmPaths} from './backend_wasm';\nexport {version as version_wasm} from './version';\n\nconst WASM_PRIORITY = 2;\nregisterBackend('wasm', async () => {\n const {wasm} = await init();\n return new BackendWasm(wasm);\n}, WASM_PRIORITY);\n\nnames:["_FusedMatMul","util","Abs","backend_util","Add","AddN","Identity","setup","Transpose","All","Any","wasmFunc","ArgMax","AvgPool","Reshape","BatchMatMul","slice_util","buffer","sliceImplCPU","Slice","BatchToSpaceND","Cast","Ceil","ClipByValue","concatImplCPU","Concat","Conv2D","Conv2DBackpropInput","Cos","Cosh","CropAndResize","Cumsum","DepthToSpace","DepthwiseConv2dNative","Elu","supportsFullBroadcast","Equal","Exp","ExpandDims","Fill","FlipLeftRight","Floor","FloorDiv","FusedBatchNorm","FusedConv2D","FusedDepthwiseConv2D","GatherNd","GatherV2","Greater","GreaterEqual","setupFunc","LeakyRelu","Less","LessEqual","Log","LogicalAnd","Max","Maximum","MaxPool","Mean","Min","Minimum","MirrorPad","Multiply","Neg","NonMaxSuppressionV3","NonMaxSuppressionV4","NonMaxSuppressionV5","kernelFunc","NotEqual","OneHot","OnesLike","Pack","PadV2","Pow","Prelu","Prod","rangeImplCPU","Range","RealDiv","Relu","Relu6","ResizeBilinear","Reverse","RotateWithOffset","Round","Rsqrt","ScatterNd","Select","Sigmoid","Sin","Softmax","SpaceToBatchND","SplitV","Sqrt","Square","SquaredDifference","Step","StridedSlice","Sub","Sum","Tan","Tanh","Tile","TopK","Transform","Unpack","ZerosLike","registerKernel","env","require$$0","require$$1","require$$2","global","require$$3","require$$4","tslib_1.__extends","DataStorage","engine","KernelBackend","wasmFactoryThreadedSimd","wasmFactory","deprecationWarn","registerBackend"],mappings:";EAAA;EAiBA;EACA,IAAY,QAMX;EAND,WAAY,QAAQ;MACIB,6CAAW,CAAA;MACX,yCAAS,CAAA;MACT,uCAAQ,CAAA;MACR,2CAAU,CAAA;MACV,iDAAa,CAAA;EACf,CAAC,EANW,QAAQ,KAA R,QAAQ,QAMnB;EAED;EACA,IAAY,iBAQX;EARD,WAAY,iBAAiB;MAC3B,6DAAU,CAAA;MACV,yDAA Q,CAAA;MACR,2DAAS,CAAA;MACT,2DAAS,CAAA;MACT,mEAAa,CAAA;MACb,+DAAW,CAAA;MACX, uDAAO,CAAA;EACT,CAAC,EARW,iBAAiB,KAAjB,iBAAiB;EC3B7B;EAuBA,IAAI,eAKQ,CAAC; EAEb,SAAS,KAAC,CAAC,OAAoB;MACjC,eAAe,GAAG,OAAO,CAAC,IAAI,CAAC,KAAC,CAACA,qBAAY, EAAE,IAAI,aAAa;UACIE,QAAQ;UACR,OAAO;UACP,QAAQ;UACR,QAAQ;UACR,OAAO;UACP,QAAQ;UA CR,QAAQ;UACR,QAAQ;UACR,QAAQ;UACR,QAAQ;UACR,QAAQ;UACR,QAAQ;UACR,QAAQ;OACT,CA AC,CAAC;EACL,CAAC;EAED,SAAS,gBAAgB,CAAC,IAIzB;MACQ,IAAA,oBAAM,EAAE,sBAAO,EAAE,kB AAK,CAAS;MAC/B,IAAA,YAAC,EAAE,YAAC,EAAE,kBAAL,EAAE,sDAAsB,CAAW;MAEpD,IAAI,CAAC,C AAC,KAAC,KAAC,SAAS,IAAI,CAAC,CAAC,KAAC,KAAC,SAAS,EAAE;UACID,MAAM,IAAI,KAAC,CAC X,6DAA6D,CAAC,CAAC;OACpE;MAEM,IAAA,6BAAU,EAAE,6BAAU,EAAE,6BAAU,EAAE,qCAAc,CAAU; MACnE,IAAM,GAAG,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,CAAC,CAAC,MAAM,CAAC,CAAC, EAAE,CAAC;MAC/C,IAAM,GAAG,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,CAAC,CAAC,MAAM, CAAC,CAAC,EAAE,CAAC;MAE/C,IAAI,MAAM,GAAG,CAAC,CAAC;MACf,IAAI,IAAI,IAAI,IAAI,EAAE;U AChB,IAAM,QAAQ,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,IAAI,CAAC,MAAM,CAAC,CAAC;UA CpD,IAAI,QAAQ,CAAC,KAAC,CAAC,MAAM,KAAC,CAAC,EAAE;cAC/B,MAAM,IAAI,KAAC,CACX,iDA AiD;mBACjD,UAAQ,QAAQ,CAAC,KAAC,CAAC,MAAM,MAAG,CAAA,CAAC,CAAC;WACvC;UACD,MAA M,GAAG,QAAQ,CAAC,EAAE,CAAC;OACTb;MACD,IAAM,wBAAwB,GAAG,sBAAsB,IAAI,IAAI;UAC3D,C AAC;UACD,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,sBAAsB,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC; MAC5D,IAAM,eAAe,GACjB,iBAAiB,CAAC,UAAkD,CAAC,CAAC;MAC1E,IAAI,eAAe,IAAI,IAAI,EAAE;UA C3B,MAAM,IAAI,KAAC,CACR,UAAU,mDAAgD;cAC7D,sBAAsB,CAAC,CAAC;OAC7B;MAED,IAAM,OAA O,GAAG,UAAU,GAAG,CAAC,CAAC,KAAC,CAAC,CAAC,GAAG,CAAC,CAAC,KAAC,CAAC,CAA C,CAAC,CAAC;MACfD,IAAM,QAAQ,GAAG,UAAU,GAAG,CAAC,CAAC,KAAC,CAAC,CAAC,CAAC,GAA
```

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C,SAAS,CAAC,GAAG,CAAC,GAAG,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;MAEnD,IAAM,WAAW,GA  
AG,IAAI,UAAU,CAAC,IAAI,UAAU,CAAC,CAAC,CAAC,KAAK,CAAC,CAAC,MAAM,CAAC,CAAC;MACn  
E,IAAM,WAAW,GAAG,IAAI,UAAU,CAAC,IAAI,UAAU,CAAC,CAAC,CAAC,KAAK,CAAC,CAAC,MAAM,  
CAAC,CAAC;MAEnE,eAAe,CACX,GAAG,EAAE,WAAW,EAAE,CAAC,CAAC,KAAK,CAAC,MAAM,EAAE,  
GAAG,EAAE,WAAW,EAAE,CAAC,CAAC,KAAK,CAAC,MAAM,EACIE,UAAU,EAAE,UAAU,EAAE,eAAe,E  
AAE,MAAM,EAAE,wBAAwB,EACzE,cAAc,IAAI,CAAC,EAAE,KAAK,CAAC,CAAC;MAEhC,OAAO,GAAG,  
CAAC;EACb,CAAC;EAEM,IAAM,iBAAiB,GAAiB;MAC7C,UAAU,EAAEA,qBAAY;MACxB,WAAW,EAAE,  
MAAM;MACnB,SAAS,EAAE,KAAK;MACHb,UAAU,EAAE,gBAAoC;GACjD;;EC7GD;;;;;;;WuBgB,uB  
AAuB,CACnC,UAAkB,EAAE,OAAkB;MACxC,IAAI,QAA6D,CAAC;MAEIE,SAAS,SAAS,CAAC,OAAoB;UA  
CrC,QAAQ,GAAG,OAAO,CAAC,IAAI,CAAC,KAAK,CAAC,UAAU,EAAE,IAAI,aAAa;cACzD,QAAQ;cACR,  
QAAQ;cACR,QAAQ;WACT,CAAC,CAAC;OACJ;MAED,SAAS,UAAU,CAAC,IAAiD;UAE5D,IAAA,sBAAO,E  
AAW,iBAAC,CAAU;UACpC,IAAM,GAAG,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,CAAC,CAAC,  
MAAM,CAAC,CAAC,EAAE,CAAC;UAC/C,IAAM,GAAG,GAAG,OAAO,CAAC,UAAU,CAAC,CAAC,CAAC,  
KAAK,EAAE,OAAO,IAAI,CAAC,CAAC,KAAK,CAAC,CAAC;UAC5D,IAAM,KAAK,GAAG,OAAO,CAAC,S  
AAS,CAAC,GAAG,CAAC,GAAG,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;;UAGnD,IAAIC,aAAI,CAAC,aA  
Aa,CAAC,GAAG,CAAC,KAAK,CAAC,KAAK,CAAC,EAAE;cACvC,OAAO,GAAG,CAAC;WACZ;UAED,QA  
AQ,CAAC,GAAG,EAAE,QAAQ,CAAC,CAAC,CAAC,KAAK,CAAC,EAAE,KAAK,CAAC,CAAC;UACxC,OA  
AO,GAAG,CAAC;OACZ;MAED,OAAO,EAAC,UAAU,YAAA,EAAE,WAAW,EAAE,MAAM,EAAE,SAAS,WA  
AA,EAAE,UAAU,YAAA,EAAC,CAAC;EACIE;;ECpDA;;;;;;;EAoBO,IAAM,SAAS,GAAiB,uBAuB,CAA  
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E,SAAS,WAAA,EAAE,UAAU,YAAA,EAAC,CAAC;EACIE;;ECxFA;;;;;;;EAqBA,IAAM,qBAAqB,GAAG,IAAI,CAAC;EAE5B,IAAM,SAAS,GACIB,wBAAwB,CAACC,YAAG,EAAE,qBAAqB,CAAC;;ECxBxD;;;;;;;;;EAuBA,IAAI,QAEQ,CAAC;EAEb,SAAS,SAAS,CAAC,OAAoB;MACrC,QAAQ,GAAG,OAAO,CAAC,IAAI,CAAC,KAAK,CAACC,aAAI,EAAE,IAAI,aAAa;UACnD,OAAO;UACP,QAAQ;UACR,QAAQ;UACR,QAAQ;OACT,CAAC,CAAC;EACL,CAAC;EAED,SAAS,IAAI,CAAC,IAAkD;MACvD,IAAA,oBAAM,EAAE,sBAAO,CAAS;MAC/B,IAAM,GAAG,GAAG,OAAO,CAAC,UAAU,CAAC,MAAM,CAAC,CAAC,CAAC,CAAC,CAAC,KAAK,EAAE,MAAM,CAAC,CAAC,CAAC,CAAC,KAAK,CAAC,CAAC;;MAGjE,IAAI,aAAI,CAAC,aAAa,CAAC,GAAG,CAAC,KAAK,CAAC,KAAK,CAAC,EAAE;UACvC,OAAO,GAAG,CAAC;OACZ;MAED,IAAM,QAAQ,GAAG,MAAM,CAAC,GAAG,CAAC,UAAA,CAAC,IAAI,OAAA,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,CAAC,CAAC,MAAM,CAAC,CAAC,EAAE,GAAA,CAAC,CAAC;MACrE,IAAM,aAAa,GAAG,IAAI,UAAU,CAAC,IAAI,UAAU,CAAC,QAAQ,CAAC,CAAC,MAAM,CAAC,CAAC;MACtE,IAAM,KAAK,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,GAAG,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;MACnD,QAAQ,CAAC,aAAa,EAAE,QAAQ,CAAC,MAAM,EAAE,QAAQ,CAAC,GAAG,CAAC,KAAK,CAAC,EAAE,KAAK,CAAC,CAAC;MAErE,OAAO,GAAG,CAAC;EACb,CAAC;EAEM,IAAM,UAAU,GAAiB;MACtC,UAAU,EAAEI,aAAI;MACHb,WAAW,EAAE,MAAM;MACnB,SAAS,WAAA;MACT,UAAU,EAAE,IAAwB;GACrC;;EC1DD;;;;;;;WAsBgB,QAAQ,CAAC,IAAoD;MAE3D,IAAA,iBAAC,EAAG,sBAAO,CAAS;MACpC,IAAM,GAAG,GAAG,OAAO,CAAC,UAAU,CAAC,CAAC,CAAC,KAAK,EAAE,CAAC,CAAC,KAAK,CAAC,CAAC;MACjD,IAAM,MAAM,GAAG,OAAO,CAAC,kBAaKB,CAAC,CAAC,CAAC;MAC7C,IAAM,OAAO,GAAG,OAAO,CAAC,kBAaKB,CAAC,GAAG,CAAC,CAAC;MACHd,OAAO,CAAC,GAAG,CAAC,MAAM,CAAC,CAAC;MACpB,OAAO,GAAG,CAAC;EACb,CAAC;EAEM,IAAM,cAAc,GAAiB;MAC1C,UAAU,EAAEC,iBAAQ;MACpB,WAAW,EAAE,MAAM;MACnB,UAAU,EAAE,QAA4B;GACzC;;ECpCD;;;;;;;EAwBA,IAAI,aAE4D,CAAC;EAEjE,SAASC,OAAK,CAAC,OAAoB;MACjC,aAAa,GAAG,OAAO,CAAC,IAAI,CAAC,KAAK,CAACC,kBAAS,EAAE,IAAI,aAAa;UAC7D,QAAQ;UACR,OAAO;UACP,QAAQ;UACR,QAAQ;UACR,QAAQ;UACR,OAAO;UACP,QAAQ;OACT,CAAC,CAAC;EACL,CAAC;WAEe,SAAS,CACrB,IAC0E;MAErE,IAAA,oBAAM,EAAE,sBAAO,EAAE,kBAaK,CAAS;;MAGhC,IAAA,kDAAoE,EAAE,EAAnE,oBAAY,EAAE,YAAqD,CAAC;MAE3E,IAAI,UAAU,GAAG,IAAI,CAAC;MACtB,KAAK,IAAI,CAAC,GAAG,CAAC,EAAE,CAAC,GAAG,IAAI,CAAC,MAAM,EAAE,CAAC,EAAE,EAAE;UACpC,IAAI,IAAI,CAAC,CAAC,CAAC,KAAK,CAAC,EAAE;cACjB,UAAU,GAAG,KAAK,CAAC;WACpB;OACF;MACD,IAAM,QAAQ,GAAG,eAAe,CAAC,MAAM,CAAC,CAAC,CAAC,KAAK,EAAE,KAAK,CAAC,IAAI,CAAC,CAAC;MAC7D,IAAM,CAAC,GAAG;UACR,MAAM,EAAE,MAAM,CAAC,CAAC,CAAC,MAAM;UACvB,KAAK,EAAE,YAAY;UACnB,KAAK,EAAE,MAAM,CAAC,CAAC,CAAC,KAAK;OACtB,CAAC;MAEF,IAAI,UAAU,EAAE;UACd,IAAM,MAAM,GAAG,QAAQ,CAAC,EAAC,MAAM,QAAA,EAAE,OAAO,SAAA,EAAC,CAAC,CAAC;UAC3C,MAAM,CAAC,KAAK,GAAG,QAAQ,CAAC;UACxB,OAAO,MAAM,CAAC;OACf;MAED,IAAM,GAAG,GAAG,OAAO,CAAC,UAAU,CAAC,QAAQ,EAAE,CAAC,CAAC,KAAK,CAAC,CAAC;MACID,IAAM,GAAG,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,CAAC,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;MAC/C,IAAM,KAAK,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,GAAG,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;MACnD,IAAM,SAAS,GAAG,IAAI,UAAU,CAAC,IAAI,UAAU,CAAC,IAAI,CAAC,CAAC,MAAM,CAAC,CAAC;MAC9D,IAAM,WAAW,GAAG,IAAI,UAAU,CAAC,IAAI,UAAU,CAAC,CAAC,CAAC,KAAK,CAAC,CAAC,MAAM,CAAC,CAAC;MAEnE,aAAa,CACT,GAAG,EAAE,WAAW,EAAE,CAAC,CAAC,KAAK,CAAC,MAAM,EAAE,QAAQ,CAAC,CAAC,CAAC,KAAK,CAAC,EAAE,KAAK,EAAE,SAAS,EACrE,IAAI,CAAC,MAAM,CAAC,CAAC;MACjB,OAAO,GAAG,CAAC;EACb,CAAC;EAED,SAAS,eAAe,CAAC,OAAiB,EAAE,IAAc;MACxD,IAAM,QAAQ,GAAG,IAAI,KAAK,CAAC,OAAO,CAAC,MAAM,CAAC,CAAC;MAC3C,KAAK,IAAI,CAAC,GAAG,CAAC,EAAE,CAAC,GAAG,QAAQ,CAAC,MAAM,EAAE,CAAC,EAAE,EAAE;UACxC,QAAQ,CAAC,CAAC,CAAC,GAAG,OAAO,CAAC,IAAI,CAAC,CAAC,CAAC,CAAC,CAAC;OAChC;MACD,OAAO,QAAQ,CAAC;EACIB,CAAC;EAED,SAAS,iBAAiB,CACtB,KAAe,EAAE,IAAc;MACjC,IAAM,QAAQ,GAAa,EAAE,CAAC;MAC9B,IAAM,OAAO,GAAa,EAAE,CAAC;MAC7B,KAAK,IAAI,CAAC,GAAG,CAAC,EAAE,CAAC,GAAG,KAAK,CAAC,MAAM,EAAE,EAAE,CAAC,EAAE;UACrC,IAAI,KAAK,CAAC,CAAC,CAAC,KAAK,CAAC,EAAE;cACIB,QAAQ,CAAC,IAAI,CAAC,KAAK,CAAC,CAAC,CAAC,CAAC,CAAC;WACzB;UACD,IAAI,KAAK,CAAC,IAAI,CAAC,CAAC,CAAC,CAAC,KAAK,CAAC,EAAE;

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AC/C,IAAI,OAAO,GAAG,GAAG,CAAC;MACIB,IAAI,KAAK,GAAG,CAAC,CAAC;MAER,IAAA,8CACuC,EADtC,0BAAU,EAAE,cAAI,EAAE,8BAAY,EAAE,0CACM,CAAC;MAE9C,IAAI,kBAaKB,EAAE;UACtB,IAAM,YAAY,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,UAAU,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;UACjE,KAAK,GAAG,UAAU,CAAC;UACnB,OAAO,GAAG,YAAY,CAAC;OACxB;MAED,IAAM,SAAS,GAA G,KAAK,CAAC,KAAK,CAAC,MAAM,CAAC;MACrCP,qBAAY,CAAC,0BAA0B,CAAC,KAAK,EAAE,IAAI,EAAE,SAAS,CAAC,CAAC;MACID,IAAA,uEACuD,EADtD,gBAAQ,EAAE,mBAC4C,CAAC;MAC9D,IAAM,UAAU,GAAGF,aAAI,CAAC,aAAa,CAAC,WAAW,CAAC,CAAC;MAEnD,IAAM,GAAG,GAAG,OAAO,CAAC,UAAU,CAAC,QAAQ,EAAE,CAAC,CAAC,KAAK,CAAC,CAAC;MACID,IAAIA,aAAI,CAAC,aAAa,CAAC,KAA K,CAAC,KAAK,CAAC,KAAK,CAAC,EAAE;UACzC,IAAM,KAAK,GAAG,OAAO,CAAC,SAAS,CAAC,GAA G,CAAC,GAAG,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;UACnD,OAAO,CAAC,OAAO,EAAE,UAAU,EAA E,KAAK,CAAC,CAAC;OACrC;MAED,IAAI,kBAaKB,EAAE;;UAEtB,OAAO,CAAC,WAAW,CAAC,UAAU,C AAC,MAAM,CAAC,CAAC;OACxC;MAED,IAAI,QAAQ,EAAE;;UAEZ,IAAM,QAAQ,GAAGE,qBAAY,CAAC, oBAAoB,CAAC,GAAG,CAAC,KAAK,EAAE,YAAY,CAAC,CAAC;UAC5E,GAAG,CAAC,KAAK,GAAG,QAA Q,CAAC;OACtB;MAED,OAAO,GAAG,CAAC;EACb,CAAC;EAEM,IAAM,SAAS,GAAiB;MACrC,UAAU,EAA EO,YAAG;MACf,WAAW,EAAE,MAAM;MACnB,SAAS,EAAEH,OAAK;MACHB,UAAU,EAAE,GAAuB;GAC pC;;EC9ED;;;;;;;;;EAWBA,IAAII,UAESB,CAAC;EAE3B,SAASJ,OAAK,CAAC,OAAoB;MACjCI,UAAQ,G AAG,OAAO,CAAC,IAAI,CAAC,KAAK,CAACC,eAAM,EAAE,IAAI,aAAa;UACrD,QAAQ;UACR,QAAQ;UAC R,QAAQ;UACR,QAAQ;UACR,QAAQ;OACT,CAAC,CAAC;EAEL,CAAC;EAED,SAAS,MAAM,CACX,IAAsE; MACjE,IAAA,sBAAO,EAAE,oBAAM,EAAE,kBAaKB,CAAS;MAC/B,IAAA,iBAAI,CAA+B;MACnC,IAAA,YA AC,CAAiC;MACzC,IAAM,GAAG,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,CAAC,CAAC,MAAM,C AAC,CAAC,EAAE,CAAC;MAC/C,IAAI,OAAO,GAAG,GAAG,CAAC;MACIB,IAAI,KAAK,GAAG,CAAC,CA AC;MAER,IAAA,8CACuC,EADtC,0BAAU,EAAE,cAAI,EAAE,0CACoB,CAAC;MAE9C,IAAI,kBAaKB,EAAE; UACtB,IAAM,YAAY,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,UAAU,CAAC,MAAM,CAAC,CAAC, EAAE,CAAC;UACjE,IAAI,YAAY,KAAK,GAAG,EAAE;;cAGxB,KAAK,GAAG,UAAU,CAAC;cACnB,OAAO, GAAG,YAAY,CAAC;WACxB;OACF;MAED,IAAM,QAAQ,GAAG,KAAK,CAAC,KAAK,CAAC,KAAK,CAAC ,CAAC,EAAE,CAAC,CAAC,CAAC;MACiC,IAAM,GAAG,GAAG,OAAO,CAAC,UAAU,CAAC,QAAQ, EAAE,OAAO,CAAC,CAAC;MACID,IAAM,KAAK,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,GAAG, CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;MACnD,IAAM,SAAS,GAAGX,aAAI,CAAC,aAAa,CAAC,GAAG,C AAC,KAAK,CAAC,CAAC;MACHD,IAAM,SAAS,GAAG,KAAK,CAAC,KAAK,CAAC,IAAI,CAAC,CAAC,CA AC,CAAC,CAAC;MACvCU,UAAQ,CAAC,OAAO,EAAE,QAAQ,CAAC,KAAK,CAAC,KAAK,CAAC,EAAE,S AAS,EAAE,SAAS,EAAE,KAAK,CAAC,CAAC;MAEtE,IAAI,kBAaKB,EAAE;;UAEtB,OAAO,CAAC,WAAW,C AAC,UAAU,CAAC,MAAM,CAAC,CAAC;OACxC;MAED,OAAO,GAAG,CAAC;EACb,CAAC;EAEM,IAAM,Y AAY,GAAiB;MACxC,UAAU,EAAEC,eAAM;MACIB,WAAW,EAAE,MAAM;MACnB,UAAU,EAAE,MAA0B; MACtC,SAAS,EAAEL,OAAK;GACjB;;EChFD;;;;;;;;;EAqBA,IAAI,WAI6D,CAAC;EAEIE,SAASA,OAAK, CAAC,OAAoB;MACjC,WAAW,GAAG,OAAO,CAAC,IAAI,CAAC,KAAK,CAACM,gBAAO,EAAE,IAAI,aAAa ;UACzD,QAAQ;UACR,QAAQ;UACR,QAAQ;UACR,QAAQ;UACR,QAAQ;UACR,QAAQ;UACR,QAAQ;UAC R,QAAQ;UACR,QAAQ;UACR,QAAQ;UACR,QAAQ;UACR,QAAQ;UACR,QAAQ;OACT,CAA C,CAAC;EAEL,CAAC;EAED,SAAS,OAAO,CACZ,IAAwE;MACnE,IAAA,oBAAM,EAAE,kBAaKB,EAAE,sBA AO,CAAS;MAEtC,IAAM,CAAC,GAAG,MAAM,CAAC,CAAa,CAAC;MAC/B,IAAM,GAAG,GAAG,OAAO,CA AC,SAAS,CAAC,GAAG,CAAC,CAAC,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;MAExC,IAAA,6BAAU,EA AE,uBAAO,EAAE,eAAG,EAAE,uCAAe,CAAU;MACiD,IAAM,QAAQ,GAAGV,qBAAY,CAAC,iBAAiB,CAC3 C,CAAC,CAAC,KAAK,EAAE,UAAU,EAAE,OAAO,EAAE,CAAC,kBAaKB,GAAG,EAAE,eAAe,CAAC,CAAC ;MAE3E,IAAM,YAAY,GAAG,QAAQ,CAAC,YAAY,CAAC;MAC3C,IAAM,WAAW,GAAG,QAAQ,CAAC,WA AW,CAAC;MACzC,IAAM,MAAM,GAAG,QAAQ,CAAC,OAAO,CAAC,GAAG,CAAC;MACpC,IAAM,QAAQ, GAAG,QAAQ,CAAC,OAAO,CAAC,KAAK,CAAC;MACxC,IAAM,SAAS,GAAG,QAAQ,CAAC,OAAO,CAAC, MAAM,CAAC;MACiC,IAAM,OAAO,GAAG,QAAQ,CAAC,OAAO,CAAC,IAAI,CAAC;MACtC,IAAM,YAAY, GAAG,QAAQ,CAAC,YAAY,CAAC;MAC3C,IAAM,WAAW,GAAG,QAAQ,CAAC,WAAW,CAAC;MACzC,IA AM,QAAQ,GAAG,QAAQ,CAAC,UAAU,CAAC;MAErC,IAAI,QAAQ,CAAC,UAAU,KAAK,cAAc,EAAE;UAC

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SAAS,CAAC,CAAC;MAC7D,IAAM,KAAK,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,GAAG,CAAC,  
MAAM,CAAC,CAAC,EAAE,CAAC;MAEnD,WAAW,CACP,GAAG,EAAE,CAAC,CAAC,KAAK,CAAC,CAAC  
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Found

in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/tf-backend-wasm.js.map

No license file was found, but licenses were detected in source scan.

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```
=====\n*/\n\nimport { KernelConfig, KernelFunc, Pack, PackAttrs, PackInputs, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { concat } from './Concat';\nimport { expandDims } from './ExpandDims';\n\nexport function pack(\n args: { inputs: PackInputs, backend: BackendWasm, attrs: PackAttrs }):\n TensorInfo {\n const { inputs, backend, attrs } = args;\n const { axis } = attrs;\n\n if (inputs.length === 1) {\n return expandDims(\n { inputs: { input: inputs[0] }, backend, attrs: { dim: axis } });\n }\n\n const shape = inputs[0].shape;\n const dtype = inputs[0].dtype;\n\n inputs.forEach(t => {\n util.assertShapesMatch(\n shape, t.shape, \n 'All tensors passed to stack must have matching shapes');\n util.assert(\n dtype === t.dtype, \n () => 'All tensors passed to stack must have matching dtypes');\n });\n\n const intermediateTensorInfos: TensorInfo[] = [];\n const expandedTensors = inputs.map(t => {\n const expandedT =\n expandDims({ inputs: { input: t }, backend, attrs: { dim: axis } });\n intermediateTensorInfos.push(expandedT);\n return expandedT;\n });\n\n const result = concat({ inputs: expandedTensors, backend, attrs: { axis } });\n\n intermediateTensorInfos.forEach(t => backend.disposeData(t.dataId));\n\n return result;\n}\n\nexport const packConfig: KernelConfig = {\n kernelName: Pack,\n backendName: 'wasm',\n kernelFunc: pack as {} as KernelFunc\n};\n\n}*/
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\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Pack.js.map

No license file was found, but licenses were detected in source scan.

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\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/Rsqrt.cc

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/Sum.cc

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/ClipByValue.cc

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/Minimum.cc

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/conv2d\_impl.cc

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/Square.cc

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/FusedConv2D\_test.cc

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/opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/interpolate\_bilinear\_impl.h

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/Gather.cc

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/Add.cc

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/Relu6.cc  
 \* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/ResizeBilinear.cc  
 \* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/ResizeBilinear\_test.cc  
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 \* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/Sigmoid.cc  
 \* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/FusedDepthwiseConv2D.cc  
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 \* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/Max.cc  
 \* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/NonMaxSuppressionV5.cc  
 \* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/interpolate\_bilinear\_impl.cc  
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 \* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/util.h  
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 \* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/Greater.cc  
 \* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/NonMaxSuppressionV3.cc  
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 \* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/clamp\_impl.h  
 \* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/util\_test.cc  
 \* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/Sigmoid.h

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/Log.cc  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/AvgPool\_test.cc  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/non\_max\_suppression\_impl.cc  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/FusedConv2D.h  
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\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/ArgMax.cc  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/LessEqual.cc  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/prelu\_impl.h  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/FloorDiv.cc  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/Relu.cc  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/LeakyRelu.cc  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/ResizeBilinear.h  
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/opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/binary.h  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/ClipByValue\_test.cc  
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\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/backend.h  
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\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/MaxPool.h  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/RealDiv.cc  
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/opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/GreaterEqual.cc  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/DepthwiseConv2dNative.h  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/Maximum.cc

No license file was found, but licenses were detected in source scan.

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OR CONDITIONS OF ANY KIND, either express or implied. See the License for the specific language governing permissions and limitations under the License.

```
=====
*/\n\nimport { _FusedMatMul, _FusedMatMulAttrs, _FusedMatMulInputs, KernelConfig, KernelFunc } from
'@tensorflow/tfjs-core';\n\nimport { BackendWasm } from './backend_wasm';\n\nimport { FusableActivation } from
'./types';\n\nlet wasmFusedMatMul: (\n aId: number, aShape: Uint8Array, aShapeSize: number, bId: number,\n bShape: Uint8Array, bShapeSize:
 number, transposeA: boolean,\n transposeB: boolean, activation: number, biasId: number,\n preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) => \n void;\n\nfunction
setup(backend: BackendWasm) {\n wasmFusedMatMul = backend.wasm.cwrap(_FusedMatMul, null /* void */, [\n 'number', // a_id\n 'array', // a_shape\n 'number', // a_shape.length\n 'array', // b_id\n 'array', // b_shape\n 'number', // b_shape.length\n 'number', // transpose_a\n 'number', // transpose_b\n 'number', // activation\n 'number', // biasId\n 'number', // preluActivationWeightsId\n 'number', // leakyreluAlpha\n 'number' // out_id\n]);\n\n function fusedBatchMatMul(args: {\n inputs: _FusedMatMulInputs,\n backend: BackendWasm,\n attrs: _FusedMatMulAttrs\n }) {\n const { inputs, backend, attrs } = args;\n const { a, b, bias, preluActivationWeights } = inputs;\n\n if (a.dtype !== 'float32' || b.dtype !== 'float32') {\n throw new Error(`\n _FusedMatMul for non non-float32 tensors not yet supported.`);\n }\n\n const { transposeA, transposeB, activation, leakyreluAlpha } = attrs;\n const aId = backend.dataIdMap.get(a.dataId).id;\n const bId = backend.dataIdMap.get(b.dataId).id;\n\n let biasId = 0;\n if (bias != null) {\n const biasData = backend.dataIdMap.get(bias.dataId);\n if (biasData.shape.length !== 1) {\n throw new Error(`\n _FusedMatMul only supports rank-1 bias but got ` +\n `rank ${biasData.shape.length}`);\n }\n biasId = biasData.id;\n }\n\n const preluActivationWeightsId = preluActivationWeights == null ?\n 0 : backend.dataIdMap.get(preluActivationWeights.dataId).id;\n\n const fusedActivation =\n FusableActivation[activation as {} as keyof typeof FusableActivation];\n\n if (fusedActivation == null) {\n throw new Error(`\n ${activation} activation not yet supported for FusedConv2D ` +\n `in the wasm backend.`);\n }\n\n const leftDim = transposeA ? a.shape[2] : a.shape[1];\n const rightDim = transposeB ? b.shape[1] : b.shape[2];\n const batchDim = a.shape[0];\n\n const out = backend.makeOutput([batchDim, leftDim, rightDim], a.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const aShapeBytes = new Uint8Array(new Int32Array(a.shape).buffer);\n const bShapeBytes = new Uint8Array(new Int32Array(b.shape).buffer);\n\n wasmFusedMatMul(\n aId, aShapeBytes, a.shape.length, bId, bShapeBytes, b.shape.length,\n transposeA, transposeB, fusedActivation, biasId, preluActivationWeightsId,\n leakyreluAlpha || 0, outId);\n\n return out;\n }\n\n export const fusedMatMulConfig: KernelConfig = {\n kernelName: _FusedMatMul,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: fusedBatchMatMul as {} as KernelFunc\n };
}\n\n/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
"License");\n * you may
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not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
=====
*/\n\nimport { DataType, KernelConfig, TensorInfo, UnaryInputs, util } from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from './backend_wasm';\n\nimport { CppDType } from './types';\n\nexport function
createUnaryKernelConfig(\n kernelName: string, outType?: DataType): KernelConfig {\n let wasmFunc: (xId:
 number, dtype: number, outId: number) => void;\n\n function setupFunc(backend: BackendWasm): void {\n wasmFunc =
 backend.wasm.cwrap(kernelName, null /* void */, [\n 'number', // x_id\n 'number', // dtype\n 'number', // out_id\n]);\n }\n\n function kernelFunc(args: { backend: BackendWasm, inputs: UnaryInputs }):\n TensorInfo
```



```

{\n const {backend, inputs: {x}} = args;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out =
backend.makeOutput(x.shape, outType || x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n //
Short-circuit zero-sized tensors.\n if (util.sizeFromShape(out.shape) === 0) {\n return out;\n }\n\n
wasmFunc(xId, CppDType[x.dtype], outId);\n return out;\n }\n\n return {kernelName, backendName: 'wasm',
setupFunc, kernelFunc};\n}\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n *
Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n
*\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is
distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *
=====
*\nimport {Abs, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'/unary_kernel';\n\nexport const absConfig: KernelConfig = createUnaryKernelConfig(Abs);\n", "/*\n * @license\n *
Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or
agreed to in
writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT
WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {backend_util, BinaryInputs, DataType, KernelConfig, TensorInfo, util} from '@tensorflow/tfjs-
core';\nimport {BackendWasm} from './backend_wasm';\nimport {CppType} from './types';\n\nexport
function createBinaryKernelConfig(\n kernelName: string, supportsFullBroadcast: boolean,\n dtype?:
DataType): KernelConfig {\n let wasmFunc:\n (aId: number, aShape: Uint8Array, aShapeLen: number, bId:
number,\n bShape: Uint8Array, bShapeLen: number, dtype: number, outId: number) =>\n void;\n\n function setupFunc(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(kernelName, null /*
void
*/, [\n 'number', // a_id,\n 'array', // a_shape\n 'number', // a_shape.length\n 'number', // b_id\n
'array', // b_shape\n 'number', // b_shape.length\n 'number', // dtype\n 'number' // out_id\n]);\n\n function kernelFunc(args: {backend: BackendWasm, inputs: BinaryInputs}):\n TensorInfo {\n const {backend,
inputs} = args;\n const {a, b} = inputs;\n const aId = backend.dataIdMap.get(a.dataId).id;\n const bId =
backend.dataIdMap.get(b.dataId).id;\n const outputType = dtype != null ? dtype : a.dtype;\n const newShape =
backend_util.assertAndGetBroadcastShape(a.shape, b.shape);\n const out = backend.makeOutput(newShape,
outputType);\n\n // Short-circuit zero-sized tensors.\n if (util.sizeFromShape(newShape) === 0) {\n return
out;\n }\n\n const aShapeBytes = new Uint8Array(new Int32Array(a.shape).buffer);\n const bShapeBytes =
new Uint8Array(new Int32Array(b.shape).buffer);\n const
outId = backend.dataIdMap.get(out.dataId).id;\n const kernelFunc = () => wasmFunc(\n aId, aShapeBytes,
a.shape.length, bId, bShapeBytes, b.shape.length,\n CppDType[a.dtype], outId);\n\n // Currently only some
float operations support full broadcast.\n if (supportsFullBroadcast && a.dtype === 'float32') {\n
kernelFunc();\n return out;\n }\n\n const aBroadcastDims = backend_util.getBroadcastDims(a.shape,
newShape);\n const bBroadcastDims = backend_util.getBroadcastDims(b.shape, newShape);\n const
loopsOverAllOfA = aBroadcastDims.every((v, i) => v === i);\n const loopsOverAllOfB =
bBroadcastDims.every((v, i) => v === i);\n if (loopsOverAllOfA && loopsOverAllOfB) {\n kernelFunc();\n
return out;\n } else {\n throw new Error(\n `Broadcasting along outer dims is not yet ` +\n
`supported for ${a.dtype} ${kernelName}.`);\n }\n }\n\n return {kernelName, backendName: 'wasm', setupFunc,

```

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kernelFunc};\n}\n", "/**\n
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {Add, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from
'./binary_kernel';\n\nconst supportsFullBroadcast = true;\n\nexport const addConfig: KernelConfig =\ncreateBinaryKernelConfig(Add, supportsFullBroadcast);\n", "/**\n * @license\n
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {AddN, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from './backend_wasm';\n\nimport {CppType} from './types';\n\nlet wasmFunc:\n (inputIds:
Uint8Array, inputIdsLen: number, dtype: number, outId: number) =>\n void;\n\nfunction
setupFunc(backend: BackendWasm): void {\n wasmFunc = backend.wasm.wrap(AddN, null /* void */, [\n
'array', // input_ids\n 'number', // input_ids.length\n 'number', // dtype\n 'number', // out_id\n
]);\n}\n\nfunction addn(args: {inputs: TensorInfo[], backend: BackendWasm}) {\n const {inputs, backend} =
args;\n const out = backend.makeOutput(inputs[0].shape, inputs[0].dtype);\n // Short-circuit zero-sized tensors.\n
if (util.sizeFromShape(out.shape) === 0) {\n return out;\n }\n const inputIds = inputs.map(x =>
backend.dataIdMap.get(x.dataId).id);\n const inputIdsBytes = new Uint8Array(new Int32Array(inputIds).buffer);\n
const outId = backend.dataIdMap.get(out.dataId).id;\n wasmFunc(inputIdsBytes, inputIds.length,
CppType[out.dtype], outId);\n return out;\n}\n\nexport const addNConfig: KernelConfig = {\n kernelName:
AddN,\n backendName: 'wasm',\n setupFunc,\n kernelFunc: addn as {} as KernelFunc,\n};\n", "/**\n * @license\n
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {Identity, IdentityInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\n\nimport
{TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nexport function
identity(args: {inputs: IdentityInputs, backend: BackendWasm}):\n TensorInfo {\n const {inputs:
{x}, backend} = args;\n const out = backend.makeOutput(x.shape, x.dtype);\n const inVals =
backend.typedArrayFromHeap(x);\n const outVals = backend.typedArrayFromHeap(out);\n outVals.set(inVals);\n
return out;\n}\n\nexport const identityConfig: KernelConfig = {\n kernelName: Identity,\n backendName:
'wasm',\n kernelFunc: identity as {} as KernelFunc,\n};\n", "/**\n * @license\n * Copyright 2019 Google LLC. All
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=====\n*\n\nimport {KernelConfig, KernelFunc, TensorInfo, Transpose, TransposeAttrs, TransposeInputs} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {identity} from './Identity';\nimport {CppType} from './types';\nlet wasmTranspose: (\n xId: number, xShape: Uint8Array, xShapeLength: number, dtype: CppDType,\n outId: number, perm: Uint8Array, permLength: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmTranspose = backend.wasm.cwrap(Transpose, null /* void */, [\n 'number', // xId\n 'array', // x.shape\n 'number', // x.shape.length\n 'number', // dtype\n 'number', // outId\n 'array', // perm\n 'number', // perm.length\n]);\n\n export function transpose(\n args: {\n inputs: TransposeInputs, backend: BackendWasm, attrs: TransposeAttrs\n }): TensorInfo {\n const {inputs, backend, attrs} = args;\n\n // Reduce any dimensions with size one. Lower-rank transpose kernel performs\n // better due to simpler memory access pattern.\n const [reducedShape, perm] = removeOneSizeDims(inputs.x.shape, attrs.perm);\n\n let permIsNoOp = true;\n for (let i = 0; i < perm.length; i++) {\n if (perm[i] !== i) {\n permIsNoOp = false;\n }\n }\n\n const outShape = computeOutShape(inputs.x.shape, attrs.perm);\n const x = {\n dataId: inputs.x.dataId,\n shape: reducedShape,\n dtype: inputs.x.dtype\n };\n\n if (permIsNoOp) {\n const cloned = identity({inputs, backend});\n cloned.shape = outShape;\n return cloned;\n }\n\n const out = backend.makeOutput(outShape, x.dtype);\n const xId = backend.dataIdMap.get(x.dataId).id;\n const outId = backend.dataIdMap.get(out.dataId).id;\n const permBytes = new Uint8Array(new Int32Array(perm).buffer);\n const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n\n wasmTranspose(\n xId, xShapeBytes, x.shape.length, CppDType[x.dtype], outId, permBytes,\n perm.length);\n return out;\n }\n\n function computeOutShape(inShape: number[], perm: number[]): number[] {\n const outShape = new Array(inShape.length);\n for (let i = 0; i < outShape.length; i++) {\n outShape[i] = inShape[perm[i]];\n }\n return outShape;\n }\n\n function removeOneSizeDims(\n shape: number[], perm: number[]): [number[], number[]] {\n const newShape: number[] = [];\n const newPerm: number[] = [];\n for (let i = 0; i < shape.length; ++i) {\n if (shape[i] !== 1) {\n newShape.push(shape[i]);\n }\n if (shape[perm[i]] !== 1) {\n newPerm.push(perm[i]);\n }\n }\n for (let i = 0; i < newPerm.length; ++i) {\n let minValIdx = -1;\n for (let j = 0; j < newPerm.length; ++j) {\n if (newPerm[j] >= i && (minValIdx === -1 || newPerm[minValIdx] > newPerm[j])) {\n minValIdx = j;\n }\n }\n newPerm[minValIdx] = i;\n }\n return [newShape, newPerm];\n }\n\n export const transposeConfig: KernelConfig = {\n kernelName: Transpose,\n backendName: 'wasm',\n kernelFunc: transpose as {\n } as KernelFunc,\n setupFunc: setup,\n };,\n /**\n * @license\n * Copyright 2020 Google Inc. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n }\n\n import {backend_util, TensorInfo, util} from '@tensorflow/tfjs-core';\n import {BackendWasm} from './backend_wasm';\n import {transpose} from './Transpose';\n /**\n * Compute permutation axes and do a transpose if necessary.\n * Used by reduction ops.\n * @param x input TensorInfo\n * @param axis reduction axes\n * @param backend wasm backend instance\n */\n export function permuteAxesAndTranspose(\n x: TensorInfo, axis: number|number[],
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backend: BackendWasm): {\n transposed: TensorInfo|null,\n axes: number[],\n originalAxes: number[],\n inputWasTransposed: boolean}\n} {\n const xShape = x.shape;\n const xRank = x.shape.length;\n\n const\n originalAxes = util.parseAxisParam(axis, xShape);\n let axes = originalAxes;\n const permutedAxes =\n backend_util.getAxesPermutation(axes, xRank);\n let xTransposed = null;\n let inputWasTransposed = false;\n if\n (permutedAxes != null) {\n const newShape: number[] = new Array(xRank);\n for (let i = 0; i <\n newShape.length; i++) {\n newShape[i] = xShape[permutedAxes[i]];\n }\n axes =\n backend_util.getInnerMostAxes(axes.length, xRank);\n\n xTransposed =\n transpose({inputs: {x}, attrs: {perm: permutedAxes}, backend});\n const xId =\n backend.dataIdMap.get(x.dataId).id;\n const transposedId = backend.dataIdMap.get(xTransposed.dataId).id;\n if\n (transposedId !== xId) {\n inputWasTransposed = true;\n }\n }\n\n return {transposed: xTransposed,\n originalAxes, axes, inputWasTransposed};\n}\n\n"/**\n * @license\n * Copyright 2021 Google LLC. All Rights\n * Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file\n * except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations\n * under the License.\n *
\n
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*/\n\nimport {All, AllAttrs, AllInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util} from\n '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport\n {permuteAxesAndTranspose} from '../kernel_utils';\n\nlet wasmAll: (xId: number, reduceSize: number, outId:\n number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmAll = backend.wasm.cwrap(All, null\n /*void*/, [number, number, number]);\n}\n\nfunction all(args: {backend: BackendWasm, inputs: AllInputs, attrs:\n AllAttrs}): \n TensorInfo {\n const {backend, inputs, attrs} = args;\n const {axis, keepDims} = attrs;\n const {x}\n = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const\n {transposed, axes, originalAxes, inputWasTransposed} =\n permuteAxesAndTranspose(x, axis, backend);\n\n if\n (inputWasTransposed) {\n const transposedId\n = backend.dataIdMap.get(transposed.dataId).id;\n input = transposed;\n inputId = transposedId;\n }\n\n const\n inputRank = input.shape.length;\n backend_util.assertAxesAreInnerMostDims('all', axes, inputRank);\n const\n [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, axes);\n const\n reduceSize = util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, x.dtype);\n\n if\n (util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmAll(inputId, reduceSize, outId);\n }\n\n if (inputWasTransposed) {\n // dispose of the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const newShape =\n backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n return\n out;\n}\n\nexport const allConfig: KernelConfig = {\n kernelName: All,\n backendName: 'wasm',\n setupFunc:\n setup,\n kernelFunc:\n all\n};\n\n"/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in\n * compliance with the License.\n * You may obtain a copy of the License at\n * \n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n *
\n
=====
*/\n\nimport {Any, AnyAttrs, AnyInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util} from\n '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport

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{permuteAxesAndTranspose} from './kernel_utils';\n\nlet wasmAny:
(xId: number, reduceSize: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n
wasmAny = backend.wasm.cwrap(Any, null /*void*/, ['number, number, number']);\n}\n\nfunction any(args:
{backend: BackendWasm, inputs: AnyInputs, attrs: AnyAttrs});\n TensorInfo {\n const {backend, inputs, attrs} =
args;\n const {axis, keepDims} = attrs;\n const {x} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n
let inputId = xId;\n let input = x;\n const {transposed, axes, originalAxes, inputWasTransposed} =\n
permuteAxesAndTranspose(x, axis, backend);\n if (inputWasTransposed) {\n const transposedId =
backend.dataIdMap.get(transposed.dataId).id;\n input = transposed;\n inputId = transposedId;\n }\n const
inputRank = input.shape.length;\n backend_util.assertAxesAreInnerMostDims('any', axes, inputRank);\n const
[outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, axes);\n const
reduceSize =
 util.sizeFromShape(reduceShape);\n const out = backend.makeOutput(outShape, x.dtype);\n if
(util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmAny(inputId, reduceSize, outId);\n }\n if (inputWasTransposed) {\n // dispose of the transposed tensor.\n
backend.disposeData(transposed.dataId);\n }\n if (keepDims) {\n // reshape\n const newShape =
backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n return
out;\n}\n\nexport const anyConfig: KernelConfig = {\n kernelName: Any,\n backendName: 'wasm',\n setupFunc:
setup,\n kernelFunc: any as {} as KernelFunc\n};\n\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights
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on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *\n
=====\n\n*\n\nimport { ArgMax, ArgMaxAttrs, ArgMaxInputs, KernelConfig, KernelFunc, util } from '@tensorflow/tfjs-
core';\n\nimport { BackendWasm } from './backend_wasm';\n\nimport { permuteAxesAndTranspose } from
 './kernel_utils';\n\nimport { CppDType } from './types';\n\nlet wasmFunc: (\n xId: number, dtype: number, outerSize:
number, innerSize: number,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n
wasmFunc = backend.wasm.cwrap(ArgMax, null /* void */, [\n 'number', // x_id\n 'number', // dtype\n 'number', // outer_size\n 'number', // inner_size\n 'number'
// out_id\n]);\n}\n\nfunction argmax(\n args: {inputs: ArgMaxInputs, backend: BackendWasm, attrs:
ArgMaxAttrs}) {\n const {backend, inputs, attrs} = args;\n const {axis} = attrs as {} as ArgMaxAttrs;\n const {x}
= inputs as {} as ArgMaxInputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input
= x;\n const {transposed, axes, inputWasTransposed} =\n permuteAxesAndTranspose(x, axis, backend);\n if
(inputWasTransposed) {\n const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId
!== xId) {\n // transpose was not a no-op. We will need to dispose of this\n // once we are done.\n input =
transposed;\n inputId = transposedId;\n }\n }\n const outShape = input.shape.slice(0, -1);\n const out =
backend.makeOutput(outShape, 'int32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n const outerSize =
util.sizeFromShape(out.shape);\n const innerSize = input.shape[axes[0]];\n
wasmFunc(inputId, CppDType[input.dtype], outerSize, innerSize, outId);\n if (inputWasTransposed) {\n //
dispose of the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n return out;\n}\n\nexport
const argMaxConfig: KernelConfig = {\n kernelName: ArgMax,\n backendName: 'wasm',\n kernelFunc: argmax
as {} as KernelFunc,\n setupFunc: setup\n};\n\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights
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```
=====\n*\n\nimport {AvgPool, AvgPoolAttrs, AvgPoolInputs, backend_util, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nlet wasmAvgPool: (\n xId: number, batchSize: number, inputHeight: number, inputWidth: number,\n filterHeight: number, filterWidth: number, padTop: number, padRight: number,\n padBottom: number, padLeft: number, strideHeight: number,\n strideWidth: number, channels: number, outId: number) => void;\nfunction setup(backend: BackendWasm) {\n wasmAvgPool = backend.wasm.cwrap(AvgPool, null /* void */, [\n 'number', // xId\n 'number', // batchSize\n 'number', // inputHeight\n 'number', // inputWidth\n 'number', // filterHeight\n 'number', // filterWidth\n 'number', // padTop\n 'number', // padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', // strideHeight\n 'number', // strideWidth\n 'number', // channels\n 'number', // outId\n]);\n}\nfunction avgPool(\n args: {inputs: AvgPoolInputs, backend: BackendWasm, attrs: AvgPoolAttrs}) {\n const {inputs, attrs, backend} = args;\n const x = inputs.x as Tensor4D;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const {filterSize, strides, pad, dimRoundingMode} = attrs;\n const convInfo = backend_util.computePool2DInfo(\n x.shape, filterSize, strides, 1 /* dilations */, pad, dimRoundingMode);\n const filterHeight = convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const padRight = convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n const padLeft = convInfo.padInfo.left;\n const strideHeight = convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n const channels = convInfo.inChannels;\n if (convInfo.dataFormat !== 'channelsLast') {\n throw new Error(\n `wasm backend does not support dataFormat: ` +\n `${convInfo.dataFormat}`. Please use 'channelsLast'.`);\n }\n if (convInfo.dilationWidth !== 1 || convInfo.dilationHeight !== 1) {\n throw new Error(\n `was backend only supports average pooling with dilation = [1, 1], ` +\n `got [${convInfo.dilationHeight}, ${convInfo.dilationWidth}].`);\n }\n const out = backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmAvgPool(\n xId, x.shape[0], x.shape[1], x.shape[2], filterHeight, filterWidth,\n padTop, padRight, padBottom, padLeft, strideHeight, strideWidth, channels,\n outId);\n return out;\n}\nexport const avgPoolConfig: KernelConfig = {\n kernelName: AvgPool,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: avgPool as {} as KernelFunc\n};\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License,\n * Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\"\n * BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n=====\n*\n\nimport {KernelConfig, KernelFunc, Reshape, ReshapeAttrs, ReshapeInputs, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nexport function reshape(\n args: {inputs: ReshapeInputs, attrs: ReshapeAttrs, backend: BackendWasm}) {\n const {inputs, attrs} = args;\n const {x} = inputs;\n const {shape} = attrs;\n const xSize = util.sizeFromShape(x.shape);\n const $shape = util.inferFromImplicitShape(shape, xSize);\n util.assert(\n xSize === util.sizeFromShape($shape),\n () => `new shape: ${$shape}, old shape: ${x.shape}. New shape and old ` +\n `shape must have the same number of elements.`);\n // Backend needs to track refCount for the dataId for reshape\n op\n args.backend.incRef(x.dataId);\n return {dataId: x.dataId, shape: $shape, dtype: x.dtype};\n}\nexport const reshapeConfig: KernelConfig = {\n kernelName: Reshape,\n backendName: 'wasm',\n kernelFunc: reshape as {}
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as KernelFunc\n});\n", "/\*\n \* @license\n \* Copyright 2019 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the \"License\");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \* http://www.apache.org/licenses/LICENSE-2.0\n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

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*\n\nimport { BatchMatMul, BatchMatMulAttrs, BatchMatMulInputs, KernelConfig, KernelFunc, util } from
 '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport { reshape } from
 './Reshape';\n\nlet wasmBatchMatMul: (\n aId: number, aShape: Uint8Array, aShapeSize: number, bId: number,\n bShape: Uint8Array, bShapeSize: number, transposeA: boolean,\n transposeB: boolean, outId: number) =>
 void;\n\nfunction setup(backend: BackendWasm) {\n wasmBatchMatMul = backend.wasm.cwrap(BatchMatMul,
 null /* void */, [\n 'number', // a_id\n 'array', // a_shape\n 'number', // a_shape.length\n 'number', // b_id\n 'array', // b_shape\n 'number',
 // b_shape.length\n 'number', // transpose_a\n 'number', // transpose_b\n 'number' // out_id\n]);\n\n function batchMatMul(args: {\n inputs: BatchMatMulInputs,\n backend: BackendWasm,\n attrs:
 BatchMatMulAttrs\n }) {\n const { inputs, backend, attrs } = args;\n const { a, b } = inputs;\n const { transposeA,
 transposeB } = attrs;\n\n if (a.dtype !== 'float32' || b.dtype !== 'float32') {\n throw new Error(\n
 `BatchMatMul for non non-float32 tensors not yet supported.`);\n }\n\n const aRank = a.shape.length;\n const
 bRank = b.shape.length;\n\n const innerShapeA = transposeA ? a.shape[aRank - 2] : a.shape[aRank - 1];\n const
 innerShapeB = transposeB ? b.shape[bRank - 1] : b.shape[bRank - 2];\n\n const outerShapeA = transposeA ?
 a.shape[aRank - 1] : a.shape[aRank - 2];\n const outerShapeB = transposeB ? b.shape[bRank - 2] : b.shape[bRank -
 1];\n\n const outerDimsA = a.shape.slice(0, -2);\n const outerDimsB = b.shape.slice(0, -2);\n\n const batchDimA
 = util.sizeFromShape(outerDimsA);\n const batchDimB = util.sizeFromShape(outerDimsB);\n\n const
 batchDimsCompatible =\n batchDimA === batchDimB || batchDimA === 1 || batchDimB === 1;\n\n util.assert(\n
 aRank >= 2 && bRank >= 2 && batchDimsCompatible,\n () => `Error in matMul: the input
 batch dimensions must either be the ` +\n `same or at least one input batch dimension must be 1. Got input `
 +\n `batch dimensions of (${outerDimsA}) and (${outerDimsB}).`);\n\n const outShapeOuterDims =\n
 batchDimA > batchDimB ? a.shape.slice(0, -2) : b.shape.slice(0, -2);\n const outShape =
 outShapeOuterDims.concat([outerShapeA, outerShapeB]);\n\n util.assert(\n innerShapeA === innerShapeB,\n
 () => `Error in matMul: inner shapes (${innerShapeA}) and (` +\n `${innerShapeB}) of Tensors with shapes
 ${a.shape} and ` +\n `${b.shape} and transposeA=${transposeA}` +\n ` and transposeB=${transposeB}
 must match.`);\n\n const
 a3dShape = transposeA ? [batchDimA, innerShapeA, outerShapeA] :\n [batchDimA,
 outerShapeA, innerShapeA];\n const b3dShape = transposeB ? [batchDimB, outerShapeB, innerShapeB] :\n
 [batchDimB, innerShapeB, outerShapeB];\n\n // The rest of the implementation is designed to operate on
 rank-3 tensors\n const a3d = reshape({ inputs: { x: a }, backend, attrs: { shape: a3dShape } });\n const b3d =
 reshape({ inputs: { x: b }, backend, attrs: { shape: b3dShape } });\n\n const a3dId =
 backend.dataIdMap.get(a3d.dataId).id;\n const b3dId = backend.dataIdMap.get(b3d.dataId).id;\n\n const leftDim =
 transposeA ? a3d.shape[2] : a3d.shape[1];\n const rightDim = transposeB ? b3d.shape[1] : b3d.shape[2];\n const
 batchDim = Math.max(batchDimA, batchDimB);\n\n const out = backend.makeOutput([batchDim, leftDim,
 rightDim], a3d.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const aShapeBytes = new
 Uint8Array(new Int32Array(a3d.shape).buffer);\n\n const bShapeBytes = new Uint8Array(new Int32Array(b3d.shape).buffer);\n\n wasmBatchMatMul(\n a3dId,
 aShapeBytes, a3d.shape.length, b3dId, bShapeBytes,\n b3d.shape.length, transposeA, transposeB, outId);\n\n backend.disposeData(a3d.dataId);\n backend.disposeData(b3d.dataId);\n\n out.shape = outShape;\n return
 out;\n }\n\n export const batchMatMulConfig: KernelConfig = {\n kernelName: BatchMatMul,\n backendName:

```













XJuIG91dEJ1Zi52YWx1ZXMGYXMgVHlwZWRRcnJheTtcbn1cblxuZXhwb3J0IGZ1bmN0aW9uIHNsaWNlKfXu  
ICAgIGFyZ3M6IHtpbnB1dHM6IFNsaWNlSW5wdXRzLCBiYWNRZW5kOiBNYXR0QmFja2VuZENQVSwgYX  
R0cnM6IFNsaWNlQXR0cnN9KTpcbiAgICBUZw5zb3JjbmZvIHtcbiAgY29uc3Qge2lucHV0cywgYmFja2VuZC  
wgYXR0cnN9ID0gYXJncztcbiAgY29uc3Qge3h9ID0gaW5wdXRzO1xuICBjb25zdCB7YmVnaW4sIHNpemV9ID  
0gYXR0cnM7XG5cbiAgYXNzZXJ0Tm90Q29tcGxleCh4LCAnc2xpY2UnKTtcbiAgICBjb25zdCBbJGJlZ2luLCAk  
c2l6ZV0gPSBzbGljZV91dGlsLnBhcnNIU2xpY2VQYXJhbXMoeCwgYmVnaW4sIHNpemUpO1xuICBzbGljZV9  
1dGlsLmFzc2VydFBhcmFtc1ZhbGlkKHgsICRiZWdpbiwgJHNpemUpO1xuXG4gIGNvbnN0IHZhbHMgPSBiYW  
NRZW5kLmRhdGEuZ2V0KHguZGF0YUlkKS52YWx1ZXM7XG4gIGNvbnN0IG91dFZhbHMgPSBzbGljZUlcG  
wodmFscywgJGJlZ2luLCAkc2l6ZSwgeC5zaGFwZSwgeC5kdHlwZSk7XG4gIHJldHVybiBiYWNRZW5kLm1ha2  
VUZw5zb3JjbmZvKCRzaXplLCB4LmR0eXBILCBvdXRWYWxzKTtcbn1cblxuZXhwb3J0IGNvbnN0IHNsaWN  
lQ29uZmlnOiBLZlJwZwDb25maWcgPSB7XG4gIGtcm5lbe5hbWU6IFNsaWNlKfXuICBiYWNRZW5kTmFtZ  
TogJ2NwdScsXG4gIGtcm5lbeZ1bmM6IHNsaWNlIGFzIHt9IGFzIEtcm5lbeZ1bmNcbn07XG4iXX0=","/\*\*\n

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```
=====\n*\n\nimport {backend_util, KernelConfig, KernelFunc, Slice, slice_util, SliceAttrs, SliceInputs, TypedArray, util}\nfrom '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\nimport {sliceImplCPU} from './kernel_utils/shared';\n\nexport function slice(\n args: {inputs: SliceInputs, attrs: SliceAttrs, backend: BackendWasm}) {\n const {inputs: {x}, attrs: {begin, size}, backend} = args;\n\n const [begin_, size_] = slice_util.parseSliceParams(x, begin, size);\n const isContinous = slice_util.isSliceContinous(x.shape, begin_, size_);\n const xVals = backend.readSync(x.dataId);\n const out = backend.makeOutput(size_, x.dtype);\n const xStrides = util.computeStrides(x.shape);\n const outData = backend.dataIdMap.get(out.dataId);\n\n if (isContinous) {\n const flatOffset = slice_util.computeFlatOffset(begin_, xStrides);\n\n if (x.dtype === 'string') {\n outData.stringBytes = (xVals as Uint8Array[]).slice(flatOffset, flatOffset + util.sizeFromShape(size_));\n } else {\n const outVals = backend.typedArrayFromHeap(out);\n outVals.set((xVals as TypedArray).subarray(flatOffset, flatOffset + util.sizeFromShape(size_)));\n }\n\n return out;\n }\n\n if (x.dtype === 'string') {\n const res = sliceImplCPU(xVals, begin_, size_, x.shape, x.dtype);\n outData.stringBytes = res as Uint8Array[];\n\n return out;\n }\n\n const outVals = backend.typedArrayFromHeap(out);\n const rank = x.shape.length;\n\n if (rank === 2) {\n slice2d(xVals as TypedArray, xStrides[0], outVals, begin_ as [number, number],\n size_ as [number, number]);\n } else if (rank === 3) {\n slice3d(xVals as TypedArray, xStrides[0], xStrides[1], outVals,\n begin_ as [number, number, number], size_ as [number, number, number]);\n } else if (rank === 4) {\n slice4d(xVals as TypedArray, xStrides[0], xStrides[1], xStrides[2], outVals,\n begin_ as [number, number, number, number], size_ as [number, number, number, number]);\n } else {\n const res = sliceImplCPU(xVals, begin_, size_, x.shape, x.dtype) as TypedArray;\n outVals.set(res);\n }\n\n return out;\n}\n\nfunction slice2d(xVals: backend_util.TypedArray, xStride: number, outVals: backend_util.TypedArray, begin: [number, number],\n size: [number, number]):\n void {\n let outOffset = 0;\n const beginI = begin[0];\n const beginJ = begin[1];\n const endI = beginI + size[0];\n\n for (let i = beginI; i < endI; i++) {\n const xOffset = i * xStride + beginJ;\n outVals.set(xVals.subarray(xOffset, xOffset + size[1]), outOffset);\n outOffset += size[1];\n }\n }\n\nfunction slice3d(xVals: backend_util.TypedArray, xStride1: number, xStride2: number, outVals: backend_util.TypedArray, begin: [number, number, number],\n size: [number, number, number]):\n void {\n let outOffset = 0;\n const beginI =
```

```

begin[0];\n const beginJ = begin[1];\n const beginK = begin[2];\n const endI = beginI + size[0];\n const endJ =
beginJ + size[1];\n for (let i = beginI; i < endI; i++) {\n for (let j = beginJ; j < endJ; j++) {\n const xOffset = i *
xStride1 + j * xStride2 + beginK;\n outVals.set(xVals.subarray(xOffset, xOffset + size[2]), outOffset);\n
outOffset += size[2];\n }\n }\n\nfunction slice4d(\n xVals: backend_util.TypedArray,
xStride1: number, xStride2: number,\n xStride3: number, outVals: backend_util.TypedArray,\n begin: [number,
number, number, number],\n size: [number, number, number, number]): void {\n let outOffset = 0;\n const beginI
= begin[0];\n const beginJ = begin[1];\n const beginK = begin[2];\n const endI = beginI + size[0];\n const endJ =
beginJ + size[1];\n const endK = beginK + size[2];\n const beginL = begin[3];\n\n for (let i = beginI; i < endI; i++)
{\n for (let j = beginJ; j < endJ; j++) {\n for (let k = beginK; k < endK; k++) {\n const xOffset = i *
xStride1 + j * xStride2 + k * xStride3 + beginL;\n outVals.set(xVals.subarray(xOffset, xOffset + size[3]),
outOffset);\n outOffset += size[3];\n }\n }\n }\n\nexport const sliceConfig: KernelConfig = {\n
kernelName: Slice,\n backendName: 'wasm',\n kernelFunc: slice as {} as KernelFunc,\n};\n"/**\n * @license\n *
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http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {backend_util, BatchToSpaceND, BatchToSpaceNDAttrs, BatchToSpaceNDInputs, KernelConfig,
KernelFunc} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport
{reshape} from './Reshape';\n\nimport {slice} from './Slice';\n\nimport {transpose} from './Transpose';\n\nfunction
batchToSpaceND(args: {\n inputs: BatchToSpaceNDInputs,\n
backend: BackendWasm,\n attrs: BatchToSpaceNDAttrs\n}) {\n const {inputs, backend, attrs} = args;\n const
{x} = inputs;\n const {blockShape, crops} = attrs;\n\n const prod = blockShape.reduce((a, b) => a * b);\n\n const
reshaped = backend_util.getReshaped(x.shape, blockShape, prod);\n\n const permuted =
backend_util.getPermuted(reshaped.length, blockShape.length);\n\n const reshapedPermuted =\n
backend_util.getReshapedPermuted(x.shape, blockShape, prod);\n\n const sliceBeginCoords =\n
backend_util.getSliceBeginCoords(crops, blockShape.length);\n\n const sliceSize =\n
backend_util.getSliceSize(reshapedPermuted, crops, blockShape.length);\n\n const xReshaped = reshape({inputs:
{x}, backend, attrs: {shape: reshaped}});\n\n const xTransposed =\n transpose({inputs: {x: xReshaped}, backend,
attrs: {perm: permuted}});\n\n const xTransposedReshaped = reshape(\n {inputs: {x: xTransposed}, backend,
attrs: {shape: reshapedPermuted}});\n\n const result
= slice({\n inputs: {x: xTransposedReshaped},\n backend,\n attrs: {begin: sliceBeginCoords, size:
sliceSize}\n });\n\n backend.disposeData(xReshaped.dataId);\n backend.disposeData(xTransposed.dataId);\n
backend.disposeData(xReshaped.dataId);\n\n return result;\n}\n\nexport const batchToSpaceNDConfig:
KernelConfig = {\n kernelName: BatchToSpaceND,\n backendName: 'wasm',\n kernelFunc: batchToSpaceND as
{} as KernelFunc\n};\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed
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on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {Cast, CastAttrs, CastInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\n\nimport
{TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nexport function

```

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cast(\n args: {inputs: CastInputs, attrs: CastAttrs, backend: BackendWasm});\n TensorInfo {\n const {inputs:
{x}, attrs: {dtype}, backend} = args;\n const out = backend.makeOutput(x.shape, dtype);\n const inVals =
backend.typedArrayFromHeap(x);\n const outVals = backend.typedArrayFromHeap(out);\n outVals.set(inVals);\n }
return out;\n}\n\nexport const castConfig: KernelConfig = {\n kernelName: Cast,\n backendName: 'wasm',\n kernelFunc: cast as {} as KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2021 Google LLC. All Rights
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writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT
WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
=====
*\nimport {KernelConfig, Ceil} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'/unary_kernel';\n\nexport const ceilConfig: KernelConfig = createUnaryKernelConfig(Ceil);\n\n"/**\n *
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"AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n
* See the License for the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {ClipByValue, ClipByValueAttrs, ClipByValueInputs, KernelConfig, KernelFunc} from
 '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\n\nlet wasmClip: (xId: number, min:
number, max: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmClip =
backend.wasm.cwrap(ClipByValue, null /* void */, [\n 'number', // x_id\n 'number', // min\n 'number', //
max\n 'number' // out_id\n]);\n}\n\nfunction clip(args: {\n
 inputs: ClipByValueInputs,\n backend: BackendWasm,\n attrs: ClipByValueAttrs\n}) {\n const {inputs, backend,
attrs} = args;\n const {x} = inputs;\n const {clipValueMin, clipValueMax} = attrs;\n const xId =
backend.dataIdMap.get(x.dataId).id;\n const out = backend.makeOutput(x.shape, x.dtype);\n const outId =
backend.dataIdMap.get(out.dataId).id;\n wasmClip(xId, clipValueMin, clipValueMax, outId);\n return
out;\n}\n\nexport const clipByValueConfig: KernelConfig = {\n kernelName: ClipByValue,\n backendName:
'wasm',\n setupFunc: setup,\n kernelFunc: clip as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019
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* http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under
the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY
KIND, either express or implied.\n * See the License for the specific language governing permissions and\n *
limitations under the License.\n *
=====
*\n\nimport {backend_util, Concat, ConcatAttrs, ConcatInputs, KernelConfig, KernelFunc, util} from
 '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {concatImplCPU} from
 './kernel_utils/shared';\nimport {identity} from './Identity';\nimport {reshape} from './Reshape';\n\nexport function
concat(\n args: {inputs: ConcatInputs, backend: BackendWasm, attrs: ConcatAttrs}) {\n const {inputs, backend}
= args;\n\n const axis = util.parseAxisParam(args.attrs.axis, inputs[0].shape)[0];\n let outShape =
backend_util.computeOutShape(inputs.map(t => t.shape), axis);\n\n // Keep only non-empty tensors (ignore tensors
with 0 in their shape).\n const

```

```

$inputs = inputs.filter(t => util.sizeFromShape(t.shape) > 0);\n if ($inputs.length === 1) {\n return
identity({inputs: {x: $inputs[0]}, backend});\n }\n\n const out = backend.makeOutput(outShape,
inputs[0].dtype);\n\n if (util.sizeFromShape(outShape) === 0) {\n return out;\n }\n\n const shapes =
$inputs.map(t => t.shape);\n backend_util.assertParamsConsistent(shapes, axis);\n\n if ($inputs[0].dtype ===
'string') {\n // Any concat of n-dimensional tensors across any axis can be reduced to\n // a concatenation of two-
dimensional tensors across the axis 1 by first\n // partitioning the axes of the original tensors into those less than
the\n // axis to be concatenated and the rest. Then reshape the tensors\n // into a two-dimensional tensor by
collapsing these two sets of axes and\n // concatenate the resulting matrices across the axis 1, finally reshaping\n
// the result to have the proper shape.\n const inputs2D = $inputs.map(t => {\n const
innerSize = util.sizeFromShape(t.shape.slice(axis));\n const shape = [-1, innerSize];\n return reshape({inputs:
{x: t}, backend, attrs: {shape}});\n });\n\n const inputsValShapes = inputs2D.map(t => {\n return {vals:
backend.readSync(t.dataId), shape: t.shape};\n });\n\n // Concat 2d tensors along axis=1.\n outShape =\n backend_util.computeOutShape(inputs2D.map(t => t.shape), 1 /* axis */);\n const simplyConcat =
inputs2D[0].shape[0] === 1;\n const outVals = concatImplCPU(\n inputsValShapes, outShape,
inputs[0].dtype,\n simplyConcat) as string[];\n\n const finalOutShape =\n backend_util.computeOutShape($inputs.map(t => t.shape), axis);\n\n out.shape = finalOutShape;\n const
outData = backend.dataIdMap.get(out.dataId);\n outData.stringBytes =
backend_util.fromStringArrayToUint8(outVals);\n\n inputs2D.forEach(t => backend.disposeData(t.dataId));\n\n
return out;\n }\n\n const
batchDim = util.sizeFromShape($inputs[0].shape.slice(0, axis));\n let sumInnerDims = 0;\n const innerDims =
$inputs.map(input => {\n const innerDim = util.sizeFromShape(input.shape.slice(axis));\n sumInnerDims +=
innerDim;\n return innerDim;\n });\n const inVals = $inputs.map(input =>
backend.typedArrayFromHeap(input));\n const outVals = backend.typedArrayFromHeap(out);\n for (let b = 0; b <
batchDim; b++) {\n let outOffset = b * sumInnerDims;\n for (let i = 0; i < inVals.length; i++) {\n const
innerDim = innerDims[i];\n const inOffset = b * innerDim;\n const vals = inVals[i].subarray(inOffset,
inOffset + innerDim);\n outVals.set(vals, outOffset);\n outOffset += innerDim;\n }\n }\n return
out;\n}\n\nexport const concatConfig: KernelConfig = {\n kernelName: Concat,\n backendName: 'wasm',\n kernelFunc: concat as {} as KernelFunc,\n};\n\n", "/**\n * @license\n * Copyright 2019 Google LLC. All Rights
Reserved.\n * Licensed under the Apache
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BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {backend_util, Conv2D, Conv2DAttrs, Conv2DInputs, KernelConfig, KernelFunc, Tensor4D} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nlet wasmConv2d: (\n xId:
number, batchSize: number, inputHeight: number, inputWidth: number,\n filterId: number, filterHeight: number,
filterWidth: number, padTop: number,\n padRight: number,
padBottom: number, padLeft: number, isSamePad: number,\n dilationHeight: number, dilationWidth: number,
strideHeight: number,\n strideWidth: number, inputChannels: number, outputChannels: number,\n outId:
number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmConv2d = backend.wasm.cwrap(Conv2D,
null /* void */, [\n 'number', // xId\n 'number', // batchSize\n 'number', // inputHeight\n 'number', //
inputWidth\n 'number', // filterId\n 'number', // filterHeight\n 'number', // filterWidth\n 'number', //
padTop\n 'number', // padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', // isSamePad\n
'number', // dilationHeight\n 'number', // dilationWidth\n 'number', // strideHeight\n 'number', //
strideWidth\n 'number', // inputChannels\n 'number', // outputChannels\n 'number', // outId\n
]);\n}\n\nfunction conv2d(\n args: {inputs: Conv2DInputs, backend: BackendWasm, attrs:

```



```

Conv2DAttrs}) {\n const {inputs, attrs, backend} = args;\n\n const {x, filter} = inputs;\n const xId =
backend.dataIdMap.get(x.dataId).id;\n const filterId = backend.dataIdMap.get(filter.dataId).id;\n\n const {strides,
dilations, pad, dimRoundingMode, dataFormat} = attrs;\n\n const $dataFormat =
backend_util.convertConv2DDataFormat(dataFormat);\n\n const convInfo = backend_util.computeConv2DInfo(\n
(x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations,\n\n pad, dimRoundingMode, false,
$dataFormat);\n\n const filterHeight = convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n\n const
padTop = convInfo.padInfo.top;\n const padRight = convInfo.padInfo.right;\n const padBottom =
convInfo.padInfo.bottom;\n const padLeft = convInfo.padInfo.left;\n\n const dilationHeight =
convInfo.dilationHeight;\n const dilationWidth = convInfo.dilationWidth;\n\n const strideHeight =
convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n\n const inputChannels
= convInfo.inChannels;\n const outputChannels = convInfo.outChannels;\n\n const isSamePad =
convInfo.padInfo.type === 'SAME' ? 1 : 0;\n\n if (convInfo.dataFormat !== 'channelsLast') {\n throw new
Error(\n `wasm backend Conv2D does not support dataFormat:` +\n ` ${convInfo.dataFormat}'. Please use
'channelsLast'.`);\n };\n\n const out = backend.makeOutput(convInfo.outShape, 'float32');\n const outId =
backend.dataIdMap.get(out.dataId).id;\n\n wasmConv2d(\n xId, x.shape[0], x.shape[1], x.shape[2], filterId,
filterHeight,\n filterWidth, padTop, padRight, padBottom, padLeft, isSamePad,\n dilationHeight,
dilationWidth, strideHeight, strideWidth, inputChannels,\n outputChannels, outId);\n\n return out;\n}\n\nexport
const conv2DConfig: KernelConfig = {\n kernelName: Conv2D,\n backendName: 'wasm',\n setupFunc: setup,\n
kernelFunc: conv2d as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights
Reserved.\n * Licensed
under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with
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distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *
=====\n
*\n\nimport {backend_util, Conv2DBackpropInput, Conv2DBackpropInputAttrs, Conv2DBackpropInputInputs,
KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from
'./backend_wasm';\n\nlet wasmConv2DBackpropInput: (\n dyId: number, filterId: number, batchSize: number,
filterHeight: number,\n filterWidth: number,
inHeight: number, inWidth: number, inChannels: number,\n outHeight: number, outWidth: number, outChannels:
number,\n strideHeight: number, strideWidth: number, topPad: number, leftPad: number,\n fltS0: number, fltS1:
number, fltS2: number, xBatchStride: number,\n xRowStride: number, xColStride: number, xChannelStride:
number,\n yBatchStride: number, yRowStride: number, yColStride: number,\n yChannelStride: number, outId:
number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmConv2DBackpropInput =
backend.wasm.cwrap(Conv2DBackpropInput, null, [\n 'number', // dyId\n 'number', // filterId\n 'number', //
batchSize\n 'number', // filterHeight\n 'number', // filterWidth\n 'number', // inHeight\n 'number', //
inWidth\n 'number', // inChannels\n 'number', // outHeight\n 'number', // outWidth\n 'number', //
outChannels\n 'number', // strideHeight\n 'number', // strideWidth\n 'number', // topPad\n 'number', //
leftPad\n 'number', // fltS0\n 'number', // fltS1\n 'number', // fltS2\n 'number', //
xBatchStride\n 'number', // xRowStride\n 'number', // xColStride\n 'number', // xChannelStride\n 'number', //
yBatchStride\n 'number', // yRowStride\n 'number', // yColStride\n 'number', // yChannelStride\n 'number', //
outId\n]);\n}\n\nfunction conv2DBackpropInput(args: {\n backend: BackendWasm,\n inputs:
Conv2DBackpropInputInputs,\n attrs: Conv2DBackpropInputAttrs\n}): TensorInfo {\n const {backend, inputs,
attrs} = args;\n const {dy, filter} = inputs;\n const {strides, pad, dataFormat, dimRoundingMode, inputShape} =
attrs;\n const dilations = 1;\n const $dataFormat = backend_util.convertConv2DDataFormat(dataFormat);\n const
convInfo = backend_util.computeConv2DInfo(\n inputShape, filter.shape as [number, number, number,

```

```

number], strides,\n dilations, pad, dimRoundingMode, false /* depthwise */, $dataFormat);\n
const {\n batchSize,\n filterHeight,\n filterWidth,\n inChannels,\n inHeight,\n inWidth,\n outChannels,\n outHeight,\n outWidth,\n strideHeight,\n strideWidth\n } = convInfo;\n\n const topPad =
filterHeight - 1 - convInfo.padInfo.top;\n const leftPad = filterWidth - 1 - convInfo.padInfo.left;\n\n const
isChannelsLast = convInfo.dataFormat === 'channelsLast';\n const dxStrides =
util.computeStrides(convInfo.inShape);\n const dyStrides = util.computeStrides(dy.shape);\n const [fltS0, fltS1,
fltS2] = util.computeStrides(filter.shape);\n const xBatchStride = dxStrides[0];\n const xRowStride =
isChannelsLast ? dxStrides[1] : dxStrides[2];\n const xColStride = isChannelsLast ? dxStrides[2] : 1;\n const
xChannelStride = isChannelsLast ? 1 : dxStrides[1];\n const yBatchStride = dyStrides[0];\n const yRowStride =
isChannelsLast ? dyStrides[1] : dyStrides[2];\n const yColStride = isChannelsLast ? dyStrides[2] : 1;\n const
yChannelStride = isChannelsLast
? 1 : dyStrides[1];\n\n const out = backend.makeOutput(convInfo.inShape, 'float32');\n const outId =
backend.dataIdMap.get(out.dataId).id;\n const dyId = backend.dataIdMap.get(dy.dataId).id;\n const filterId =
backend.dataIdMap.get(filter.dataId).id;\n\n wasmConv2DBackpropInput(\n dyId, filterId, batchSize,
filterHeight, filterWidth, inHeight, inWidth,\n inChannels, outHeight, outWidth, outChannels, strideHeight,
strideWidth,\n topPad, leftPad, fltS0, fltS1, fltS2, xBatchStride, xRowStride,\n xColStride, xChannelStride,
yBatchStride, yRowStride, yColStride,\n yChannelStride, outId);\n return out;\n}\n\nexport const
conv2DBackpropInputConfig: KernelConfig = {\n kernelName: Conv2DBackpropInput,\n backendName:
'wasm',\n setupFunc: setup,\n kernelFunc: conv2DBackpropInput as {} as KernelFunc\n};\n\n"/**\n * @license\n *
Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
'License');\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an 'AS IS' BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *\n *
=====
\n\n *\n\nimport { Cos, KernelConfig } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from
'./unary_kernel';\n\nexport const cosConfig: KernelConfig = createUnaryKernelConfig(Cos);\n\n"/**\n * @license\n *
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'License');\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of
the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an 'AS IS' BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *\n *
=====
\n\n *\n\nimport { Cosh, KernelConfig } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from
'./unary_kernel';\n\nexport const coshConfig: KernelConfig = createUnaryKernelConfig(Cosh);\n\n"/**\n * @license\n *
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2.0 (the 'License');\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless
required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an
'AS IS' BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n *
See the License for the specific language governing permissions and\n * limitations under the License.\n *\n *
=====
\n\n *\n\nimport { CropAndResize, CropAndResizeAttrs, CropAndResizeInputs, KernelConfig, KernelFunc,
TensorInfo } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport { cast }
from './Cast';\n\n// Must match enum in CropAndResize.cc\nenum InterpolationMethod {\n bilinear = 0,\n nearest

```



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permutedOut;\n if (permutation !== null) {\n const undoPermutation =
backend_util.getUndoAxesPermutation(permutation);\n out = transpose(\n {inputs: {x: permutedOut}, attrs:
{perm: undoPermutation}, backend});\n backend.disposeData(permutedX.dataId);\n
backend.disposeData(permutedOut.dataId);\n };\n return out;\n}\n\nexport const cumsumConfig: KernelConfig
= {\n kernelName: Cumsum,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: cumsum as {} as
KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless
required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====
*\n\nimport {DepthToSpace, DepthToSpaceAttrs, DepthToSpaceInputs, KernelConfig, KernelFunc, TensorInfo,
util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm}
from './backend_wasm';\n\nlet wasmDepthToSpace: (\n xId: number, blockSize: number, channelsLast: number,
xStrides: Uint8Array,\n xStridesLength: number, outputShape: Uint8Array, outputStrides: Uint8Array,\n
outSize: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n
wasmDepthToSpace = backend.wasm.cwrap(DepthToSpace, null /*void*/, [\n 'number', // xId\n 'number', //
blockSize\n 'number', // channelsLast\n 'array', // xStrides\n 'number', // xStridesLength\n 'array', //
outputShape\n 'array', // outputStrides\n 'number', // outSize\n 'number', // outId\n]);\n}\n\nexport function
depthToSpace(args: {\n backend: BackendWasm,\n inputs: DepthToSpaceInputs,\n attrs: DepthToSpaceAttrs\n}):
TensorInfo {\n const {backend, inputs, attrs} = args;\n const {x} = inputs;\n const {blockSize, dataFormat} =
attrs;\n const batchSize = x.shape[0];\n const inputHeight = (dataFormat === 'NHWC') ? x.shape[1]
: x.shape[2];\n const inputWidth = (dataFormat === 'NHWC') ? x.shape[2] : x.shape[3];\n const inputDepth =
(dataFormat === 'NHWC') ? x.shape[3] : x.shape[1];\n const outputHeight = inputHeight * blockSize;\n const
outputWidth = inputWidth * blockSize;\n const outputDepth = inputDepth / (blockSize * blockSize);\n const
outputShape = (dataFormat === 'NHWC') ?\n [batchSize, outputHeight, outputWidth, outputDepth] :\n [batchSize, outputDepth, outputHeight, outputWidth];\n const out = backend.makeOutput(outputShape,
'float32');\n const xData = backend.dataIdMap.get(x.dataId);\n const xId = xData.id;\n const xStridesBytes =\n new Uint8Array(new Int32Array(util.computeStrides(x.shape)).buffer);\n const outputShapeBytes = new
Uint8Array(new Int32Array(outputShape).buffer);\n const outStridesBytes =\n new Uint8Array(new
Int32Array(util.computeStrides(outputShape)).buffer);\n const outId = backend.dataIdMap.get(out.dataId).id;\n
const channelsLast
= dataFormat === 'NHWC' ? 1 : 0;\n wasmDepthToSpace(\n xId, blockSize, channelsLast, xStridesBytes,
x.shape.length - 1,\n outputShapeBytes, outStridesBytes, outputShape.length, outId);\n return
out;\n}\n\nexport const depthToSpaceConfig: KernelConfig = {\n kernelName: DepthToSpace,\n backendName:
'wasm',\n setupFunc: setup,\n kernelFunc: depthToSpace as {} as KernelFunc\n};\n", "/*\n * @license\n *
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\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {backend_util, DepthwiseConv2dNative, DepthwiseConv2dNativeAttrs,
DepthwiseConv2dNativeInputs, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';\n\nimport

```

```

{BackendWasm} from './backend_wasm';\n\nlet wasmDepthwiseConv2d: (\n xId: number, batchSize: number,
inputHeight: number, inputWidth: number,\n filterId: number, filterHeight: number, filterWidth: number, padTop:
number,\n padRight: number, padBottom: number, padLeft: number, isSamePad: number,\n dilationHeight:
number, dilationWidth: number, strideHeight: number,\n strideWidth: number, inputChannels: number,
outputChannels: number,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n
wasmDepthwiseConv2d =\n backend.wasm.cwrap(DepthwiseConv2dNative, null /* void */, [\n 'number', //
xId\n 'number', // batchSize\n 'number',
// inputHeight\n 'number', // inputWidth\n 'number', // filterId\n 'number', // filterHeight\n
'number', // filterWidth\n 'number', // padTop\n 'number', // padRight\n 'number', // padBottom\n
'number', // padLeft\n 'number', // isSamePad\n 'number', // dilationHeight\n 'number', //
dilationWidth\n 'number', // strideHeight\n 'number', // strideWidth\n 'number', // inputChannels\n
'number', // outputChannels\n 'number', // outId\n]);\n\nfunction depthwiseConv2d(args: {\n inputs:
DepthwiseConv2dNativeInputs,\n backend: BackendWasm,\n attrs: DepthwiseConv2dNativeAttrs\n}) {\n const
{inputs, attrs, backend} = args;\n\n const {x, filter} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n
const filterId = backend.dataIdMap.get(filter.dataId).id;\n\n const {strides, dilations, pad, dimRoundingMode} =
attrs;\n\n const $dilations = dilations
=== null ? [1, 1] : dilations;\n\n const convInfo = backend_util.computeConv2DInfo(\n (x as Tensor4D).shape,
(filter as Tensor4D).shape, strides,\n ($dilations as number | [number, number]), pad, dimRoundingMode,\n
true /* depthwise */);\n\n const filterHeight = convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n
const padTop = convInfo.padInfo.top;\n const padRight = convInfo.padInfo.right;\n const padBottom =
convInfo.padInfo.bottom;\n const padLeft = convInfo.padInfo.left;\n const dilationHeight =
convInfo.dilationHeight;\n const dilationWidth = convInfo.dilationWidth;\n const strideHeight =
convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n const inputChannels =
convInfo.inChannels;\n const outputChannels = convInfo.outChannels;\n const isSamePad = convInfo.padInfo.type
=== 'SAME' ? 1 : 0;\n\n if (convInfo.dataFormat !== 'channelsLast') {\n throw new Error(\n `wasm backend
DepthwiseConv2dNative does not support
dataFormat:` +\n `${convInfo.dataFormat}`. Please use 'channelsLast'.`);\n }\n\n const out =
backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmDepthwiseConv2d(\n xId, x.shape[0], x.shape[1], x.shape[2], filterId, filterHeight,\n filterWidth,
padTop, padRight, padBottom, padLeft, isSamePad,\n dilationHeight, dilationWidth, strideHeight, strideWidth,
inputChannels,\n outputChannels, outId);\n return out;\n}\n\nexport const depthwiseConv2dNativeConfig:
KernelConfig = {\n kernelName: DepthwiseConv2dNative,\n backendName: 'wasm',\n setupFunc: setup,\n
kernelFunc: depthwiseConv2d as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2021 Google LLC. All
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distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n */\n
=====\n
*/\nimport {Elu, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'/unary_kernel';\n\nexport const eluConfig: KernelConfig = createUnaryKernelConfig(Elu);\n\n"/**\n * @license\n *
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agreed to in writing, software\n

```

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```
=====\n*\nimport {Equal, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from './binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const equalConfig: KernelConfig =\n createBinaryKernelConfig(Equal, supportsFullBroadcast, 'bool');\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n
```

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```
=====\n*\nimport {Exp, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from './unary_kernel';\n\nexport const expConfig: KernelConfig = createUnaryKernelConfig(Exp, 'float32');\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport {ExpandDims, ExpandDimsAttrs, ExpandDimsInputs, KernelConfig, KernelFunc, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {reshape} from './Reshape';\n\nexport function expandDims(args: {\n inputs: ExpandDimsInputs,\n attrs: ExpandDimsAttrs,\n backend: BackendWasm\n}) {\n const {inputs, attrs, backend} = args;\n const {input} = inputs;\n const {dim} = attrs;\n\n const inputRank = input.shape.length;\n const newShape = input.shape.slice();\n let $dim = dim;\n if (dim < 0) {\n // Negative value is counted from the tail of rank.\n util.assert(\n -(inputRank + 1) <= dim,\n () => `Axis must be in the interval [${-(inputRank + 1)}, ${\n inputRank\n }]);\n $dim = inputRank + dim + 1;\n }\n newShape.splice($dim, 0, 1);\n\n return reshape({x: input}, backend, attrs: {shape: newShape});\n}\n\nexport const expandDimsConfig:\n KernelConfig = {\n kernelName: ExpandDims,\n backendName: 'wasm',\n kernelFunc: expandDims as {\n KernelFunc,\n },\n };\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport {KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\n\nimport {Fill, FillAttrs} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nexport function fill(args: {\n attrs: FillAttrs,\n backend: BackendWasm\n}) {\n const {attrs: {shape, value, dtype}, backend} = args;\n const out = backend.makeOutput(shape, dtype);\n const outVals = backendtypedArrayFromHeap(out);\n outVals.fill(value as number);\n return out;\n}\n\nexport const fillConfig: KernelConfig = {\n kernelName: Fill,\n backendName: 'wasm',\n kernelFunc: fill as {\n KernelFunc,\n },\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All
```

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```
=====\n*\n\nimport {FlipLeftRight, FlipLeftRightInputs, KernelConfig, KernelFunc, TensorInfo} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\n\nlet wasmFlipLeftRight: (\n xId: number, batch: number, imageHeight: number, imageWidth: number,\n numChannels: number, outId: number) =>\n void;\n\nfunction setup(backend: BackendWasm) {\n wasmFlipLeftRight = backend.wasm.cwrap(FlipLeftRight, null /* void */, [\n 'number', // xId\n 'number', // batch\n 'number', // imageHeight\n 'number', // imageWidth\n 'number', // numChannels\n 'number', // outId\n]);\n}\n\nexport function flipLeftRight(\n args: {inputs: FlipLeftRightInputs, backend: BackendWasm}): TensorInfo {\n const {inputs, backend} = args;\n const {image} = inputs;\n const out = backend.makeOutput(image.shape, image.dtype);\n const imageId = backend.dataIdMap.get(image.dataId).id;\n const outId = backend.dataIdMap.get(out.dataId).id;\n const [batch, imageHeight, imageWidth, numChannels] = image.shape;\n wasmFlipLeftRight(\n imageId, batch, imageHeight, imageWidth, numChannels, outId);\n return out;\n}\n\nexport const flipLeftRightConfig:\n KernelConfig = {\n kernelName: FlipLeftRight,\n backendName: 'wasm',\n kernelFunc: flipLeftRight as {\n KernelFunc,\n setupFunc: setup\n },\n },\n /**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n};
```

=====\n\*\n\nimport {Floor, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from './unary\_kernel';\n\nexport const floorConfig: KernelConfig = createUnaryKernelConfig(Floor);\n\n/\*\*\n \* @license\n \* Copyright 2019 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the \"License\");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \*\n \* <http://www.apache.org/licenses/LICENSE-2.0>\n \*\n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*/

```
=====\n*\n\nimport {FloorDiv, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from './binary_kernel';\n\nconst supportsFullBroadcast = false;\nexport const floorDivConfig: KernelConfig =\n createBinaryKernelConfig(FloorDiv, supportsFullBroadcast);\n\n/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

=====\n\*\n\nimport {FloorDiv, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from './binary\_kernel';\n\nconst supportsFullBroadcast = false;\nexport const floorDivConfig: KernelConfig =\n createBinaryKernelConfig(FloorDiv, supportsFullBroadcast);\n\n/\*\*\n \* @license\n \* Copyright 2019 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the \"License\");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \*\n \* <http://www.apache.org/licenses/LICENSE-2.0>\n \*\n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*/

=====\n\*\n\nimport {FloorDiv, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from './binary\_kernel';\n\nconst supportsFullBroadcast = false;\nexport const floorDivConfig: KernelConfig =\n createBinaryKernelConfig(FloorDiv, supportsFullBroadcast);\n\n/\*\*\n \* @license\n \* Copyright 2019 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the \"License\");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \*\n \* <http://www.apache.org/licenses/LICENSE-2.0>\n \*\n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*/

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*\n\nimport {FusedBatchNorm, FusedBatchNormAttrs, FusedBatchNormInputs, KernelConfig, KernelFunc,
TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nlet
wasmBatchNorm: (\n xId: number, meanId: number, varianceId: number, offsetId: number,\n scaleId: number,
varianceEpsilon: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n
wasmBatchNorm = backend.wasm.cwrap(\n FusedBatchNorm, null /* void */,\n ['number', 'number',
'number', 'number', 'number', 'number']);\n}\n\nfunction fusedBatchNorm(args: {\n backend:
BackendWasm,\n inputs: FusedBatchNormInputs,\n
 attrs: FusedBatchNormAttrs\n}): TensorInfo {\n const {backend, inputs, attrs} = args;\n const {varianceEpsilon}
= attrs;\n const {x, mean, variance, offset, scale} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n
const meanId = backend.dataIdMap.get(mean.dataId).id;\n const varianceId =
backend.dataIdMap.get(variance.dataId).id;\n const offsetId = offset != null ?
backend.dataIdMap.get(offset.dataId).id : 0;\n const scaleId = scale != null ?
backend.dataIdMap.get(scale.dataId).id : 0;\n\n const out = backend.makeOutput(x.shape, x.dtype);\n // Short-
circuit zero-sized tensors.\n if (util.sizeFromShape(x.shape) === 0) {\n return out;\n }\n\n const outId =
backend.dataIdMap.get(out.dataId).id;\n\n wasmBatchNorm(\n xId, meanId, varianceId, offsetId, scaleId,
varianceEpsilon, outId);\n return out;\n}\n\nexport const fusedBatchNormConfig: KernelConfig = {\n kernelName:
FusedBatchNorm,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: fusedBatchNorm
as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n */
=====

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=====
*\n\nimport {backend_util, FusedConv2D, FusedConv2DAttrs, FusedConv2DInputs, KernelConfig, KernelFunc,
Tensor4D} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport
{FusableActivation} from './types';\n\nlet
wasmFusedConv2d: (\n xId: number, batchSize: number, inputHeight: number, inputWidth: number,\n filterId:
number, filterHeight: number, filterWidth: number,\n biasId: number, padTop: number, padRight: number,
padBottom: number,\n padLeft: number, isSamePad: number, dilationHeight: number,\n dilationWidth:
number, strideHeight: number, strideWidth: number,\n inputChannels: number, outputChannels: number,
activation: number,\n preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>\n
void;\n\nfunction setup(backend: BackendWasm) {\n wasmFusedConv2d = backend.wasm.cwrap(FusedConv2D,
null /* void */, [\n 'number', // xId\n 'number', // batchSize\n 'number', // inputHeight\n 'number', //
inputWidth\n 'number', // filterId\n 'number', // filterHeight\n 'number', // filterWidth\n 'number', // biasId\n
'number', // padTop\n 'number', // padRight\n 'number', // padBottom\n 'number', // padLeft\n
'number', // isSamePad\n 'number', // dilationHeight\n 'number', // dilationWidth\n 'number', //
strideHeight\n 'number', // strideWidth\n 'number', // inputChannels\n 'number', // outputChannels\n
'number', // activation\n 'number', // preluActivationWeightsId\n 'number', // leakyreluAlpha\n 'number', //
outId\n]);\n}\n\nfunction fusedConv2d(args: {\n inputs: FusedConv2DInputs,\n backend: BackendWasm,\n attrs:
FusedConv2DAttrs\n}) {\n const {inputs, attrs, backend} = args;\n const {x, filter, bias, preluActivationWeights} =
inputs;\n const {\n strides,\n pad,\n dilations,\n dataFormat,\n dimRoundingMode,\n activation,\n
leakyreluAlpha\n } = attrs;\n\n const convInfo = backend_util.computeConv2DInfo(\n (x as Tensor4D).shape,
(filter as Tensor4D).shape, strides, dilations,\n pad, dimRoundingMode);\n\n const fusedActivation =\n
FusableActivation[activation as { } as keyof typeof FusableActivation];\n

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 if (fusedActivation == null) {\n throw new Error(\n `${activation} activation not yet supported for
FusedConv2D` +\n `in the wasm backend.`);\n }\n\n const xId = backend.dataIdMap.get(x.dataId).id;\n const
filterId = backend.dataIdMap.get(filter.dataId).id;\n\n const outputChannels = convInfo.outChannels;\n\n let biasId
= 0;\n if (bias != null) {\n const biasData = backend.dataIdMap.get(bias.dataId);\n if (biasData.shape.length !==
= 1) {\n throw new Error(\n `FusedConv2D only supports rank-1 bias but got` +\n `rank
${biasData.shape.length}`);\n }\n if (biasData.shape[0] !== outputChannels) {\n throw new Error(\n
`FusedConv2D bias shape (${biasData.shape}) does not` +\n `match the number of output channels
(${outputChannels})`);\n }\n biasId = biasData.id;\n }\n\n const filterHeight = convInfo.filterHeight;\n const
filterWidth = convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n
 const padRight = convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n const padLeft =
convInfo.padInfo.left;\n const dilationHeight = convInfo.dilationHeight;\n const dilationWidth =
convInfo.dilationWidth;\n const strideHeight = convInfo.strideHeight;\n const strideWidth =
convInfo.strideWidth;\n const inputChannels = convInfo.inChannels;\n const isSamePad = convInfo.padInfo.type
=== 'SAME' ? 1 : 0;\n const batchSize = convInfo.batchSize;\n const inHeight = convInfo.inHeight;\n const
inWidth = convInfo.inWidth;\n\n if (dataFormat !== 'NHWC') {\n throw new Error(\n `wasm backend
FusedConv2D does not support dataFormat:` +\n `${dataFormat}`. Please use 'NHWC'.);\n }\n\n const out =
backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n const
preluActivationWeightsId = preluActivationWeights == null ?\n 0 :\n backend.dataIdMap.get(preluActivationWeights.dataId).id;\n\n wasmFusedConv2d(\n
 xId, batchSize, inHeight, inWidth, filterId, filterHeight, filterWidth,\n biasId, padTop, padRight, padBottom,
padLeft, isSamePad, dilationHeight,\n dilationWidth, strideHeight, strideWidth, inputChannels,
outputChannels,\n fusedActivation, preluActivationWeightsId, leakyreluAlpha || 0, outId);\n\n return
out;\n}\n\nexport const fusedConv2DConfig: KernelConfig = {\n kernelName: FusedConv2D,\n backendName:
'wasm',\n setupFunc: setup,\n kernelFunc: fusedConv2d as { } as KernelFunc\n};\n", "/**\n * @license\n *
Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
`License`);\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an `AS IS` BASIS,\n *
WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {backend_util, FusedDepthwiseConv2D, FusedDepthwiseConv2DAttrs,
FusedDepthwiseConv2DInputs, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from '../backend_wasm';\n\nimport {FusableActivation} from './types';\n\nlet
wasmFusedDepthwiseConv2d:\n (xId: number, batchSize: number, inputHeight: number, inputWidth: number,\n filterId: number, filterHeight: number, filterWidth: number,\n biasId: number, padTop: number, padRight:
number, padBottom: number,\n padLeft: number, isSamePad: number, dilationHeight: number,\n dilationWidth: number, strideHeight: number, strideWidth: number,\n inputChannels: number, outputChannels:
number, activation: number,\n preluActivationWeightsId:
number, leakyreluAlpha: number, outId: number) =>\n void;\n\nfunction setup(backend: BackendWasm) {\n
wasmFusedDepthwiseConv2d =\n backend.wasm.cwrap(FusedDepthwiseConv2D, null /* void */, [\n
'number', // xId\n 'number', // batchSize\n 'number', // inputHeight\n 'number', // inputWidth\n
'number', // filterId\n 'number', // filterHeight\n 'number', // filterWidth\n 'number', // biasId\n
'number', // padTop\n 'number', // padRight\n 'number', // padBottom\n 'number', // padLeft\n
'number', // isSamePad\n 'number', // dilationHeight\n 'number', // dilationWidth\n 'number', //
strideHeight\n 'number', // strideWidth\n 'number', // inputChannels\n 'number', // outputChannels\n
'number', // activation\n 'number', // preluActivationWeightsId\n 'number', // leakyreluAlpha\n

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'number',
// outId\n]);\n}\n\nfunction fusedDepthwiseConv2d(args: {\n inputs: FusedDepthwiseConv2DInputs,\n backend: BackendWasm,\n attrs: FusedDepthwiseConv2DAttrs\n}) {\n const {inputs, attrs, backend} = args;\n const {x, filter, bias, preluActivationWeights} = inputs;\n const {\n strides,\n pad,\n dilations,\n dataFormat,\n dimRoundingMode,\n activation,\n leakyreluAlpha\n } = attrs;\n const convInfo =\n backend_util.computeConv2DInfo(\n (x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations,\n pad, dimRoundingMode, true /* depthwise */);\n const fusedActivation =\n FusableActivation[activation as {\n as key of typeof FusableActivation\n }];\n if (fusedActivation == null) {\n throw new Error(\n `${activation}\n activation not yet supported for FusedDepthwiseConv2D` +\n `in the wasm backend.`);\n }\n const xId =\n backend.dataIdMap.get(x.dataId).id;\n const filterId = backend.dataIdMap.get(filter.dataId).id;\n const outputChannels = convInfo.outChannels;\n let biasId = 0;\n if (bias != null) {\n const biasData =\n backend.dataIdMap.get(bias.dataId);\n if (biasData.shape.length !== 1) {\n throw new Error(\n `FusedDepthwiseConv2D only supports rank-1 bias but got`\n `rank ${biasData.shape.length}`);\n }\n if (biasData.shape[0] !== outputChannels) {\n throw new Error(\n `FusedDepthwiseConv2D bias shape\n (${biasData.shape}) does not`\n `match the number of output channels (${outputChannels})`);\n }\n biasId = biasData.id;\n }\n const filterHeight = convInfo.filterHeight;\n const filterWidth =\n convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const padRight = convInfo.padInfo.right;\n const\n padBottom = convInfo.padInfo.bottom;\n const padLeft = convInfo.padInfo.left;\n const dilationHeight =\n convInfo.dilationHeight;\n const dilationWidth = convInfo.dilationWidth;\n const strideHeight =\n convInfo.strideHeight;\n const\n strideWidth = convInfo.strideWidth;\n const inputChannels = convInfo.inChannels;\n const isSamePad =\n convInfo.padInfo.type === 'SAME' ? 1 : 0;\n const batchSize = convInfo.batchSize;\n const inHeight =\n convInfo.inHeight;\n const inWidth = convInfo.inWidth;\n if (dataFormat !== 'NHWC') {\n throw new Error(\n `wasm backend FusedDepthwiseConv2D does not support dataFormat:`\n `${dataFormat}`. Please use\n 'NHWC'.);\n }\n const out = backend.makeOutput(convInfo.outShape, 'float32');\n const outId =\n backend.dataIdMap.get(out.dataId).id;\n const preluActivationWeightsId = preluActivationWeights == null ?\n 0\n :\n backend.dataIdMap.get(preluActivationWeights.dataId).id;\n wasmFusedDepthwiseConv2d(\n xId,\n batchSize, inHeight, inWidth, filterId, filterHeight, filterWidth,\n biasId, padTop, padRight, padBottom, padLeft,\n isSamePad, dilationHeight,\n dilationWidth, strideHeight, strideWidth, inputChannels, outputChannels,\n fusedActivation, preluActivationWeightsId, leakyreluAlpha || 0, outId);\n return out;\n}\n\nexport const\n fusedDepthwiseConv2DConfig: KernelConfig = {\n kernelName: FusedDepthwiseConv2D,\n backendName:\n 'wasm',\n setupFunc: setup,\n kernelFunc: fusedDepthwiseConv2d as {\n as KernelFunc\n };n\n}"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n *
=====
*/\n\nimport {gather_util, GatherNd, GatherNdInputs, KernelConfig, TensorInfo} from '@tensorflow/tfjs-\n core';\nimport {BackendWasm} from './backend_wasm';\nimport {CppType} from './types';\n\nlet\n wasmGatherNd: (\n xId: number, dtype: CCppType, indicesId: number, numSlices: number,\n sliceRank:\n number, sliceSize: number, strides: Uint8Array, outId: number) =>\n void;\n\nfunction setup(backend:\n BackendWasm): void {\n wasmGatherNd = backend.wasm.cwrap(GatherNd, null /*void*/, [\n 'number', // xId\n 'number', // dtype\n 'number', // indicesId\n 'number', // numSlices\n 'number', // sliceRank\n 'number', //\n sliceSize\n 'array', // strides\n 'number' // outId\n]);\n}\n\nfunction gatherNd(args: {backend: BackendWasm,\n inputs: GatherNdInputs}):\n TensorInfo {\n const {backend, inputs} = args;\n const {params, indices} =\n inputs;\n const [resultShape, numSlices, sliceSize, strides] =\n gather_util.prepareAndValidate(params,

```

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indices);\n\n const out = backend.makeOutput(resultShape, params.dtype);\n if (numSlices === 0) {\n return
out;\n }\n\n const indicesShape = indices.shape;\n const sliceRank = indicesShape[indicesShape.length - 1];\n\n const xData = backend.dataIdMap.get(params.dataId);\n const xId = xData.id;\n const indicesData =
backend.dataIdMap.get(indices.dataId);\n const indicesId = indicesData.id;\n\n const stridesBytes = new
Uint8Array(new Int32Array(strides).buffer);\n\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmGatherNd(\n xId, CppDType[params.dtype], indicesId, numSlices, sliceRank, sliceSize,\n stridesBytes,
outId);\n\n return out;\n}\n\n\nexport const gatherNdConfig: KernelConfig = {\n kernelName: GatherNd,\n
backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: gatherNd\n};\n\n", "/*\n * @license\n * Copyright 2019
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not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====*\n
*\n\nimport {backend_util, GatherV2, GatherV2Attrs, GatherV2Inputs, KernelConfig, KernelFunc, Tensor,
TensorInfo, TypedArray, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from
'./backend_wasm';\n\nimport {reshape} from './Reshape';\n\nimport {CppType} from './types';\n\nlet wasmGather:
(\n xId: number, dtype: CppDType, xStrides: Uint8Array, stridesSize: number,\n indicesId: number, batchSize:
number, outStrides:
 Uint8Array,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmGather =
backend.wasm.cwrap('Gather', null /*void*/, [\n 'number', // xId\n 'number', // dtype\n 'array', // xStrides\n
'number', // stridesSize\n 'number', // indicesId\n 'number', // batchSize\n 'array', // outStrides\n
'number' // outId\n]);\n}\n\nfunction gatherV2(\n args: {backend: BackendWasm, inputs: GatherV2Inputs, attrs:
GatherV2Attrs}): \n TensorInfo {\n const {backend, inputs, attrs} = args;\n const {x, indices} = inputs;\n const
{axis, batchDims} = attrs;\n\n // Throw error when any index is out of bound.\n const parsedAxis =
util.parseAxisParam(axis, x.shape)[0];\n const indicesVals = backend.readSync(indices.dataId) as TypedArray;\n
const axisDim = x.shape[parsedAxis];\n for (let i = 0; i < indicesVals.length; ++i) {\n const index =
indicesVals[i];\n util.assert(\n index <= axisDim - 1 && index >= 0,\n
 () =>\n `GatherV2: the index value ${index} is not in [0, ${axisDim - 1}]);\n }\n\n const shapeInfo =
backend_util.segment_util.collectGatherOpShapeInfo(\n x as Tensor, indices as Tensor, parsedAxis,
batchDims);\n\n const flattenX = reshape({\n inputs: {x},\n attrs: {\n shape: [\n shapeInfo.batchSize,
shapeInfo.outerSize, shapeInfo.dimSize,\n shapeInfo.sliceSize\n]\n },\n backend\n });\n const
indicesSize = util.sizeFromShape(indices.shape);\n const flattenIndex = reshape({\n inputs: {x: indices},\n attrs:
{shape: [shapeInfo.batchSize, indicesSize / shapeInfo.batchSize]},\n backend\n });\n const flattenOutputShape =
[\n shapeInfo.batchSize, shapeInfo.outerSize, indicesSize / shapeInfo.batchSize,\n shapeInfo.sliceSize\n];\n\n const out = backend.makeOutput(flattenOutputShape, x.dtype);\n if (util.sizeFromShape(x.shape) === 0) {\n
return out;\n }\n\n const stridesSize = flattenX.shape.length - 1;\n\n const
xData = backend.dataIdMap.get(flattenX.dataId);\n const xId = xData.id;\n\n const indicesData =
backend.dataIdMap.get(flattenIndex.dataId);\n const indicesId = indicesData.id;\n\n const outId =
backend.dataIdMap.get(out.dataId).id;\n\n const xStridesBytes = new Uint8Array(\n new
Int32Array(util.computeStrides(flattenX.shape)).buffer);\n const outStridesBytes = new Uint8Array(\n new
Int32Array(util.computeStrides(flattenOutputShape)).buffer);\n\n wasmGather(\n xId, CppDType[x.dtype],
xStridesBytes, stridesSize, indicesId,\n shapeInfo.batchSize, outStridesBytes, outId);\n\n backend.disposeData(flattenX.dataId);\n backend.disposeData(flattenIndex.dataId);\n\n // reshape\n out.shape =
shapeInfo.outputShape;\n return out;\n}\n\n\nexport const gatherV2Config: KernelConfig = {\n kernelName:
GatherV2,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: gatherV2 as { } as KernelFunc\n};\n\n", "/*\n

```

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compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\nimport {Greater, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
'./binary_kernel';\n\nconst supportsFullBroadcast = false;\nexport const greaterConfig: KernelConfig =\ncreateBinaryKernelConfig(Greater, supportsFullBroadcast, 'bool');\n", "/**\n * @license\n * Copyright 2019 Google
LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\nimport {GreaterEqual, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig}
from './binary_kernel';\n\nconst supportsFullBroadcast = false;\nexport const greaterEqualConfig: KernelConfig =\ncreateBinaryKernelConfig(GreaterEqual, supportsFullBroadcast, 'bool');\n", "/**\n * @license\n * Copyright 2019
Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {KernelConfig, KernelFunc, LeakyRelu, LeakyReluAttrs, LeakyReluInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {CppType} from
'./types';\n\nlet wasmFunc: (\n xId: number, dtype: number, leakyreluAlpha: number, outId: number) =>
void;\n\nfunction
setupFunc(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(LeakyRelu, null /* void */, [\n
'number', // x_id\n 'number', // dtype\n 'number', // leakyrelu_alpha\n 'number', // out_id\n]);\n\n\nexport
function leakyRelu(\n args:\n {inputs: LeakyReluInputs, attrs: LeakyReluAttrs, backend: BackendWasm});\n\nTensorInfo {\n const {inputs: {x}, attrs: {alpha}, backend} = args;\n\n const xId =
backend.dataIdMap.get(x.dataId).id;\n // According to TF API, LeakyRelu returns float32 when input is either
float32\n // or int32.\n const out = backend.makeOutput(x.shape, 'float32');\n\n if (util.sizeFromShape(x.shape)
!== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmFunc(xId, CppDType[x.dtype], alpha,
outId);\n }\n\n return out;\n}\n\n\nexport const leakyReluConfig: KernelConfig = {\n kernelName: LeakyRelu,\n backendName: 'wasm',\n setupFunc,\n kernelFunc: leakyRelu as {} as KernelFunc,\n};\n", "/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for

```

the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\nimport {KernelConfig, Less} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from\n './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const lessConfig: KernelConfig =\n createBinaryKernelConfig(Less, supportsFullBroadcast, 'bool');\n"/**\n * @license\n * Copyright\n * 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an\n * "AS IS"\n * BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport {KernelConfig, LessEqual} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from\n './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const lessEqualConfig: KernelConfig =\n createBinaryKernelConfig(LessEqual, supportsFullBroadcast, 'bool');\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an\n * "AS IS"\n * BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\nimport {KernelConfig, Log} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from\n './unary_kernel';\nexport const logConfig: KernelConfig =\n createUnaryKernelConfig(Log);\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License,\n * Version 2.0 (the\n * "License");\n * you may not use this file except in compliance with the License.\n * You may\n * obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by\n * applicable law or agreed to in writing, software\n * distributed under the License is distributed on an\n * "AS IS"\n * BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the\n * License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\nimport {KernelConfig, LogicalAnd} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from\n './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const logicalAndConfig: KernelConfig =\n createBinaryKernelConfig(LogicalAnd, supportsFullBroadcast, 'bool');\n"/**\n * @license\n * Copyright 2019\n * Google LLC. All Rights Reserved.\n * Licensed under the\n * Apache License, Version 2.0 (the\n * "License");\n * you may not use this file except in compliance with the\n * License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n * on an\n * "AS IS"\n * BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n * implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n * License.\n *
```

```
=====\n*\n\nimport {backend_util, KernelConfig, KernelFunc, Max, MaxAttrs, MaxInputs, TensorInfo, util} from\n '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport\n {permuteAxesAndTranspose} from './kernel_utils';\nimport {CppType} from './types';\n\nlet wasmMax: (xId:\n number, dtype: number, reduceSize: number, outId: number) =>\n void;\n\nfunction\n setup(backend: BackendWasm): void {\n wasmMax = backend.wasm.cwrap(Max, null /*void*/, [\n 'number', //\n x_id\n 'number', // dtype\n 'number', // reduce_size\n 'number', // out_id\n]);\n\nfunction max(args:
```

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{backend: BackendWasm, inputs: MaxInputs, attrs: MaxAttrs});\n TensorInfo {\n const {backend, inputs, attrs} =
args;\n const {reductionIndices: axis, keepDims} = attrs;\n const {x} = inputs;\n const xId =
backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const {transposed, axes, originalAxes,
inputWasTransposed} =\n permuteAxesAndTranspose(x, axis, backend);\n\n if (inputWasTransposed) {\n
const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n input = transposed;\n inputId =
transposedId;\n }\n\n const inputRank = input.shape.length;\n backend_util.assertAxesAreInnerMostDims('max',
axes, inputRank);\n const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape,
axes);\n const reduceSize = util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape,
x.dtype);\n if (util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmMax(inputId, CppDType[x.dtype], reduceSize, outId);\n }\n\n if (inputWasTransposed) {\n // dispose of the
transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const
newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n
return out;\n}\n\nexport const maxConfig: KernelConfig = {\n kernelName: Max,\n backendName: 'wasm',\n
setupFunc: setup,\n kernelFunc: max as { } as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n
* http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*\nimport {KernelConfig, Maximum} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
'/binary_kernel';\nconst supportsFullBroadcast = false;\nexport const maximumConfig: KernelConfig =\ncreateBinaryKernelConfig(Maximum, supportsFullBroadcast);\n", "/*\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n
* http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {backend_util, KernelConfig, KernelFunc, MaxPool, MaxPoolAttrs, MaxPoolInputs, Tensor4D, util}
from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\n\nlet wasmMaxPool: (\n xId:
number, batchSize: number, inputHeight: number, inputWidth: number,\n filterHeight: number, filterWidth:
number, padTop: number, padRight: number,\n padBottom: number, padLeft: number, dilationHeight: number,\n
dilationWidth: number, strideHeight: number, strideWidth: number,\n inputChannels: number, outputChannels:
number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmMaxPool =
backend.wasm.cwrap(MaxPool, null /* void */, [\n 'number', // xId\n 'number', // batchSize\n 'number', //
inputHeight\n 'number', // inputWidth\n 'number', // filterHeight\n 'number', // filterWidth\n 'number', //
padTop\n 'number', // padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', //
dilationHeight\n 'number', // dilationWidth\n 'number', // strideHeight\n 'number', // strideWidth\n 'number',
// inputChannels\n 'number', // outputChannels\n 'number', // outId\n]);\n}\n\nfunction maxPool(\n args:
{inputs: MaxPoolInputs, backend: BackendWasm, attrs: MaxPoolAttrs}) {\n const {inputs, attrs, backend} =
args;\n\n const x = inputs.x as Tensor4D;\n const xId = backend.dataIdMap.get(x.dataId).id;\n\n // TF API
supports int32 input. CPU and WebGL backend also support int32\n // input. WASM backend doesn't

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support it because it uses xnnpack which only\n // supports float32.\n /\n // Add the following assert only for the
WASM backend instead of at core op\n // level.\n /\n // TODO: add support for int32 input.\n util.assert(\n
x.dtype === 'float32',\n () =>\n `Error in MaxPool: only float32 input is supported. Got ${x.dtype}.`);\n\n
const {filterSize, strides, pad, dimRoundingMode} = attrs;\n const convInfo = backend_util.computePool2DInfo(\n
 x.shape, filterSize, strides, 1 /* dilations */, pad, dimRoundingMode);\n\n const filterHeight =
convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const
padRight = convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n const padLeft =
convInfo.padInfo.left;\n const dilationHeight = convInfo.dilationHeight;\n const dilationWidth =
convInfo.dilationWidth;\n const strideHeight = convInfo.strideHeight;\n const strideWidth =
convInfo.strideWidth;\n\n
const inputChannels = convInfo.inChannels;\n const outputChannels = convInfo.outChannels;\n\n if
(convInfo.dataFormat !== 'channelsLast') {\n throw new Error(\n `wasm backend does not support
dataFormat: ` +\n `${convInfo.dataFormat}`. Please use 'channelsLast'.`);\n }\n\n const out =
backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n
wasmMaxPool(\n xId, x.shape[0], x.shape[1], x.shape[2], filterHeight, filterWidth,\n padTop, padRight, padBottom, padLeft, dilationHeight, dilationWidth,\n strideHeight, strideWidth, inputChannels, outputChannels, outId);\n return out;\n}\n\nexport const maxPoolConfig: KernelConfig = {\n kernelName: MaxPool,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: maxPool as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
"License");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *\n
=====\n\n
*/\n\nimport {backend_util, KernelConfig, KernelFunc, Mean, MeanAttrs, MeanInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {cast} from './Cast';\n\nimport
{permuteAxesAndTranspose} from './kernel_utils';\n\nlet wasmMean: (xId: number, reduceSize: number, outId:
number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmMean =\n backend.wasm.cwrap(Mean,\n null /*void*/, ['number, number, number']);\n\n\n export function mean(\n args: {backend: BackendWasm,\n inputs: MeanInputs, attrs: MeanAttrs});\n TensorInfo {\n const {backend, inputs, attrs} = args;\n const {axis,\n keepDims} = attrs;\n const {x} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const {transposed, axes, originalAxes, inputWasTransposed} =\n permuteAxesAndTranspose(x, axis, backend);\n\n let reductionAxes = axes;\n if (inputWasTransposed) {\n const
transposedId = backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId !== xId) {\n // transpose was
not a no-op. We will need to dispose of this\n // once we are done.\n input = transposed;\n inputId =
transposedId;\n reductionAxes = backend_util.getInnerMostAxes(\n reductionAxes.length,\n input.shape.length);\n }\n }\n\n backend_util.assertAxesAreInnerMostDims(\n 'mean', reductionAxes,\n input.shape.length);\n\n const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n const reduceSize = util.sizeFromShape(reduceShape);\n let castedInput = input;\n if (input.dtype !== 'float32') {\n castedInput =\n cast({backend, inputs: {x: input}, attrs: {dtype: 'float32'}});\n inputId =
backend.dataIdMap.get(castedInput.dataId).id;\n }\n\n const out = backend.makeOutput(outShape, 'float32');\n if
(util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmMean(inputId, reduceSize, outId);\n }\n\n if (inputWasTransposed) {\n // dispose of the transposed
tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const newShape =

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backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n if (input.dtype
!=='float32') {\n backend.disposeData(castedInput.dataId);\n }\n\n return out;\n}\n\nexport
 const meanConfig: KernelConfig = {\n kernelName: Mean,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: mean as { } as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport { backend_util, KernelConfig, KernelFunc, Min, MinAttrs, MinInputs, TensorInfo, util } from
'@tensorflow/tfjs-core';\n\nimport
 { BackendWasm } from '../backend_wasm';\n\nimport { permuteAxesAndTranspose } from './kernel_utils';\n\nimport
 { CppDType } from './types';\n\nlet wasmMin: (xId: number, dtype: number, reduceSize: number, outId: number)
=>\n void;\n\nfunction setup(backend: BackendWasm): void {\n wasmMin = backend.wasm.cwrap(Min, null
/*void*/, [\n 'number', // x_id\n 'number', // dtype\n 'number', // reduce_size\n 'number', // out_id\n
]);\n}\n\nfunction min(args: { backend: BackendWasm, inputs: MinInputs, attrs: MinAttrs }):\n TensorInfo {\n
 const { backend, inputs, attrs } = args;\n const { axis, keepDims } = attrs;\n const { x } = inputs;\n const xId =
backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const { transposed, axes, originalAxes,
inputWasTransposed } =\n permuteAxesAndTranspose(x, axis, backend);\n\n if (inputWasTransposed) {\n
 const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId !== xId)
 {\n // transpose was not a no-op. We will need to dispose of this\n // once we are done.\n input =
transposed;\n inputId = transposedId;\n }\n}\n\n const inputRank = input.shape.length;\n backend_util.assertAxesAreInnerMostDims('min', axes, inputRank);\n const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, axes);\n const reduceSize =
 util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, input.dtype);\n if
 (util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n
 wasmMin(inputId, CppDType[x.dtype], reduceSize, outId);\n }\n\n if (inputWasTransposed) {\n // dispose of the
transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const
newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n}\n\n
return out;\n}\n\nexport const minConfig: KernelConfig
 = {\n kernelName: Min,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: min as { } as
 KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====\n
*/\n\nimport { KernelConfig, Minimum } from '@tensorflow/tfjs-core';\n\nimport { createBinaryKernelConfig } from
'./binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport
 const minimumConfig: KernelConfig =\n createBinaryKernelConfig(Minimum,
 supportsFullBroadcast);\n", "/*\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed

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```
=====\n*\n\nimport { KernelConfig, KernelFunc, MirrorPad, MirrorPadAttrs, MirrorPadInputs } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport { CppDType } from './types';\n\n// Must match enum in MirrorPad.cc\nenum MirrorPaddingMode {\n reflect = 0,\n symmetric = 1\n}\n\nlet wasmMirrorPad: (\n xId: number, xShapeBytes: Uint8Array, xShapeLength: number, xDtype: number,\n prePaddingsBytes: Uint8Array, postPaddingsBytes: Uint8Array, mode: number,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmMirrorPad = backend.wasm.cwrap(MirrorPad, null /* void */, [\n 'number', // xId\n 'array', // x.shape\n 'number', // x.shape.length\n 'number', // x.dtype\n 'array', // pre-paddings\n 'array', // post-paddings\n 'number', // mode\n 'number', // outId\n]);\n\n function mirrorPad(args: {\n inputs: MirrorPadInputs,\n backend: BackendWasm,\n attrs: MirrorPadAttrs\n }) {\n const { inputs: { x }, backend, attrs: { paddings, mode } } = args;\n const outShape = paddings.map((p, i) => p[0] /* beforePad */ + x.shape[i] + p[1] /* afterPad */);\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out = backend.makeOutput(outShape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n const prePaddingsFlat = paddings.map(padTuple => padTuple[0]);\n const postPaddingsFlat = paddings.map(padTuple => padTuple[1]);\n const prePaddingsBytes = new Uint8Array(new Int32Array(prePaddingsFlat).buffer);\n const postPaddingsBytes = new Uint8Array(new Int32Array(postPaddingsFlat).buffer);\n const wasmMirrorPad = (\n xId, xShapeBytes, x.shape.length, CppDType[x.dtype], prePaddingsBytes,\n postPaddingsBytes, MirrorPaddingMode[mode], outId);\n return out;\n }\n\n export const mirrorPadConfig: KernelConfig = {\n kernelName: MirrorPad,\n backendName: 'wasm',\n kernelFunc: mirrorPad as {\n } as KernelFunc,\n setupFunc: setup\n };\n\n /**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
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\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport { KernelConfig, Multiply } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from './binary_kernel';\n\nconst supportsFullBroadcast = true;\n\nexport const multiplyConfig: KernelConfig = (\n createBinaryKernelConfig(Multiply, supportsFullBroadcast);\n\n /**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n*\n\nimport { KernelConfig, Neg } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from './unary_kernel';\n\nexport const negConfig: KernelConfig = createUnaryKernelConfig(Neg);\n\n/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an
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\"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n
 * See the License for the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {BackendWasm} from './backend_wasm';\n\n// Analogous to `struct Result` in
`non_max_suppression_impl.h`\n\ninterface Result {\n pSelectedIndices: number;\n selectedSize: number;\n pSelectedScores: number;\n pValidOutputs: number;\n}\n\n/**\n * Parse the result of the c++ method, which has the
shape equivalent to\n * `Result`\n */\n\nexport function parseResultStruct(\n backend: BackendWasm, resOffset:
number): Result {\n const result = new Int32Array(backend.wasm.HEAPU8.buffer,
 resOffset, 4);\n const pSelectedIndices = result[0];\n const selectedSize = result[1];\n const pSelectedScores =
 result[2];\n const pValidOutputs = result[3];\n // Since the result was allocated on the heap, we have to delete it.\n
 backend.wasm._free(resOffset);\n return {pSelectedIndices, selectedSize, pSelectedScores,
 pValidOutputs};\n}\n\n",/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under
the Apache License, Version 2.0 (the `License`);\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless
required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an `AS IS` BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n
 * =====
*\n\nimport {KernelConfig, KernelFunc, NonMaxSuppressionV3, NonMaxSuppressionV3Attrs,
NonMaxSuppressionV3Inputs, TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from
 './backend_wasm';\n\nimport {parseResultStruct} from './NonMaxSuppression_util';\n\nlet wasmFunc: (\n
 boxesId: number, scoresId: number, maxOutputSize: number,\n iouThreshold: number, scoreThreshold: number)
=> number;\n\nfunction setup(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(\n
 NonMaxSuppressionV3,\n 'number', // Result*\n [\n 'number', // boxesId\n 'number', // scoresId\n
 'number', // maxOutputSize\n 'number', // iouThreshold\n 'number', // scoreThreshold\n
]);\n}\n\nfunction kernelFunc(args: {\n backend: BackendWasm,\n inputs: NonMaxSuppressionV3Inputs,\n attrs:
 NonMaxSuppressionV3Attrs\n}): TensorInfo {\n const {backend, inputs,
 attrs} = args;\n const {iouThreshold, maxOutputSize, scoreThreshold} = attrs;\n const {boxes, scores} =
 inputs;\n const boxesId = backend.dataIdMap.get(boxes.dataId).id;\n const scoresId =
 backend.dataIdMap.get(scores.dataId).id;\n const resOffset =\n wasmFunc(boxesId, scoresId, maxOutputSize,
 iouThreshold, scoreThreshold);\n const {pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs} =\n
 parseResultStruct(backend, resOffset);\n // Since we are not using scores for V3, we have to delete it from the
 heap.\n backend.wasm._free(pSelectedScores);\n backend.wasm._free(pValidOutputs);\n const
 selectedIndicesTensor =\n backend.makeOutput([selectedSize, 'int32', pSelectedIndices);\n return
 selectedIndicesTensor;\n}\n\nexport const nonMaxSuppressionV3Config: KernelConfig = {\n kernelName:
 NonMaxSuppressionV3,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: kernelFunc as {} as
 KernelFunc,\n};\n\n",/**\n * @license\n * Copyright 2020
 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the `License`);\n * you
 may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
 http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
 software\n * distributed under the License is distributed on an `AS IS` BASIS,\n * WITHOUT WARRANTIES
 OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
 governing permissions and\n * limitations under the License.\n
 * =====
*\n\nimport {KernelConfig, KernelFunc, NonMaxSuppressionV4, NonMaxSuppressionV4Attrs,
NonMaxSuppressionV4Inputs, TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from
 './backend_wasm';\n\nimport {parseResultStruct} from './NonMaxSuppression_util';\n\nlet wasmFunc: (\n

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boxesId: number, scoresId:
 number, maxOutputSize: number,\n iouThreshold: number, scoreThreshold: number,\n padToMaxOutputSize:
boolean) => number;\n\nfunction setup(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(\n NonMaxSuppressionV4,\n 'number', // Result*\n [\n 'number', // boxesId\n 'number', // scoresId\n 'number', // maxOutputSize\n 'number', // iouThreshold\n 'number', // scoreThreshold\n 'bool', //
padToMaxOutputSize\n]);\n}\n\nfunction nonMaxSuppressionV4(args: {\n backend: BackendWasm,\n inputs:
NonMaxSuppressionV4Inputs,\n attrs: NonMaxSuppressionV4Attrs\n}): TensorInfo[] {\n const {backend, inputs,
attrs} = args;\n const {iouThreshold, maxOutputSize, scoreThreshold, padToMaxOutputSize} =\n attrs;\n const
{boxes, scores} = inputs;\n\n const boxesId = backend.dataIdMap.get(boxes.dataId).id;\n const scoresId =
backend.dataIdMap.get(scores.dataId).id;\n\n const resOffset = wasmFunc(\n boxesId,
scoresId, maxOutputSize, iouThreshold, scoreThreshold,\n padToMaxOutputSize);\n\n const {pSelectedIndices,
selectedSize, pSelectedScores, pValidOutputs} =\n parseResultStruct(backend, resOffset);\n\n // Since we are
not using scores for V4, we have to delete it from the heap.\n backend.wasm._free(pSelectedScores);\n\n const
selectedIndicesTensor =\n backend.makeOutput([selectedSize], 'int32', pSelectedIndices);\n\n const
validOutputsTensor = backend.makeOutput([], 'int32', pValidOutputs);\n\n return [selectedIndicesTensor,
validOutputsTensor];\n}\n\n\nexport const nonMaxSuppressionV4Config: KernelConfig = {\n kernelName:
NonMaxSuppressionV4,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: nonMaxSuppressionV4 as {}
as KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under
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BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {KernelConfig, KernelFunc, NonMaxSuppressionV5, NonMaxSuppressionV5Attrs,
NonMaxSuppressionV5Inputs, TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from
'./backend_wasm';\n\nimport {parseResultStruct} from './NonMaxSuppression_util';\n\nlet wasmFunc:\n (boxesId: number, scoresId: number, maxOutputSize: number,\n iouThreshold: number, scoreThreshold: number,
softNmsSigma: number) =>\n number;\n\nfunction setup(backend: BackendWasm): void {\n wasmFunc
= backend.wasm.cwrap(\n NonMaxSuppressionV5,\n 'number', // Result*\n [\n 'number', //
boxesId\n 'number', // scoresId\n 'number', // maxOutputSize\n 'number', // iouThreshold\n
'number', // scoreThreshold\n 'number', // softNmsSigma\n]);\n}\n\nfunction kernelFunc(args: {\n
backend: BackendWasm,\n inputs: NonMaxSuppressionV5Inputs,\n attrs: NonMaxSuppressionV5Attrs\n}):
TensorInfo[] {\n const {backend, inputs, attrs} = args;\n const {iouThreshold, maxOutputSize, scoreThreshold,
softNmsSigma} = attrs;\n const {boxes, scores} = inputs;\n\n const boxesId =
backend.dataIdMap.get(boxes.dataId).id;\n const scoresId = backend.dataIdMap.get(scores.dataId).id;\n\n const
resOffset = wasmFunc(\n boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold,\n softNmsSigma);\n\n const {pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs} =\n parseResultStruct(backend, resOffset);\n\n //
Since we are not using validOutputs for V5, we have to delete it from the\n // heap.\n backend.wasm._free(pValidOutputs);\n\n const selectedIndicesTensor =\n backend.makeOutput([selectedSize],
'int32', pSelectedIndices);\n const selectedScoresTensor =\n backend.makeOutput([selectedSize], 'float32',
pSelectedScores);\n\n return [selectedIndicesTensor, selectedScoresTensor];\n}\n\n\nexport const
nonMaxSuppressionV5Config: KernelConfig = {\n kernelName: NonMaxSuppressionV5,\n backendName:
'wasm',\n setupFunc: setup,\n kernelFunc: kernelFunc as {} as KernelFunc,\n};\n\n"/**\n * @license\n * Copyright
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```
=====
*import {KernelConfig, NotEqual} from '@tensorflow/tfjs-core';
import {createBinaryKernelConfig} from './binary_kernel';
const supportsFullBroadcast = false;
export const notEqualConfig: KernelConfig =
createBinaryKernelConfig(NotEqual, supportsFullBroadcast, 'bool');
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```

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```
=====
*import {KernelConfig, KernelFunc, OneHot, OneHotAttrs, OneHotInputs} from '@tensorflow/tfjs-core';
import {BackendWasm} from './backend_wasm';
let wasmOneHot: (indicesId: number, depth: number, onValue: number, offValue: number, outId: number) => void;
function setup(backend: BackendWasm) {
 wasmOneHot = backend.wasm.wrap(OneHot, null /* void */, [number, // indices_id
 number, // depth, number, // onValue, number, // offValue, number // out_id]);
 function oneHot(args: {inputs: OneHotInputs, attrs: OneHotAttrs, backend: BackendWasm}) {
 const {inputs, backend, attrs} = args;
 const {indices} = inputs;
 const {depth, onValue, offValue} = attrs;
 const out = backend.makeOutput([...indices.shape, depth], 'int32');
 const outId = backend.dataIdMap.get(out.dataId).id;
 const indicesData = backend.dataIdMap.get(indices.dataId);
 const indicesId = indicesData.id;
 wasmOneHot(indicesId, depth, onValue, offValue, outId);
 return out;
 }
 export const oneHotConfig: KernelConfig = {
 kernelName: OneHot,
 backendName: 'wasm',
 setupFunc: setup,
 kernelFunc: oneHot as {} as KernelFunc;
 };
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```

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```
=====
*import {KernelConfig, KernelFunc, OnesLike, OnesLikeInputs} from '@tensorflow/tfjs-core';
import {BackendWasm} from './backend_wasm';
function onesLike(args: {inputs: OnesLikeInputs, backend: BackendWasm}) {
 const {inputs: {x}, backend} = args;
 const out = backend.makeOutput(x.shape, x.dtype);
 const outVals = backend.typedArrayFromHeap(out);
 outVals.fill(1);
 return out;
}
export const onesLikeConfig: KernelConfig = {
 kernelName: OnesLike,
 backendName: 'wasm',
 kernelFunc: onesLike as {} as KernelFunc;
};
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```

the License.\n \*

```
=====\n
*\n\nimport {KernelConfig, KernelFunc, Pack, PackAttrs, PackInputs, TensorInfo, util} from '@tensorflow/tfjs-
core';\nimport {BackendWasm} from './backend_wasm';\n\nimport {concat} from './Concat';\nimport
{expandDims} from './ExpandDims';\n\nexport function pack(\n args: {inputs: PackInputs, backend:
BackendWasm, attrs: PackAttrs});\n TensorInfo {\n const {inputs, backend, attrs} = args;\n const {axis} =
attrs;\n\n if (inputs.length === 1) {\n return expandDims(\n
 {inputs: {input: inputs[0]}, backend, attrs: {dim: axis}});\n }\n\n const shape = inputs[0].shape;\n const dtype
= inputs[0].dtype;\n\n inputs.forEach(t => {\n util.assertShapesMatch(\n shape, t.shape, \n 'All tensors
passed to stack must have matching shapes');\n util.assert(\n dtype === t.dtype, \n () => 'All tensors passed
to stack must have matching dtypes');\n });\n\n const intermediateTensorInfos: TensorInfo[] = [];\n const
expandedTensors = inputs.map(t => {\n const expandedT =\n expandDims({inputs: {input: t}, backend, attrs:
{dim: axis}});\n intermediateTensorInfos.push(expandedT);\n return expandedT;\n });\n\n const result =
concat({inputs: expandedTensors, backend, attrs: {axis}});\n\n intermediateTensorInfos.forEach(t =>
backend.disposeData(t.dataId));\n\n return result;\n })\n\nexport const packConfig: KernelConfig = {\n kernelName:
Pack, \n backendName: 'wasm', \n kernelFunc: pack as {} as KernelFunc\n};\n", "/*\n
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```

```
=====\n
*\n\nimport {KernelConfig, KernelFunc, PadV2, PadV2Attrs, PadV2Inputs, util} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {fill} from './Fill';\n\nimport {CppType}
from './types';\n\nlet wasmPadV2: (\n xId: number, xShapeBytes:
 Uint8Array, xShapeLength: number, xDtype: number, \n prePaddingsBytes: Uint8Array, postPaddingsBytes:
 Uint8Array, \n constantValue: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n
 wasmPadV2 = backend.wasm.cwrap(PadV2, null /* void */, [\n 'number', // xId\n 'array', // x.shape\n
 'number', // x.shape.length\n 'number', // x.dtype\n 'array', // pre-paddings\n 'array', // post-paddings\n
 'number', // constantValue\n 'number', // outId\n]);\n\n function pad(\n args: {inputs: PadV2Inputs, backend:
BackendWasm, attrs: PadV2Attrs}) {\n const {inputs: {x}, backend, attrs: {paddings, constantValue}} = args;\n\n
 const outShape = paddings.map(\n (p, i) => p[0] /* beforePad */ + x.shape[i] + p[1] /* afterPad */);\n\n if
(util.sizeFromShape(x.shape) === 0) {\n // Short-circuit the computation, since x doesn't have value, only\n //
the shape is used to compute output shape to pad.\n return fill({\n
 backend, \n attrs: {shape: outShape, value: constantValue, dtype: x.dtype}\n });\n }\n\n const xId =
backend.dataIdMap.get(x.dataId).id;\n const out = backend.makeOutput(outShape, x.dtype);\n const
outTensorData = backend.dataIdMap.get(out.dataId);\n const outId = outTensorData.id;\n\n const xShapeBytes =
new Uint8Array(new Int32Array(x.shape).buffer);\n\n const prePaddingsFlat = paddings.map(padTuple =>
padTuple[0]);\n const postPaddingsFlat = paddings.map(padTuple => padTuple[1]);\n const prePaddingsBytes =\n new
Uint8Array(new Int32Array(prePaddingsFlat).buffer);\n const postPaddingsBytes =\n new
Uint8Array(new Int32Array(postPaddingsFlat).buffer);\n\n wasmPadV2(\n xId, xShapeBytes, x.shape.length,
CppType[x.dtype], prePaddingsBytes, \n postPaddingsBytes, constantValue, outId);\n return out;\n })\n\nexport
const padV2Config: KernelConfig = {\n kernelName: PadV2, \n backendName: 'wasm', \n kernelFunc: pad as {} as
KernelFunc, \n setupFunc: setup\n};\n", "/*\n
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```
=====\n*\nimport {KernelConfig, Pow} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const powConfig: KernelConfig =\ncreateBinaryKernelConfig(Pow, supportsFullBroadcast);\n"/**\n *
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```

```
=====\n*\nimport {KernelConfig, KernelFunc, Prelu, PreluInputs} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {cast} from './Cast';\nlet wasmPrelu: (xId: number, weightsId: number, outId: number) => void;\nfunction setup(backend: BackendWasm) {\n wasmPrelu = backend.wasm.cwrap(Prelu, null /* void */, [\n 'number', // x_id\n 'number', // weights_id\n 'number' // out_id\n]);\n function prelu(args: {inputs: PreluInputs, backend: BackendWasm}) {\n const {inputs, backend} = args;\n const {x, alpha} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const weightsId = backend.dataIdMap.get(alpha.dataId).id;\n let inputId = xId;\n const input = x;\n let castedInput = input;\n if (input.dtype !== 'float32') {\n castedInput = cast({backend, inputs: {x}, attrs: {dtype: 'float32'}});\n }\n inputId = backend.dataIdMap.get(castedInput.dataId).id;\n const out = backend.makeOutput(x.shape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmPrelu(inputId, weightsId, outId);\n if (input.dtype !== 'float32') {\n backend.disposeData(castedInput.dataId);\n }\n return out;\n }\n export const preluConfig: KernelConfig = {\n kernelName: Prelu,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: prelu as {} as KernelFunc\n };\n "/**\n *
```

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```

```
=====\n*\nimport {backend_util, KernelConfig, KernelFunc, Prod, ProdAttrs, ProdInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {permuteAxesAndTranspose} from './kernel_utils';\nimport {CppType} from './types';\nlet wasmProd: (\n xId: number, reduceSize: number,\n dtype: number, outId: number) => void;\nfunction setup(backend: BackendWasm): void {\n wasmProd = backend.wasm.cwrap(Prod, null /*void*/, [\n 'number',\n 'number',\n 'number',\n 'number'\n]);\n function prod(args: {\n backend: BackendWasm,\n inputs: ProdInputs,\n attrs: ProdAttrs\n }): TensorInfo {\n const {backend, inputs, attrs} = args;\n const {axis, keepDims} = attrs;\n const {x} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n const {transposed, axes, originalAxes, inputWasTransposed} =\n permuteAxesAndTranspose(x, axis, backend);\n let reductionAxes = axes;\n if (inputWasTransposed) {\n const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId !== xId) {\n // transpose was not a no-op. We will need to dispose of this\n // once we are done.\n input = transposed;\n inputId = transposedId;\n reductionAxes =\n backend_util.getInnerMostAxes(\n reductionAxes.length, input.shape.length);\n }\n }\n }\n}
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backend_util.assertAxesAreInnerMostDims(\n 'prod', reductionAxes, input.shape.length);\n const [outShape,\n reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n const reduceSize\n = util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, input.dtype);\n if\n (util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmProd(inputId, reduceSize, CppDType[out.dtype], outId);\n }\n\n if (inputWasTransposed) {\n // dispose of\n the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const\n newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n return out;\n}\n\nexport const prodConfig:

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 KernelConfig = {\n kernelName: Prod,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: prod as {} as\n KernelFunc\n};\n", "/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the\n Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the\n License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n License.\n *

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=====\n\n*\n\nimport {KernelConfig, KernelFunc, Range, RangeAttrs, TensorInfo} from '@tensorflow/tfjs-core';\nimport\n {BackendWasm} from '../backend_wasm';\nimport

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 {rangeImplCPU} from '../kernel_utils/shared';\n\nexport const range = (\n (args: {backend: BackendWasm, attrs:\n RangeAttrs}): TensorInfo => {\n const {backend, attrs} = args;\n const {start, stop, step, dtype} = attrs;\n const values = rangeImplCPU(start, stop, step, dtype);\n const out = backend.makeOutput([values.length],\n dtype);\n const outVals = backend.typedArrayFromHeap(out);\n outVals.set(values);\n return out;\n\n});\n\nexport const rangeConfig: KernelConfig = {\n kernelName: Range,\n backendName: 'wasm',\n kernelFunc:

```

```

 range as {} as KernelFunc\n};\n", "/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in\n compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n software\n

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=====\n\n*\n\nimport {KernelConfig, RealDiv} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from\n '../binary_kernel';\n\nconst supportsFullBroadcast = true;\n\nexport const realDivConfig: KernelConfig =\n createBinaryKernelConfig(RealDiv, supportsFullBroadcast);\n", "/**\n * @license\n * Copyright 2019 Google LLC.\n All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this\n file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n software\n

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=====\n\n*\n\nimport {KernelConfig, Relu} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from\n '../unary_kernel';\n\nexport const reluConfig: KernelConfig = createUnaryKernelConfig(Relu);\n", "/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the

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```
=====
*\nimport {KernelConfig, Relu6} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
 './unary_kernel';\nexport const relu6Config: KernelConfig = createUnaryKernelConfig(Relu6);\n", "/**\n *
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```

```
=====
*\n\nimport {KernelConfig, KernelFunc, ResizeBilinear, ResizeBilinearAttrs, ResizeBilinearInputs, TensorInfo,
util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {cast} from
 './Cast';\n\nlet wasmResizeBilinear: (\n xId: number, batch: number, oldHeight: number, oldWidth: number,\n numChannels: number, newHeight: number, newWidth: number,\n alignCorners: number, halfPixelCenters:
 number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmResizeBilinear =
 backend.wasm.cwrap(ResizeBilinear, null /*void*/, [\n 'number', // xId\n 'number', // batch\n 'number', //
 oldHeight\n 'number', // oldWidth\n 'number', // numChannels\n 'number', // newHeight\n 'number', //
 newWidth\n 'number', // alignCorners\n 'number',
 // halfPixelCenters\n 'number' // outId\n]);\n\n function resizeBilinear(args: {\n backend: BackendWasm,\n inputs: ResizeBilinearInputs,\n attrs: ResizeBilinearAttrs\n }): TensorInfo {\n const {backend, inputs, attrs} =
 args;\n const {images} = inputs;\n const {alignCorners, halfPixelCenters, size} = attrs;\n const [newHeight,
 newWidth] = size;\n const [batch, oldHeight, oldWidth, numChannels] = images.shape;\n const outShape =
 [batch, newHeight, newWidth, numChannels];\n let xData = backend.dataIdMap.get(images.dataId);\n let
 castedData;\n if (xData.dtype !== 'float32') {\n castedData =\n cast({backend, inputs: {x: images}, attrs:
 {dtype: 'float32'}});\n xData = backend.dataIdMap.get(castedData.dataId);\n }\n const xId = xData.id;\n const
 out = backend.makeOutput(outShape, 'float32');\n if (util.sizeFromShape(images.shape) === 0) {\n return out;\n
 }\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmResizeBilinear(\n
 xId, batch, oldHeight, oldWidth, numChannels, newHeight, newWidth,\n alignCorners ? 1 : 0,
 halfPixelCenters ? 1 : 0, outId);\n if (castedData != null) {\n backend.disposeData(castedData.dataId);\n
 }\n return out;\n }\n\n export const resizeBilinearConfig: KernelConfig = {\n kernelName: ResizeBilinear,\n
 backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: resizeBilinear as {} as KernelFunc\n };}\n", "/**\n *
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```

```
=====
*\n\nimport {KernelConfig, KernelFunc, Reverse, ReverseAttrs, ReverseInputs, TensorInfo, util} from
 '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {identity} from
 './Identity';\nimport {reshape} from './Reshape';\n\nlet wasmReverse: (\n xId: number, axes: Uint8Array,\n axesLength: number, outShape: Uint8Array,\n outShapeLength: number, outId: number) => void;\n\nfunction
```



```

setup(backend: BackendWasm) {
 wasmReverse = backend.wasm.cwrap(Reverse, null, [
 'number', // x_id
 'array', // axes
 'number', // axes_length
 'array', // out_shape
 'number', // out_shape_length
 'number', // out_id
]);
 export function reverse(
 args: {inputs: ReverseInputs, backend: BackendWasm, attrs: ReverseAttrs}):
 TensorInfo {
 const {inputs, backend, attrs} = args;
 const {x} = inputs;
 const {dims} = attrs;
 const axes = util.parseAxisParam(dims, x.shape);
 if (x.shape.length === 0) {
 return identity({inputs: {x}, backend});
 }
 const out = backend.makeOutput(x.shape, x.dtype);
 const xId = backend.dataIdMap.get(x.dataId).id;
 const outId = backend.dataIdMap.get(out.dataId).id;
 const axesBytes = new Uint8Array(new Int32Array(axes).buffer);
 const outShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);
 wasmReverse(xId, axesBytes, axes.length, outShapeBytes, x.shape.length, outId);
 const reshaped = reshape({inputs: {x: out}, attrs: {shape: x.shape}, backend});
 backend.disposeData(out.dataId);
 return reshaped;
 }
 export const reverseConfig: KernelConfig = {
 kernelName: Reverse,
 backendName: 'wasm',
 kernelFunc: reverse as {} as KernelFunc,
 setupFunc: setup
 };
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 */
}

import {KernelConfig, KernelFunc, RotateWithOffset, RotateWithOffsetAttrs, RotateWithOffsetInputs, TensorInfo} from '@tensorflow/tfjs-core';
import {backend_util} from '@tensorflow/tfjs-core';
import {BackendWasm} from './backend_wasm';
let wasmRotate: (
 xId: number, batch: number, imageHeight: number, imageWidth: number,
 numChannels: number, radians: number, centerX: number, centerY: number,
 fillBytes: Uint8Array, fillLength: number, outId: number) => void;
function setup(backend: BackendWasm) {
 wasmRotate = backend.wasm.cwrap(RotateWithOffset, null /* void */, [
 'number', // xId
 'number', // batch
 'number', // imageHeight
 'number', // imageWidth
 'number', // numChannels
 'number', // radians
 'number', // centerX
 'number', // centerY
 'array', // fillBytes
 'number', // fillLength
 'number', // outId
]);
 export function rotateWithOffset(
 args: {inputs: RotateWithOffsetInputs, backend: BackendWasm, attrs: RotateWithOffsetAttrs}):
 TensorInfo {
 const {inputs, backend, attrs} = args;
 const {image} = inputs;
 const {radians, fillValue, center} = attrs;
 const out = backend.makeOutput(image.shape, image.dtype);
 const imageId = backend.dataIdMap.get(image.dataId).id;
 const outId = backend.dataIdMap.get(out.dataId).id;
 const [batch, imageHeight, imageWidth, numChannels] = image.shape;
 const [centerX, centerY] = backend_util.getImageCenter(center, imageHeight, imageWidth);
 const fillIsBlack = fillValue === 0;
 const fullOpacityValue = 255;
 const fillValues = typeof fillValue === 'number' ? [fillValue, fillValue, fillValue, fillIsBlack ? 0 : fullOpacityValue] : [...fillValue, fullOpacityValue];
 const fillBytes = new Uint8Array(new Int32Array(fillValues).buffer);
 wasmRotate(imageId, batch, imageHeight, imageWidth, numChannels, radians, centerX, centerY, fillBytes, fillValues.length, outId);
 return out;
 }
 export const rotateWithOffsetConfig: KernelConfig = {
 kernelName: RotateWithOffset,
 backendName: 'wasm',
 kernelFunc: rotateWithOffset as {} as KernelFunc,
 setupFunc: setup
 };
 /**
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 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
 * See the License for the specific language governing permissions and
 * limitations under the License.
 */
}

```

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=====
*\nimport {KernelConfig, Round} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'./unary_kernel';\nexport const roundConfig: KernelConfig = createUnaryKernelConfig(Round);\n", "/*\n *
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
*\nimport {KernelConfig, Rsqrt} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'./unary_kernel';\nexport const rsqrtConfig: KernelConfig = createUnaryKernelConfig(Rsqrt);\n", "/*\n *
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BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
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=====
*\n\nimport {KernelConfig, KernelFunc, scatter_util, ScatterNd, ScatterNdAttrs, ScatterNdInputs, TensorInfo, util}
from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {CppType} from
'./types';\n\nlet wasmScatterNd: (\n indicesId: number, updatesId: number, dtype: CppDType, sliceRank:
number,\n numUpdates: number, sliceSize: number, strides: Uint8Array,\n outputSize: number, outId: number)
=> void;\n\nfunction setup(backend: BackendWasm): void {\n wasmScatterNd = backend.wasm.cwrap(ScatterNd,
null /*void*/, [\n 'number', // indicesId\n 'number',
// updatesId\n 'number', // dtype\n 'number', // sliceRank\n 'number', // numUpdates\n 'number', //
sliceSize\n 'array', // strides\n 'number', // outputSize\n 'number' // outId\n]);\n}\n\nfunction scatterNd(\n
args:\n {backend: BackendWasm, inputs: ScatterNdInputs, attrs: ScatterNdAttrs};\n TensorInfo {\n const
{backend, inputs, attrs} = args;\n const {indices, updates} = inputs;\n const {shape} = attrs;\n\n const out =
backend.makeOutput(shape, updates.dtype);\n if (util.sizeFromShape(shape) === 0) {\n return out;\n }\n\n const
{sliceRank, numUpdates, sliceSize, strides, outputSize} =\n scatter_util.calculateShapes(updates, indices,
shape);\n\n const indicesData = backend.dataIdMap.get(indices.dataId);\n const indicesId = indicesData.id;\n\n const
updatesData = backend.dataIdMap.get(updates.dataId);\n const updatesId = updatesData.id;\n\n const
stridesBytes = new Uint8Array(new Int32Array(strides).buffer);\n\n const
outId = backend.dataIdMap.get(out.dataId).id;\n wasmScatterNd(\n indicesId, updatesId,
CppType[updates.dtype], sliceRank, numUpdates,\n sliceSize, stridesBytes, outputSize, outId);\n\n return
out;\n })\n\nexport const scatterNdConfig: KernelConfig = {\n kernelName: ScatterNd,\n backendName: 'wasm',\n
setupFunc: setup,\n kernelFunc: scatterNd as {} as KernelFunc\n};\n", "/*\n * \n * @license\n * Copyright 2020
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations
under the License.\n *
=====
*\n\nimport {KernelConfig, KernelFunc, Select, SelectInputs, util} from '@tensorflow/tfjs-core';\nimport

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{BackendWasm} from './backend_wasm';\n\nlet wasmSelect: (\n conditionId: number, tId: number, eId: number,
offset: number,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmSelect =
backend.wasm.cwrap('SelectV2', null, [\n 'number', // conditionId\n 'number', // tId\n 'number', // eId\n 'number', // offset\n 'number', // outId\n]);\n}\n\nfunction select(args: {inputs: SelectInputs, backend:
BackendWasm}) {\n const {inputs, backend} = args;\n const {condition, t, e} = inputs;\n const conditionId =
backend.dataIdMap.get(condition.dataId).id;\n const tId = backend.dataIdMap.get(t.dataId).id;\n const eId =
backend.dataIdMap.get(e.dataId).id;\n const out = backend.makeOutput(t.shape, t.dtype);\n const outId =
backend.dataIdMap.get(out.dataId).id;\n\n const cRank = condition.shape.length;\n const tRank = t.shape.length;\n const offset = cRank === 0 || cRank > 1
|| tRank === 1 ?\n 1 : \n util.sizeFromShape(t.shape.slice(1));\n\n wasmSelect(conditionId, tId, eId, offset,
outId);\n return out;\n}\n\nexport const selectConfig: KernelConfig = {\n kernelName: Select,\n backendName:
'wasm',\n kernelFunc: select as { } as KernelFunc,\n setupFunc: setup\n};\n\n"/**\n * @license\n * Copyright 2019
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See
the License for the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {KernelConfig, KernelFunc, Sigmoid, SigmoidInputs, TensorInfo, util} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from './backend_wasm';\n\nlet wasmFunc: (xId: number, outId: number) =>
void;\n\nfunction setup(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(Sigmoid, null /*
void */, ['number', 'number']);\n}\n\nfunction sigmoid(args: {backend: BackendWasm, inputs: SigmoidInputs});\n
TensorInfo {\n const {backend, inputs: {x}} = args;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out
= backend.makeOutput(x.shape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n // Short-
circuit zero-sized tensors.\n if (util.sizeFromShape(out.shape) === 0) {\n return out;\n }\n}\n\n wasmFunc(xId,
outId);\n return out;\n}\n\nexport const sigmoidConfig:
KernelConfig = {\n kernelName: 'Sigmoid',\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: sigmoid
as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed
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under the License.\n *
=====\n
*/\n\nimport {KernelConfig, Sin} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'./unary_kernel';\n\nexport const
sinConfig: KernelConfig = createUnaryKernelConfig(Sin);\n\n"/**\n * @license\n * Copyright 2020 Google LLC.
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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=====\n
*/\n\nimport {KernelConfig, KernelFunc, Softmax, SoftmaxAttrs, SoftmaxInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nlet wasmFunc: (xId: number, outId:

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number,
channels: number, batch: number) =>\n void;\n\nfunction setup(backend: BackendWasm): void {\n wasmFunc =
backend.wasm.cwrap(Softmax, null /* void */, [\n 'number', // xId\n 'number', // outId\n 'number', //
channels\n 'number' // batch\n]);\n\nfunction softmax(\n args: {backend: BackendWasm, inputs:
SoftmaxInputs, attrs: SoftmaxAttrs}):\n TensorInfo {\n const {backend, inputs: {logits}, attrs: {dim}} = args;\n
const xId = backend.dataIdMap.get(logits.dataId).id;\n const out = backend.makeOutput(logits.shape,
logits.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const channels = logits.shape[dim];\n
const batch = util.sizeFromShape(logits.shape) / channels;\n\n // Short-circuit zero-sized tensors.\n if
(util.sizeFromShape(out.shape) === 0) {\n return out;\n }\n\n wasmFunc(xId, outId, channels, batch);\n return
out;\n}\n\nexport const softmaxConfig: KernelConfig = {\n kernelName: Softmax,\n backendName: 'wasm',\n
setupFunc:
setup,\n kernelFunc: softmax as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2021 Google LLC. All
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=====
*\n\nimport {backend_util, KernelConfig, KernelFunc, ReshapeAttrs, ReshapeInputs, SpaceToBatchND,
SpaceToBatchNDAttrs, SpaceToBatchNDInputs, TensorInfo, TransposeAttrs, TransposeInputs, util} from
'@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from './backend_wasm';\n\nimport {padV2Config} from './PadV2';\n\nimport {reshape} from
'./Reshape';\n\nimport {transpose} from './Transpose';\n\nfunction spaceToBatchND(args: {\n inputs:
SpaceToBatchNDInputs,\n backend: BackendWasm,\n attrs: SpaceToBatchNDAttrs\n}) {\n const {inputs,
backend, attrs} = args;\n const {x} = inputs;\n const {blockShape, paddings} = attrs;\n\n const prod =
util.sizeFromShape(blockShape);\n\n const completePaddings: Array<number, number> = [[0, 0]];\n
completePaddings.push(...(paddings as Array<number, number>));\n\n for (let i = 1 + blockShape.length; i <
x.shape.length; ++i) {\n completePaddings.push([0, 0]);\n }\n\n const paddedX = padV2Config.kernelFunc({\n
inputs: {x},\n backend,\n attrs: {paddings: completePaddings, constantValue: 0}\n }) as TensorInfo;\n\n const
reshapedPaddedShape =\n backend_util.getReshaped(paddedX.shape, blockShape, prod, false);\n\n const
permutedReshapedPaddedPermutation
= backend_util.getPermuted(\n reshapedPaddedShape.length, blockShape.length, false);\n\n const flattenShape
=\n backend_util.getReshapedPermuted(paddedX.shape, blockShape, prod, false);\n\n const reshapeInputs:
ReshapeInputs = {x: paddedX};\n const reshapeAttrs: ReshapeAttrs = {shape: reshapedPaddedShape};\n const
paddedXReshaped =\n reshape({inputs: reshapeInputs, backend, attrs: reshapeAttrs});\n\n const transposeInputs:
TransposeInputs = {x: paddedXReshaped};\n const transposeAttrs:\n TransposeAttrs = {perm:
permutedReshapedPaddedPermutation};\n const paddedXT =\n transpose({inputs: transposeInputs, backend,
attrs: transposeAttrs});\n\n const resultReshapeInputs: ReshapeInputs = {x: paddedXT};\n const
resultReshapeAttrs: ReshapeAttrs = {shape: flattenShape};\n const result = reshape(\n {inputs:
resultReshapeInputs, backend, attrs: resultReshapeAttrs});\n\n backend.disposeData(paddedX.dataId);\n
backend.disposeData(paddedXReshaped.dataId);\n
backend.disposeData(paddedXT.dataId);\n\n return result;\n}\n\nexport const spaceToBatchNDConfig:
KernelConfig = {\n kernelName: SpaceToBatchND,\n backendName: 'wasm',\n kernelFunc: spaceToBatchND as
{} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
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```
=====\n*\n\nimport { KernelConfig, KernelFunc, SplitV, SplitVAttrs, SplitVInputs, util } from '@tensorflow/tfjs-core';\nimport { backend_util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport { slice } from './Slice';\nexport function splitV(\n args: { inputs: SplitVInputs, attrs: SplitVAttrs, backend: BackendWasm }) {\n const { inputs, attrs, backend } = args;\n const { x } = inputs;\n const { numOrSizeSplits, axis } = attrs;\n const $axis = util.parseAxisParam(axis, x.shape)[0];\n const splitSizes = backend_util.prepareSplitSize(x, numOrSizeSplits, $axis);\n const begin = new Array(x.shape.length).fill(0);\n const size = x.shape.slice();\n return splitSizes.map(s => {\n const xSliceSize = [...size];\n xSliceSize[$axis] = s;\n const xSlice = slice({ inputs: { x }, attrs: { begin, size: xSliceSize }, backend });\n begin[$axis] += s;\n return xSlice;\n });\n}\n\nexport const splitVConfig: KernelConfig = {\n kernelName: SplitV,\n backendName: 'wasm',\n kernelFunc: splitV as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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=====\n*\n\nimport { KernelConfig, Sqrt } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from './unary_kernel';\nexport const sqrtConfig: KernelConfig = createUnaryKernelConfig(Sqrt);\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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=====\n*\n\nimport { KernelConfig, Square } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from './unary_kernel';\nexport const squareConfig: KernelConfig = createUnaryKernelConfig(Square);\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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=====\n*\n\nimport { KernelConfig, SquaredDifference } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from './binary_kernel';\nconst supportsFullBroadcast = true;\nexport const squaredDifferenceConfig: KernelConfig =\n createBinaryKernelConfig(SquaredDifference, supportsFullBroadcast);\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
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=====\n*\n\nimport {KernelConfig, KernelFunc, Step, StepAttrs, StepInputs, TensorInfo} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {CppType} from './types';\n\nlet wasmStep:\n(xId: number, alpha: number, dtype: number, outId: number) =>\n void;\n\nfunction setup(backend:\nBackendWasm): void {\n wasmStep = backend.wasm.cwrap(Step, null /*void*/, [\n 'number', // x_id\n 'number', // alpha\n 'number', // dtype\n 'number', // out_id\n]);\n}\n\nfunction step(\nargs: {backend: BackendWasm, inputs: StepInputs, attrs: StepAttrs};\n TensorInfo {\n const {backend, inputs, attrs} = args;\n const {alpha} = attrs;\n const {x} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out = backend.makeOutput(x.shape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmStep(xId, alpha, CppDType[x.dtype], outId);\n return out;\n})\n\nexport const stepConfig: KernelConfig = {\n kernelName: Step,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: step as {} as\n KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport {KernelConfig, KernelFunc, slice_util, StridedSlice, StridedSliceAttrs, StridedSliceInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {reshape} from './Reshape';\nimport {slice} from './Slice';\n\nlet wasmStridedSlice: (\n xId: number, xStridesBytes: Uint8Array,\n xRank: number,\n beginBytes: Uint8Array, endBytes: Uint8Array, stridesBytes: Uint8Array,\n outShapeBytes: Uint8Array, outStridesBytes: Uint8Array,\n outShapeLength: number, outId: number) => void;\n\nfunction\nsetup(backend: BackendWasm):\n void {\n wasmStridedSlice = backend.wasm.cwrap(StridedSlice, null /*void*/, [\n 'number', // xId\n 'array', // xStrides\n 'number', // xRank\n 'array', // beginBytes\n 'array', // endBytes\n 'array', // stridesBytes\n 'array', // outShapeBytes\n 'array', // outStridesBytes\n 'number', // outShapeLength\n 'number', // outId\n]);\n }\n\n export function stridedSlice(args: {\n backend: BackendWasm,\n inputs: StridedSliceInputs,\n attrs: StridedSliceAttrs\n }): TensorInfo {\n const {backend, inputs, attrs} = args;\n const {x} = inputs;\n const {\n begin,\n end,\n strides,\n beginMask,\n endMask,\n ellipsisMask,\n newAxisMask,\n shrinkAxisMask\n } = attrs;\n const {\n finalShapeSparse,\n finalShape,\n isIdentity,\n sliceDim0,\n isSimpleSlice,\n begin: $begin,\n end: $end,\n strides: $strides\n } =\n slice_util.sliceInfo(\n x.shape,\n begin, end, strides, beginMask, endMask,\n ellipsisMask,\n newAxisMask, shrinkAxisMask);\n let result;\n if (isIdentity) {\n // Optimization #1, slice is a no-op plus reshape\n result = reshape({inputs: {x}, backend, attrs: {shape: finalShape}});\n } else if (sliceDim0 || isSimpleSlice) {\n // Optimization #2, slice is memory contiguous (only occurs in dim 0)\n util.assert(\n x.shape.length >= 1,\n () => `Input must have rank at least 1, got: ${x.shape.length}`);\n const size = slice_util.computeOutShape($begin, $end, $strides);\n // To tolerate begin[0] > end[0] (a 0-output slice), we min(begin, end).\n const sliced = slice({inputs: {x}, backend, attrs: {begin: $begin, size}});\n result =\n reshape({inputs: {x: sliced}, backend, attrs: {shape: finalShape}});\n backend.disposeData(sliced.dataId);\n } else {\n const out = backend.makeOutput(finalShapeSparse, 'float32');\n const xId = backend.dataIdMap.get(x.dataId).id;\n const xStridesBytes =\n new Uint8Array(new Int32Array(util.computeStrides(x.shape)).buffer);\n const beginBytes = new\n Uint8Array(new Int32Array($begin).buffer);\n const endBytes = new Uint8Array(new
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Int32Array($end).buffer);\n const stridesBytes = new Uint8Array(new Int32Array($strides).buffer);\n\n const
outputShapeBytes =\n new Uint8Array(new Int32Array(finalShapeSparse).buffer);\n const outStridesBytes =
new Uint8Array(\n new Int32Array(util.computeStrides(finalShapeSparse)).buffer);\n const outId =
backend.dataIdMap.get(out.dataId).id;\n\n wasmStridedSlice(\n xId, xStridesBytes, x.shape.length,
beginBytes, endBytes, stridesBytes,\n outputShapeBytes, outStridesBytes, finalShapeSparse.length, outId);\n\n result = reshape({inputs: {x: out}, backend, attrs: {shape: finalShape}});\n\n backend.disposeData(out.dataId);\n
}\n\n return result;\n}\n\nexport const stridedSliceConfig: KernelConfig = {\n kernelName: StridedSlice,\n backendName: 'wasm',\n setupFunc:
 setup,\n kernelFunc: stridedSlice as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC.
All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\nimport {KernelConfig, Sub} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
'/binary_kernel';\nconst supportsFullBroadcast = true;\nexport const subConfig: KernelConfig =\ncreateBinaryKernelConfig(Sub,
 supportsFullBroadcast);\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====\n
*/\n\nimport {backend_util, KernelConfig, KernelFunc, Sum, SumAttrs, SumInputs, TensorInfo, util} from
 '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport
{permuteAxesAndTranspose} from './kernel_utils';\nimport
{CppType} from './types';\n\nlet wasmSum: (xId: number, reduceSize: number, dtype: number, outId: number)
=>\n void;\n\nfunction setup(backend: BackendWasm): void {\n wasmSum = backend.wasm.cwrap(Sum, null
/*void*/, [\n 'number', // input_id\n 'number', // reduce_size\n 'number', // dtype\n 'number', // out_id\n
]);\n\n function sum(args: {backend: BackendWasm, inputs: SumInputs, attrs: SumAttrs}):\n TensorInfo {\n
const {backend, inputs, attrs} = args;\n const {axis, keepDims} = attrs;\n const {x} = inputs;\n const xId =
backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const {transposed, axes, originalAxes,
inputWasTransposed} =\n permuteAxesAndTranspose(x, axis, backend);\n\n let reductionAxes = axes;\n if
(inputWasTransposed) {\n const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId
!== xId) {\n // transpose was not a no-op. We will need to dispose of this\n
 // once we are done.\n input = transposed;\n inputId = transposedId;\n reductionAxes =
backend_util.getInnerMostAxes(\n reductionAxes.length, input.shape.length);\n }\n\n backend_util.assertAxesAreInnerMostDims(\n 'sum', reductionAxes, input.shape.length);\n const [outShape,
reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n const reduceSize
= util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, input.dtype);\n if
(util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmSum(inputId, reduceSize, CppDType[out.dtype], outId);\n }\n\n if (inputWasTransposed) {\n // dispose of
the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const
newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n
}

```

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return out;\n}\n\nexport
const sumConfig: KernelConfig = {\n kernelName: Sum,\n backendName: 'wasm',\n setupFunc: setup,\n
kernelFunc: sum as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2021 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*\nimport {KernelConfig, Tan} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'./unary_kernel';\n\nexport const
tanConfig: KernelConfig = createUnaryKernelConfig(Tan);\n", "/*\n * @license\n * Copyright 2019 Google LLC.
All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*\nimport {KernelConfig, Tanh} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'./unary_kernel';\n\nexport const tanhConfig: KernelConfig = createUnaryKernelConfig(Tanh);\n", "/*\n * @license\n
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http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {KernelConfig, KernelFunc, Tile, TileAttrs, TileInputs} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from './backend_wasm';\n\nimport {CppType} from './types';\n\nlet wasmTile: (\n xId:
number, xShape: Uint8Array, xShapeSize: number, newShape: Uint8Array,\n newShapeSize: number,
dtype: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmTile =
backend.wasm.cwrap(Tile, null /* void */, [\n 'number', // x_id\n 'array', // x_shape\n 'number', //
x_shape.length\n 'array', // new_shape\n 'number', // new_shape.length\n 'number' // out_id\n]);\n}\n\nfunction tile(\n args: {inputs: TileInputs, backend: BackendWasm, attrs: TileAttrs}) {\n const {inputs,
backend, attrs} = args;\n const {x} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const {reps} =
attrs;\n const newShape: number[] = new Array(x.shape.length);\n for (let i = 0; i < newShape.length; i++) {\n
newShape[i] = x.shape[i] * reps[i];\n }\n const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n
const newShapeBytes = new Uint8Array(new Int32Array(newShape).buffer);\n const out =
backend.makeOutput(newShape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmTile(\n
xId, xShapeBytes,
x.shape.length, newShapeBytes, newShape.length,\n CppDType[out.dtype], outId);\n return out;\n}\n\nexport
const tileConfig: KernelConfig = {\n kernelName: Tile,\n backendName: 'wasm',\n setupFunc: setup,\n
kernelFunc: tile as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *

```



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```
=====\n\n*\n\nimport\n\n{KernelConfig, KernelFunc, TensorInfo, TopK, TopKAttrs, TopKInputs} from '@tensorflow/tfjs-core';\nimport\n\n{BackendWasm} from './backend_wasm';\nimport {CppType} from './types';\n\nlet wasmTopK: (\n xId: number, xShapeBytes: Uint8Array, xShapeLength: number, xDtype: CCppType, k: number, sorted: boolean, outValuesId: number, outIndicesId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmTopK = backend.wasm.cwrap(TopK, null /* void */, [\n 'number', // xId\n 'array', // x.shape\n 'number', // x.shape.length\n 'number', // x.dtype\n 'number', // k\n 'bool', // sorted\n 'number', // outValuesId\n 'number', // outIndicesId\n]);\n\n export const topk: (\n args: {inputs: TopKInputs, backend: BackendWasm, attrs: TopKAttrs}) => TensorInfo[] | TensorInfo = ({inputs, backend, attrs}) => {\n const {x} = inputs;\n const {k, sorted} = attrs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n const outputShape = x.shape.slice();\n outputShape[outputShape.length - 1] = k;\n const outValues = backend.makeOutput(outputShape, x.dtype);\n const outValuesId = backend.dataIdMap.get(outValues.dataId).id;\n const outIndices = backend.makeOutput(outputShape, 'int32');\n const outIndicesId = backend.dataIdMap.get(outIndices.dataId).id;\n\n wasmTopK(xId, xShapeBytes, x.shape.length, CCppType[x.dtype], k, sorted, outValuesId, outIndicesId);\n\n return [outValues, outIndices];\n };\n\n export const topKConfig: KernelConfig = {\n kernelName: TopK,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: topk as {} as KernelFunc,\n };\n\n /**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * "License");\n * you may not use
```

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```
=====\n\n*\n\nimport {KernelConfig, KernelFunc, TensorInfo, Transform, TransformAttrs, TransformInputs, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\n\nlet wasmTransform: (\n imageId: number, transformsId: number, isBatchTransform: boolean, batch: number, outHeight: number, outWidth: number, numChannels: number, imageWidth: number, imageHeight: number, strides: Uint8Array, stridesLength: number, interpolationModeId: number, fillModeId: number, fillValue: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmTransform = backend.wasm.cwrap(Transform, null /* void */, [\n 'number', // imageId\n 'number', // transformsId\n 'bool', // isBatchTransform\n 'number', // batch\n 'number', // outHeight\n 'number', // outWidth\n 'number', // numChannels\n 'number', // imageWidth\n 'number', // imageHeight\n 'array', // strides\n 'number', // stridesLength\n 'number', // interpolationModeId\n 'number', // fillModeId\n 'number', // fillValue\n 'number', // outId\n]);\n\n function transform(\n args: {\n backend: BackendWasm, inputs: TransformInputs, attrs: TransformAttrs\n }): TensorInfo {\n const {backend, inputs, attrs} = args;\n const {image, transforms} = inputs;\n const {interpolation, fillMode, fillValue, outputShape} = attrs;\n const [batch, imageHeight, imageWidth, numChannels] = image.shape;\n const [outHeight, outWidth] =\n outputShape != null ? outputShape : [imageHeight, imageWidth];\n const outShape = [batch, outHeight, outWidth, numChannels] as [number, number, number, number];\n const strides =\n new Uint8Array(new
```

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Int32Array(util.computeStrides(image.shape)).buffer);\n\n const out = backend.makeOutput(outShape,
image.dtype);\n\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const imageData =
backend.dataIdMap.get(image.dataId);\n\n const imageId = imageData.id;\n\n const transformsData =
backend.dataIdMap.get(transforms.dataId);\n\n const transformsId = transformsData.id;\n\n const
interpolationModeId = interpolation === 'nearest' ? 1 : 2;\n\n let fillModeId;\n\n switch (fillMode) {\n\n case
'constant':\n\n fillModeId = 1;\n\n break;\n\n case 'reflect':\n\n fillModeId = 2;\n\n break;\n\n case 'wrap':\n\n fillModeId = 3;\n\n break;\n\n case 'nearest':\n\n fillModeId = 4;\n\n
break;\n\n default:\n\n fillModeId = 1;\n\n break;\n\n } \n\n wasmTransform(\n\n imageId, transformsId,
(transforms.shape[0] > 1), batch, outHeight,\n\n outWidth, numChannels, imageWidth, imageHeight, strides,\n\n image.shape.length - 1, interpolationModeId, fillModeId, fillValue,\n\n outId);\n\n\n return out;\n\n}\n\n\nexport const
transformConfig: KernelConfig = {\n\n kernelName: Transform,\n\n backendName: 'wasm',\n\n setupFunc: setup,\n\n kernelFunc: transform as {} as KernelFunc\n\n};\n\n"/**\n\n * @license\n\n * Copyright 2019 Google LLC. All Rights
Reserved.\n\n * Licensed under the Apache License, Version 2.0 (the "License");\n\n * you may not use this file
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and\n\n \* limitations under the License.\n\n \*

```
=====\n\n*\n\n\nimport { KernelConfig, KernelFunc, TensorInfo, Unpack, UnpackAttrs, UnpackInputs } from
'@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport { slice } from
 './Slice';\n\nfunction unpack(\n\n args: { inputs: UnpackInputs, backend: BackendWasm, attrs: UnpackAttrs }):\n\n TensorInfo[] {\n\n const { inputs, backend, attrs } = args;\n\n const { value } = inputs;\n\n let { axis } = attrs;\n\n if (axis <
0) {\n\n axis += value.shape.length;\n\n }\n\n\n const numOutputs = value.shape[axis];\n\n const rank =
value.shape.length;\n\n const outShape: number[] = new Array(rank - 1);\n\n let outIndex = 0;\n\n for (let i = 0; i < rank;
i++) {\n\n if (i !== axis) {\n\n outShape[outIndex++] = value.shape[i];\n\n }\n\n }\n\n const outs: TensorInfo[] =
new Array(numOutputs);\n\n const begin = new Array(rank).fill(0);\n\n const size = value.shape.slice();\n\n size[axis] =
1;\n\n for (let i = 0; i < outs.length; i++) {\n\n begin[axis] = i;\n\n outs[i] = slice({ inputs: { x: value }, attrs: { begin,
size }, backend});\n\n }\n\n return outs.map(({ dataId, dtype }) => ({ dataId, dtype, shape: outShape }));\n\n}\n\n\nexport
const unpackConfig: KernelConfig = {\n\n kernelName: Unpack,\n\n backendName: 'wasm',\n\n kernelFunc: unpack as
{ } as KernelFunc,\n\n};\n\n"/**\n\n * @license\n\n * Copyright 2020 Google LLC. All Rights Reserved.\n\n * Licensed
under the Apache License, Version 2.0 (the "License");\n\n * you may not use this file except in compliance with the
License.\n\n * You may obtain a copy of the License at\n\n * http://www.apache.org/licenses/LICENSE-2.0\n\n * Unless required by applicable law or agreed to in writing, software\n\n * distributed under the License is distributed
on an "AS IS" BASIS,\n\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express
or implied.\n\n * See the License for the specific language governing permissions and\n\n * limitations under the
License.\n\n *
```

```
=====\n\n*\n\n\nimport { KernelConfig, KernelFunc, ZerosLike, ZerosLikeInputs } from '@tensorflow/tfjs-core';\n\nimport
{ BackendWasm } from '../backend_wasm';\n\nfunction zerosLike(args: { inputs: ZerosLikeInputs, backend:
BackendWasm }) {\n\n const { inputs: { x }, backend } = args;\n\n const out = backend.makeOutput(x.shape, x.dtype);\n\n const outVals = backend.typedArrayFromHeap(out);\n\n outVals.fill(0);\n\n return out;\n\n}\n\n\nexport const
zerosLikeConfig: KernelConfig = {\n\n kernelName: ZerosLike,\n\n backendName: 'wasm',\n\n kernelFunc: zerosLike
as { } as KernelFunc,\n\n};\n\n"/**\n\n * @license\n\n * Copyright 2020 Google LLC. All Rights Reserved.\n\n * Licensed
under the Apache License, Version 2.0 (the "License");\n\n * you may not use this file except in compliance with the
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```

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```
We explicitly import the modular kernels so they get registered in the global registry when we compile the library. A modular build would replace the contents of this file and import only the kernels that are needed.
\nimport {KernelConfig, registerKernel} from '@tensorflow/tfjs-core';
\nimport {fusedMatMulConfig} from './kernels/_FusedMatMul';
\nimport {absConfig} from './kernels/Abs';
\nimport {addConfig} from './kernels/Add';
\nimport {addNConfig} from './kernels/AddN';
\nimport {allConfig} from './kernels/All';
\nimport {anyConfig} from './kernels/Any';
\nimport {argMaxConfig} from './kernels/ArgMax';
\nimport {avgPoolConfig} from './kernels/AvgPool';
\nimport {batchMatMulConfig} from './kernels/BatchMatMul';
\nimport {batchToSpaceNDConfig} from './kernels/BatchToSpaceND';
\nimport {castConfig} from './kernels/Cast';
\nimport {ceilConfig} from './kernels/Ceil';
\nimport {clipByValueConfig} from './kernels/ClipByValue';
\nimport {concatConfig} from './kernels/Concat';
\nimport {conv2DConfig} from './kernels/Conv2D';
\nimport {conv2DBackpropInputConfig} from './kernels/Conv2DBackpropInput';
\nimport {cosConfig} from './kernels/Cos';
\nimport {coshConfig} from './kernels/Cosh';
\nimport {cropAndResizeConfig} from './kernels/CropAndResize';
\nimport {cumsumConfig} from './kernels/Cumsum';
\nimport {depthToSpaceConfig} from './kernels/DepthToSpace';
\nimport {depthwiseConv2dNativeConfig} from './kernels/DepthwiseConv2dNative';
\nimport {eluConfig} from './kernels/Elu';
\nimport {equalConfig} from './kernels/Equal';
\nimport {expConfig} from './kernels/Exp';
\nimport {expandDimsConfig} from './kernels/ExpandDims';
\nimport {fillConfig} from './kernels/Fill';
\nimport {flipLeftRightConfig} from './kernels/FlipLeftRight';
\nimport {floorConfig} from './kernels/Floor';
\nimport {floorDivConfig} from './kernels/FloorDiv';
\nimport {fusedBatchNormConfig} from './kernels/FusedBatchNorm';
\nimport {fusedConv2DConfig} from './kernels/FusedConv2D';
\nimport {fusedDepthwiseConv2DConfig} from './kernels/FusedDepthwiseConv2D';
\nimport {gatherNdConfig} from './kernels/GatherNd';
\nimport {gatherV2Config} from './kernels/GatherV2';
\nimport {greaterConfig} from './kernels/Greater';
\nimport {greaterEqualConfig} from './kernels/GreaterEqual';
\nimport {identityConfig} from './kernels/Identity';
\nimport {leakyReluConfig} from './kernels/LeakyRelu';
\nimport {lessConfig} from './kernels/Less';
\nimport {lessEqualConfig} from './kernels/LessEqual';
\nimport {logConfig} from './kernels/Log';
\nimport {logicalAndConfig} from './kernels/LogicalAnd';
\nimport {maxConfig} from './kernels/Max';
\nimport {maximumConfig} from './kernels/Maximum';
\nimport {maxPoolConfig} from './kernels/MaxPool';
\nimport {meanConfig} from './kernels/Mean';
\nimport {minConfig} from './kernels/Min';
\nimport {minimumConfig} from './kernels/Minimum';
\nimport {mirrorPadConfig} from './kernels/MirrorPad';
\nimport {multiplyConfig} from './kernels/Multiply';
\nimport {negConfig} from './kernels/Neg';
\nimport {nonMaxSuppressionV3Config} from './kernels/NonMaxSuppressionV3';
\nimport {nonMaxSuppressionV4Config} from './kernels/NonMaxSuppressionV4';
\nimport {nonMaxSuppressionV5Config} from './kernels/NonMaxSuppressionV5';
\nimport {notEqualConfig} from './kernels/NotEqual';
\nimport {oneHotConfig} from './kernels/OneHot';
\nimport {onesLikeConfig} from './kernels/OnesLike';
\nimport {packConfig} from './kernels/Pack';
\nimport {padV2Config} from './kernels/PadV2';
\nimport {powConfig} from './kernels/Pow';
\nimport {preluConfig} from './kernels/Prelu';
\nimport {prodConfig} from './kernels/Prod';
\nimport {rangeConfig} from './kernels/Range';
\nimport {realDivConfig} from './kernels/RealDiv';
\nimport {reluConfig} from './kernels/Relu';
\nimport {relu6Config} from './kernels/Relu6';
\nimport {reshapeConfig} from './kernels/Reshape';
\nimport {resizeBilinearConfig} from './kernels/ResizeBilinear';
\nimport {reverseConfig} from './kernels/Reverse';
\nimport {rotateWithOffsetConfig} from './kernels/RotateWithOffset';
\nimport {roundConfig} from './kernels/Round';
\nimport {rsqrtConfig} from './kernels/Rsqrt';
\nimport {scatterNdConfig} from './kernels/ScatterNd';
\nimport {selectConfig} from
```

```

./kernels/Select';\nimport {sigmoidConfig} from './kernels/Sigmoid';\nimport {sinConfig} from
./kernels/Sin';\nimport {sliceConfig} from './kernels/Slice';\nimport {softmaxConfig} from
./kernels/Softmax';\nimport {spaceToBatchNDConfig} from './kernels/SpaceToBatchND';\nimport {splitVConfig}
from './kernels/SplitV';\nimport {sqrtConfig} from './kernels/Sqrt';\nimport
{squareConfig} from './kernels/Square';\nimport {squaredDifferenceConfig} from
./kernels/SquaredDifference';\nimport {stepConfig} from './kernels/Step';\nimport {stridedSliceConfig} from
./kernels/StridedSlice';\nimport {subConfig} from './kernels/Sub';\nimport {sumConfig} from
./kernels/Sum';\nimport {tanConfig} from './kernels/Tan';\nimport {tanhConfig} from './kernels/Tanh';\nimport
{tileConfig} from './kernels/Tile';\nimport {topKConfig} from './kernels/TopK';\nimport {transformConfig} from
./kernels/Transform';\nimport {transposeConfig} from './kernels/Transpose';\nimport {unpackConfig} from
./kernels/Unpack';\nimport {zerosLikeConfig} from './kernels/ZerosLike';\n\n// List all kernel configs here\nconst
kernelConfigs: KernelConfig[] = [\n absConfig,\n addConfig,\n addNConfig,\n allConfig,\n anyConfig,\n
 argMaxConfig,\n avgPoolConfig,\n batchMatMulConfig,\n batchToSpaceNDConfig,\n castConfig,\n
 ceilConfig,\n clipByValueConfig,\n concatConfig,\n
 conv2DConfig,\n conv2DBackpropInputConfig,\n cosConfig,\n coshConfig,\n cropAndResizeConfig,\n
 cumsumConfig,\n depthToSpaceConfig,\n depthwiseConv2dNativeConfig,\n eluConfig,\n equalConfig,\n
 expConfig,\n expandDimsConfig,\n fillConfig,\n flipLeftRightConfig,\n floorConfig,\n floorDivConfig,\n
 fusedMatMulConfig,\n fusedBatchNormConfig,\n fusedConv2DConfig,\n fusedDepthwiseConv2DConfig,\n
 gatherNdConfig,\n gatherV2Config,\n greaterConfig,\n greaterEqualConfig,\n identityConfig,\n
 leakyReluConfig,\n lessConfig,\n lessEqualConfig,\n logConfig,\n logicalAndConfig,\n maxConfig,\n
 maximumConfig,\n maxPoolConfig,\n meanConfig,\n minConfig,\n minimumConfig,\n mirrorPadConfig,\n
 multiplyConfig,\n negConfig,\n nonMaxSuppressionV3Config,\n nonMaxSuppressionV4Config,\n
 nonMaxSuppressionV5Config,\n notEqualConfig,\n oneHotConfig,\n onesLikeConfig,\n packConfig,\n
 padV2Config,\n powConfig,\n preluConfig,\n prodConfig,\n rangeConfig,\n realDivConfig,\n
 reluConfig,\n relu6Config,\n reshapeConfig,\n resizeBilinearConfig,\n reverseConfig,\n
 rotateWithOffsetConfig,\n rsqrtConfig,\n roundConfig,\n scatterNdConfig,\n selectConfig,\n sigmoidConfig,\n
 sinConfig,\n sliceConfig,\n softmaxConfig,\n spaceToBatchNDConfig,\n splitVConfig,\n sqrtConfig,\n
 squareConfig,\n squaredDifferenceConfig,\n stepConfig,\n stridedSliceConfig,\n subConfig,\n sumConfig,\n
 tanConfig,\n tanhConfig,\n tileConfig,\n topKConfig,\n transformConfig,\n transposeConfig,\n unpackConfig,\n
 zerosLikeConfig];\n\nfor (const kernelConfig of kernelConfigs) {\n registerKernel(kernelConfig);\n}\n", "/*\n *
@license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law
or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\nimport {env} from 'tensorflow/tfjs-core';\nconst ENV = env();\n/**\n * True if SIMD is supported.\n
*\n// From: https://github.com/GoogleChromeLabs/wasm-feature-detect\nENV.registerFlag(\n // This typed array
passed in to WebAssembly.validate is WebAssembly binary\n // code. In this case it is a small program that
contains SIMD\n // instructions.\n 'WASM_HAS_SIMD_SUPPORT', async () => WebAssembly.validate(new
Uint8Array([\n 0, 97, 115, 109, 1, 0, 0, 0, 1, 4, 1, 96, 0, 0, 3,\n 2, 1, 0, 10, 9, 1, 7, 0, 65, 0, 253, 15, 26,
11\n]));\n/**\n * True if threads are supported.\n
*\n// From: https://github.com/GoogleChromeLabs/wasm-feature-
detect\nENV.registerFlag('WASM_HAS_MULTITHREAD_SUPPORT', async () => {\n // TODO(annxingyuan):
Enable node support once this is resolved:\n // https://github.com/tensorflow/tfjs/issues/3830\n if
(ENV.get('IS_NODE')) {\n return false;\n }\n\n try {\n // Test for transferability of SABs (needed for Firefox)\n

```

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// https://groups.google.com/forum/#!msg/mozilla.dev.platform/IHkBZIHETpA/dwsMNchWEQAJ\n new
MessageChannel().port1.postMessage(new SharedArrayBuffer(1));\n // This typed array is a WebAssembly
program containing threaded\n // instructions.\n return WebAssembly.validate(new Uint8Array([\n 0, 97,
115, 109, 1, 0, 0, 0, 1, 4, 1, 96, 0, 0, 3, 2, 1, 0, 5,\n 4, 1, 3, 1, 1, 10, 11, 1, 9, 0, 65, 0, 254, 16, 2, 0, 26,
11\n]));\n } catch (e) {\n return false;\n }\n});\n", "\nvar WasmBackendModuleThreadedSimd = (function() {\n
var _scriptDir = typeof document !== 'undefined'
&& document.currentScript ? document.currentScript.src : undefined;\n if (typeof __filename !== 'undefined')
_scriptDir = _scriptDir || __filename;\n return (\nfunction(WasmBackendModuleThreadedSimd) {\n
WasmBackendModuleThreadedSimd = WasmBackendModuleThreadedSimd || {};\n\nfunction
GROWABLE_HEAP_I8(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}
return HEAP8}function
GROWABLE_HEAP_U8(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}
return HEAPU8}function
GROWABLE_HEAP_I32(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}
return HEAP32}function
GROWABLE_HEAP_U32(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}
return HEAPU32}function
GROWABLE_HEAP_F64(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}
return HEAPF64}var Module=typeof
WasmBackendModuleThreadedSimd!="undefined"?WasmBackendModuleThreadedSimd: {};var
readyPromiseResolve,readyPromiseReject;Module["ready"]=new
Promise(function(resolve,reject){readyPromiseResolve=resolve;readyPromiseReject=reject});var
moduleOverrides={};var key;for(key in
Module){if(Module.hasOwnProperty(key)){moduleOverrides[key]=Module[key]}}var arguments_=[];var
thisProgram=("./this.program");var quit_=function(status,toThrow){throw toThrow};var
ENVIRONMENT_IS_WEB=false;var ENVIRONMENT_IS_WORKER=false;var
ENVIRONMENT_IS_NODE=false;var ENVIRONMENT_IS_SHELL=false;ENVIRONMENT_IS_WEB=typeof
window==="object";ENVIRONMENT_IS_WORKER=typeof
importScripts==="function";ENVIRONMENT_IS_NODE=typeof process==="object"&&typeof
process.versions==="object"&&typeof
process.versions.node==="string";ENVIRONMENT_IS_SHELL=!ENVIRONMENT_IS_WEB&&!ENVIRONM
ENT_IS_NODE&&!ENVIRONMENT_IS_WORKER;var
ENVIRONMENT_IS_PTHREAD=Module["ENVIRONMENT_IS_PTHREAD"]||false;if(ENVIRONMENT_IS_P
THREAD){buffer=Module["buffer"]}var scriptDirectory="";function
locateFile(path){if(Module["locateFile"]){return Module["locateFile"](path,scriptDirectory)}return
scriptDirectory+path}var read_,readAsync,readBinary,setWindowTitle;var nodeFS;var
nodePath;if(ENVIRONMENT_IS_NODE){if(ENVIRONMENT_IS_WORKER){scriptDirectory=require("path").
dirname(scriptDirectory)+"^"}else{scriptDirectory=__dirname+"^"}read_=function
shell_read(filename,binary){if(!nodeFS)nodeFS=require("fs");if(!nodePath)nodePath=require("path");filename=nonodePath["normalize"](filename);return
nodeFS["readFileSync"](filename,binary?null:"utf8");};readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret};if(process["argv"].length>1){thisProgram=process["argv"][1].replace(/\\/g,"^")}arguments_=process["arg
v"].slice(2);process["on"]("uncaughtException",function(ex){if(!(ex instanceof ExitStatus)){throw
ex}});process["on"]("unhandledRejection",abort);quit_=function(status){process["exit"](status)};Module["insep
ect"]=function(){return"[Emscripten
Module object]";};var
nodeWorkerThreads;try{nodeWorkerThreads=require("worker_threads")}catch(e){console.error("The

```

```

\worker_threads\ module is not supported in this node.js build - perhaps a newer version is needed?);throw
e}global.Worker=nodeWorkerThreads.Worker}else if(ENVIRONMENT_IS_SHELL){if(typeof
read!=="undefined"){read_=function shell_read(f){return read(f)}readBinary=function readBinary(f){var
data;if(typeof readbuffer==="function"){return new
Uint8Array(readbuffer(f))data=read(f,"binary");assert(typeof data==="object");return data};if(typeof
scriptArgs!="undefined"){arguments_=scriptArgs}else if(typeof
arguments!="undefined"){arguments_=arguments}if(typeof
quit==="function"){quit_=function(status){quit(status)}if(typeof print!="undefined"){if(typeof
console==="undefined")console={};console.log=print;console.warn=console.error=typeof
printErr!="undefined"?printErr:print}}else
if(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER){if(ENVIRONMENT_IS_WORKER){scriptDire
ctory=self.location.href}else
if(typeof
document!="undefined"&&document.currentScript){scriptDirectory=document.currentScript.src}if(typeof
_scriptDir !== "undefined" &&
_scriptDir){scriptDirectory=_scriptDir}if(scriptDirectory.indexOf("blob:")!==0){scriptDirectory=scriptDirectory.s
ubstr(0,scriptDirectory.lastIndexOf("/")+1)}else{scriptDirectory=""}}if(ENVIRONMENT_IS_NODE){read_=fun
ction
shell_read(filename,binary){if(!nodeFS)nodeFS=require("fs");if(!nodePath)nodePath=require("path");filename=n
odePath["normalize"](filename);return
nodeFS["readFileSync"](filename,binary?null:"utf8");}readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret}else{read_=function(url){var xhr=new XMLHttpRequest;xhr.open("GET",url,false);xhr.send(null);return
xhr.responseText};if(ENVIRONMENT_IS_WORKER){readBinary=function(url){var xhr=new
XMLHttpRequest;xhr.open("GET",url,false);xhr.responseType="arraybuffer";xhr.send(null);return
new Uint8Array(xhr.response)}}readAsync=function(url,onload,onerror){var xhr=new
XMLHttpRequest;xhr.open("GET",url,true);xhr.responseType="arraybuffer";xhr.onload=function(){if(xhr.status
===200||xhr.status===0&&xhr.response){onload(xhr.response);return}onerror();}xhr.onerror=onerror;xhr.send(null)
}setWindowTitle=function(title){document.title=title}}else{if(ENVIRONMENT_IS_NODE){if(typeof
performance==="undefined"){global.performance=require("perf_hooks").performance}}var
out=Module["print"]||console.log.bind(console);var err=Module["printErr"]||console.warn.bind(console);for(key
in
moduleOverrides){if(moduleOverrides.hasOwnProperty(key)){Module[key]=moduleOverrides[key]}}moduleOverr
ides=null;if(Module["arguments"])arguments_=Module["arguments"];if(Module["thisProgram"])thisProgram=
Module["thisProgram"];if(Module["quit"])quit_=Module["quit"];function
warnOnce(text){if(!warnOnce.shown)warnOnce.shown={};if(!warnOnce.shown[text]){warnOnce.shown[text]=1;er
r(text)}}var
Atomics_load=Atomics.load;var Atomics_store=Atomics.store;var
Atomics_compareExchange=Atomics.compareExchange;var
wasmBinary;if(Module["wasmBinary"])wasmBinary=Module["wasmBinary"];var
noExitRuntime=Module["noExitRuntime"]||true;if(typeof WebAssembly!="object"){abort("no native wasm
support detected")}var wasmMemory;var wasmModule;var ABORT=false;var EXITSTATUS;function
assert(condition,text){if(!condition){abort("Assertion failed: "+text)}}function getCFunc(ident){var
func=Module["_"+ident];assert(func,"Cannot call unknown function "+ident+", make sure it is exported");return
func}function ccall(ident,returnType,argTypes,args,opts){var toC={"string":function(str){var
ret=0;if(str===null&&str===undefined&&str===0){var
len=(str.length<<2)+1;ret=stackAlloc(len);stringToUTF8(str,ret,len)}return ret},"array":function(arr){var
ret=stackAlloc(arr.length);writeArrayToMemory(arr,ret);return ret}};function

```

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convertReturnValue(ret){if(returnType===\"string\")return
UTF8ToString(ret);if(returnType===\"boolean\")return Boolean(ret);return ret}var func=getCFunc(ident);var
cArgs=[];var stack=0;if(args){for(var i=0;i<args.length;i++){var
converter=toC[argTypes[i]];if(converter){if(stack===0)stack=stackSave();cArgs[i]=converter(args[i])}else{cArgs[i
]=args[i]}}var ret=func.apply(null,cArgs);ret=convertReturnValue(ret);if(stack!==0)stackRestore(stack);return
ret}function cwrap(ident,returnType,argTypes,opts){argTypes=argTypes||[];var
numericArgs=argTypes.every(function(type){return type===\"number\"});var
numericRet=returnType!==\"string\";if(numericRet&&numericArgs&&!opts){return getCFunc(ident)}return
function(){return ccall(ident,returnType,argTypes,arguments,opts)}}function
UTF8ArrayToString(heap,idx,maxBytesToRead){var endIdx=idx+maxBytesToRead;var
str=\"\";while(!(idx>=endIdx)){var u0=heap[idx++];if(!u0)return
str;if(!(u0&128)){str+=String.fromCharCode(u0);continue}var
u1=heap[idx++]&63;if((u0&224)==192){str+=String.fromCharCode((u0&31)<<6|u1);continue}var
u2=heap[idx++]&63;if((u0&240)==224){u0=(u0&15)<<12|u1<<6|u2}else{u0=(u0&7)<<18|u1<<12|u2<<6|heap[id
x++]&63}if(u0<65536){str+=String.fromCharCode(u0)}else{var ch=u0-
65536;str+=String.fromCharCode(55296|ch>>10,56320|ch&1023)}}return str}function
UTF8ToString(ptr,maxBytesToRead){return
ptr?UTF8ArrayToString(GROWABLE_HEAP_U8(),ptr,maxBytesToRead):\"\"}function
stringToUTF8Array(str,heap,outIdx,maxBytesToWrite){if(!(maxBytesToWrite>0))return 0;var startIdx=outIdx;var
endIdx=outIdx+maxBytesToWrite-1;for(var i=0;i<str.length;++i){var
u=str.charCodeAt(i);if(u>=55296&&u<=57343){var
u1=str.charCodeAt(++i);u=65536+((u&1023)<<10|u1&1023)}if(u<=127){if(outIdx>=endIdx)break;heap[outIdx++]
=u}else if(u<=2047){if(outIdx+1>=endIdx)break;heap[outIdx++]=192|u>>6;heap[outIdx++]=128|u&63}else
if(u<=65535){if(outIdx+2>=endIdx)break;heap[outIdx++]=224|u>>12;heap[outIdx++]=128|u>>6&63;heap[outIdx
++]=128|u&63}else{if(outIdx+3>=endIdx)break;heap[outIdx++]=240|u>>18;heap[outIdx++]=128|u>>12&63;heap[
outIdx++]=128|u>>6&63;heap[outIdx++]=128|u&63}}heap[outIdx]=0;return
outIdx-startIdx}function stringToUTF8(str,outPtr,maxBytesToWrite){return
stringToUTF8Array(str,GROWABLE_HEAP_U8(),outPtr,maxBytesToWrite)}function lengthBytesUTF8(str){var
len=0;for(var i=0;i<str.length;++i){var
u=str.charCodeAt(i);if(u>=55296&&u<=57343)u=65536+((u&1023)<<10)|str.charCodeAt(++i)&1023;if(u<=127)+
+len;else if(u<=2047)len+=2;else if(u<=65535)len+=3;else len+=4}return len}function
writeArrayToMemory(array,buffer){GROWABLE_HEAP_I8().set(array,buffer)}function
alignUp(x,multiple){if(x%multiple>0){x+=multiple-x%multiple}return x}var
buffer,HEAP8,HEAPU8,HEAP16,HEAPU16,HEAP32,HEAPU32,HEAPF32,HEAPF64;function
updateGlobalBufferAndViews(buf){buffer=buf;Module[\"HEAP8\"]=HEAP8=new
Int8Array(buf);Module[\"HEAP16\"]=HEAP16=new Int16Array(buf);Module[\"HEAP32\"]=HEAP32=new
Int32Array(buf);Module[\"HEAPU8\"]=HEAPU8=new Uint8Array(buf);Module[\"HEAPU16\"]=HEAPU16=new
Uint16Array(buf);Module[\"HEAPU32\"]=HEAPU32=new
Uint32Array(buf);Module[\"HEAPF32\"]=HEAPF32=new
Float32Array(buf);Module[\"HEAPF64\"]=HEAPF64=new Float64Array(buf)}var
INITIAL_MEMORY=Module[\"INITIAL_MEMORY\"]||16777216;if(ENVIRONMENT_IS_PTHREAD){wasmM
emory=Module[\"wasmMemory\"]};buffer=Module[\"buffer\"]}else{if(Module[\"wasmMemory\"]){wasmMemory=
Module[\"wasmMemory\"]}else{wasmMemory=new
WebAssembly.Memory({\"initial\":INITIAL_MEMORY/65536,\"maximum\":2147483648/65536,\"shared\":true});
if(!(wasmMemory.buffer instanceof SharedArrayBuffer)){err(\"requested a shared WebAssembly.Memory but the
returned buffer is not a SharedArrayBuffer, indicating that while the browser has SharedArrayBuffer it does not
have WebAssembly threads support - you may need to set a
flag\");if(ENVIRONMENT_IS_NODE){console.log(\"(on node you may need: --experimental-wasm-threads --

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experimental-wasm-bulk-memory and also use a recent version)\")}throw Error(\\"bad
memory\");}}if(wasmMemory){buffer=wasmMemory.buffer}INITIAL_MEMORY=buffer.byteLength;updateGlobalBufferAndViews(buffer);var
wasmTable;var __ATPRERUN__=[];var __ATINIT__=[];var __ATMAIN__=[];var __ATEXIT__=[];var
__ATPOSTRUN__=[];var runtimeInitialized=false;var
runtimeExited=false;if(!ENVIRONMENT_IS_PTHREAD)__ATINIT__.push({func:function(){__wasm_call_ctors()}});function preRun(){if(ENVIRONMENT_IS_PTHREAD)return;if(Module[\"preRun\"]){if(typeof
Module[\"preRun\"]!==\"function\")Module[\"preRun\"]=[Module[\"preRun\"]];while(Module[\"preRun\"].length){addOnPreRun(Module[\"preRun\"].shift())}callRuntimeCallbacks(__ATPRERUN__)}function
initRuntime(){runtimeInitialized=true;if(ENVIRONMENT_IS_PTHREAD)return;callRuntimeCallbacks(__ATINIT__)}function
preMain(){if(ENVIRONMENT_IS_PTHREAD)return;callRuntimeCallbacks(__ATMAIN__)}function
exitRuntime(){if(ENVIRONMENT_IS_PTHREAD)return;runtimeExited=true}function
postRun(){if(ENVIRONMENT_IS_PTHREAD)return;if(Module[\"postRun\"]){if(typeof
Module[\"postRun\"]!==\"function\")Module[\"postRun\"]=[Module[\"postRun\"]];while(Module[\"postRun\"].length){addOnPostRun(Module[\"postRun\"].shift())}callRuntimeCallbacks(__ATPOSTRUN__)}function
addOnPreRun(cb){__ATPRERUN__.unshift(cb)}function addOnPostRun(cb){__ATPOSTRUN__.unshift(cb)}var
runDependencies=0;var runDependencyWatcher=null;var dependenciesFulfilled=null;function
addRunDependency(id){assert(!ENVIRONMENT_IS_PTHREAD,\\\"addRunDependency cannot be used in a
pthread
worker\\");runDependencies++;if(Module[\"monitorRunDependencies\"]){Module[\"monitorRunDependencies\"](runDependencies)}}function removeRunDependency(id){runDependencies--;if(Module[\"monitorRunDependencies\"]){Module[\"monitorRunDependencies\"](runDependencies)}if(runDependencies==0){if(runDependencyWatcher!==null){clearInterval(runDependencyWatcher);runDependencyWatcher=null}if(dependenciesFulfilled){var
callback=dependenciesFulfilled;dependenciesFulfilled=null;callback()}}Module[\"preloadedImages\"]={};Module[\"preloadedAudios\"]={};function
abort(what){if(Module[\"onAbort\"]){Module[\"onAbort\"](what)}if(ENVIRONMENT_IS_PTHREAD)console.error(\\\"Pthread
aborting at \\\"+(new Error).stack);what+=\\\"\\\";err(what);ABORT=true;EXITSTATUS=1;what=\\\"abort(\\\"+what+\\\").
Build with -s ASSERTIONS=1 for more info.\\\";var e=new
WebAssembly.RuntimeError(what);readyPromiseReject(e);throw e}function hasPrefix(str,prefix){return
String.prototype.startsWith?str.startsWith(prefix):str.indexOf(prefix)===0}var
dataURIPrefix=\\\"data:application/octet-stream;base64,\\\";function isDataURI(filename){return
hasPrefix(filename,dataURIPrefix)}var fileURIPrefix=\\\"file://\\\";function isFileURI(filename){return
hasPrefix(filename,fileURIPrefix)}var wasmBinaryFile=\\\"tfjs-backend-wasm-threaded-
simd.wasm\\\";if(!isDataURI(wasmBinaryFile)){wasmBinaryFile=locateFile(wasmBinaryFile)}function
getBinary(file){try{if(file===wasmBinaryFile&&wasmBinary){return new
Uint8Array(wasmBinary)}if(readBinary){return readBinary(file)}else{throw\\\"both async and sync fetching of the
wasm failed\\\"}}catch(err){abort(err)}}function
getBinaryPromise(){if(!wasmBinary&&(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER)){if(typeof
fetch===\\\"function\\\"&&!isFileURI(wasmBinaryFile)){return fetch(wasmBinaryFile,{credentials:\\\"same-origin\\\"}).then(function(response){if(!response[\\\"ok\\\"]){throw\\\"failed to load wasm binary file at
\\\"+wasmBinaryFile+\\\"\\\"}return response[\\\"arrayBuffer\\\"]()).catch(function(){return
getBinary(wasmBinaryFile)})}else{if(readAsync){return new
Promise(function(resolve,reject){readAsync(wasmBinaryFile,function(response){resolve(new
Uint8Array(response)),reject}))})}return Promise.resolve().then(function(){return
getBinary(wasmBinaryFile)})}function createWasm(){var info={\\\"a\\\":asmLibraryArg};function

```



```

receiveInstance(instance,module){ var
exports=instance.exports;Module["asm"]=exports;wasmTable=Module["asm"]["I"];wasmModule=module;if(!E
NVIROMENT_IS_PTHREAD){ var
numWorkersToLoad=PThread.unusedWorkers.length;PThread.unusedWorkers.forEach(function(w){PThread.load
WasmModuleToWorker(w,function(){if(!--numWorkersToLoad)removeRunDependency("\wasm-
instantiate\");}})}if(!ENVIRONMENT_IS_PTHREAD){addRunDependency("\wasm-instantiate\");function
receiveInstantiatedSource(output){receiveInstance(output["instance"],output["module"]);function
instantiateArrayBuffer(receiver){return getBinaryPromise().then(function(binary){return
WebAssembly.instantiate(binary,info)).then(receiver,function(reason){err("\failed to asynchronously prepare
wasm: "+reason);abort(reason)})}function instantiateAsync(){if(!wasmBinary&&typeof
WebAssembly.instantiateStreaming===\function\&&!isDataURI(wasmBinaryFile)&&!isFileURI(wasmBinaryFil
e)&&typeof fetch===\function\"){return fetch(wasmBinaryFile,{credentials:\same-
origin\}).then(function(response){ var result=WebAssembly.instantiateStreaming(response,info);return
result.then(receiveInstantiatedSource,function(reason){err("\wasm streaming compile failed: "+reason);err("\falling
back to ArrayBuffer instantiation\");return instantiateArrayBuffer(receiveInstantiatedSource)})})}else{return
instantiateArrayBuffer(receiveInstantiatedSource)}if(Module["instantiateWasm"]){try{var
exports=Module["instantiateWasm"](info,receiveInstance);return exports}catch(e){err("\Module.instantiateWasm
callback failed with error: "+e);return false}}instantiateAsync().catch(PromiseReject);return{}}var
ASM_CONSTS={10520:function(){throw\Canceled!\"},10538:function($0,$1){setTimeout(function(){__emscript
en_do_dispatch_to_thread($0,$1),0});function initPthreadsJS(){PThread.initRuntime()}function
callRuntimeCallbacks(callbacks){while(callbacks.length>0){var callback=callbacks.shift();if(typeof
callback===\function\){callback(Module);continue}var func=callback.func;if(typeof
func===\number\){if(callback.arg===undefined){wasmTable.get(func)()}else{wasmTable.get(func)(callback.arg
)}}else{func(callback.arg===undefined?null:callback.arg)}}}var
ERRNO_CODES={EPERM:63,ENOENT:44,ESRCH:71,EINTR:27,EIO:29,ENXIO:60,E2BIG:1,ENOEXEC:45,E
BADF:8,ECHILD:12,EAGAIN:6,EWOULDBLOCK:6,ENOMEM:48,EACCES:2,EFAULT:21,ENOTBLK:105,EB
USY:10,EEXIST:20,EXDEV:75,ENODEV:43,ENOTDIR:54,EISDIR:31,EINVAL:28,ENFILE:41,EMFILE:33,EN
OTTY:59,ETXTBSY:74,EFBIG:22,ENOSPC:51,ESPIPE:70,EROFS:69,EMLINK:34,EPIPE:64,EDOM:18,ERAN
GE:68,ENOMSG:49,EIDRM:24,ECHRNG:106,EL2NSYNC:156,EL3HLT:107,EL3RST:108,ELNRNG:109,EUNA
TCH:110,ENOSIG:111,EL2HLT:112,EDEADLK:16,ENOLCK:46,EBADE:113,EBADR:114,EXFULL:115,ENOA
NO:104,EBADRQC:103,EBADSLT:102,EDEADLOCK:16,EBFONT:101,ENOSTR:100,ENODATA:116,ETIME:
117,ENOSR:118,ENONET:119,ENOPKG:120,EREMOTE:121,ENOLINK:47,EADV:122,ESRMNT:123,ECOMM
:124,EPROTO:65,EMULTIHOP:36,EDOTDOT:125,EBADMSG:9,ENOTUNIQ:126,EBADFD:127,EREMCHG:1
28,ELIBACC:129,ELIBBAD:130,ELIBSCN:131,ELIBMAX:132,ELIBEXEC:133,ENOSYS:52,ENOTEMPTY:55,
ENAMETOOLONG:37,ELOOP:32,EOPNOTSUPP:138,EPFNOSUPPORT:139,ECONNRESET:15,ENOBUFS:42,
EAFNOSUPPORT:5,EPROTOTYPE:67,ENOTSOCK:57,ENOPROTOOPT:50,ESHUTDOWN:140,ECONNREFU
SED:14,EADDRINUSE:3,ECONNABORTED:13,ENETUNREACH:40,ENETDOWN:38,ETIMEDOUT:73,EHOS
TDOWN:142,EHOSTUNREACH:23,EINPROGRESS:26,EALREADY:7,EDESTADDRREQ:17,EMSGSIZE:35,E
PROTONOSUPPORT:66,ESOCKTNOSUPPORT:137,EADDRNOTAVAIL:4,ENETRESET:39,EISCONN:30,EN
OTCONN:53,ETOOMANYREFS:141,EUSERS:136,EDQUOT:19,ESTALE:72,ENOTSUP:138,ENOMEDIUM:14
8,EILSEQ:25,E_OVERFLOW:61,ECANCELED:11,ENOTRECOVERABLE:56,EOWNERDEAD:62,ESTRPIPE:13
5};function
__emscripten_futex_wake(addr,count){if(addr<=0||addr>GROWABLE_HEAP_I8().length||addr&3!=0||count<0)retu
rn-28;if(count==0)return 0;if(count>=2147483647)count=Infinity;var
mainThreadWaitAddress=Atomics.load(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2);var
mainThreadWoken=0;if(mainThreadWaitAddress==addr){var
loadedAddr=Atomics.compareExchange(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2,mainTh
readWaitAddress,0);if(loadedAddr==mainThreadWaitAddress){--count;mainThreadWoken=1;if(count<=0)return

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1}}var ret=Atomics.notify(GROWABLE_HEAP_I32(),addr>>2,count);if(ret>=0)return
ret+mainThreadWoken;throw`"Atomics.notify returned an unexpected value
`"+ret}Module[`_emscripten_futex_wake\"]=_emscripten_futex_wake;function
killThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw`"Internal Error! killThread() can only ever be
called from main application thread!";if(!pthread_ptr)throw`"Internal Error! Null pthread_ptr in
killThread!";GROWABLE_HEAP_I32()[pthread_ptr+12>>2]=0;var
pthread=PThread.threads[pthread_ptr];pthread.worker.terminate();PThread.freeThreadData(pthread);PThread.runni
ngWorkers.splice(PThread.runningWorkers.indexOf(pthread.worker),1);pthread.worker pthread=undefined}functio
n cancelThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw`"Internal Error! cancelThread() can only
ever be called from main application thread!";if(!pthread_ptr)throw`"Internal Error! Null pthread_ptr in
cancelThread!";var
pthread=PThread.threads[pthread_ptr];pthread.worker.postMessage({`cmd\":"cancel\`})}function
cleanupThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw`"Internal Error! cleanupThread() can only
ever be called from main
application thread!";if(!pthread_ptr)throw`"Internal Error! Null pthread_ptr in cleanupThread!";var
pthread=PThread.threads[pthread_ptr];if(pthread){GROWABLE_HEAP_I32()[pthread_ptr+12>>2]=0;var
worker=pthread.worker;PThread.returnWorkerToPool(worker)}var
PThread={unusedWorkers:[],runningWorkers:[],initMainThreadBlock:function(){var pthreadPoolSize=8;for(var
i=0;i<pthreadPoolSize;++i){PThread.allocateUnusedWorker()}},initRuntime:function(){var
tb=_malloc(228);for(var
i=0;i<228/4;++i)GROWABLE_HEAP_U32()[tb/4+i]=0;GROWABLE_HEAP_I32()[tb+12>>2]=tb;var
headPtr=tb+152;GROWABLE_HEAP_I32()[headPtr>>2]=headPtr;var tlsMemory=_malloc(512);for(var
i=0;i<128;++i)GROWABLE_HEAP_U32()[tlsMemory/4+i]=0;Atomics.store(GROWABLE_HEAP_U32(),tb+100
>>2,tlsMemory);Atomics.store(GROWABLE_HEAP_U32(),tb+40>>2,tb);__emscripten_thread_init(tb,!ENVIRON
MENT_IS_WORKER,1);_emscripten_register_main_browser_thread_id(tb);initWorker:function(){},threads:{},t
hreadExitHandlers:[],setThreadStatus:function(){},runExitHandlers:function(){while(PThread.threadExitHandlers.l
ength>0){PThread.threadExitHandlers.pop()}if(ENVIRONMENT_IS_PTHREAD&&_pthread_self())__pthread
_tsd_run_dtors(),runExitHandlersAndDeinitThread:function(tb,exitCode){Atomics.store(GROWABLE_HEAP_U
32(),tb+56>>2,1);Atomics.store(GROWABLE_HEAP_U32(),tb+60>>2,0);PThread.runExitHandlers();Atomics.stor
e(GROWABLE_HEAP_U32(),tb+4>>2,exitCode);Atomics.store(GROWABLE_HEAP_U32(),tb+0>>2,1);_emscri
pten_futex_wake(tb+0,2147483647);__emscripten_thread_init(0,0,0)},threadExit:function(exitCode){var
tb=_pthread_self();if(tb){PThread.runExitHandlersAndDeinitThread(tb,exitCode);if(ENVIRONMENT_IS_PTHRE
AD){postMessage({`cmd\":"exit\`})}},threadCancel:function(){PThread.runExitHandlersAndDeinitThread(_pthr
ead_self(),-1);postMessage({`cmd\":"cancelDone\`})},terminateAllThreads:function(){for(var t in
PThread.threads){var
pthread=PThread.threads[t];if(pthread&&pthread.worker){PThread.returnWorkerToPool(pthread.worker)}PThre
ad.threads={};for(var
i=0;i<PThread.unusedWorkers.length;++i){var
worker=PThread.unusedWorkers[i];worker.terminate()}PThread.unusedWorkers=[];for(var
i=0;i<PThread.runningWorkers.length;++i){var worker=PThread.runningWorkers[i];var
pthread=worker pthread;PThread.freeThreadData(pthread);worker.terminate()}PThread.runningWorkers=[],freeTh
readData:function(pthread){if(!pthread)return;if(pthread.threadInfoStruct){var
tlsMemory=GROWABLE_HEAP_I32()[pthread.threadInfoStruct+100>>2];GROWABLE_HEAP_I32()[pthread.thr
eadInfoStruct+100>>2]=0;_free(tlsMemory);_free(pthread.threadInfoStruct)}pthread.threadInfoStruct=0;if(pthread.
allocatedOwnStack&&pthread.stackBase)_free(pthread.stackBase);pthread.stackBase=0;if(pthread.worker)pthread.
worker pthread=null},returnWorkerToPool:function(worker){PThread.runWithoutMainThreadQueuedCalls(funcio
n){delete
PThread.threads[worker pthread.threadInfoStruct];PThread.unusedWorkers.push(worker);PThread.runningWorker

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s.splice(PThread.runningWorkers.indexOf(worker),1);PThread.freeThreadData(worker.pthread);worker.pthread=un
defined)),runWithoutMainThreadQueuedCalls:function(func){GROWABLE_HEAP_I32()[__emscripten_allow_m
ain_runtime_queued_calls>>2]=0;try{func()}finally{GROWABLE_HEAP_I32()[__emscripten_allow_main_runti
me_queued_calls>>2]=1}},receiveObjectTransfer:function(data){},loadWasmModuleToWorker:function(worker,o
nFinishedLoading){worker.onmessage=function(e){var
d=e["data"];var
cmd=d["cmd"];if(worker.pthread)PThread.currentProxiedOperationCallerThread=worker.pthread.threadInfoStruct;
if(d["targetThread"]&&d["targetThread"]!=_pthread_self()){var
thread=PThread.pthreads[d.targetThread];if(thread){thread.worker.postMessage(e.data,d["transferList"]);}else{con
sole.error('Internal error! Worker sent a message \''+cmd+'\' to target pthread '+d["targetThread"]+', but that
thread no longer
exists!')}PThread.currentProxiedOperationCallerThread=undefined;return}if(cmd===\'processQueuedMainThread
Work\'){_emscripten_main_thread_process_queued_calls()}else
if(cmd===\'spawnThread\'){spawnThread(e.data)}else
if(cmd===\'cleanupThread\'){cleanupThread(d["thread"])}else
if(cmd===\'killThread\'){killThread(d["thread"])}else
if(cmd===\'cancelThread\'){cancelThread(d["thread"])}else
if(cmd===\'loaded\'){worker.loaded=true;if(onFinishedLoading)onFinishedLoading(worker);if(worker.runPthread)
{worker.runPthread();delete worker.runPthread}}else if(cmd===\'print\'){out("Thread \"+d["threadId"]+"\":
'+d["text"])}else if(cmd===\'printErr\'){err("Thread \"+d["threadId"]+"\": \'+d["text"])}else
if(cmd===\'alert\'){alert("Thread \"+d["threadId"]+"\": \'+d["text"])}else if(cmd===\'exit\'){var
detached=worker.pthread&&Atomics.load(GROWABLE_HEAP_U32(),worker.pthread.threadInfoStruct+64>>2);if
(detached){PThread.returnWorkerToPool(worker)}else
if(cmd===\'exitProcess\'){try{exit(d["returnCode"])}catch(e){if(e instanceof ExitStatus)return;throw e}}else
if(cmd===\'cancelDone\'){PThread.returnWorkerToPool(worker)}else
if(cmd===\'objectTransfer\'){PThread.receiveObjectTransfer(e.data)}else
if(e.data.target===\'setImmediate\'){worker.postMessage(e.data)}else{err("worker sent an unknown command
'+cmd)}PThread.currentProxiedOperationCallerThread=undefined};worker.onerror=function(e){err("pthread sent
an error! \'+e.filename+\":'+e.lineno+\":
'+e.message)};if(ENVIRONMENT_IS_NODE){worker.on("message",function(data){worker.onmessage({data:d
ata})});worker.on("error",function(data){worker.onerror(data)});worker.on("exit",function(data){})}worker.post
Message({"cmd":\'load\',\'urlOrBlob\':Module["mainScriptUrlOrBlob"]|_scriptDir,"wasmMemory\':wasmMe
memory,\"wasmModule\':wasmModule})),allocateUnusedWorker:function(){var pthreadMainJs=locateFile(\'tfjs-
backend-wasm-threaded-simd.worker.js\');PThread.unusedWorkers.push(new
Worker(pthreadMainJs)),getNewWorker:function(){if(PThread.unusedWorkers.length==0){PThread.allocateUnus
edWorker();PThread.loadWasmModuleToWorker(PThread.unusedWorkers[0])}if(PThread.unusedWorkers.length>
0)return
PThread.unusedWorkers.pop();else return null},busySpinWait:function(msecs){var
t=performance.now()+msecs;while(performance.now()<t){}}};function
establishStackSpace(stackTop,stackMax){_emscripten_stack_set_limits(stackTop,stackMax);stackRestore(stackTop
)}Module["establishStackSpace"]=establishStackSpace;function getNoExitRuntime(){return
noExitRuntime}Module["getNoExitRuntime"]=getNoExitRuntime;function invokeEntryPoint(ptr,arg){return
wasmTable.get(ptr)(arg)}Module["invokeEntryPoint"]=invokeEntryPoint;function
__assert_fail(condition,filename,line,func){abort("Assertion failed: \'+UTF8ToString(condition)+'", at:
'+[filename?UTF8ToString(filename):\'unknown filename\',line,func?UTF8ToString(func):\'unknown
function\'])}function __call_main(argc,argv){var returnCode=_main(argc,argv)}var
_emscripten_get_now;if(ENVIRONMENT_IS_NODE){_emscripten_get_now=function(){var
t=process["hrtime"]();return t[0]*1e3+t[1]/1e6}}else

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if(ENVIRONMENT_IS_PTHREAD){_emscripten_get_now=function(){return
performance.now()-Module[\"__performance_now_clock_drift\"]}}else if(typeof
dateNow!=\"undefined\"){_emscripten_get_now=dateNow}else _emscripten_get_now=function(){return
performance.now()};function setErrNo(value){GROWABLE_HEAP_I32()[__errno_location()>>2]=value;return
value}function _atexit(func,arg){if(ENVIRONMENT_IS_PTHREAD)return
_emscripten_proxy_to_main_thread_js(1,1,func,arg)}function
_emscripten_notify_thread_queue(targetThreadId,mainThreadId){if(targetThreadId==mainThreadId){postMessag
e({\"cmd\": \"processQueuedMainThreadWork\"})}else
if(ENVIRONMENT_IS_PTHREAD){postMessage({\"targetThread\":targetThreadId,\"cmd\": \"processThreadQueu
e\"})}else {var pthread=PThread.pthreads[targetThreadId];var
worker=pthread&&pthread.worker;if(!worker){return}worker.postMessage({\"cmd\": \"processThreadQueue\"})}ret
urn 1}function _abort(){abort()}function _emscripten_asm_const_int(code,sigPtr,argbuf){var
args=readAsmConstArgs(sigPtr,argbuf);return ASM_CONSTS[code].apply(null,args)}function
_emscripten_conditional_set_current_thread_status(expectedStatus,newStatus){}function
_emscripten_futex_wait(addr,val,timeout){if(addr<=0||addr>GROWABLE_HEAP_I8().length||addr&3!=0)return-
28;if(!ENVIRONMENT_IS_WEB){var
ret=Atomics.wait(GROWABLE_HEAP_I32(),addr>>2,val,timeout);if(ret===\"timed-out\")return-
73;if(ret===\"not-equal\")return-6;if(ret===\"ok\")return 0;throw\"Atomics.wait returned an unexpected value
\"+ret}else {if(Atomics.load(GROWABLE_HEAP_I32(),addr>>2)!=val){return-6}var
tNow=performance.now();var tEnd=tNow+timeout;var
lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),_emscripten_main_thread_futex>>2,addr);while(1){tNo
w=performance.now();if(tNow>tEnd){lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),_emscripten_mai
n_thread_futex>>2,0);return-
73}lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),_emscripten_main_thread_futex>>2,0);if(lastAddr==
0){break}_emscripten_main_thread_process_queued_calls();if(Atomics.load(GROWABLE_HEAP_I32(),addr>>2)!
=val){return-
6}lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),_emscripten_main_thread_futex>>2,addr)}return
0}}function
_emscripten_memcpy_big(dest,src,num){GROWABLE_HEAP_U8().copyWithin(dest,src,src+num)}function
_emscripten_num_logical_cores(){if(ENVIRONMENT_IS_NODE)return require(\"os\").cpus().length;return
navigator[\"hardwareConcurrency\"]}function _emscripten_proxy_to_main_thread_js(index,sync){var
numCallArgs=arguments.length-2;var stack=stackSave();var serializedNumCallArgs=numCallArgs;var
args=stackAlloc(serializedNumCallArgs*8);var b=args>>3;for(var i=0;i<numCallArgs;i++){var
arg=arguments[2+i];GROWABLE_HEAP_F64()[b+i]=arg}var
ret=_emscripten_run_in_main_runtime_thread_js(index,serializedNumCallArgs,args,sync);stackRestore(stack);retur
n ret}var _emscripten_receive_on_main_thread_js_callArgs=[];var readAsmConstArgsArray=[];function
readAsmConstArgs(sigPtr,buf){readAsmConstArgsArray.length=0;var
ch;buf>>=2;while(ch=GROWABLE_HEAP_U8()[sigPtr++){var
double=ch<105;if(double&&buf&1)buf++;readAsmConstArgsArray.push(double?GROWABLE_HEAP_F64()[buf
++>>1]:GROWABLE_HEAP_I32()[buf]);++buf}return
readAsmConstArgsArray}function
_emscripten_receive_on_main_thread_js(index,numCallArgs,args){_emscripten_receive_on_main_thread_js_callA
rgs.length=numCallArgs;var b=args>>3;for(var
i=0;i<numCallArgs;i++){_emscripten_receive_on_main_thread_js_callArgs[i]=GROWABLE_HEAP_F64()[b+i]}v
ar isEmAsmConst=index<0;var func=!isEmAsmConst?proxiedFunctionTable[index]:ASM_CONSTS[-index-
1];return func.apply(null,_emscripten_receive_on_main_thread_js_callArgs)}function
_emscripten_get_heap_size(){return GROWABLE_HEAP_U8().length}function
emscripten_realloc_buffer(size){try {wasmMemory.grow(size-

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buffer.byteLength+65535>>>16);updateGlobalBufferAndViews(wasmMemory.buffer);return
1}catch(e){}}function _emscripten_resize_heap(requestedSize){var
oldSize=_emscripten_get_heap_size();if(requestedSize<=oldSize){return false}var
maxHeapSize=2147483648;if(requestedSize>maxHeapSize){return false}for(var
cutDown=1;cutDown<=4;cutDown*=2){var
overGrownHeapSize=oldSize*(1+.2/cutDown);overGrownHeapSize=Math.min(overGrownHeapSize,requestedSize
+100663296);var
newSize=Math.min(maxHeapSize,alignUp(Math.max(requestedSize,overGrownHeapSize),65536));var
replacement=emscripten_realloc_buffer(newSize);if(replacement){return true}}return false}var
JSEvents={inEventHandler:0,removeAllEventListeners:function(){for(var i=JSEvents.eventHandlers.length-
1;i>=0;--
i){JSEvents._removeHandler(i)}JSEvents.eventHandlers=[];JSEvents.deferredCalls=[]},registerRemoveEventListene
rs:function(){if(!JSEvents.removeEventListenersRegistered){__ATEXIT__.push(JSEvents.removeAllEventListene
rs);JSEvents.removeEventListenersRegistered=true}},deferredCalls:[],deferCall:function(targetFunction,precedence
,argsList){function arraysHaveEqualContent(arrA,arrB){if(arrA.length!=arrB.length)return false;for(var i in
arrA){if(arrA[i]!=arrB[i])return false}return true}for(var i in JSEvents.deferredCalls){var
call=JSEvents.deferredCalls[i];if(call.targetFunction==targetFunction&&arraysHaveEqualContent(call.argsList,args
List))){return}}JSEvents.deferredCalls.push({targetFunction:targetFunction,precedence:precedence,argsList:argsList
});JSEvents.deferredCalls.sort(function(x,y){return
x.precedence<y.precedence}),removeDeferredCalls:function(targetFunction){for(var
i=0;i<JSEvents.deferredCalls.length;++i){if(JSEvents.deferredCalls[i].targetFunction==targetFunction){JSEvents.d
eferredCalls.splice(i,1);--i}},canPerformEventHandlerRequests:function(){return
JSEvents.inEventHandler&&JSEvents.currentEventHandler.allowsDeferredCalls},runDeferredCalls:function(){if(!J
SEvents.canPerformEventHandlerRequests()){return}for(var i=0;i<JSEvents.deferredCalls.length;++i){var
call=JSEvents.deferredCalls[i];JSEvents.deferredCalls.splice(i,1);--
i;call.targetFunction.apply(null,call.argsList)},eventHandlers:[],removeAllHandlersOnTarget:function(target,event
TypeString){for(var
i=0;i<JSEvents.eventHandlers.length;++i){if(JSEvents.eventHandlers[i].target==target&&(!eventTypeString||event
TypeString==JSEvents.eventHandlers[i].eventTypeString)){JSEvents._removeHandler(i--
)}}},_removeHandler:function(i){var
h=JSEvents.eventHandlers[i];h.target.removeEventListener(h.eventTypeString,h.eventListenerFunc,h.useCapture);J
SEvents.eventHandlers.splice(i,1)},registerOrRemoveHandler:function(eventHandler){var jsEventHandler=function
jsEventHandler(event){++JSEvents.inEventHandler;JSEvents.currentEventHandler=eventHandler;JSEvents.runDef
erredCalls();eventHandler.handlerFunc(event);JSEvents.runDeferredCalls();--
JSEvents.inEventHandler};if(eventHandler.callbackfunc){eventHandler.eventListenerFunc=jsEventHandler;eventH
andler.target.addEventListener(eventHandler.eventTypeString,jsEventHandler,eventHandler.useCapture);JSEvents.e
ventHandlers.push(eventHandler);JSEvents.registerRemoveEventListeners()}else{for(var
i=0;i<JSEvents.eventHandlers.length;++i){if(JSEvents.eventHandlers[i].target==eventHandler.target&&JSEvents.e
ventHandlers[i].eventTypeString==eventHandler.eventTypeString){JSEvents._removeHandler(i--
)}}},queueEventHandlerOnThread_iiii:function(targetThread,eventHandlerFunc,eventTypeId,eventData,userData)
{var
stackTop=stackSave();var
varargs=stackAlloc(12);GROWABLE_HEAP_I32()[varargs>>2]=eventTypeId;GROWABLE_HEAP_I32()[varargs
+4>>2]=eventData;GROWABLE_HEAP_I32()[varargs+8>>2]=userData;__emscripten_call_on_thread(0,targetThr
ead,637534208,eventHandlerFunc,eventData,varargs);stackRestore(stackTop)},getTargetThreadForEventCallback:f
unction(targetThread){switch(targetThread){case 1:return 0;case 2:return
PThread.currentProxiedOperationCallerThread;default:return
targetThread}},getNodeNameForTarget:function(target){if(!target)return\"\":if(target==window)return\"#window\";

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if(target==screen)return\"#screen\";return
target&&target.nodeName?target.nodeName:\"\",fullscreenEnabled:function(){return
document.fullscreenEnabled||document.webkitFullscreenEnabled}};function stringToNewUTF8(jsString){ var
length=lengthBytesUTF8(jsString)+1;var cString=_malloc(length);stringToUTF8(jsString,cString,length);return
cString}function
_emsripten_set_offscreencanvas_size_on_target_thread_js(targetThread,targetCanvas,width,height){ var
stackTop=stackSave();var varargs=stackAlloc(12);var
targetCanvasPtr=0;if(targetCanvas){targetCanvasPtr=stringToNewUTF8(targetCanvas)}GROWABLE_HEAP_I32(
)[varargs>>2]=targetCanvasPtr;GROWABLE_HEAP_I32()[varargs+4>>2]=width;GROWABLE_HEAP_I32()[var
args+8>>2]=height;__emsripten_call_on_thread(0,targetThread,657457152,0,targetCanvasPtr,varargs);stackRestor
e(stackTop)}function
_emsripten_set_offscreencanvas_size_on_target_thread(targetThread,targetCanvas,width,height){targetCanvas=tar
getCanvas?UTF8ToString(targetCanvas):\"\";_emsripten_set_offscreencanvas_size_on_target_thread_js(targetThr
ead,targetCanvas,width,height)}function maybeCStringToJsString(cString){ return
cString>2?UTF8ToString(cString):cString}var specialHTMLTargets=[0,typeof
document!=\"undefined\"?document:0,typeof window!=\"undefined\"?window:0];function
findEventTarget(target){target=maybeCStringToJsString(target);var
domElement=specialHTMLTargets[target]||(typeof
document!=\"undefined\"?document.querySelector(target):undefined);return domElement}function
findCanvasEventTarget(target){return findEventTarget(target)}function
_emsripten_set_canvas_element_size_calling_thread(target,width,height){ var
canvas=findCanvasEventTarget(target);if(!canvas)return-
4;if(canvas.canvasSharedPtr){ GROWABLE_HEAP_I32()[canvas.canvasSharedPtr>>2]=width;GROWABLE_HEA
P_I32()[canvas.canvasSharedPtr+4>>2]=height}if(canvas.offscreenCanvas||!canvas.controlTransferredOffscreen){if
(canvas.offscreenCanvas)canvas=canvas.offscreenCanvas;var
autoResizeViewport=false;if(canvas.GLctxObject&&canvas.GLctxObject.GLctx){ var
prevViewport=canvas.GLctxObject.GLctx.getParameter(2978);autoResizeViewport=prevViewport[0]==0&&prev
Viewport[1]==0&&prevViewport[2]==canvas.width&&prevViewport[3]==canvas.height}canvas.width=width;
canvas.height=height;if(autoResizeViewport){ canvas.GLctxObject.GLctx.viewport(0,0,width,height)} } else
if(canvas.canvasSharedPtr){ var
targetThread=GROWABLE_HEAP_I32()[canvas.canvasSharedPtr+8>>2];_emsripten_set_offscreencanvas_size_o
n_target_thread(targetThread,target,width,height);return 1} else{return-4}return 0}function
_emsripten_set_canvas_element_size_main_thread(target,width,height){if(ENVIRONMENT_IS_PTHREAD)retur
n _emsripten_proxy_to_main_thread_js(2,1,target,width,height);return
_emsripten_set_canvas_element_size_calling_thread(target,width,height)}function
_emsripten_set_canvas_element_size(target,width,height){ var
canvas=findCanvasEventTarget(target);if(canvas){ return
_emsripten_set_canvas_element_size_calling_thread(target,width,height)} else{return
_emsripten_set_canvas_element_size_main_thread(target,width,height)} }function
_emsripten_set_current_thread_status(newStatus){ }function
_emsripten_set_thread_name(threadId,name){ }function __webgl_enable_ANGLE_instanced_arrays(ctx){ var
ext=ctx.getExtension(\"ANGLE_instanced_arrays\");if(ext){ ctx[\"vertexAttribDivisor\"]=function(index,divisor){ ex
t[\"vertexAttribDivisorANGLE\"](index,divisor)}; ctx[\"drawArraysInstanced\"]=function(mode,first,count,primcou
nt){ ext[\"drawArraysInstancedANGLE\"](mode,first,count,primcount)}; ctx[\"drawElementsInstanced\"]=function(
mode,count,type,indices,primcount){ ext[\"drawElementsInstancedANGLE\"](mode,count,type,indices,primcount)};
return
1} }function __webgl_enable_OES_vertex_array_object(ctx){ var
ext=ctx.getExtension(\"OES_vertex_array_object\");if(ext){ ctx[\"createVertexArray\"]=function(){ return

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ext["createVertexArrayOES"]();ctx["deleteVertexArray"]=function(vao){ext["deleteVertexArrayOES"](vao)};
ctx["bindVertexArray"]=function(vao){ext["bindVertexArrayOES"](vao)};ctx["isVertexArray"]=function(vao)
{return ext["isVertexArrayOES"](vao)};return 1}}function __webgl_enable_WEBGL_draw_buffers(ctx){var
ext=ctx.getExtension("WEBGL_draw_buffers");if(ext){ctx["drawBuffers"]=function(n,bufs){ext["drawBuffers
WEBGL"](n,bufs)};return
1}}function
__webgl_enable_WEBGL_multi_draw(ctx){return!(ctx.multiDrawWebgl=ctx.getExtension("WEBGL_multi_dra
w"))}var
GL={counter:1,buffers:[],programs:[],framebuffers:[],renderbuffers:[],textures:[],uniforms:[],shaders:[],vaos:[],cont
exts:{},offscreenCanvases:{},timerQueriesEXT:[],programInfos:{},stringCache:{},unpackAlignment:4,recordError:
function recordError(errorCode){if(!GL.lastError){GL.lastError=errorCode}},getNewId:function(table){var
ret=GL.counter++;for(var i=table.length;i<ret;i++){table[i]=null}return
ret},getSource:function(shader,count,string,length){var source="";for(var i=0;i<count;++i){var
len=length?GROWABLE_HEAP_I32()[length+i*4>>2]:-
1;source+=UTF8ToString(GROWABLE_HEAP_I32()[string+i*4>>2],len<0?undefined:len)}return
source},createContext:function(canvas,webGLContextAttributes){var
ctx=canvas.getContext("webgl",webGLContextAttributes);if(!ctx)return 0;var
handle=GL.registerContext(ctx,webGLContextAttributes);return
handle},registerContext:function(ctx,webGLContextAttributes){var
handle=_malloc(8);GROWABLE_HEAP_I32()[handle+4>>2]=_pthread_self();var
context={handle:handle,attributes:webGLContextAttributes,version:webGLContextAttributes.majorVersion,GLctx:
ctx};if(ctx.canvas)ctx.canvas.GLctxObject=context;GL.contexts[handle]=context;if(typeof
webGLContextAttributes.enableExtensionsByDefault===undefined||webGLContextAttributes.enableExtensions
ByDefault){GL.initExtensions(context)}return
handle},makeContextCurrent:function(contextHandle){GL.currentContext=GL.contexts[contextHandle];Module.ctx
=GLctx=GL.currentContext&&GL.currentContext.GLctx;return!(contextHandle&&!GLctx)},getContext:function(c
ontextHandle){return
GL.contexts[contextHandle]},deleteContext:function(contextHandle){if(GL.currentContext===GL.contexts[context
Handle])GL.currentContext=null;if(typeof
JSEvents===object)JSEvents.removeAllHandlersOnTarget(GL.contexts[contextHandle].GLctx.canvas);if(GL.co
ntexts[contextHandle]&&GL.contexts[contextHandle].GLctx.canvas)GL.contexts[contextHandle].GLctx.canvas.GL
ctxObject=undefined;_free(GL.contexts[contextHandle].handle);GL.contexts[contextHandle]=null},initExtensions:f
unction(context){if(!context)context=GL.currentContext;if(context.initExtensionsDone)return;context.initExtension
sDone=true;var
GLctx=context.GLctx;__webgl_enable_ANGLE_instanced_arrays(GLctx);__webgl_enable_OES_vertex_array_obj
ect(GLctx);__webgl_enable_WEBGL_draw_buffers(GLctx);GLctx.disjointTimerQueryExt=GLctx.getExtension("
EXT_disjoint_timer_query");__webgl_enable_WEBGL_multi_draw(GLctx);var
exts=GLctx.getSupportedExtensions()||[];exts.forEach(function(ext){if(ext.indexOf("lose_context")<0&&ext.inde
xOf("debug")<0){GLctx.getExtension(ext)}}),populateUniformTable:function(program){var
p=GL.programs[program];var
ptable=GL.programInfos[program]={uniforms:{},maxUniformLength:0,maxAttributeLength:-
1,maxUniformBlockNameLength:-1};var utable=ptable.uniforms;var
numUniforms=GLctx.getProgramParameter(p,35718);for(var i=0;i<numUniforms;++i){var
u=GLctx.getActiveUniform(p,i);var
name=u.name;ptable.maxUniformLength=Math.max(ptable.maxUniformLength,name.length+1);if(name.slice(-
1)!="\"){name=name.slice(0,name.lastIndexOf("\["))}var loc=GLctx.getUniformLocation(p,name);if(loc){var
id=GL.getNewId(GL.uniforms);utable[name]=[u.size,id];GL.uniforms[id]=loc;for(var j=1;j<u.size;++j){var
n=name+"\["+j+"\]";loc=GLctx.getUniformLocation(p,n);id=GL.getNewId(GL.uniforms);GL.uniforms[id]=loc}}}}

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});var __emscripten_webgl_power_preferences=["default","\low-power","\high-performance"];function
__emscripten_webgl_do_create_context(target,attributes){var a=attributes>>2;var
powerPreference=GROWABLE_HEAP_I32()[a+(24>>2)];var
contextAttributes={"alpha":!!GROWABLE_HEAP_I32()[a+(0>>2)],"depth":!!GROWABLE_HEAP_I32()[a+(4
>>2)],"stencil":!!GROWABLE_HEAP_I32()[a+(8>>2)],"antialias":!!GROWABLE_HEAP_I32()[a+(12>>2)],"p
remultipliedAlpha":!!GROWABLE_HEAP_I32()[a+(16>>2)],"preserveDrawingBuffer":!!GROWABLE_HEAP_
I32()[a+(20>>2)],"powerPreference":__emscripten_webgl_power_preferences[powerPreference],"failIfMajorPerf
ormanceCaveat":!!GROWABLE_HEAP_I32()[a+(28>>2)],majorVersion:GROWABLE_HEAP_I32()[a+(32>>2)],
minorVersion:GROWABLE_HEAP_I32()[a+(36>>2)],enableExtensionsByDefault:GROWABLE_HEAP_I32()[a+(
40>>2)],explicitSwapControl:GROWABLE_HEAP_I32()[a+(44>>2)],proxyContextToMainThread:GROWABLE_
HEAP_I32()[a+(48>>2)],renderViaOffscreenBackBuffer:GROWABLE_HEAP_I32()[a+(52>>2)]};var
canvas=findCanvasEventTarget(target);if(!canvas){return 0}if(contextAttributes.explicitSwapControl){return
0}var contextHandle=GL.createContext(canvas,contextAttributes);return contextHandle}function
__emscripten_webgl_create_context(a0,a1){return __emscripten_webgl_do_create_context(a0,a1)}var
SYSCALLS={mappings:{},buffers:[null,[],[]],printChar:function(stream,curr){var
buffer=SYSCALLS.buffers[stream];if(curr===0||curr===10){(stream===1?out:err)(UTF8ArrayToString(buffer,0));
buffer.length=0}else{buffer.push(curr)},varargs:undefined,get:function(){SYSCALLS.varargs+=4;var
ret=GROWABLE_HEAP_I32()[SYSCALLS.varargs-4>>2];return ret},getStr:function(ptr){var
ret=UTF8ToString(ptr);return ret},get64:function(low,high){return low}};function
_fd_close(fd){if(ENVIRONMENT_IS_PTHREAD)return __emscripten_proxy_to_main_thread_js(3,1,fd);return
0}function _fd_seek(fd,offset_low,offset_high,whence,newOffset){if(ENVIRONMENT_IS_PTHREAD)return
__emscripten_proxy_to_main_thread_js(4,1,fd,offset_low,offset_high,whence,newOffset)}function
_fd_write(fd,iow,iovcnt,pnum){if(ENVIRONMENT_IS_PTHREAD)return
__emscripten_proxy_to_main_thread_js(5,1,fd,iow,iovcnt,pnum);var num=0;for(var i=0;i<iovcnt;i++){var
ptr=GROWABLE_HEAP_I32()[iow+i*8>>2];var len=GROWABLE_HEAP_I32()[iow+(i*8+4)>>2];for(var
j=0;j<len;j++){SYSCALLS.printChar(fd,GROWABLE_HEAP_U8()[ptr+j])}num+=len}GROWABLE_HEAP_I32
()[pnum>>2]=num;return 0}function _pthread_cleanup_pop(execute){var
routine=PThread.threadExitHandlers.pop();if(execute)routine()}function
_pthread_cleanup_push(routine,arg){PThread.threadExitHandlers.push(function(){wasmTable.get(routine)(arg))}}f
unction
spawnThread(threadParams){if(ENVIRONMENT_IS_PTHREAD)throw"Internal Error! spawnThread() can only
ever be called from main application thread!";var
worker=PThread.getNewWorker();if(worker.pthread!==undefined)throw"Internal
error!";if(!threadParams.pthread_ptr)throw"Internal error, no pthread
ptr!";PThread.runningWorkers.push(worker);var tlsMemory=_malloc(128*4);for(var
i=0;i<128;++i){GROWABLE_HEAP_I32()[tlsMemory+i*4>>2]=0}var
stackHigh=threadParams.stackBase+threadParams.stackSize;var
pthread=PThread.pthreads[threadParams.pthread_ptr]={worker:worker,stackBase:threadParams.stackBase,stackSize
:threadParams.stackSize,allocatedOwnStack:threadParams.allocatedOwnStack,threadInfoStruct:threadParams.pthrea
d_ptr};var
tis=pthread.threadInfoStruct>>2;Atomics.store(GROWABLE_HEAP_U32(),tis+(64>>2),threadParams.detached);A
tomics.store(GROWABLE_HEAP_U32(),tis+(100>>2),tlsMemory);Atomics.store(GROWABLE_HEAP_U32(),tis
+(40>>2),pthread.threadInfoStruct);Atomics.store(GROWABLE_HEAP_U32(),tis+(80>>2),threadParams.stackSiz
e);Atomics.store(GROWABLE_HEAP_U32(),tis+(76>>2),stackHigh);Atomics.store(GROWABLE_HEAP_U32(),t
is+(104>>2),threadParams.stackSize);Atomics.store(GROWABLE_HEAP_U32(),tis+(104+8>>2),stackHigh);Atom
ics.store(GROWABLE_HEAP_U32(),tis+(104+12>>2),threadParams.detached);var
global_libc=__emscripten_get_global_libc();var
global_locale=global_libc+40;Atomics.store(GROWABLE_HEAP_U32(),tis+(172>>2),global_locale);worker.pthr

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ead=pthread;var
msg={"cmd\\":\\"run\\",\\"start_routine\\":threadParams.startRoutine,\\"arg\\":threadParams.arg,\\"threadInfoStruct\\":theadParams.pthread_ptr,\\"stackBase\\":threadParams.stackBase,\\"stackSize\\":threadParams.stackSize};worker.runPthead=function(){msg.time=performance.now();worker.postMessage(msg,threadParams.transferList)};if(worker.loaded){worker.runPthead();delete worker.runPthead}}function
_pthread_create(pthread_ptr,attr,start_routine,arg){if(typeof SharedArrayBuffer===\\"undefined\\"){err(\\"Current environment does not support SharedArrayBuffer, pthreads are not available!\");return
6}if(!pthread_ptr){err(\\"pthread_create called with a null thread pointer!\");return 28}var transferList=[];var error=0;if(ENVIRONMENT_IS_PTHREAD&&(transferList.length===0||error)){return
_emscipten_sync_run_in_main_thread_4(687865856,pthread_ptr,attr,start_routine,arg)}if(error)return error;var stackSize=0;var stackBase=0;var detached=0;if(attr&&attr!=-1){stackSize=GROWABLE_HEAP_I32()[attr>>2];stackSize+=81920;stackBase=GROWABLE_HEAP_I32()[attr+8>>2];detached=GROWABLE_HEAP_I32()[attr+12>>2]!==0}else{stackSize=2097152}var allocatedOwnStack=stackBase===0;if(allocatedOwnStack){stackBase=_memalign(16,stackSize)}else{stackBase=stackSize;assert(stackBase>0)}var threadInfoStruct=_malloc(228);for(var i=0;i<228>>2;+i)GROWABLE_HEAP_U32()[threadInfoStruct>>2+i]=0;GROWABLE_HEAP_I32()[pthread_ptr>>2]=threadInfoStruct;GROWABLE_HEAP_I32()[threadInfoStruct+12>>2]=threadInfoStruct;var headPtr=threadInfoStruct+152;GROWABLE_HEAP_I32()[headPtr>>2]=headPtr;var threadParams={stackBase:stackBase,stackSize:stackSize,allocatedOwnStack:allocatedOwnStack,detached:detached,startRoutine:start_routine,pthread_ptr:threadInfoStruct,arg:arg,transferList:transferList};if(ENVIRONMENT_IS_PTHREAD){threadParams.cmd=\\\"spawnThread\\\";postMessage(threadParams,transferList)}else{spawnThread(threadParams)}return 0}function __pthread_testcancel_js(){if(!ENVIRONMENT_IS_PTHREAD)return;var tb=_pthread_self();if(!tb)return;var cancelDisabled=Atomics.load(GROWABLE_HEAP_U32(),tb+56>>2);if(cancelDisabled)return;var canceled=Atomics.load(GROWABLE_HEAP_U32(),tb+0>>2);if(canceled===2)throw\\"Canceled!\"}function _emscipten_check_blocking_allowed(){if(ENVIRONMENT_IS_NODE)return;if(ENVIRONMENT_IS_WORKER)return;warnOnce(\\"Blocking on the main thread is very dangerous, see https://emscipten.org/docs/porting/pthreads.html#blocking-on-the-main-browser-thread\\")}function __emscipten_do_pthread_join(thread,status,block){if(!thread){err(\\"pthread_join attempted on a null thread pointer!\");return ERRNO_CODES.ESRCH}if(ENVIRONMENT_IS_PTHREAD&&_pthread_self()===thread){err(\\"PThread \"+thread+\\\" is attempting to join to itself!\");return ERRNO_CODES.EDEADLK}else if(!ENVIRONMENT_IS_PTHREAD&&_emscipten_main_browser_thread_id()===thread){err(\\"Main thread \"+thread+\\\" is attempting to join to itself!\");return ERRNO_CODES.EDEADLK}var self=GROWABLE_HEAP_I32()[thread+12>>2];if(self!==thread){err(\\"pthread_join attempted on thread \"+thread+\\\", which does not point to a valid thread, or does not exist anymore!\");return ERRNO_CODES.ESRCH}var detached=Atomics.load(GROWABLE_HEAP_U32(),thread+64>>2);if(detached){err(\\"Attempted to join thread \"+thread+\\\", which was already detached!\");return ERRNO_CODES.EINVAL}if(block){_emscipten_check_blocking_allowed()}for(;;){var threadStatus=Atomics.load(GROWABLE_HEAP_U32(),thread+0>>2);if(threadStatus===1){var threadExitCode=Atomics.load(GROWABLE_HEAP_U32(),thread+4>>2);if(status)GROWABLE_HEAP_I32()[status>>2]=threadExitCode;Atomics.store(GROWABLE_HEAP_U32(),thread+64>>2,1);if(!ENVIRONMENT_IS_PTHREAD)cleanupThread(thread);else postMessage({\\"cmd\\":\\"cleanupThread\\",\\"thread\\":thread});return 0}if(!block){return ERRNO_CODES.EBUSY}}_pthread_testcancel_js();if(!ENVIRONMENT_IS_PTHREAD)_emscipten_main_thread_process_queued_calls();_emscipten_futex_wait(thread+0,threadStatus,ENVIRONMENT_IS_PTHREAD?100:1)}}function _pthread_join(thread,status){return __emscipten_do_pthread_join(thread,status,true)}function

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_sysconf(name){if(ENVIRONMENT_IS_PTHREAD)return
_emsripten_proxy_to_main_thread_js(6,1,name);switch(name){case 30:return 16384;case 85:var
maxHeapSize=2147483648;return maxHeapSize/16384;case 132:case 133:case 12:case 137:case 138:case 15:case
235:case 16:case 17:case 18:case 19:case 20:case 149:case 13:case 10:case 236:case 153:case 9:case 21:case 22:case
159:case 154:case 14:case 77:case 78:case 139:case 82:case 68:case 67:case 164:case
11:case 29:case 47:case 48:case 95:case 52:case 51:case 46:return 200809;case 27:case 246:case 127:case 128:case
23:case 24:case 160:case 161:case 181:case 182:case 242:case 183:case 184:case 243:case 244:case 245:case
165:case 178:case 179:case 49:case 50:case 168:case 169:case 175:case 170:case 171:case 172:case 97:case 76:case
32:case 173:case 35:case 80:case 81:case 79:return-1;case 176:case 177:case 7:case 155:case 8:case 157:case
125:case 126:case 92:case 93:case 129:case 130:case 131:case 94:case 91:return 1;case 74:case 60:case 69:case
70:case 4:return 1024;case 31:case 42:case 72:return 32;case 87:case 26:case 33:return 2147483647;case 34:case
1:return 47839;case 38:case 36:return 99;case 43:case 37:return 2048;case 0:return 2097152;case 3:return
65536;case 28:return 32768;case 44:return 32767;case 75:return 16384;case 39:return 1e3;case 89:return 700;case
71:return 256;case 40:return 255;case 2:return 100;case 180:return 64;case 25:return 20;case 5:return 16;case
6:return
6;case 73:return 4;case 84:{if(typeof navigator===\"object\")return navigator[\"hardwareConcurrency\"]||1;return
1}}setErrNo(28);return-1}if(!ENVIRONMENT_IS_PTHREAD)PThread.initMainThreadBlock();var GLctx;var
proxiedFunctionTable=[null,_atexit,_emsripten_set_canvas_element_size_main_thread,_fd_close,_fd_seek,_fd_wr
ite,_sysconf];var
asmLibraryArg={\"e\":__assert_fail,\"r\":__call_main,\"x\":_emsripten_notify_thread_queue,\"b\":_abort,\"y\":
_emsripten_asm_const_int,\"j\":_emsripten_conditional_set_current_thread_status,\"d\":_emsripten_futex_wait,\"
c\":_emsripten_futex_wake,\"f\":_emsripten_get_now,\"p\":_emsripten_memcpy_big,\"A\":_emsripten_num_l
ogical_cores,\"u\":_emsripten_receive_on_main_thread_js,\"q\":_emsripten_resize_heap,\"v\":_emsripten_set_ca
nvas_element_size,\"i\":_emsripten_set_current_thread_status,\"s\":_emsripten_set_thread_name,\"w\":_emscrip
ten_webgl_create_context,\"l\":_fd_close,\"n\":_fd_seek,\"g\":_fd_write,\"o\":initPthreadsJS,\"a\":wasmMemory|Mo
dule[\"wasmMemory\"],\"z\":_pthread_cleanup_pop,\"k\":_pthread_cleanup_push,\"h\":_pthread_create,\"m\":_pthr
ead_join,\"t\":_sysconf};var
asm=createWasm();var
__wasm_call_ctors=Module[\"__wasm_call_ctors\"]=function(){return(__wasm_call_ctors=Module[\"__wasm
_call_ctors\"]=Module[\"asm\"][\"B\"]).apply(null,arguments)};var
_init=Module[\"_init\"]=function(){return(_init=Module[\"_init\"]=Module[\"asm\"][\"C\"]).apply(null,arguments)};
var
_init_with_threads_count=Module[\"_init_with_threads_count\"]=function(){return(_init_with_threads_count=Mod
ule[\"_init_with_threads_count\"]=Module[\"asm\"][\"D\"]).apply(null,arguments)};var
_get_threads_count=Module[\"_get_threads_count\"]=function(){return(_get_threads_count=Module[\"_get_threads
_count\"]=Module[\"asm\"][\"E\"]).apply(null,arguments)};var
_register_tensor=Module[\"_register_tensor\"]=function(){return(_register_tensor=Module[\"_register_tensor\"]=M
odule[\"asm\"][\"F\"]).apply(null,arguments)};var
_dispose_data=Module[\"_dispose_data\"]=function(){return(_dispose_data=Module[\"_dispose_data\"]=Module[\"
asm\"][\"G\"]).apply(null,arguments)};var
_dispose=Module[\"_dispose\"]=function(){return(_dispose=Module[\"_dispose\"]=Module[\"asm\"][\"H\"]).apply(
null,arguments)};var
_Abs=Module[\"_Abs\"]=function(){return(_Abs=Module[\"_Abs\"]=Module[\"asm\"][\"J\"]).apply(null,arguments
)};var
_Add=Module[\"_Add\"]=function(){return(_Add=Module[\"_Add\"]=Module[\"asm\"][\"K\"]).apply(null,argumen
ts)};var
_AddN=Module[\"_AddN\"]=function(){return(_AddN=Module[\"_AddN\"]=Module[\"asm\"][\"L\"]).apply(null,ar
guments)};var

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_All=Module["_All"]=function(){return(_All=Module["_All"]=Module["asm"][["M"]]).apply(null,arguments)};
var
_Any=Module["_Any"]=function(){return(_Any=Module["_Any"]=Module["asm"][["N"]]).apply(null,arguments)};var
_ArgMax=Module["_ArgMax"]=function(){return(_ArgMax=Module["_ArgMax"]=Module["asm"][["O"]]).apply(null,arguments)};var
_AvgPool=Module["_AvgPool"]=function(){return(_AvgPool=Module["_AvgPool"]=Module["asm"][["P"]]).apply(null,arguments)};var
_BatchMatMul=Module["_BatchMatMul"]=function(){return(_BatchMatMul=Module["_BatchMatMul"]=Module["asm"][["Q"]]).apply(null,arguments)};var
_Ceil=Module["_Ceil"]=function(){return(_Ceil=Module["_Ceil"]=Module["asm"][["R"]]).apply(null,arguments)};var
_ClipByValue=Module["_ClipByValue"]=function(){return(_ClipByValue=Module["_ClipByValue"]=Module["asm"][["S"]]).apply(null,arguments)};var
_Conv2D=Module["_Conv2D"]=function(){return(_Conv2D=Module["_Conv2D"]=Module["asm"][["T"]]).apply(null,arguments)};var
_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=function(){return(_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=Module["asm"][["U"]]).apply(null,arguments)};var
_Cos=Module["_Cos"]=function(){return(_Cos=Module["_Cos"]=Module["asm"][["V"]]).apply(null,arguments)};var
_Cosh=Module["_Cosh"]=function(){return(_Cosh=Module["_Cosh"]=Module["asm"][["W"]]).apply(null,arguments)};var
_CropAndResize=Module["_CropAndResize"]=function(){return(_CropAndResize=Module["_CropAndResize"]=Module["asm"][["X"]]).apply(null,arguments)};var
_Cumsum=Module["_Cumsum"]=function(){return(_Cumsum=Module["_Cumsum"]=Module["asm"][["Y"]]).apply(null,arguments)};var
_DepthToSpace=Module["_DepthToSpace"]=function(){return(_DepthToSpace=Module["_DepthToSpace"]=Module["asm"][["Z"]]).apply(null,arguments)};var
_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=function(){return(_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=Module["asm"][["_"]]).apply(null,arguments)};var
_Elu=Module["_Elu"]=function(){return(_Elu=Module["_Elu"]=Module["asm"][["$"]]).apply(null,arguments)};var
_Equal=Module["_Equal"]=function(){return(_Equal=Module["_Equal"]=Module["asm"][["aa"]]).apply(null,arguments)};var
_Exp=Module["_Exp"]=function(){return(_Exp=Module["_Exp"]=Module["asm"][["ba"]]).apply(null,arguments)};var
_FlipLeftRight=Module["_FlipLeftRight"]=function(){return(_FlipLeftRight=Module["_FlipLeftRight"]=Module["asm"][["ca"]]).apply(null,arguments)};var
_Floor=Module["_Floor"]=function(){return(_Floor=Module["_Floor"]=Module["asm"][["da"]]).apply(null,arguments)};var
_FloorDiv=Module["_FloorDiv"]=function(){return(_FloorDiv=Module["_FloorDiv"]=Module["asm"][["ea"]]).apply(null,arguments)};var
_FusedBatchNorm=Module["_FusedBatchNorm"]=function(){return(_FusedBatchNorm=Module["_FusedBatchNorm"]=Module["asm"][["fa"]]).apply(null,arguments)};var
_FusedConv2D=Module["_FusedConv2D"]=function(){return(_FusedConv2D=Module["_FusedConv2D"]=Module["asm"][["ga"]]).apply(null,arguments)};var
_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=function(){return(_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=Module["asm"][["ha"]]).apply(null,arguments)};var

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_Gather=Module["_Gather"]=function(){return(_Gather=Module["_Gather"]=Module["asm"][["ia"]]).apply(null,arguments)};var
_GatherNd=Module["_GatherNd"]=function(){return(_GatherNd=Module["_GatherNd"]=Module["asm"][["ja"]]).apply(null,arguments)};var
_Greater=Module["_Greater"]=function(){return(_Greater=Module["_Greater"]=Module["asm"][["ka"]]).apply(null,arguments)};var
_GreaterEqual=Module["_GreaterEqual"]=function(){return(_GreaterEqual=Module["_GreaterEqual"]=Module["asm"][["la"]]).apply(null,arguments)};var
_LeakyRelu=Module["_LeakyRelu"]=function(){return(_LeakyRelu=Module["_LeakyRelu"]=Module["asm"][["ma"]]).apply(null,arguments)};var
_Less=Module["_Less"]=function(){return(_Less=Module["_Less"]=Module["asm"][["na"]]).apply(null,arguments)};var
_LessEqual=Module["_LessEqual"]=function(){return(_LessEqual=Module["_LessEqual"]=Module["asm"][["oa"]]).apply(null,arguments)};var
_Log=Module["_Log"]=function(){return(_Log=Module["_Log"]=Module["asm"][["pa"]]).apply(null,arguments)};var
_LogicalAnd=Module["_LogicalAnd"]=function(){return(_LogicalAnd=Module["_LogicalAnd"]=Module["asm"][["qa"]]).apply(null,arguments)};var
_Max=Module["_Max"]=function(){return(_Max=Module["_Max"]=Module["asm"][["ra"]]).apply(null,arguments)};var
_MaxPool=Module["_MaxPool"]=function(){return(_MaxPool=Module["_MaxPool"]=Module["asm"][["sa"]]).apply(null,arguments)};var
_Maximum=Module["_Maximum"]=function(){return(_Maximum=Module["_Maximum"]=Module["asm"][["ta"]]).apply(null,arguments)};var
_Mean=Module["_Mean"]=function(){return(_Mean=Module["_Mean"]=Module["asm"][["ua"]]).apply(null,arguments)};var
_Min=Module["_Min"]=function(){return(_Min=Module["_Min"]=Module["asm"][["va"]]).apply(null,arguments)};var
_Minimum=Module["_Minimum"]=function(){return(_Minimum=Module["_Minimum"]=Module["asm"][["wa"]]).apply(null,arguments)};var
_MirrorPad=Module["_MirrorPad"]=function(){return(_MirrorPad=Module["_MirrorPad"]=Module["asm"][["xa"]]).apply(null,arguments)};var
_Multiply=Module["_Multiply"]=function(){return(_Multiply=Module["_Multiply"]=Module["asm"][["ya"]]).apply(null,arguments)};var
_Neg=Module["_Neg"]=function(){return(_Neg=Module["_Neg"]=Module["asm"][["za"]]).apply(null,arguments)};var
_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=function(){return(_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=Module["asm"][["Aa"]]).apply(null,arguments)};var
_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=function(){return(_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=Module["asm"][["Ba"]]).apply(null,arguments)};var
_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=function(){return(_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=Module["asm"][["Ca"]]).apply(null,arguments)};var
_NotEqual=Module["_NotEqual"]=function(){return(_NotEqual=Module["_NotEqual"]=Module["asm"][["Da"]]).apply(null,arguments)};var
_OneHot=Module["_OneHot"]=function(){return(_OneHot=Module["_OneHot"]=Module["asm"][["Ea"]]).apply(null,arguments)};var
_PadV2=Module["_PadV2"]=function(){return(_PadV2=Module["_PadV2"]=Module["asm"][["Fa"]]).apply(null,arguments)};var

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_Pow=Module["_Pow"]=function(){return(_Pow=Module["_Pow"]=Module["asm"][_"Ga"]).apply(null,arguments)};var
_Prelu=Module["_Prelu"]=function(){return(_Prelu=Module["_Prelu"]=Module["asm"][_"Ha"]).apply(null,arguments)};var
_Prod=Module["_Prod"]=function(){return(_Prod=Module["_Prod"]=Module["asm"][_"Ia"]).apply(null,arguments)};var
_RealDiv=Module["_RealDiv"]=function(){return(_RealDiv=Module["_RealDiv"]=Module["asm"][_"Ja"]).apply(null,arguments)};var
_RelU=Module["_Relu"]=function(){return(_Relu=Module["_Relu"]=Module["asm"][_"Ka"]).apply(null,arguments)};var
_RelU6=Module["_Relu6"]=function(){return(_Relu6=Module["_Relu6"]=Module["asm"][_"La"]).apply(null,arguments)};var
_ResizeBilinear=Module["_ResizeBilinear"]=function(){return(_ResizeBilinear=Module["_ResizeBilinear"]=Module["asm"][_"Ma"]).apply(null,arguments)};var
_Reverse=Module["_Reverse"]=function(){return(_Reverse=Module["_Reverse"]=Module["asm"][_"Na"]).apply(null,arguments)};var
_RotateWithOffset=Module["_RotateWithOffset"]=function(){return(_RotateWithOffset=Module["_RotateWithOffset"]=Module["asm"][_"Oa"]).apply(null,arguments)};var
_Round=Module["_Round"]=function(){return(_Round=Module["_Round"]=Module["asm"][_"Pa"]).apply(null,arguments)};var
_Rsqrt=Module["_Rsqrt"]=function(){return(_Rsqrt=Module["_Rsqrt"]=Module["asm"][_"Qa"]).apply(null,arguments)};var
_ScatterNd=Module["_ScatterNd"]=function(){return(_ScatterNd=Module["_ScatterNd"]=Module["asm"][_"Ra"]).apply(null,arguments)};var
_SelectV2=Module["_SelectV2"]=function(){return(_SelectV2=Module["_SelectV2"]=Module["asm"][_"Sa"]).apply(null,arguments)};var
_Sigmoid=Module["_Sigmoid"]=function(){return(_Sigmoid=Module["_Sigmoid"]=Module["asm"][_"Ta"]).apply(null,arguments)};var
_Sin=Module["_Sin"]=function(){return(_Sin=Module["_Sin"]=Module["asm"][_"Ua"]).apply(null,arguments)};var
_Softmax=Module["_Softmax"]=function(){return(_Softmax=Module["_Softmax"]=Module["asm"][_"Va"]).apply(null,arguments)};var
_Sqrt=Module["_Sqrt"]=function(){return(_Sqrt=Module["_Sqrt"]=Module["asm"][_"Wa"]).apply(null,arguments)};var
_Square=Module["_Square"]=function(){return(_Square=Module["_Square"]=Module["asm"][_"Xa"]).apply(null,arguments)};var
_SquaredDifference=Module["_SquaredDifference"]=function(){return(_SquaredDifference=Module["_SquaredDifference"]=Module["asm"][_"Ya"]).apply(null,arguments)};var
_Step=Module["_Step"]=function(){return(_Step=Module["_Step"]=Module["asm"][_"Za"]).apply(null,arguments)};var
_StridedSlice=Module["_StridedSlice"]=function(){return(_StridedSlice=Module["_StridedSlice"]=Module["asm"][_"a"]).apply(null,arguments)};var
_Sub=Module["_Sub"]=function(){return(_Sub=Module["_Sub"]=Module["asm"][_"Sa"]).apply(null,arguments)};var
_Sum=Module["_Sum"]=function(){return(_Sum=Module["_Sum"]=Module["asm"][_"ab"]).apply(null,arguments)};var
_Tan=Module["_Tan"]=function(){return(_Tan=Module["_Tan"]=Module["asm"][_"bb"]).apply(null,arguments)};var

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_Tanh=Module["_Tanh"]=function(){return(_Tanh=Module["_Tanh"]=Module["asm"][["cb"]]).apply(null,arguments)};var
_Tile=Module["_Tile"]=function(){return(_Tile=Module["_Tile"]=Module["asm"][["db"]]).apply(null,arguments)};var
_TopK=Module["_TopK"]=function(){return(_TopK=Module["_TopK"]=Module["asm"][["eb"]]).apply(null,arguments)};var
_Transform=Module["_Transform"]=function(){return(_Transform=Module["_Transform"]=Module["asm"][["fb"]]).apply(null,arguments)};var
_Transpose=Module["_Transpose"]=function(){return(_Transpose=Module["_Transpose"]=Module["asm"][["gb"]]).apply(null,arguments)};var
__FusedMatMul=Module["__FusedMatMul"]=function(){return(__FusedMatMul=Module["__FusedMatMul"]=Module["asm"][["hb"]]).apply(null,arguments)};var
_malloc=Module["_malloc"]=function(){return(_malloc=Module["_malloc"]=Module["asm"][["ib"]]).apply(null,arguments)};var
_free=Module["_free"]=function(){return(_free=Module["_free"]=Module["asm"][["jb"]]).apply(null,arguments)};var
__errno_location=Module["__errno_location"]=function(){return(__errno_location=Module["__errno_location"]=Module["asm"][["kb"]]).apply(null,arguments)};var
_emscripten_get_global_libc=Module["_emscripten_get_global_libc"]=function(){return(_emscripten_get_global_libc=Module["_emscripten_get_global_libc"]=Module["asm"][["lb"]]).apply(null,arguments)};var
_thread_self=Module["_thread_self"]=function(){return(_thread_self=Module["_thread_self"]=Module["asm"][["mb"]]).apply(null,arguments)};var
__pthread_tsd_run_dtors=Module["__pthread_tsd_run_dtors"]=function(){return(__pthread_tsd_run_dtors=Module["__pthread_tsd_run_dtors"]=Module["asm"][["nb"]]).apply(null,arguments)};var
_emscripten_main_thread_process_queued_calls=Module["_emscripten_main_thread_process_queued_calls"]=function(){return(_emscripten_main_thread_process_queued_calls=Module["_emscripten_main_thread_process_queued_calls"]=Module["asm"][["ob"]]).apply(null,arguments)};var
_emscripten_current_thread_process_queued_calls=Module["_emscripten_current_thread_process_queued_calls"]=function(){return(_emscripten_current_thread_process_queued_calls=Module["_emscripten_current_thread_process_queued_calls"]=Module["asm"][["pb"]]).apply(null,arguments)};var
_emscripten_register_main_browser_thread_id=Module["_emscripten_register_main_browser_thread_id"]=function(){return(_emscripten_register_main_browser_thread_id=Module["_emscripten_register_main_browser_thread_id"]=Module["asm"][["qb"]]).apply(null,arguments)};var
_emscripten_main_browser_thread_id=Module["_emscripten_main_browser_thread_id"]=function(){return(_emscripten_main_browser_thread_id=Module["_emscripten_main_browser_thread_id"]=Module["asm"][["rb"]]).apply(null,arguments)};var
__emscripten_do_dispatch_to_thread=Module["__emscripten_do_dispatch_to_thread"]=function(){return(__emscripten_do_dispatch_to_thread=Module["__emscripten_do_dispatch_to_thread"]=Module["asm"][["sb"]]).apply(null,arguments)};var
_emscripten_sync_run_in_main_thread_4=Module["_emscripten_sync_run_in_main_thread_4"]=function(){return(_emscripten_sync_run_in_main_thread_4=Module["_emscripten_sync_run_in_main_thread_4"]=Module["asm"][["tb"]]).apply(null,arguments)};var
_emscripten_run_in_main_runtime_thread_js=Module["_emscripten_run_in_main_runtime_thread_js"]=function(){return(_emscripten_run_in_main_runtime_thread_js=Module["_emscripten_run_in_main_runtime_thread_js"]=Module["asm"][["ub"]]).apply(null,arguments)};var
__emscripten_call_on_thread=Module["__emscripten_call_on_thread"]=function(){return(__emscripten_call_on_thread=Module["__emscripten_call_on_thread"]=Module["asm"][["vb"]]).apply(null,arguments)};var
_emscripten_tls_init=Module["_emscripten_tls_init"]=function(){return(_emscripten_tls_init=Module["_emscript

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en_tls_init\"]=Module[\asm\"][\wb\"]).apply(null,arguments)};var
__emscripten_thread_init=Module[__emscripten_thread_init"]=function(){return(__emscripten_thread_init=Module[__emscripten_thread_init"]=Module[\asm\"][\xb\"]).apply(null,arguments)};var
stackSave=Module[\stackSave"]=function(){return(stackSave=Module[\stackSave"]=Module[\asm\"][\yb\"]).apply(null,arguments)};var
stackRestore=Module[\stackRestore"]=function(){return(stackRestore=Module[\stackRestore"]=Module[\asm\"][\zb\"]).apply(null,arguments)};var
stackAlloc=Module[\stackAlloc"]=function(){return(stackAlloc=Module[\stackAlloc"]=Module[\asm\"][\Ab\"]).apply(null,arguments)};var
__emscripten_stack_set_limits=Module[__emscripten_stack_set_limits"]=function(){return(__emscripten_stack_set_limits=Module[__emscripten_stack_set_limits"]=Module[\asm\"][\Bb\"]).apply(null,arguments)};var
__memalign=Module[__memalign"]=function(){return(__memalign=Module[__memalign"]=Module[\asm\"][\Cb\"]).apply(null,arguments)};var
__emscripten_allow_main_runtime_queued_calls=Module[__emscripten_allow_main_runtime_queued_calls"]=10512;var
__emscripten_main_thread_futex=Module[__emscripten_main_thread_futex"]=12148;Module[\cwrap"]=cwrap;Module[\PThread"]=PThread;Module[\PThread"]=PThread;Module[\wasmMemory"]=wasmMemory;Module[\ExitStatus"]=ExitStatus;var calledRun;function
ExitStatus(status){this.name="\ExitStatus";this.message="\Program terminated with
exit(\"+status+\")";this.status=status}dependenciesFulfilled=function
runCaller(){if(!calledRun)run();if(!calledRun)dependenciesFulfilled=runCaller};function
run(args){args=args||arguments_;if(runDependencies>0){return}if(ENVIRONMENT_IS_PTHREAD){readyPromiseResolve(Module);initRuntime();postMessage({"cmd":"loaded"});return}preRun();if(runDependencies>0){return}function
doRun(){if(calledRun)return;calledRun=true;Module[\calledRun"]=true;if(ABORT)return;initRuntime();preMain();readyPromiseResolve(Module);if(Module[\onRuntimeInitialized"])Module[\onRuntimeInitialized]();postRun()}if(Module[\setStatus\"])Module[\setStatus\"](\\"Running..\");setTimeout(function(){setTimeout(function(){Module[\setStatus\"](\\"\"),1);doRun(),1})else{doRun()}}Module[\run"]=run;function
exit(status,implicit){if(implicit&&noExitRuntime&&status===0){return}if(!implicit){if(ENVIRONMENT_IS_PTHREAD){postMessage({"cmd":"exitProcess","returnCode":status});throw new
ExitStatus(status)}else{}}if(noExitRuntime){}else{PThread.terminateAllThreads();EXITSTATUS=status;exitRuntime();if(Module[\onExit\"])Module[\onExit\"](status);ABORT=true}quit_(status,new
ExitStatus(status))}if(Module[\preInit\"])if(typeof
Module[\preInit\"]==\function\"){Module[\preInit\"]=Module[\preInit\"];while(Module[\preInit\"].length>0){Module[\preInit\"].pop()}if(ENVIRONMENT_IS_PTHREAD){noExitRuntime=false;PThread.initWorker()}run();\n\n return WasmBackendModuleThreadedSimd.ready\n\n\n)}();\nif
(typeof exports === 'object' && typeof module === 'object')\n module.exports =
WasmBackendModuleThreadedSimd;\nelse if (typeof define === 'function' && define['amd'])\n define([],
function() { return WasmBackendModuleThreadedSimd; });\nelse if (typeof exports === 'object')\n
exports["WasmBackendModuleThreadedSimd"] = WasmBackendModuleThreadedSimd;\n", "export const
wasmWorkerContents = 'var Module={};function threadPrintErr(){var
text=Array.prototype.slice.call(arguments).join(" ");console.error(text)}function threadAlert(){var
text=Array.prototype.slice.call(arguments).join("
\");postMessage({cmd:"alert",text:text,threadId:Module[_pthread_self\]()})}var
err=threadPrintErr;this.alert=threadAlert;Module[\instantiateWasm\"]=function(info,receiveInstance){var
instance=new
WebAssembly.Instance(Module[\wasmModule\"],info);Module[\wasmModule\"]=null;receiveInstance(instance);return instance.exports};function

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moduleLoaded() { this.onmessage=function(e){ try { if(e.data.cmd===\"load\") { Module[\"wasmModule\"]=e.data.wasmModule; Module[\"wasmMemory\"]=e.data.wasmMemory; Module[\"buffer\"]=Module[\"wasmMemory\"].buffer; Module[\"ENVIRONMENT_IS_PTHREAD\"] = true; if(typeof e.data.urlOrBlob===\"string\") { importScripts(e.data.urlOrBlob)} else { var objectUrl=URL.createObjectURL(e.data.urlOrBlob); importScripts(objectUrl); URL.revokeObjectURL(objectUrl) } WasmBackendModuleThreadedSimd(Module).then(function(instance) { Module=instance; moduleLoaded() }) else if(e.data.cmd===\"objectTransfer\") { Module[\"PThread\"].receiveObjectTransfer(e.data)} else if(e.data.cmd===\"run\") { Module[\"__performance_now_clock_drift\"] = performance.now() - e.data.time; Module[\"__emscripten_thread_init\"](e.data.threadInfoStruct,0,0); var max=e.data.stackBase; var top=e.data.stackBase+e.data.stackSize; Module[\"establishStackSpace\"](top,max); Module[\"__emscripten_tls_init\"](); Module[\"PThread\"].receiveObjectTransfer(e.data); Module[\"PThread\"].setThreadStatus(Module[\"_pthread_self\"](),1); try { var result=Module[\"invokeEntryPoint\"](e.data.start_routine,e.data.arg); if(!Module[\"getNoExitRuntime\"]()) Module[\"PThread\"].threadExit(result) } catch(ex) { if(ex===\"Canceled!\") { Module[\"PThread\"].threadCancel() } else if(ex!==\"unwind\") { if(ex instanceof Module[\"ExitStatus\"]){ if(Module[\"getNoExitRuntime\"]()) { } else { Module[\"PThread\"].threadExit(ex.status) } } else { Module[\"PThread\"].threadExit(-2); throw ex } } } else if(e.data.cmd===\"cancel\") { if(Module[\"_pthread_self\"]()) { Module[\"PThread\"].threadCancel() } } else if(e.data.target===\"setimmediate\") { } else if(e.data.cmd===\"processThreadQueue\") { if(Module[\"_pthread_self\"]()) { Module[\"__emscripten_current_thread_process_queued_calls\"]() } } else { err(\"worker.js received unknown command \"+e.data.cmd); err(e.data) } } catch(ex) { err(\"worker.js onmessage() captured an uncaught exception: \"+ex); if(ex&&ex.stack) err(ex.stack); throw ex } }; if(typeof process===\"object\" && typeof process.versions===\"object\" && typeof process.versions.node===\"string\") { self={location:{href: __filename}}; var onmessage=this.onmessage; var nodeWorkerThreads=require(\"worker_threads\"); global.Worker=nodeWorkerThreads.Worker; var parentPort=nodeWorkerThreads.parentPort; parentPort.on(\"message\",function(data) { onmessage({data:data}) }); var nodeFS=require(\"fs\"); var nodeRead=function(filename) { return nodeFS.readFileSync(filename,\"utf8\") }; function globalEval(x) { global.require=require; global.Module=Module; eval.call(null,x) } importScripts=function(f) { globalEval(nodeRead(f)); postMessage=function(msg) { parentPort.postMessage(msg) }; if(typeof performance===\"undefined\") { performance={now:function() { return Date.now() } } }; \"nvar WasmBackendModule = (function() { \\n var _scriptDir = typeof document !== 'undefined' && document.currentScript ? document.currentScript.src : undefined; \\n if (typeof __filename !== 'undefined') _scriptDir = _scriptDir || __filename; \\n return (\\nfunction(WasmBackendModule) { \\n WasmBackendModule = WasmBackendModule || {}; \\n \\nvar Module=typeof WasmBackendModule!==\"undefined\"?WasmBackendModule: {}; var readyPromiseResolve,readyPromiseReject; Module[\"ready\"] = new Promise(function(resolve,reject) { readyPromiseResolve=resolve; readyPromiseReject=reject }); var moduleOverrides = {}; var key; for(key in Module) { if(Module.hasOwnProperty(key)) { moduleOverrides[key]=Module[key] } } var arguments_=[]; var thisProgram= \"/this.program\"; var quit_ = function(status,toThrow) { throw toThrow }; var ENVIRONMENT_IS_WEB=false; var ENVIRONMENT_IS_WORKER=false; var ENVIRONMENT_IS_NODE=false; var ENVIRONMENT_IS_SHELL=false; ENVIRONMENT_IS_WEB=typeof window===\"object\"; ENVIRONMENT_IS_WORKER=typeof importScripts===\"function\"; ENVIRONMENT_IS_NODE=typeof process===\"object\" && typeof process.versions===\"object\" && typeof process.versions.node===\"string\"; ENVIRONMENT_IS_SHELL=!ENVIRONMENT_IS_WEB&&!ENVIRONMENT_IS_NODE&&!ENVIRONMENT_IS_WORKER; var scriptDirectory= \"\"; function

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```

locateFile(path){if(Module[\'locateFile\']){return Module[\'locateFile\'](path,scriptDirectory)}return
scriptDirectory+path}var read_,readAsync,readBinary,setWindowTitle;var nodeFS;var
nodePath;if(ENVIRONMENT_IS_NODE){if(ENVIRONMENT_IS_WORKER){scriptDirectory=require(\'path\').
dirname(scriptDirectory)+\'/\'}else{scriptDirectory=__dirname+\'/\'}read_=function
shell_read(filename,binary){if(!nodeFS)nodeFS=require(\'fs\');if(!nodePath)nodePath=require(\'path\');filename=n
odePath[\'normalize\'](filename);return
nodeFS[\'readFileSync\'](filename,binary?null:\'utf8\');}readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret};if(process[\'argv\'].length>1){thisProgram=process[\'argv\'][1].replace(/\\|\\/g,\'\\\'')}arguments_=process[\'arg
v\'].slice(2);process[\'on\'](\\'uncaughtException\',function(ex){if(!(ex instanceof ExitStatus)){throw
ex}});process[\'on\'](\\'unhandledRejection\',abort);quit_=function(status){process[\'exit\'](status)};Module[\'insep
ect\']=function(){return[\'Emscripten Module object\']} }else
if(ENVIRONMENT_IS_SHELL){if(typeof read!=\"undefined\"){read_=function shell_read(f){return
read(f)} }readBinary=function readBinary(f){var data;if(typeof readbuffer===\"function\"){return new
Uint8Array(readbuffer(f))}data=read(f,\"binary\");assert(typeof data===\"object\");return data};if(typeof
scriptArgs!=\"undefined\"){arguments_=scriptArgs}else if(typeof
arguments!=\"undefined\"){arguments_=arguments}if(typeof
quit===\"function\"){quit_=function(status){quit(status)}}if(typeof print===\"undefined\"){if(typeof
console===\"undefined\")console={};console.log=print;console.warn=console.error=typeof
printErr!=\"undefined\"?printErr:print} }else
if(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER){if(ENVIRONMENT_IS_WORKER){scriptDire
ctory=self.location.href}else if(typeof
document!=\"undefined\"&&document.currentScript){scriptDirectory=document.currentScript.src}if(!_scriptDir){s
criptDirectory=_scriptDir}if(scriptDirectory.indexOf(\'blob:\')!=\"=0){scriptDirectory=scriptDirectory.substr(0,script
Directory.lastIndexOf(\'/\')+1)}else{scriptDirectory=\'\'} }read_=function(url){var
xhr=new XMLHttpRequest;xhr.open(\'GET\',url,false);xhr.send(null);return
xhr.responseText};if(ENVIRONMENT_IS_WORKER){readBinary=function(url){var xhr=new
XMLHttpRequest;xhr.open(\'GET\',url,false);xhr.responseType=\'arraybuffer\';xhr.send(null);return new
Uint8Array(xhr.response)} }readAsync=function(url,onload,onerror){var xhr=new
XMLHttpRequest;xhr.open(\'GET\',url,true);xhr.responseType=\'arraybuffer\';xhr.onload=function(){if(xhr.status
===200||xhr.status===0&&xhr.response){onload(xhr.response);return}onerror()} ;xhr.onerror=onerror;xhr.send(null)}
}setWindowTitle=function(title){document.title=title} }else{ }var
out=Module[\'print\']||console.log.bind(console);var err=Module[\'printErr\']||console.warn.bind(console);for(key
in
moduleOverrides){if(moduleOverrides.hasOwnProperty(key)){Module[key]=moduleOverrides[key]} }moduleOverr
ides=null;if(Module[\'arguments\'])arguments_=Module[\'arguments\'];if(Module[\'thisProgram\'])thisProgram=
Module[\'thisProgram\'];if(Module[\'quit\'])quit_=Module[\'quit\'];var
wasmBinary;if(Module[\'wasmBinary\'])wasmBinary=Module[\'wasmBinary\'];var
noExitRuntime=Module[\'noExitRuntime\']||true;if(typeof WebAssembly!=\"object\"){abort(\'no native wasm
support detected\')}var wasmMemory;var ABORT=false;var EXITSTATUS;function
assert(condition,text){if(!condition){abort(\'Assertion failed: \'+text)}}function getCFunc(ident){var
func=Module[\'_\'+ident];assert(func,\'Cannot call unknown function \'+ident+\", make sure it is exported\");return
func}function ccall(ident,returnType,argTypes,args,opts){var toC={\'string\':function(str){var
ret=0;if(str!=\"null\"&&str!=\"undefined\"&&str!=\"=0){var
len=(str.length<<2)+1;ret=stackAlloc(len);stringToUTF8(str,ret,len)}return ret},\'array\':function(arr){var
ret=stackAlloc(arr.length);writeArrayToMemory(arr,ret);return ret}};function
convertReturnValue(ret){if(returnType===\"string\")return UTF8ToString(ret);if(returnType===\"boolean\")return

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Boolean(ret);return ret}var func=getCFunc(ident);var cArgs=[];var stack=0;if(args){for(var
i=0;i<args.length;i++){var
converter=toC[argTypes[i]];if(converter){if(stack===0)stack=stackSave();cArgs[i]=converter(args[i])}else{cArgs[i
]=args[i]}}var ret=func.apply(null,cArgs);ret=convertReturnValue(ret);if(stack!==0)stackRestore(stack);return
ret}function cwrap(ident,returnType,argTypes,opts){argTypes=argTypes||[];var
numericArgs=argTypes.every(function(type){return type==="number"});var
numericRet=returnType!=="string";if(numericRet&&numericArgs&&!opts){return getCFunc(ident)}return
function(){return ccall(ident,returnType,argTypes,arguments,opts)}}var UTF8Decoder=typeof
TextDecoder!=="undefined"?new TextDecoder("utf8"):undefined;function
UTF8ArrayToString(heap,idx,maxBytesToRead){var endIdx=idx+maxBytesToRead;var
endPtr=idx;while(heap[endPtr]&&!(endPtr>=endIdx))++endPtr;if(endPtr-
idx>16&&heap.subarray&&UTF8Decoder){return UTF8Decoder.decode(heap.subarray(idx,endPtr))}else{var
str="";while(idx<endPtr){var u0=heap[idx++];if(!(u0&128)){str+=String.fromCharCode(u0);continue}var
u1=heap[idx++]&63;if((u0&224)==192){str+=String.fromCharCode((u0&31)<<6|u1);continue}var
u2=heap[idx++]&63;if((u0&240)==224){u0=(u0&15)<<12|u1<<6|u2}else{u0=(u0&7)<<18|u1<<12|u2<<6|heap[id
x++]&63}if(u0<65536){str+=String.fromCharCode(u0)}else{var ch=u0-
65536;str+=String.fromCharCode(55296|ch>>10,56320|ch&1023)}}return str}function
UTF8ToString(ptr,maxBytesToRead){return
ptr?UTF8ArrayToString(HEAPU8,ptr,maxBytesToRead):""}function
stringToUTF8Array(str,heap,outIdx,maxBytesToWrite){if(!(maxBytesToWrite>0))return 0;var startIdx=outIdx;var
endIdx=outIdx+maxBytesToWrite-1;for(var i=0;i<str.length;++i){var
u=str.charCodeAt(i);if(u>=55296&&u<=57343){var
u1=str.charCodeAt(++i);u=65536+((u&1023)<<10|u1&1023)}if(u<=127){if(outIdx>=endIdx)break;heap[outIdx++
]=u}else if(u<=2047){if(outIdx+1>=endIdx)break;heap[outIdx++]=192|u>>6;heap[outIdx++]=128|u&63}else
if(u<=65535){if(outIdx+2>=endIdx)break;heap[outIdx++]=224|u>>12;heap[outIdx++]=128|u>>6&63;heap[outIdx
++]=128|u&63}else{if(outIdx+3>=endIdx)break;heap[outIdx++]=240|u>>18;heap[outIdx++]=128|u>>12&63;heap[
outIdx++]=128|u>>6&63;heap[outIdx++]=128|u&63}}heap[outIdx]=0;return
outIdx-startIdx}function stringToUTF8(str,outPtr,maxBytesToWrite){return
stringToUTF8Array(str,HEAPU8,outPtr,maxBytesToWrite)}function
writeArrayToMemory(array,buffer){HEAP8.set(array,buffer)}function
alignUp(x,multiple){if(x%multiple>0){x+=multiple-x%multiple}return x}var
buffer,HEAP8,HEAPU8,HEAP16,HEAPU16,HEAP32,HEAPU32,HEAPF32,HEAPF64;function
updateGlobalBufferAndViews(buf){buffer=buf;Module["HEAP8"]=HEAP8=new
Int8Array(buf);Module["HEAP16"]=HEAP16=new Int16Array(buf);Module["HEAP32"]=HEAP32=new
Int32Array(buf);Module["HEAPU8"]=HEAPU8=new Uint8Array(buf);Module["HEAPU16"]=HEAPU16=new
Uint16Array(buf);Module["HEAPU32"]=HEAPU32=new
Uint32Array(buf);Module["HEAPF32"]=HEAPF32=new
Float32Array(buf);Module["HEAPF64"]=HEAPF64=new
Float64Array(buf)}var INITIAL_MEMORY=Module["INITIAL_MEMORY"]||16777216;var wasmTable;var
__ATPRERUN__=[];var __ATINIT__=[];var __ATMAIN__=[];var __ATPOSTRUN__=[];var
runtimeInitialized=false;__ATINIT__.push({func:function(){__wasm_call_ctors()}});function
preRun(){if(Module["preRun"]){if(typeof
Module["preRun"]=="function")Module["preRun"]=[Module["preRun"]];while(Module["preRun"].length){a
ddOnPreRun(Module["preRun"].shift())}callRuntimeCallbacks(__ATPRERUN__)}function
initRuntime(){runtimeInitialized=true;callRuntimeCallbacks(__ATINIT__)}function
preMain(){callRuntimeCallbacks(__ATMAIN__)}function postRun(){if(Module["postRun"]){if(typeof
Module["postRun"]=="function")Module["postRun"]=[Module["postRun"]];while(Module["postRun"].lengt
h){addOnPostRun(Module["postRun"].shift())}callRuntimeCallbacks(__ATPOSTRUN__)}function

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addOnPreRun(cb){__ATPRERUN__.unshift(cb)}function addOnPostRun(cb){__ATPOSTRUN__.unshift(cb)}var
runDependencies=0;var runDependencyWatcher=null;var
dependenciesFulfilled=null;function
addRunDependency(id){runDependencies++;if(Module["monitorRunDependencies"]){Module["monitorRunDep
dependencies"](runDependencies)}}function removeRunDependency(id){runDependencies--
;if(Module["monitorRunDependencies"]){Module["monitorRunDependencies"](runDependencies)}if(runDepend
encies==0){if(runDependencyWatcher!==null){clearInterval(runDependencyWatcher);runDependencyWatcher=nul
l}if(dependenciesFulfilled){var
callback=dependenciesFulfilled;dependenciesFulfilled=null;callback()}}Module["preloadedImages"]={};Module
["preloadedAudios"]={};function
abort(what){if(Module["onAbort"]){Module["onAbort"](what)}what+="\n";err(what);ABORT=true;EXITSTAT
US=1;what="abort("+what+"\n). Build with -s ASSERTIONS=1 for more info.";var e=new
WebAssembly.RuntimeError(what);readyPromiseReject(e);throw e}function hasPrefix(str,prefix){return
String.prototype.startsWith?str.startsWith(prefix):str.indexOf(prefix)===0}var
dataURIPrefix="data:application/octet-stream;base64,";function
isDataURI(filename){return hasPrefix(filename,dataURIPrefix)}var fileURIPrefix="file://";function
isFileURI(filename){return hasPrefix(filename,fileURIPrefix)}var wasmBinaryFile="tfjs-backend-
wasm.wasm";if(!isDataURI(wasmBinaryFile)){wasmBinaryFile=locateFile(wasmBinaryFile)}function
getBinary(file){try{if(file===wasmBinaryFile&&wasmBinary){return new
Uint8Array(wasmBinary)}if(readBinary){return readBinary(file)}else{throw"both async and sync fetching of the
wasm failed"}}catch(err){abort(err)}}function
getBinaryPromise(){if(!wasmBinary&&(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER)){if(typeof
fetch==="function"&&!isFileURI(wasmBinaryFile)){return fetch(wasmBinaryFile,{credentials:"same-
origin"}).then(function(response){if(!response["ok"]){throw"failed to load wasm binary file at
"+wasmBinaryFile+""}return response["arrayBuffer"]()).catch(function(){return
getBinary(wasmBinaryFile)})}else{if(readAsync){return new
Promise(function(resolve,reject){readAsync(wasmBinaryFile,function(response){resolve(new
Uint8Array(response))},reject)}))}return Promise.resolve().then(function(){return
getBinary(wasmBinaryFile)})}function createWasm(){var info={"a":asmLibraryArg};function
receiveInstance(instance,module){var
exports=instance.exports;Module["asm"]=exports;wasmMemory=Module["asm"]()["j"];updateGlobalBufferAnd
Views(wasmMemory.buffer);wasmTable=Module["asm"]()["r"];removeRunDependency("wasm-
instantiate")}addRunDependency("wasm-instantiate");function
receiveInstantiatedSource(output){receiveInstance(output["instance"]);}function
instantiateArrayBuffer(receiver){return getBinaryPromise().then(function(binary){return
WebAssembly.instantiate(binary,info)}).then(receiver,function(reason){err("failed to asynchronously prepare
wasm: "+reason);abort(reason)})}function instantiateAsync(){if(!wasmBinary&&typeof
WebAssembly.instantiateStreaming===function"&&!isDataURI(wasmBinaryFile)&&!isFileURI(wasmBinaryFil
e)&&typeof
fetch==="function"){return fetch(wasmBinaryFile,{credentials:"same-origin"}).then(function(response){var
result=WebAssembly.instantiateStreaming(response,info);return
result.then(receiveInstantiatedSource,function(reason){err("wasm streaming compile failed: "+reason);err("falling
back to ArrayBuffer instantiation");return instantiateArrayBuffer(receiveInstantiatedSource)}))}else{return
instantiateArrayBuffer(receiveInstantiatedSource)}if(Module["instantiateWasm"]){try{var
exports=Module["instantiateWasm"](info,receiveInstance);return exports}catch(e){err("Module.instantiateWasm
callback failed with error: "+e);return false}}instantiateAsync().catch(readyPromiseReject);return{}}function
callRuntimeCallbacks(callbacks){while(callbacks.length>0){var callback=callbacks.shift();if(typeof
callback==="function"){callback(Module);continue}var func=callback.func;if(typeof

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func===\"number\"){if(callback.arg===undefined){wasmTable.get(func)()}else{wasmTable.get(func)(callback.arg)}
}else{func(callback.arg===undefined?null:callback.arg)}}function
_abort(){abort()}function
_emscritpen_memcpy_big(dest,src,num){HEAPU8.copyWithin(dest,src,src+num)}function
_emscritpen_get_heap_size(){return HEAPU8.length}function
emscritpen_realloc_buffer(size){try{wasmMemory.grow(size-
buffer.byteLength+65535>>>16);updateGlobalBufferAndViews(wasmMemory.buffer);return
1}catch(e){}}function _emscritpen_resize_heap(requestedSize){var oldSize=_emscritpen_get_heap_size();var
maxHeapSize=2147483648;if(requestedSize>maxHeapSize){return false}for(var
cutDown=1;cutDown<=4;cutDown*=2){var
overGrownHeapSize=oldSize*(1+.2/cutDown);overGrownHeapSize=Math.min(overGrownHeapSize,requestedSize
+100663296);var
newSize=Math.min(maxHeapSize,alignUp(Math.max(requestedSize,overGrownHeapSize),65536));var
replacement=emscritpen_realloc_buffer(newSize);if(replacement){return true}}return false}var
SYSCALLS={mappings:{},buffers:[null,[],[]],printChar:function(stream,curr){var
buffer=SYSCALLS.buffers[stream];if(curr===0||curr===10){(stream===1?out:err)(UTF8ArrayToString(buffer,0));
buffer.length=0}else{buffer.push(curr)}},varargs:undefined,get:function(){SYSCALLS.varargs+=4;var
ret=HEAP32[SYSCALLS.varargs-4>>2];return ret},getStr:function(ptr){var ret=UTF8ToString(ptr);return
ret},get64:function(low,high){return low}};function _fd_close(fd){return 0}function
_fd_seek(fd,offset_low,offset_high,whence,newOffset){}function _fd_write(fd,iovcnt,pnum){var num=0;for(var
i=0;i<iovcnt;i++){var ptr=HEAP32[iov+i*8>>2];var len=HEAP32[iov+(i*8+4)>>2];for(var
j=0;j<len;j++){SYSCALLS.printChar(fd,HEAPU8[ptr+j])}num+=len}HEAP32[pnum>>2]=num;return 0}function
_thread_create(){return 6}function _thread_join(){return 28}function
setErrNo(value){HEAP32[___errno_location()>>2]=value;return value}function
_sysconf(name){switch(name){case 30:return 16384;case 85:var maxHeapSize=2147483648;return
maxHeapSize/16384;case 132:case 133:case 12:case 137:case 138:case 15:case 235:case 16:case
17:case 18:case 19:case 20:case 149:case 13:case 10:case 236:case 153:case 9:case 21:case 22:case 159:case
154:case 14:case 77:case 78:case 139:case 82:case 68:case 67:case 164:case 11:case 29:case 47:case 48:case 95:case
52:case 51:case 46:return 200809;case 27:case 246:case 127:case 128:case 23:case 24:case 160:case 161:case
181:case 182:case 242:case 183:case 184:case 243:case 244:case 245:case 165:case 178:case 179:case 49:case
50:case 168:case 169:case 175:case 170:case 171:case 172:case 97:case 76:case 32:case 173:case 35:case 80:case
81:case 79:return -1;case 176:case 177:case 7:case 155:case 8:case 157:case 125:case 126:case 92:case 93:case
129:case 130:case 131:case 94:case 91:return 1;case 74:case 60:case 69:case 70:case 4:return 1024;case 31:case
42:case 72:return 32;case 87:case 26:case 33:return 2147483647;case 34:case 1:return 47839;case 38:case 36:return
99;case 43:case 37:return 2048;case 0:return 2097152;case 3:return 65536;case 28:return 32768;case 44:return
32767;case
75:return 16384;case 39:return 1e3;case 89:return 700;case 71:return 256;case 40:return 255;case 2:return 100;case
180:return 64;case 25:return 20;case 5:return 16;case 6:return 6;case 73:return 4;case 84:{if(typeof
navigator===\"object\")return navigator[\"hardwareConcurrency\"]||1;return 1}}setErrNo(28);return -1}var
asmLibraryArg={\"a\":_abort,\"d\":_emscritpen_memcpy_big,\"e\":_emscritpen_resize_heap,\"f\":_fd_close,\"c\":_f
d_seek,\"b\":_fd_write,\"h\":_thread_create,\"g\":_thread_join,\"i\":_sysconf};var asm=createWasm();var
___wasm_call_ctors=Module[\"___wasm_call_ctors\"]=function(){return(___wasm_call_ctors=Module[\"___wasm
_call_ctors\"]=Module[\"asm\"][\"k\"]).apply(null,arguments)};var
_init=Module[\"_init\"]=function(){return(_init=Module[\"_init\"]=Module[\"asm\"][\"l\"]).apply(null,arguments)};
var
_init_with_threads_count=Module[\"_init_with_threads_count\"]=function(){return(_init_with_threads_count=Mod
ule[\"_init_with_threads_count\"]=Module[\"asm\"][\"m\"]).apply(null,arguments)};var

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_get_threads_count=Module["_get_threads_count"]=function(){return(_get_threads_count=Module["_get_threads_count"]=Module["_asm"][["n"]]).apply(null,arguments)};var
_register_tensor=Module["_register_tensor"]=function(){return(_register_tensor=Module["_register_tensor"]=Module["asm"][["o"]]).apply(null,arguments)};var
_dispose_data=Module["_dispose_data"]=function(){return(_dispose_data=Module["_dispose_data"]=Module["_asm"][["p"]]).apply(null,arguments)};var
_dispose=Module["_dispose"]=function(){return(_dispose=Module["_dispose"]=Module["asm"][["q"]]).apply(null,arguments)};var
_Abs=Module["_Abs"]=function(){return(_Abs=Module["_Abs"]=Module["_asm"][["s"]]).apply(null,arguments)};var
_Add=Module["_Add"]=function(){return(_Add=Module["_Add"]=Module["_asm"][["t"]]).apply(null,arguments)};var
_AddN=Module["_AddN"]=function(){return(_AddN=Module["_AddN"]=Module["asm"][["u"]]).apply(null,arguments)};var
_All=Module["_All"]=function(){return(_All=Module["_All"]=Module["_asm"][["v"]]).apply(null,arguments)};var
_Any=Module["_Any"]=function(){return(_Any=Module["_Any"]=Module["_asm"][["w"]]).apply(null,arguments)};var
_ArgMax=Module["_ArgMax"]=function(){return(_ArgMax=Module["_ArgMax"]=Module["_asm"][["x"]]).apply(null,arguments)};var
_AvgPool=Module["_AvgPool"]=function(){return(_AvgPool=Module["_AvgPool"]=Module["asm"][["y"]]).apply(null,arguments)};var
_BatchMatMul=Module["_BatchMatMul"]=function(){return(_BatchMatMul=Module["_BatchMatMul"]=Module["asm"][["z"]]).apply(null,arguments)};var
_Ceil=Module["_Ceil"]=function(){return(_Ceil=Module["_Ceil"]=Module["asm"][["A"]]).apply(null,arguments)};var
_ClipByValue=Module["_ClipByValue"]=function(){return(_ClipByValue=Module["_ClipByValue"]=Module["asm"][["B"]]).apply(null,arguments)};var
_Conv2D=Module["_Conv2D"]=function(){return(_Conv2D=Module["_Conv2D"]=Module["asm"][["C"]]).apply(null,arguments)};var
_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=function(){return(_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=Module["asm"][["D"]]).apply(null,arguments)};var
_Cos=Module["_Cos"]=function(){return(_Cos=Module["_Cos"]=Module["asm"][["E"]]).apply(null,arguments)};var
_Cosh=Module["_Cosh"]=function(){return(_Cosh=Module["_Cosh"]=Module["asm"][["F"]]).apply(null,arguments)};var
_CropAndResize=Module["_CropAndResize"]=function(){return(_CropAndResize=Module["_CropAndResize"]=Module["asm"][["G"]]).apply(null,arguments)};var
_Cumsum=Module["_Cumsum"]=function(){return(_Cumsum=Module["_Cumsum"]=Module["asm"][["H"]]).apply(null,arguments)};var
_DepthToSpace=Module["_DepthToSpace"]=function(){return(_DepthToSpace=Module["_DepthToSpace"]=Module["asm"][["I"]]).apply(null,arguments)};var
_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=function(){return(_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=Module["asm"][["J"]]).apply(null,arguments)};var
_Elu=Module["_Elu"]=function(){return(_Elu=Module["_Elu"]=Module["asm"][["K"]]).apply(null,arguments)};var
_Equal=Module["_Equal"]=function(){return(_Equal=Module["_Equal"]=Module["asm"][["L"]]).apply(null,arguments)};var

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_Exp=Module["_Exp"]=function(){return(_Exp=Module["_Exp"]=Module["asm"]["M"]).apply(null,arguments)};var
_FlipLeftRight=Module["_FlipLeftRight"]=function(){return(_FlipLeftRight=Module["_FlipLeftRight"]=Module["asm"]["N"]).apply(null,arguments)};var
_Floor=Module["_Floor"]=function(){return(_Floor=Module["_Floor"]=Module["asm"]["O"]).apply(null,arguments)};var
_FloorDiv=Module["_FloorDiv"]=function(){return(_FloorDiv=Module["_FloorDiv"]=Module["asm"]["P"]).apply(null,arguments)};var
_FusedBatchNorm=Module["_FusedBatchNorm"]=function(){return(_FusedBatchNorm=Module["_FusedBatchNorm"]=Module["asm"]["Q"]).apply(null,arguments)};var
_FusedConv2D=Module["_FusedConv2D"]=function(){return(_FusedConv2D=Module["_FusedConv2D"]=Module["asm"]["R"]).apply(null,arguments)};var
_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=function(){return(_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=Module["asm"]["S"]).apply(null,arguments)};var
_Gather=Module["_Gather"]=function(){return(_Gather=Module["_Gather"]=Module["asm"]["T"]).apply(null,arguments)};var
_GatherNd=Module["_GatherNd"]=function(){return(_GatherNd=Module["_GatherNd"]=Module["asm"]["U"]).apply(null,arguments)};var
_Greater=Module["_Greater"]=function(){return(_Greater=Module["_Greater"]=Module["asm"]["V"]).apply(null,arguments)};var
_GreaterEqual=Module["_GreaterEqual"]=function(){return(_GreaterEqual=Module["_GreaterEqual"]=Module["asm"]["W"]).apply(null,arguments)};var
_LeakyRelu=Module["_LeakyRelu"]=function(){return(_LeakyRelu=Module["_LeakyRelu"]=Module["asm"]["X"]).apply(null,arguments)};var
_Less=Module["_Less"]=function(){return(_Less=Module["_Less"]=Module["asm"]["Y"]).apply(null,arguments)};var
_LessEqual=Module["_LessEqual"]=function(){return(_LessEqual=Module["_LessEqual"]=Module["asm"]["Z"]).apply(null,arguments)};var
_Log=Module["_Log"]=function(){return(_Log=Module["_Log"]=Module["asm"]["_"]).apply(null,arguments)};var
_LogicalAnd=Module["_LogicalAnd"]=function(){return(_LogicalAnd=Module["_LogicalAnd"]=Module["asm"]["$"]).apply(null,arguments)};var
_Max=Module["_Max"]=function(){return(_Max=Module["_Max"]=Module["asm"]["aa"]).apply(null,arguments)};var
_MaxPool=Module["_MaxPool"]=function(){return(_MaxPool=Module["_MaxPool"]=Module["asm"]["ba"]).apply(null,arguments)};var
_Maximum=Module["_Maximum"]=function(){return(_Maximum=Module["_Maximum"]=Module["asm"]["ca"]).apply(null,arguments)};var
_Mean=Module["_Mean"]=function(){return(_Mean=Module["_Mean"]=Module["asm"]["da"]).apply(null,arguments)};var
_Min=Module["_Min"]=function(){return(_Min=Module["_Min"]=Module["asm"]["ea"]).apply(null,arguments)};var
_Minimum=Module["_Minimum"]=function(){return(_Minimum=Module["_Minimum"]=Module["asm"]["fa"]).apply(null,arguments)};var
_MirrorPad=Module["_MirrorPad"]=function(){return(_MirrorPad=Module["_MirrorPad"]=Module["asm"]["ga"]).apply(null,arguments)};var
_Multiply=Module["_Multiply"]=function(){return(_Multiply=Module["_Multiply"]=Module["asm"]["ha"]).apply(null,arguments)};var

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_Neg=Module["_Neg"]=function(){return(_Neg=Module["_Neg"]=Module["asm"][\["ia\"]).apply(null,argument
s)};var
_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=function(){return(_NonMaxSuppressionV3=Mod
ule["_NonMaxSuppressionV3"]=Module["asm"][\["ja\"]).apply(null,arguments)};var
_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=function(){return(_NonMaxSuppressionV4=Mod
ule["_NonMaxSuppressionV4"]=Module["asm"][\["ka\"]).apply(null,arguments)};var
_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=function(){return(_NonMaxSuppressionV5=Mod
ule["_NonMaxSuppressionV5"]=Module["asm"][\["la\"]).apply(null,arguments)};var
_NotEqual=Module["_NotEqual"]=function(){return(_NotEqual=Module["_NotEqual"]=Module["asm"][\["ma\
"]).apply(null,arguments)};var
_OneHot=Module["_OneHot"]=function(){return(_OneHot=Module["_OneHot"]=Module["asm"][\["na\"]).app
ly(null,arguments)};var
_PadV2=Module["_PadV2"]=function(){return(_PadV2=Module["_PadV2"]=Module["asm"][\["oa\"]).apply(nul
l,arguments)};var
_Pow=Module["_Pow"]=function(){return(_Pow=Module["_Pow"]=Module["asm"][\["pa\"]).apply(null,argume
nts)};var
_Prelu=Module["_Prelu"]=function(){return(_Prelu=Module["_Prelu"]=Module["asm"][\["qa\"]).apply(null,argu
ments)};var
_Prod=Module["_Prod"]=function(){return(_Prod=Module["_Prod"]=Module["asm"][\["ra\"]).apply(null,argum
ents)};var
_RealDiv=Module["_RealDiv"]=function(){return(_RealDiv=Module["_RealDiv"]=Module["asm"][\["sa\"]).app
ly(null,arguments)};var
_RelU=Module["_Relu"]=function(){return(_Relu=Module["_Relu"]=Module["asm"][\["ta\"]).apply(null,argume
nts)};var
_RelU6=Module["_Relu6"]=function(){return(_Relu6=Module["_Relu6"]=Module["asm"][\["ua\"]).apply(null,ar
guments)};var
_ResizeBilinear=Module["_ResizeBilinear"]=function(){return(_ResizeBilinear=Module["_ResizeBilinear"]=Mo
dule["asm"][\["va\"]).apply(null,arguments)};var
_Reverse=Module["_Reverse"]=function(){return(_Reverse=Module["_Reverse"]=Module["asm"][\["wa\"]).app
ly(null,arguments)};var
_RotateWithOffset=Module["_RotateWithOffset"]=function(){return(_RotateWithOffset=Module["_RotateWith
Offset"]=Module["asm"][\["xa\"]).apply(null,arguments)};var
_Round=Module["_Round"]=function(){return(_Round=Module["_Round"]=Module["asm"][\["ya\"]).apply(nul
l,arguments)};var
_Rsqrt=Module["_Rsqrt"]=function(){return(_Rsqrt=Module["_Rsqrt"]=Module["asm"][\["za\"]).apply(null,arg
uments)};var
_ScatterNd=Module["_ScatterNd"]=function(){return(_ScatterNd=Module["_ScatterNd"]=Module["asm"][\["Aa
\"]).apply(null,arguments)};var
_SelectV2=Module["_SelectV2"]=function(){return(_SelectV2=Module["_SelectV2"]=Module["asm"][\["Ba\"])
.apply(null,arguments)};var
_Sigmoid=Module["_Sigmoid"]=function(){return(_Sigmoid=Module["_Sigmoid"]=Module["asm"][\["Ca\"]).ap
ply(null,arguments)};var
_Sin=Module["_Sin"]=function(){return(_Sin=Module["_Sin"]=Module["asm"][\["Da\"]).apply(null,arguments)
};var
_Softmax=Module["_Softmax"]=function(){return(_Softmax=Module["_Softmax"]=Module["asm"][\["Ea\"]).ap
ply(null,arguments)};var
_Sqrt=Module["_Sqrt"]=function(){return(_Sqrt=Module["_Sqrt"]=Module["asm"][\["Fa\"]).apply(null,argumen
ts)};var

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_Square=Module["_Square"]=function(){return(_Square=Module["_Square"]=Module["asm"][["Ga"]]).apply(null,arguments)};var
_SquaredDifference=Module["_SquaredDifference"]=function(){return(_SquaredDifference=Module["_SquaredDifference"]=Module["asm"][["Ha"]]).apply(null,arguments)};var
_Step=Module["_Step"]=function(){return(_Step=Module["_Step"]=Module["asm"][["Ia"]]).apply(null,arguments)};var
_StridedSlice=Module["_StridedSlice"]=function(){return(_StridedSlice=Module["_StridedSlice"]=Module["asm"][["Ja"]]).apply(null,arguments)};var
_Sub=Module["_Sub"]=function(){return(_Sub=Module["_Sub"]=Module["asm"][["Ka"]]).apply(null,arguments)};var
_Sum=Module["_Sum"]=function(){return(_Sum=Module["_Sum"]=Module["asm"][["La"]]).apply(null,arguments)};var
_Tan=Module["_Tan"]=function(){return(_Tan=Module["_Tan"]=Module["asm"][["Ma"]]).apply(null,arguments)};var
_Tanh=Module["_Tanh"]=function(){return(_Tanh=Module["_Tanh"]=Module["asm"][["Na"]]).apply(null,arguments)};var
_Tile=Module["_Tile"]=function(){return(_Tile=Module["_Tile"]=Module["asm"][["Oa"]]).apply(null,arguments)};var
_TopK=Module["_TopK"]=function(){return(_TopK=Module["_TopK"]=Module["asm"][["Pa"]]).apply(null,arguments)};var
_Transform=Module["_Transform"]=function(){return(_Transform=Module["_Transform"]=Module["asm"][["Qa"]]).apply(null,arguments)};var
_Transpose=Module["_Transpose"]=function(){return(_Transpose=Module["_Transpose"]=Module["asm"][["Ra"]]).apply(null,arguments)};var
__FusedMatMul=Module["__FusedMatMul"]=function(){return(__FusedMatMul=Module["__FusedMatMul"]=Module["asm"][["Sa"]]).apply(null,arguments)};var
_malloc=Module["_malloc"]=function(){return(_malloc=Module["_malloc"]=Module["asm"][["Ta"]]).apply(null,arguments)};var
_free=Module["_free"]=function(){return(_free=Module["_free"]=Module["asm"][["Ua"]]).apply(null,arguments)};var
__errno_location=Module["__errno_location"]=function(){return(__errno_location=Module["__errno_location"]=Module["asm"][["Va"]]).apply(null,arguments)};var
stackSave=Module["stackSave"]=function(){return(stackSave=Module["stackSave"]=Module["asm"][["Wa"]]).apply(null,arguments)};var
stackRestore=Module["stackRestore"]=function(){return(stackRestore=Module["stackRestore"]=Module["asm"][["Xa"]]).apply(null,arguments)};var
stackAlloc=Module["stackAlloc"]=function(){return(stackAlloc=Module["stackAlloc"]=Module["asm"][["Ya"]]).apply(null,arguments)};Module["cwrap"]=cwrap;var calledRun;function
ExitStatus(status){this.name="ExitStatus";this.message="Program terminated with
exit("+status+")";this.status=status}dependenciesFulfilled=function
runCaller(){if(!calledRun)run();if(!calledRun)dependenciesFulfilled=runCaller};function
run(args){args=args||arguments_;if(runDependencies>0){return}preRun();if(runDependencies>0){return}function
doRun(){if(calledRun)return;calledRun=true;Module["calledRun"]=true;if(ABORT)return;initRuntime();preMain();
readyPromiseResolve(Module);if(Module["onRuntimeInitialized"])Module["onRuntimeInitialized"]();postRun()}
if(Module["setStatus"]){Module["setStatus"]("Running..");setTimeout(function(){setTimeout(function(){Module["setStatus"]("");},1);doRun()},1)}else{doRun()}}Module["run"]=run;if(Module["preInit"]){if(typeof
Module["preInit"]=="function")Module["preInit"]=[Module["preInit"]];while(Module["preInit"].length>0){
Module["preInit"].pop()}}run();\n\n\n

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this.dataIdMap.get(dataId);\n data.refCount--;\n if (!force && data.refCount > 0) {\n return false;\n }\n this.wasm._free(data.memoryOffset);\n this.wasm.tfjs.disposeData(data.id);\n this.dataIdMap.delete(dataId);\n }\n return true;\n }\n /** Return refCount of a `TensorData`. */\n refCount(dataId: DataId): number {\n if (this.dataIdMap.has(dataId)) {\n const tensorData =\n this.dataIdMap.get(dataId);\n return tensorData.refCount;\n }\n return 0;\n }\n incRef(dataId: DataId) {\n const data = this.dataIdMap.get(dataId);\n if (data != null) {\n data.refCount++;\n }\n }\n floatPrecision():\n 32 {\n return 32;\n }\n // Returns the memory offset of a tensor. Useful for debugging and unit\n // testing.\n getMemoryOffset(dataId: DataId): number {\n return this.dataIdMap.get(dataId).memoryOffset;\n }\n dispose() {\n this.wasm.tfjs.dispose();\n if ('PThread' in this.wasm) {\n this.wasm.PThread.terminateAllThreads();\n }\n this.wasm = null;\n }\n memory() {\n return {unreliable:\n false};\n }\n /**\n * Make a tensor info for the output of an op. If `memoryOffset` is not\n * present, this method\n * allocates memory on the WASM heap. If `memoryOffset` is present, the memory was allocated elsewhere (in\n * c++) and we just record\n * the pointer where that memory lives.\n */\n makeOutput(shape: number[], dtype:\n DataType, memoryOffset?: number):\n TensorInfo {\n let dataId: {};\n if (memoryOffset == null) {\n dataId = this.write(null /* values */, shape, dtype);\n } else {\n const id = this.dataIdNextNumber++;\n dataId = {id};\n this.dataIdMap.set(dataId, {id, memoryOffset, shape, dtype, refCount: 1});\n const size =\n util.sizeFromShape(shape);\n this.wasm.tfjs.registerTensor(id, size, memoryOffset);\n }\n return {dataId,\n shape, dtype};\n }\n typedArrayFromHeap({shape, dtype, dataId}: TensorInfo):\n backend_util.TypedArray\n {\n const buffer = this.wasm.HEAPU8.buffer;\n const {memoryOffset} = this.dataIdMap.get(dataId);\n const size = util.sizeFromShape(shape);\n switch (dtype) {\n case 'float32':\n return new\n Float32Array(buffer, memoryOffset, size);\n case 'int32':\n return new Int32Array(buffer, memoryOffset,\n size);\n case 'bool':\n return new Uint8Array(buffer, memoryOffset, size);\n default:\n throw new\n Error(`Unknown dtype ${dtype}`);\n }\n }\n function createInstantiateWasmFunc(path: string) {\n // this\n // will be replace by rollup plugin patchWechatWebAssembly in\n // miniprogram's output.\n // tslint:disable-next-\n // line:no-any\n return (imports: any, callback: any) => {\n util.fetch(path, {credentials: 'same-\n origin'}).then((response) => {\n if (!response['ok']) {\n imports.env.a(`failed to load wasm binary file at\n '${path}'`);\n }\n response.arrayBuffer().then(binary => {\n WebAssembly.instantiate(binary,\n imports).then(output => {\n callback(output.instance, output.module);\n });\n });\n });\n return {};\n });\n }\n /**\n * Returns the path of the WASM binary.\n * @param\n * simdSupported whether SIMD is supported\n * @param\n * threadsSupported whether multithreading is supported\n * @param\n * wasmModuleFolder the directory containing the WASM binaries.\n */\n function getPathToWasmBinary(\n simdSupported: boolean, threadsSupported: boolean,\n wasmModuleFolder: string) {\n if (wasmPath != null) {\n // If wasmPath is defined, the user has supplied a full path to\n // the vanilla .wasm binary.\n return\n wasmPath;\n }\n let path: WasmBinaryName = 'tfjs-backend-wasm.wasm';\n if (simdSupported &&\n threadsSupported) {\n path = 'tfjs-backend-wasm-threaded-simd.wasm';\n } else if (simdSupported) {\n path =\n 'tfjs-backend-wasm-simd.wasm';\n }\n if (wasmFileMap != null) {\n if (wasmFileMap[path] != null) {\n return\n wasmFileMap[path];\n }\n }\n return wasmModuleFolder + path;\n }\n /**\n * Initializes the wasm\n * module and creates the js <--> wasm bridge.\n * NOTE: We wrap the wasm module in a object with property\n * 'wasm' instead of\n * returning Promise<BackendWasmModule> to avoid freezing Chrome (last tested\n * in\n * Chrome 76).\n */\n export async function init(): Promise<{wasm: BackendWasmModule}> {\n const\n [simdSupported, threadsSupported] = await Promise.all([\n env().getAsync('WASM_HAS_SIMD_SUPPORT'),\n env().getAsync('WASM_HAS_MULTITHREAD_SUPPORT')\n]);\n return new Promise((resolve, reject) =>\n {\n const factoryConfig: WasmFactoryConfig = {};\n /**\n * This function overrides the Emscripten\n * module locateFile utility.\n * @param path The relative path to the file that needs to be loaded.\n * @param\n * prefix The path to the main JavaScript file's directory.\n */\n factoryConfig.locateFile = (path, prefix) => {\n if (path.endsWith('.worker.js')) {\n const response = wasmWorkerContents;\n const blob = new\n Blob([response], {type: 'application/javascript'});\n }\n }\n });\n }\n
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 return URL.createObjectURL(blob);\n }\n\n if (path.endsWith('.wasm')) {\n return
getPathToWasmBinary(\n simdSupported as boolean, threadsSupported as boolean,\n wasmPathPrefix
!= null ? wasmPathPrefix : prefix);\n }\n return prefix + path;\n };\n\n // Use the instantiateWasm override
when system fetch is not available.\n // Reference:\n // https://github.com/emscripten-
core/emscripten/blob/2bca083cbbd5a4133db61fbd74d04f7feecfa907/tests/manual_wasm_instantiate.html#L170\n
if (customFetch) {\n factoryConfig.instantiateWasm =\ncreateInstantiateWasmFunc(getPathToWasmBinary(\n simdSupported as boolean, threadsSupported as
boolean,\n wasmPathPrefix != null ? wasmPathPrefix : ''));\n }\n\n let initialized = false;\n
factoryConfig.onAbort = () => {\n if (initialized) {\n // Emscripten already called console.warn so no need to
double log.\n return;\n }\n if (initAborted) {\n // Emscripten calls `onAbort` twice, resulting in double error\n
// messages.\n return;\n }\n initAborted = true;\n const rejectMsg =\n 'Make sure the server can
serve the `.wasm` file relative to the '+\n 'bundled js file. For more details see
https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-wasm/README.md#using-bundlers;\n
reject({message: rejectMsg});\n };\n\n let wasm: Promise<BackendWasmModule>;\n // If `wasmPath` has
been defined we must initialize the vanilla module.\n if (threadsSupported && simdSupported && wasmPath ==
null) {\n factoryConfig.mainScriptUrlOrBlob = new Blob(\n [\n var WasmBackendModuleThreadedSimd = `
+\n wasmFactoryThreadedSimd.toString(),\n {type: 'text/javascript'});\n wasm =
wasmFactoryThreadedSimd(factoryConfig);\n } else {\n // The wasmFactory works for both vanilla and SIMD
binaries.\n wasm = wasmFactory(factoryConfig);\n }\n\n // The WASM module has been successfully
created by the factory.\n // Any error will be caught by the onAbort callback defined above.\n
wasm.then((module) => {\n initialized = true;\n initAborted = false;\n\n const voidReturnType: string =
null;\n // Using the tfjs namespace to avoid conflict with emscripten's API.\n module.tfjs = {\n init:
module.cwrap('init', null, []),\n initWithThreadCount:\n module.cwrap('init_with_threads_count', null,
['number']),\n getThreadCount: module.cwrap('get_threads_count', 'number', []),\n registerTensor:
module.cwrap(\n 'register_tensor', null,\n [\n 'number', // id\n 'number', // size\n
 'number', // memoryOffset\n]),\n disposeData: module.cwrap('dispose_data', voidReturnType,
['number']),\n dispose: module.cwrap('dispose', voidReturnType,
[],\n);\n\n resolve({wasm: module});\n });\n\n function typedArrayFromBuffer(\n buffer:
ArrayBuffer, dtype: DataType): backend_util.TypedArray {\n switch (dtype) {\n case 'float32':\n return new
Float32Array(buffer);\n case 'int32':\n return new Int32Array(buffer);\n case 'bool':\n return new
Uint8Array(buffer);\n default:\n throw new Error(`Unknown dtype ${dtype}`);\n }\n }\n\n const
wasmBinaryNames = [\n 'tfjs-backend-wasm.wasm', 'tfjs-backend-wasm-simd.wasm',\n 'tfjs-backend-wasm-
threaded-simd.wasm'\n] as const;\n type WasmBinaryName = typeof wasmBinaryNames[number];\n\n let
wasmPath: string = null;\n let wasmPathPrefix: string = null;\n let wasmFileMap: {[key in WasmBinaryName]?:
string} = {};\n let initAborted = false;\n let customFetch = false;\n\n /**\n * @deprecated Use `setWasmPaths`
instead.\n * Sets the path to the `.wasm` file which will be fetched when the wasm\n * backend is initialized. See\n *
https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-wasm/README.md#using-bundlers\n
 * for more details.\n * @param path wasm file path or url\n * @param usePlatformFetch optional boolean to use
platform fetch to download\n * the wasm file, default to false.\n *\n * @doc {heading: 'Environment', namespace:
'wasm'}\n */\n export function setWasmPath(path: string, usePlatformFetch = false): void {\n deprecationWarn(\n
 'setWasmPath has been deprecated in favor of setWasmPaths and'\n +\n ' will be removed in a future release.);\n if
(initAborted) {\n throw new Error(\n 'The WASM backend was already initialized. Make sure you call '+\n
 '\n `setWasmPath()` before you call `tf.setBackend()` or `tf.ready()`);\n }\n wasmPath = path;\n customFetch =
usePlatformFetch;\n }\n\n /**\n * Configures the locations of the WASM binaries.\n *\n * ``js\n * setWasmPaths({\n *
'tfjs-backend-wasm.wasm': 'renamed.wasm',\n * 'tfjs-backend-wasm-simd.wasm': 'renamed-simd.wasm',\n *
'tfjs-backend-wasm-threaded-simd.wasm': 'renamed-threaded-simd.wasm'\n * });\n * tf.setBackend('wasm');\n *\n * ``\n * @param prefixOrFileMap This can be either a string or object:\n * - (string) The path to the directory

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where the WASM binaries are located.  
 \* Note that this prefix will be used to load each binary (vanilla,  
 \* SIMD-enabled, threading-enabled, etc.).  
 \* - (object) Mapping from names of WASM binaries to custom  
 \* full paths specifying the locations of those binaries. This is useful if  
 \* your WASM binaries are not all located  
 \* in the same directory, or if your  
 \* WASM binaries have been renamed.  
 \* @param usePlatformFetch optional  
 \* boolean to use platform fetch to download  
 \* the wasm file, default to false.  
 \* @doc {heading:  
 \* 'Environment', namespace: 'wasm'}  
 \* ^\nexport function setWasmPaths(\n prefixOrFileMap: string|{\n[key in  
 \* WasmBinaryName]?: string},\n usePlatformFetch = false): void {\n if (initAborted) {\n throw new  
 \* Error(\n "The WASM backend was already initialized. Make sure you call '+\n  
 \* ^setWasmPaths()' before  
 \* you call `tf.setBackend()` or '+\n  
 \* ^tf.ready()`);\n }\n\n if (typeof prefixOrFileMap === 'string') {\n  
 \* wasmPathPrefix = prefixOrFileMap;\n } else {\n wasmFileMap = prefixOrFileMap;\n const missingPaths =\n  
 \* wasmBinaryNames.filter(name => wasmFileMap[name] == null);\n if (missingPaths.length > 0) {\n throw  
 \* new Error(\n ^There were no entries found for the following binaries: `+\n  
 \* ^\${missingPaths.join(',')}.  
 \* Please either call setWasmPaths with a `+\n  
 \* ^map providing a path for each binary, or with a string indicating  
 \* `+\n  
 \* ^the directory where all the binaries can be found.`);\n } }\n\n customFetch =  
 \* usePlatformFetch;\n}\n\n/\*\* Used in unit tests. \*/\nexport function resetWasmPath(): void {\n wasmPath = null;\n  
 \* wasmPathPrefix = null;\n wasmFileMap = {};\n customFetch = false;\n initAborted  
 \* = false;\n}\n\nlet threadsCount = -1;\nlet actualThreadsCount = -1;\n\n/\*\*\n \* Sets the number of threads that will  
 \* be used by XNNPACK to create  
 \* threadpool (default to the number of logical CPU cores).\n \*\n \* This must be  
 \* called before calling `tf.setBackend('wasm')`.\n \*/\nexport function setThreadsCount(numThreads: number) {\n  
 \* threadsCount = numThreads;\n}\n\n/\*\*\n \* Gets the actual threads count that is used by XNNPACK.\n \*\n \* It is set  
 \* after the backend is initialized.\n \*/\nexport function getThreadsCount(): number {\n if (actualThreadsCount === -1)  
 \* {\n throw new Error("WASM backend not initialized.");\n }\n return actualThreadsCount;\n}\n\n/\*\* @license  
 \* See the LICENSE file. \*/\n\n// This code is auto-generated, do not modify this file!\nconst version =  
 \* '3.11.0';\nexport { version }; \n\n/\*\*\n \* @license  
 \* Copyright 2020 Google LLC. All Rights Reserved.\n \*\n \* Licensed under the Apache License, Version 2.0 (the "License");  
 \* you may not use this file except in  
 \* compliance  
 \* with the License.  
 \* You may obtain a copy of the License at  
 \* <http://www.apache.org/licenses/LICENSE-2.0>  
 \* Unless required by applicable law or agreed to in writing, software  
 \* distributed under the License is  
 \* distributed on an "AS IS" BASIS,  
 \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either  
 \* express or implied.  
 \* See the License for the specific language governing permissions and  
 \* limitations under  
 \* the License.\n \*

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*\n\nimport './flags_wasm';\n\nimport {registerBackend} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm,

init} from './backend_wasm';\n\nexport {BackendWasm, getThreadsCount, setThreadsCount, setWasmPath,

setWasmPaths} from './backend_wasm';\n\nexport {version as version_wasm} from './version';\n\nconst

WASM_PRIORITY = 2;\nregisterBackend('wasm', async () => {\n const {wasm} = await init();\n return new

BackendWasm(wasm);\n},

WASM_PRIORITY);\n\n], "names":["_FusedMatMul","util","Abs","backend_util","Add","AddN","Identity","setup",

"Transpose","All","Any","wasmFunc","ArgMax","AvgPool","Reshape","BatchMatMul","slice_util","buffer","sliceI

mplCPU","Slice","BatchToSpaceND","Cast","Ceil","ClipByValue","concatImplCPU","Concat","Conv2D","Conv2

DBackpropInput","Cos","Cosh","CropAndResize","Cumsum","DepthToSpace","DepthwiseConv2dNative","Elu","s

upportsFullBroadcast","Equal","Exp","ExpandDims","Fill","FlipLeftRight","Floor","FloorDiv","FusedBatchNorm",

"FusedConv2D","FusedDepthwiseConv2D","GatherNd","GatherV2","Greater","GreaterEqual","setupFunc","Leaky

Relu","Less","LessEqual","Log","LogicalAnd","Max","Maximum","MaxPool","Mean","Min","Minimum","Mirror

Pad","Multiply","Neg","NonMaxSuppressionV3","NonMaxSuppressionV4","NonMaxSuppressionV5","kernelFunc

","NotEqual","OneHot","OnesLike","Pack","PadV2","Pow","Prelu","Prod","rangeImplCPU","Range","RealDiv","R

elu","Relu6","ResizeBilinear","Reverse","RotateWithOffset","Round","Rsqrt","ScatterNd","Select","Sigmoid","Sin

","Softmax","SpaceToBatchND","SplitV","Sqrt","Square","SquaredDifference","Step","StridedSlice","Sub","Sum",
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"Tan", "Tanh", "Tile", "TopK", "Transform", "Unpack", "ZerosLike", "registerKernel", "env", "tslib\_1.\_\_extends", "DataStorage", "engine", "KernelBackend", "tslib\_1.\_\_awaiter", "registerBackend"], "mappings": ";;;;;;;;;;;;;AAAA;;;;;;;;;;AAiBA;AACa,IAAY,QAMX;AAND,WAAY,QAAQ;IACiB,6CAAW,CAAA;IACX,yCAAS,CAAA;IACT,uCAAQ,CAAA;IACR,2CAAU,CAAA;IACV,iDAAa,CAAA;AACf,CAAC,EANW,QAAQ,KAAR,QAAQ,QAMnB;AAED;AACa,IAAY,iBAQX;AARD,WAAY,iBAAiB;IAC3B,6DAAU,CAAA;IACV,yDAAQ,CAAA;IACR,2DAAS,CAAA;IACT,2DAAS,CAAA;IACT,mEAAa,CAAA;IACb,+DAAW,CAAA;IACX,uDAAO,CAAA;AACT,CAAC,EARW,iBAAiB,KAAjB,iBAAiB;;AC3B7B;;;;;;;;;;;;;AAuBA,IAAI,eAKQ,CAAC;AAEb,SAAS,KAAK,CAAC,OAaOB;IACjC,eAAe,GAAG,OAaO,CAAC,IAAI,CAAC,KAAK,CAACA,qBAAY,EAAE,IAAI,aAAa;QACIE,QAAQ;QACR,OAaO;QACP,QAAQ;QACR,QAAQ;QACR,OAaO;QACP,QAAQ;QACR,QAAQ;QACR,QAAQ;QACR,QAAQ;QACR,QAAQ;QACR,QAAQ;QACT,CAAC,CAAC;AACL,CAAC;AAED,SAAS,gBAAGb,CAAC,IAIzB;IACQ,IAAA,oBAAM,EAAE,sBAaO,EAAE,kBAaK,CAAS;IAC/B,IAAA,YAAC,EAAE,YAAC,EAAE,kBAaI,EAAE,sDAAsB,CAAW;IAEpD,IAAI,CAAC,CAAC,KAAK,KAAK,SAAS,IAAI,CAAC,CAAC,KAAK,KAAK,SAAS,EAAE;QACID,MAAM,IAAI,KAAK,CACX,6DAA6D,CAAC,CAAC;KACpE;IAEM,IAAA,6BAAU,EAAE,6BAAU,EAAE,6BAAU,EAAE,qCAAc,CAAU;IACnE,IAAM,GAAG,GAAG,OAaO,CAAC,SAAS,CAAC,GAAG,CAAC,CAAC,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;IAC/C,IAAM,GAAG,GAAG,OAaO,CAAC,SAAS,CAAC,GAAG,CAAC,CAAC,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;IAE/C,IAAI,MAAM,GAAG,CAAC,CAAC;IACf,IAAI,IAAI,IAAI,IAAI,EAAE;QACbB,IAAM,QAAQ,GAAG,OAaO,CAAC,SAAS,CAAC,GAAG,CAAC,IAAI,CAAC,MAAM,CAAC,CAAC;QACpD,IAAI,QAAQ,CAAC,KAAK,CAAC,MAAM,KAAK,CAAC,EAAE;YAC/B,MAAM,IAAI,KAAK,CACX,iDAaiD;iBACjD,UAAQ,QAAQ,CAAC,KAAK,CAAC,MAAM,MAAG,CAAA,CAAC,CAAC;SACvC;QACD,MAAM,GAAG,QAAQ,CAAC,EAAE,CAAC;KACtB;IACD,IAAM,wBAawB,GAAG,sBAAsB,IAAI,IAAI;QAC3D,CAAC;QACD,OAaO,CAAC,SAAS,CAAC,GAAG,CAAC,sBAAsB,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;IAC5D,IAAM,eAAe,GACjB,iBAAiB,C AAC,UAAkD,CAAC,CAAC;IACIE,IAAI,eAAe,IAAI,IAAI,EAAE;QAC3B,MAAM,IAAI,KAAK,CACR,UAAU,mDAAGD;YAC7D,sBAAsB,CAAC,CAAC;KAC7B;IAED,IAAM,OAaO,GAAG,UAAU,GAAG,CAAC,CAAC,KAAK,CAAC,CAAC,CAAC,GAAG,CAAC,CAAC,KAAK,CAAC,CAAC,CAAC,CAAC;IACrD,IAAM,QAAQ,GAAG,UAAU,GAAG,CAAC,CAAC,KAAK,CAAC,CAAC,GAAG,CAAC,CAAC,KAAK,CAAC,CAAC,CAA C,CAAC;IACtD,IAAM,QAAQ,GAAG,CAAC,CAAC,KAAK,CAAC,CAAC,CAAC,CAAC;IAE5B,IAAM,GAAG,GAAG,OAaO,CAAC,UAAU,CAAC,CAAC,QAAQ,EAAE,OAaO,EAAE,QAAQ,CAAC,EAAE,CAAC,CAAC,KAAK,CAAC,CAAC;IACvE,IAAM,KAAK,GAAG,OAaO,CAAC,SAAS,CAAC,GAAG,CAAC,GAAG,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;IAEnD,IAAM,WAaw,GAAG,IAAI,UAAU,CAAC,IAAI,UAAU,CAAC,CAAC,CAAC,KAAK,CAAC,CAAC,MAAM,CAAC,CAAC;IAEnE,eAAe,CACX,GAAG,EAAE,WAaw,EAAE,CAAC,CAAC,KAAK,CAAC,MAAM,EAAE,GAAG,EAAE,WAaw,EAAE,CAAC,CAAC,KAAK,CAAC,MAAM,EACIE,UAAU,EAAE,UAAU,EAAE,eAAe,EAAE,MAAM,EAAE,wBAawB,EACzE,cAAc,IAAI,CAAC,EAAE,KAAK,CAAC,CAAC;IAEhC,OAaO,GAAG,CAAC;AACb,CAAC;AAEM,IAAM,iBAAiB,GAAiB;IAC7C,UAAU,EAAEA,qBAAY;IACxB,WAaw,EAAE,MAAM;IACnB,SAAS,EAAE,KAAK;IACbB,UAAU,EAAE,gBAaOC;CACjD;;AC7GD;;;;;;;;;;;;;SAuBgB,uBAAuB,CACnC,UAAkB,EAAE,OAaKB;IACxC,IAAI,QAA6D,CAAC;IAEIE,SAAS,SAAS,CAAC,OAaOB;QACrC,QAAQ,GAAG,OAaO,CAAC,IAAI,CAAC,KAAK,CAAC,UAAU,EAAE,IAAI,aAAa;YACzD,QAAQ;YACR,QAAQ;YACR,QAAQ;SACT,CAAC,CAAC;KACJ;IAED,SAAS,UAAU,CAAC,IAAiD;QAE5D,IAAA,sBAaO,EAAW,iBAAC,CAAU;QACpC,IAAM,GAAG,GAAG,OAaO,CAAC,SAAS,CAAC,GAAG,CAAC,CAAC,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;QAC/C,IAAM,GAAG,GAAG,OAaO,CAAC,UAAU,CAAC,CAAC,CAAC,KAAK,EAAE,OAaO,IAAI,CAAC,CAAC,KAAK,CAAC,CAAC;QAC5D,IAAM,KAAK,GAAG,OAaO,CAAC,SAAS,CAAC,GAAG,CAAC,GAAG,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;;QAGnD,IAAIC,aAAI,CAAC,aAAa,CAAC,GAAG,CAAC,KAAK,CAAC,KAAK,CAAC,EAAE;YACvC,OAaO,GAAG,CAAC;SACZ;QAED,QAAQ,CAAC,GAAG,EAAE,QAAQ,CAAC,CAAC,CAAC,KAAK,CAAC,EAAE,KAAK,CAAC,CAAC;QACxC,OAaO,GAAG,CAAC;KACZ;IAED,OAaO,EAAC,UAAU,YAAA,EAAE,WAaw,EAAE,MAAM,EAAE,SAAS,WAAA,EAAE,UAAU,YAAA,EAAC,CAAC;AACIE;;ACpDA;;;;;;;;;;;;;AAoBO,IAAM,SAAS,GAAiB,uBAAuB,CAACC,YAAG,CAAC;;ACpBnE;;;;;;;;;;;;;SAuBgB,wBAawB,CACpC,

UAAkB,EAAE,qBAA8B,EACID,KAAgB;IACIB,IAAI,QAGQ,CAAC;IAEb,SAAS,SAAS,CAAC,OAAoB;QACrC ,QAAQ,GAAG,OAAO,CAAC,IAAI,CAAC,KAAK,CAAC,UAAU,EAAE,IAAI,aAAa;YACzD,QAAQ;YACR,OA AO;YACP,QAAQ;YACR,QAAQ;YACR,OAAO;YACP,QAAQ;YACR,QAAQ;YACR,QAAQ;SACT,CAAC,CAA C;KACJ;IAED,SAAS,UAAU,CAAC,IAAKD;QAE7D,IAAA,sBAAO,EAAE,oBAAM,CAAS;QACxB,IAAA,YAA C,EAAE,YAAC,CAAW;QACtB,IAAM,GAAG,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,CAAC,CAAC ,MAAM,CAAC,CAAC,EAAE,CAAC;QAC/C,IAAM,GAAG,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC, CAAC,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;QAE/C,IAAM,UAAU,GAAG,KAAK,IAAI,IAAI,GAAG,KA AK,GAAG,CAAC,CAAC,KAAK,CAAC;QACnD,IAAM,QAAQ,GAAGC,qBAAY,CAAC,0BAA0B,CAAC,CAA C,CAAC,KAAK,EAAE,CAAC,CAAC,KAAK,CAAC,CAAC;QAC3E,IAAM,GAAG,GAAG,OAAO,CAAC,UAA U,CAAC,QAAQ,EAAE,UAAU,CAAC,CAAC;;QAGrD,IAAIF,aAAI,CAAC,aAAa,CAAC,QAAQ,CAAC,KAAK, CAAC,EAAE;YACtC,OAAO,GAAG,CAAC;SACZ;QAED,IAAM,WAAW,GAAG,IAAI,UAAU,CAAC,IAAI,UA AU,CAAC,CAAC,CAAC,KAAK,CAAC,CAAC,MAAM,CAAC,CAAC;QACnE,IAAM,WAAW,GAAG,IAAI,UA AU,CAAC,IAAI,UAAU,CAAC,CAAC,CAAC,KAAK,CAAC,CAAC,MAAM,CAAC,CAAC;QACnE,IAAM,KAA K,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,GAAG,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;QACn D,IAAM,UAAU,GAAG,cAAM,OAAA,QAAQ,CAC7B,GAAG,EAAE,WAAW,EAAE,CAAC,CAAC,KAAK,CAA C,MAAM,EAAE,GAAG,EAAE,WAAW,EAAE,CAAC,CAAC,KAAK,CAAC,MAAM,EACIE,QAAQ,CAAC,CA AC,CAAC,KAAK,CAAC,EAAE,KAAK,CAAC,GAAA,CAAC;;QAG9B,IAAI,qBAAqB,IAAI,CAAC,CAAC,KA AK,KAAK,SAAS,EAAE;YACID,UAAU,EAAE,CAAC;YACb,OAAO,GAAG,CAAC;SACZ;QAED,IAAM,cAAc, GAAGE,qBAAY,CAAC,gBAAgB,CAAC,CAAC,CAAC,KAAK,EAAE,QAAQ,CAAC,CAAC;QACxE,IAAM,cA Ac,GAAGA,qBAAY,CAAC,gBAAgB,CAAC,CAAC,CAAC,KAAK,EAAE,QAAQ,CAAC,CAAC;QACxE,IAAM, eAAe,GAAG,cAAc,CAAC,KAAK,CAAC,UAAU,CAAC,EAAE,CAAC,IAAK,OAAA,CAAC,KAAK,CAAC,GAA A,CAAC,CAAC;QACHe,IAAM,eAAe,GAAG,cAAc,CAAC,KAAK,CAAC,UAAU,CAAC,EAAE,CAAC,IAAK,O AAA,CAAC,KAAK,CAAC,GAAA,CAAC,CAAC;QACHe,IAAI,eAAe,IAAI,eAAe,EAAE;YACtC,UAAU,EAAE, CAAC;YACb,OAAO,GAAG,CAAC;SACZ;aAAM;YACL,MAAM,IAAI,KAAK,CACX,2CAA2C;iBAC3C,mBA AiB,CAAC,CAAC,KAAK,SAAI,UAAU,MAAG,CAAA,CAAC,CAAC;SACHe;KACF;IAED,OAAO,EAAC,UAA U,YAAA,EAAE,WAAW,EAAE,MAAM,EAAE,SAAS,WAAA,EAAE,UAAU,YAAA,EAAC,CAAC;AACIE;;ACx FA;;;;;;;AAqBA,IAAM,qBAAqB,GAAG,IAAI,CAAC;AAE5B,IAAM,SAAS,GACIB,wBAAwB,CAACC,Y AAG,EAAE,qBAAqB,CAAC;;ACxBxD;;;;;;;AAuBA,IAAI,QAEQ,CAAC;AAEb,SAAS,SAAS,CAAC,OAA oB;IACrC,QAAQ,GAAG,OAAO,CAAC,IAAI,CAAC,KAAK,CAACC,aAAI,EAAE,IAAI,aAAa;QACnD,OAAO; QACP,QAAQ;QACR,QAAQ;QACR,QAAQ;KACT,CAAC,CAAC;AACL,CAAC;AAED,SAAS,IAAI,CAAC,IAA kD;IACvD,IAAA,oBAAM,EAAE,sBAAO,CAAS;IAC/B,IAAM,GAAG,GAAG,OAAO,CAAC,UAAU,CAAC,MA AM,CAAC,CAAC,CAAC,CAAC,KAAK,EAAE,MAAM,CAAC,CAAC,CAAC,CAAC,KAAK,CAAC,CAAC;;IA GjE,IAAIJ,aAAI,CAAC,aAAa,CAAC,GAAG,CAAC,KAAK,CAAC,KAAK,CAAC,EAAE;QACvC,OAAO,GAAG ,CAAC;KACZ;IAED,IAAM,QAAQ,GAAG,MAAM,CAAC,GAAG,CAAC,UAAA,CAAC,IAAI,OAAA,OAAO,C AAC,SAAS,CAAC,GAAG,CAAC,CAAC,CAAC,MAAM,CAAC,CAAC,EAAE,GAAA,CAAC,CAAC;IACrE,IAA M,aAAa,GAAG,IAAI,UAAU,CAAC,IAAI,UAAU,CAAC,QAAQ,CAAC,CAAC,MAAM,CAAC,CAAC;IACtE,IA AM,KAAK,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,GAAG,CAAC,MAAM,CAAC,CAAC,EAAE,CA AC;IACnD,QAAQ,CAAC,aAAa,EAAE,QAAQ,CAAC,MAAM,EAAE,QAAQ,CAAC,GAAG,CAAC,KAAK,CAA C,EAAE,KAAK,CAAC,CAAC;IAErE,OAAO,GAAG,CAAC;AACb,CAAC;AAEM,IAAM,UAAU,GAaiB;IACtC, UAAU,EAAEI,aAAI;IACb,WAAW,EAAE,MAAM;IACnB,SAAS,WAAA;IACT,UAAU,EAAE,IAAwB;CACrC; ;AC1DD;;;;;;;SAsBgB,QAAQ,CAAC,IAAoD;IAE3D,IAAA,iBAAC,EAAG,sBAAO,CAAS;IACpC,IAAM,G AAG,GAAG,OAAO,CAAC,UAAU,CAAC,CAAC,CAAC,KAAK,EAAE,CAAC,CAAC,KAAK,CAAC,CAAC;IA CjD,IAAM,MAAM,GAAG,OAAO,CAAC,kBAaKB,CAAC,CAAC,CAAC,CAAC;IAC7C,IAAM,OAAO,GAAG, OAAO,CAAC,kBAaKB,CAAC,GAAG,CAAC,CAAC;IACbD,OAAO,CAAC,GAAG,CAAC,MAAM,CAAC,CAA C;IACpB,OAAO,GAAG,CAAC;AACb,CAAC;AAEM,IAAM,cAAc,GAaiB;IAC1C,UAAU,EAAEC,iBAAQ;IAC pB,WAAW,EAAE,MAAM;IACnB,UAAU,EAAE,QAA4B;CACzC;;ACpCD;;;;;;;AAwBA,IAAI,aAE4D,CA AC;AAEjE,SAASC,OAAK,CAAC,OAAoB;IACjC,aAAa,GAAG,OAAO,CAAC,IAAI,CAAC,KAAK,CAACC,kB AAS,EAAE,IAAI,aAAa;QAC7D,QAAQ;QACR,OAAO;QACP,QAAQ;QACR,QAAQ;QACR,QAAQ;QACR,OAA

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K;CACjB;;ACtHD;:::;AAqBA;:::;SAQgB,uBAAuB,CACnC,CAAA,EAAE,IAAQb,EAAE,OAAoB;IAM5  
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E,EAAC,IAAI,EAAE,YAAY,EAAC,EAAE,OAAO,SAAA,EAAC,CAAC,CAAC;QAEEnE,IAAM,GAAG,GAAG,O  
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D,IAAM,QAAQ,GAAGE,qBAAY,CAAC,iBAAiB,CAC3C,CAAC,CAAC,KAAK,EAAE,UAAU,EAAE,OAAO,EAAE,CAAC,kBAaKB,GAAG,EAAE,eAAe,CAAC,CAAC;IAE3E,IAAM,YAAY,GAAG,QAAQ,CAAC,YAAY,CAAC;IAC3C,IAAM,WAAW,GAAG,QAAQ,CAAC,WAAW,CAAC;IACzC,IAAM,MAAM,GAAG,QAAQ,CAAC,OAAO,CAAC,GAAG,CAAC;IACpC,IAAM,QAAQ,GAAG,QAAQ,CAAC,OAAO,CAAC,KAAK,CAAC;IACxC,IAAM,SAAS,GAAG,QAAQ,CAAC,OAAO,CAAC,MAAM,CAAC;IAC1C,IAAM,OAAO,GAAG,QAAQ,CAAC,OAAO,CAAC,IAAI,CAAC;IACtC,IAAM,cAAc,GAAG,QAAQ,CAAC,cAAc,CAAC;IAC/C,IAAM,aAAa,GAAG,QAAQ,CAAC,aAAa,CAAC;IAC7C,IAAM,YAAY,GAAG,QAAQ,CAAC,YAAY,CAAC;IAC3C,IAAM,WAAW,GAAG,QAAQ,CAAC,WAAW,CAAC;IACzC,IAAM,aAAa,GAAG,QAAQ,CAAC,UAAU,CAAC;IAC1C,IAAM,cAAc,GAAG,QAAQ,CAAC,WAAW,CAAC;IAE5C,IAAI,QAAQ,CAAC,UAAU,KAAK,cAAc,EAAE;QAC1C,MAAM,IAAI,KAAK,CACX,4CAA4C;aACzC,QAAQ,CAAC,UAAU,kCAA+B,CAAA,CAAC,CAAC;KAC5D;IAED,IAAM,GAAG,GAAG,OAAO,CAAC,UAAU,CAAC,QAAQ,CAAC,QAAQ,EAAE,SAAS,CAAC,CAAC;IAC7D,IAAM,KAAK,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,GAAG,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;IAEnD,WAAW,CACP,GAAG,EAAE,CAAC,CAAC,KAAK,CAAC,CAAC,CAAC,EAAE,CAAC,CAAC,KAAK,CAAC,CAAC,CAAC,EAAE,CAAC,CAAC,KAAK,CAAC,CAAC,CAAC,EAAE,YAAY,EAAE,WAAW,EACIE,MAAM,EAAE,QAAQ,EAAE,SAAS,EAAE,OAAO,EAAE,cAAc,EAAE,aAAa,EACnE,YAAY,EAAE,WAAW,EAAE,aAAa,EAAE,cAAc,EAAE,KAAK,CAAC,CAAC;IACrE,OAAO,GAAG,CAAC;AACb,CAAC;AAEM,IAAM,aAAa,GAaIB;IACzC,UAAU,EAAEuD,gBAAO;IACnB,WAAW,EAAE,MAAM;IACnB,SAAS,EAAEnD,OAAK;IAChB,UAAU,EAAE,OAA2B;CACxC;;AC5GD;::::::::::AAwBA,IAAI,QAAKE,CAAC;AAEvE,SAASA,OAAK,CAAC,OAAoB;IACjC,QAAQ;QACJ,OAAO,CAAC,IAAI,CAAC,KAAK,CAACoD,aAAI,EAAE,IAAI,WAAW,CAAC,wBAAwB,CAAC,CAAC,CAAC;AAC1E,CAAC;SAEe,IAAI,CAChB,IAaKE;IAE7D,IAAA,sBAAO,EAAE,oBAAM,EAAE,kBAaK,CAAS;IAC/B,IAAA,iBAAI,EAAE,yBAAQ,CAAU;IACxB,IAAA,YAAC,CAAW;IACnB,IAAM,GAAG,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,CAAC,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;IAC/C,IAAI,OAAO,GAAG,GAAG,CAAC;IACIB,IAAI,KAAK,GAAG,CAAC,CAAC;IAER,IAAA,8CACuC,EADtC,0BAAU,EAAE,cAAI,EAAE,8BAAY,EAAE,0CACM,CAAC;IAE9C,IAAI,aAAa,GAAG,IAAI,CAAC;IACzB,IAAI,kBAaKB,EAAE;QACtB,IAAM,YAAY,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,UAAU,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;QACjE,IAAI,YAAY,KAAK,GAAG,EAAE;;YAGxB,KAAK,GAAG,UAAU,CAAC;YACnB,OAAO,GAAG,YAAY,CAAC;YACvB,aAAa,GAAGxD,qBAAY,CAAC,gBAAGB,CACzC,aAAa,CAAC,MAAM,EAAE,KAAK,CAAC,KAAK,CAAC,MAAM,CAAC,CAAC;SAC/C;KACF;IAEDA,qBAAY,CAAC,0BAA0B,CACnC,MAAM,EAAE,aAAa,EAAE,KAAK,CAAC,KAAK,CAAC,MAAM,CAAC,CAAC;IACzC,IAAA,gFACgE,EAD/D,gBAAQ,EAAE,mBACqD,CAAC;IACvE,IAAM,UAAU,GAAGF,aAAI,CAAC,aAAa,CAAC,WAAW,CAAC,CAAC;IACnD,IAAI,WAAW,GAAG,KAAK,CAAC;IACxB,IAAI,KAAK,CAAC,KAAK,KAAK,SAAS,EAAE;QAC7B,WAAW;YACP,IAAI,CAAC,EAAC,OAAO,SAAA,EAAE,MAAM,EAAE,EAAC,CAAC,EAAE,KAAK,EAAC,EAAE,KAAK,EAAE,EAAC,KAAK,EAAE,SAAS,EAAC,EAAC,CAAC,CAAC;QACnE,OAAO,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,WAAW,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;KACxD;IAED,IAAM,GAAG,GAAG,OAAO,CAAC,UAAU,CAAC,QAAQ,EAAE,SAAS,CAAC,CAAC;IACpD,IAAIA,aAAI,CAAC,aAAa,CAAC,KAAK,CAAC,KAAK,CAAC,KAAK,CAAC,EAAE;QACzC,IAAM,KAAK,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,GAAG,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;QACnD,QA AQ,CAAC,OAAO,EAAE,UAAU,EAAE,KAAK,CAAC,CAAC;KACtC;IAED,IAAI,kBAaKB,EAAE;;QAEtB,OA AO,CAAC,WAAW,CAAC,UAAU,CAAC,MAAM,CAAC,CAAC;KACxC;IAED,IAAI,QAAQ,EAAE;;QAEZ,IAA M,QAAQ,GAAGE,qBAAY,CAAC,oBAAoB,CAAC,GAAG,CAAC,KAAK,EAAE,YAAY,CAAC,CAAC;QAC5E,GAAG,CAAC,KAAK,GAAG,QAAQ,CAAC;KACtB;IAED,IAAI,KAAK,CAAC,KAAK,KAAK,SAAS,EAAE;QA C7B,OAAO,CAAC,WAAW,CAAC,WAAW,CAAC,MAAM,CAAC,CAAC;KACzC;IAED,OAAO,GAAG,CAAC; AACb,CAAC;AAEM,IAAM,UAAU,GAaIB;IACtC,UAAU,EAAEwD,aAAI;IAChB,WAAW,EAAE,MAAM;IAC nB,SAAS,EAAEpD,OAAK;IACnB,UAAU,EAAE,IAAwB;CACrC;;ACIGD;::::::::::AAwBA,IAAI,OACI,CAA C;AAET,SAASA,OAAK,CAAC,OAAoB;IACjC,OAAO,GAAG,OAAO,CAAC,IAAI,CAAC,KAAK,CAACqD,YA AG,EAAE,IAAI,WAAW;QAC/C,QAAQ;QACR,QAAQ;QACR,QAAQ;QACR,QAAQ;QACT,CAAC,CAAC;AA CL,CAAC;AAED,SAAS,GAAG,CAAC,IAAgE;IAEpE,IAAA,sBAAO,EAAE,oBAAM,EAAE,kBAaK,CAAS;IA C/B,IAAA,iBAAI,EAAE,yBAAQ,CAAU;IACxB,IAAA,YAAC,CAAW;IACnB,IAAM,GAAG,GAAG,OAAO,CA

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Found  
in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-

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No license file was found, but licenses were detected in source scan.

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the License.\n *
=====
*\n\nimport {KernelConfig, KernelFunc, ZerosLike, ZerosLikeInputs} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from '../backend_wasm';\n\nfunction zerosLike(args: {inputs: ZerosLikeInputs, backend:
BackendWasm}) {\n const {inputs: {x}, backend} = args;\n const out = backend.makeOutput(x.shape, x.dtype);\n
const outVals = backend.typedArrayFromHeap(out);\n outVals.fill(0);\n return out;\n}\n\nexport const
zerosLikeConfig: KernelConfig = {\n kernelName: ZerosLike,\n backendName: 'wasm',\n kernelFunc: zerosLike
as { } as KernelFunc,\n};\n"}

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Found in path(s):

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/opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/ZerosLike.js.map

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```
=====\n*\n\nimport { KernelConfig, KernelFunc, NonMaxSuppressionV4, NonMaxSuppressionV4Attrs,
NonMaxSuppressionV4Inputs, TensorInfo } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from
 './backend_wasm';\nimport { parseResultStruct } from './NonMaxSuppression_util';\n\nlet wasmFunc: (\n boxesId: number, scoresId: number, maxOutputSize: number,\n iouThreshold: number, scoreThreshold: number,\n padToMaxOutputSize: boolean) => number;\n\nfunction setup(backend: BackendWasm): void {\n wasmFunc =
 backend.wasm.cwrap(\n NonMaxSuppressionV4,\n 'number', // Result*\n [\n 'number', // boxesId\n 'number', // scoresId\n 'number', // maxOutputSize\n 'number', //
 iouThreshold\n 'number', // scoreThreshold\n 'bool', // padToMaxOutputSize\n]);\n\n function
 nonMaxSuppressionV4(args: {\n backend: BackendWasm,\n inputs: NonMaxSuppressionV4Inputs,\n attrs:
 NonMaxSuppressionV4Attrs\n }): TensorInfo[] {\n const { backend, inputs, attrs } = args;\n const { iouThreshold,
 maxOutputSize, scoreThreshold, padToMaxOutputSize } =\n attrs;\n const { boxes, scores } = inputs;\n const
 boxesId = backend.dataIdMap.get(boxes.dataId).id;\n const scoresId =
 backend.dataIdMap.get(scores.dataId).id;\n const resOffset = wasmFunc(\n boxesId, scoresId, maxOutputSize,
 iouThreshold, scoreThreshold,\n padToMaxOutputSize);\n const { pSelectedIndices, selectedSize,
 pSelectedScores, pValidOutputs } =\n parseResultStruct(backend, resOffset);\n // Since we are not using scores
 for V4, we have to delete it from the heap.\n backend.wasm._free(pSelectedScores);\n const
 selectedIndicesTensor =\n backend.makeOutput([selectedSize],
 'int32', pSelectedIndices);\n const validOutputsTensor =
 backend.makeOutput([], 'int32', pValidOutputs);\n return [selectedIndicesTensor, validOutputsTensor];\n }\n\n export const nonMaxSuppressionV4Config:
 KernelConfig = {\n kernelName: NonMaxSuppressionV4,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: nonMaxSuppressionV4 as { } as KernelFunc,\n };*\n}
```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-  
wasm/dist/kernels/NonMaxSuppressionV4.js.map

No license file was found, but licenses were detected in source scan.

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```
=====\n*\n\nimport {backend_util, Conv2D, Conv2DAttrs, Conv2DInputs, KernelConfig, KernelFunc, Tensor4D} from
'@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nlet wasmConv2d: (\n xId:
number, batchSize: number, inputHeight: number, inputWidth: number,\n filterId: number, filterHeight: number,
filterWidth: number, padTop: number, padRight: number, padBottom: number, padLeft: number, isSamePad:
number,\n dilationHeight: number, dilationWidth: number, strideHeight: number, strideWidth: number,
inputChannels: number, outputChannels: number, outId: number) => void;\n\nfunction setup(backend:
BackendWasm) {\n wasmConv2d = backend.wasm.cwrap(Conv2D,
 null /* void */, [\n 'number', // xId\n 'number', // batchSize\n 'number', // inputHeight\n 'number', // inputWidth\n 'number', // filterId\n 'number', // filterHeight\n 'number', // filterWidth\n 'number', // padTop\n 'number', // padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', // isSamePad\n 'number', // dilationHeight\n 'number', // dilationWidth\n 'number', // strideHeight\n 'number', // strideWidth\n 'number', // inputChannels\n 'number', // outputChannels\n 'number', // outId\n]);\n\n function conv2d(\n args: {inputs: Conv2DInputs, backend: BackendWasm, attrs: Conv2DAttrs}) {\n const {inputs, attrs, backend} = args;\n const {x, filter} = inputs;\n const xId =
backend.dataIdMap.get(x.dataId).id;\n const filterId = backend.dataIdMap.get(filter.dataId).id;\n const {strides,
dilations, pad, dimRoundingMode, dataFormat} = attrs;\n const $dataFormat =
backend_util.convertConv2DDataFormat(dataFormat);\n
```

```

const convInfo = backend_util.computeConv2DInfo(\n (x as Tensor4D).shape, (filter as Tensor4D).shape,
strides, dilations,\n pad, dimRoundingMode, false, $dataFormat);\n\n const filterHeight =
convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const
padRight = convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n const padLeft =
convInfo.padInfo.left;\n const dilationHeight = convInfo.dilationHeight;\n const dilationWidth =
convInfo.dilationWidth;\n const strideHeight = convInfo.strideHeight;\n const strideWidth =
convInfo.strideWidth;\n const inputChannels = convInfo.inChannels;\n const outputChannels =
convInfo.outChannels;\n const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;\n\n if
(convInfo.dataFormat !== 'channelsLast') {\n throw new Error(\n `wasm backend Conv2D does not support
dataFormat:` +\n `${convInfo.dataFormat}`. Please
use 'channelsLast'.`);\n } \n\n const out = backend.makeOutput(convInfo.outShape, 'float32');\n const outId =
backend.dataIdMap.get(out.dataId).id;\n\n wasmConv2d(\n xId, x.shape[0], x.shape[1], x.shape[2], filterId,
filterHeight,\n filterWidth, padTop, padRight, padBottom, padLeft, isSamePad,\n dilationHeight,
dilationWidth, strideHeight, strideWidth, inputChannels,\n outputChannels, outId);\n return out;\n}\n\nexport
const conv2DConfig: KernelConfig = {\n kernelName: Conv2D,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: conv2d as { } as KernelFunc\n};\n"}

```

Found in path(s):

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* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
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```
=====\n*\n\nimport { All, AllAttrs, AllInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util } from\n '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport\n {permuteAxesAndTranspose} from './kernel_utils';\nlet\n wasmAll: (xId: number, reduceSize: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm):\n void {\n wasmAll = backend.wasm.cwrap(All, null /*void*/, ['number, number, number']);\n}\n\nfunction all(args:\n {backend: BackendWasm, inputs: AllInputs, attrs: AllAttrs}):\n TensorInfo {\n const {backend, inputs, attrs} =\n args;\n const {axis, keepDims} = attrs;\n const {x} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n const {transposed, axes, originalAxes, inputWasTransposed} =\n permuteAxesAndTranspose(x, axis, backend);\n if (inputWasTransposed) {\n const transposedId =\n backend.dataIdMap.get(transposed.dataId).id;\n input = transposed;\n inputId = transposedId;\n }\n const\n inputRank = input.shape.length;\n backend_util.assertAxesAreInnerMostDims('all', axes, inputRank);\n const\n [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, axes);\n const\n reduceSize\n = util.sizeFromShape(reduceShape);\n const out = backend.makeOutput(outShape, x.dtype);\n if\n (util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmAll(inputId, reduceSize, outId);\n }\n if (inputWasTransposed) {\n // dispose of the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n if (keepDims) {\n // reshape\n const newShape =\n backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n return\n out;\n}\n\nexport const allConfig: KernelConfig = {\n kernelName: All,\n backendName: 'wasm',\n setupFunc:\n setup,\n kernelFunc: all as {} as KernelFunc\n};\n"}\n
```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/All.js.map

No license file was found, but licenses were detected in source scan.

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```
=====\n*\n\nimport { backend_util, KernelConfig, KernelFunc, Slice, slice_util, SliceAttrs, SliceInputs, TypedArray, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { sliceImplCPU } from '../kernel_utils/shared';\nexport function slice(\n args: { inputs: SliceInputs, attrs: SliceAttrs, backend: BackendWasm }) {\n const { inputs: { x }, attrs: { begin, size }, backend } = args;\n const [begin_, size_] = slice_util.parseSliceParams(x, begin, size);\n const isContinuous = slice_util.isSliceContinuous(x.shape, begin_, size_);\n\n const xVals = backend.readSync(x.dataId);\n const out = backend.makeOutput(size_, x.dtype);\n const xStrides = util.computeStrides(x.shape);\n const outData = backend.dataIdMap.get(out.dataId);\n if (isContinuous) {\n const flatOffset = slice_util.computeFlatOffset(begin_, xStrides);\n if (x.dtype === 'string') {\n outData.stringBytes =\n (xVals as Uint8Array[]).slice(flatOffset, flatOffset +\n util.sizeFromShape(size_));\n } else {\n const outVals = backend.typedArrayFromHeap(out);\n outVals.set(\n (xVals as TypedArray).subarray(flatOffset, flatOffset +\n util.sizeFromShape(size_));\n);\n return out;\n }\n if (x.dtype === 'string') {\n const res = sliceImplCPU(xVals, begin_, size_, x.shape, x.dtype);\n outData.stringBytes = res as Uint8Array[];\n return out;\n }\n const outVals = backend.typedArrayFromHeap(out);\n const rank = x.shape.length;\n if (rank === 2) {\n slice2d(\n xVals as TypedArray, xStrides[0], outVals, begin_ as [number, number],\n size_ as [number, number]);\n } else if (rank === 3) {\n slice3d(\n xVals as TypedArray, xStrides[0], xStrides[1], outVals,\n begin_ as [number, number, number], size_ as [number, number, number]);\n } else if (rank === 4) {\n slice4d(\n xVals as TypedArray, xStrides[0], xStrides[1], xStrides[2], outVals,\n begin_ as [number, number, number, number],\n size_ as [number, number, number, number]);\n } else {\n const res =\n sliceImplCPU(xVals, begin_, size_, x.shape, x.dtype) as TypedArray;\n outVals.set(res);\n }\n return out;\n }\n\n function slice2d(\n xVals: backend_util.TypedArray, xStride: number,\n outVals: backend_util.TypedArray, begin: [number, number],\n size: [number, number]): void {\n let outOffset = 0;\n const beginI = begin[0];\n const beginJ = begin[1];\n const endI = beginI + size[0];\n for (let i = beginI; i < endI; i++) {\n const xOffset = i * xStride + beginJ;\n outVals.set(xVals.subarray(xOffset, xOffset + size[1]),\n outOffset);\n outOffset += size[1];\n }\n }\n\n function slice3d(\n xVals: backend_util.TypedArray, xStride1:\n number, xStride2: number,\n outVals: backend_util.TypedArray, begin: [number, number, number],\n size: [number, number, number]): void {\n let outOffset = 0;\n const beginI = begin[0];\n const beginJ = begin[1];\n const beginK = begin[2];\n const endI = beginI + size[0];\n const endJ = beginJ + size[1];\n for (let i = beginI; i < endI; i++) {\n for (let j = beginJ; j < endJ; j++) {\n const xOffset = i * xStride1 + j * xStride2 + beginK;\n outVals.set(xVals.subarray(xOffset, xOffset + size[2]),\n outOffset);\n outOffset += size[2];\n }\n }\n }\n\n function slice4d(\n xVals: backend_util.TypedArray, xStride1: number, xStride2: number,\n xStride3: number, outVals: backend_util.TypedArray,\n begin: [number, number, number, number],\n size: [number, number, number, number]): void {\n let outOffset = 0;\n const beginI = begin[0];\n const beginJ = begin[1];\n const beginK = begin[2];\n const endI = beginI + size[0];\n const endJ = beginJ + size[1];\n const endK = beginK + size[2];\n const beginL = begin[3];\n for (let i = beginI; i < endI; i++) {\n for (let j = beginJ; j < endJ; j++) {\n for (let k = beginK; k < endK; k++) {\n const xOffset = i * xStride1 + j * xStride2 + k * xStride3 + beginL;\n outVals.set(xVals.subarray(xOffset, xOffset + size[3]),\n outOffset);\n outOffset += size[3];\n }\n }\n }\n }\n\n export const sliceConfig: KernelConfig = {\n kernelName: Slice,\n backendName: 'wasm',\n kernelFunc: slice as { } as KernelFunc,\n };\n}
```

Found in path(s):



```
'number', // exclusive\n 'number', // reverse\n 'number', // final_dim\n 'number', // out_id\n 'number' //
dtype\n]);\n}\n\nexport function cumsum(\n args: {inputs: CumsumInputs, backend: BackendWasm, attrs:
CumsumAttrs});\nTensorInfo {\n const {inputs, backend, attrs} = args;\n
const {x} = inputs;\n const {axis, exclusive, reverse} = attrs;\n const xRank = x.shape.length;\n\n
util.assert(x.dtype === 'float32' || x.dtype === 'int32',\n () => `cumsum does not support ${x.dtype} tensors in the
WASM backend`);\n // permute required axis to inner most axis\n const permutation =
backend_util.getAxesPermutation([axis], xRank);\n let permutedX = x;\n if (permutation !== null) {\n
permutedX = transpose({inputs: {x}, attrs: {perm: permutation}, backend});\n }\n const permutedAxis =
backend_util.getInnerMostAxes(1, xRank)[0];\n backend_util.assertAxesAreInnerMostDims('cumsum',
[permutedAxis], xRank);\n\n const permutedOut = backend.makeOutput(permutedX.shape, permutedX.dtype);\n
const finalDim = permutedX.shape[permutedAxis];\n const permutedXId =
backend.dataIdMap.get(permutedX.dataId).id;\n const permutedOutId =
backend.dataIdMap.get(permutedOut.dataId).id;\n wasmCumsum(permutedXId, exclusive ? 1 : 0, reverse ? 1 : 0,
finalDim,\n
permutedOutId, CppDType[x.dtype]);\n\n // transpose data back if permuted\n let out = permutedOut;\n if
(permutation !== null) {\n const undoPermutation = backend_util.getUndoAxesPermutation(permutation);\n out
= transpose(\n {inputs: {x: permutedOut}, attrs: {perm: undoPermutation}, backend});\n
backend.disposeData(permutedX.dataId);\n backend.disposeData(permutedOut.dataId);\n }\n return
out;\n}\n\nexport const cumsumConfig: KernelConfig = {\n kernelName: Cumsum,\n backendName: 'wasm',\n
setupFunc: setup,\n kernelFunc: cumsum as {} as KernelFunc\n};\n"]}
```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Cumsum.js.map

No license file was found, but licenses were detected in source scan.

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agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
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=====\n
*\n\nimport {Add, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from
'/binary_kernel';\n\nconst supportsFullBroadcast = true;\n\nexport const addConfig: KernelConfig =\ncreateBinaryKernelConfig(Add, supportsFullBroadcast);\n"]}
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Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Add.js.map

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```
=====\n*\n\nimport {KernelConfig, KernelFunc, scatter_util, ScatterNd, ScatterNdAttrs, ScatterNdInputs, TensorInfo, util}
from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {CppDType} from
 './types';\nlet wasmScatterNd: (\n indicesId: number, updatesId: number, dtype: CppDType, sliceRank:
 number,\n numUpdates: number, sliceSize: number, strides: Uint8Array,\n outputSize: number, outId: number)
=> void;\nfunction setup(backend: BackendWasm): void {\n wasmScatterNd = backend.wasm.cwrap(ScatterNd,
 null /*void*/, [\n 'number', // indicesId\n 'number', // updatesId\n 'number', // dtype\n 'number', //
 sliceRank\n 'number', // numUpdates\n 'number', // sliceSize\n 'array', // strides\n 'number', // outputSize\n 'number' // outId\n]);\n\n function scatterNd(\n args: {\n backend: BackendWasm, inputs:
 ScatterNdInputs, attrs: ScatterNdAttrs\n }): TensorInfo {\n const {backend, inputs, attrs} = args;\n const {indices,
 updates} = inputs;\n const {shape} = attrs;\n\n const out = backend.makeOutput(shape, updates.dtype);\n if
(util.sizeFromShape(shape) === 0) {\n return out;\n }\n const {sliceRank, numUpdates, sliceSize, strides,
 outputSize} =\n scatter_util.calculateShapes(updates, indices, shape);\n const indicesData =
 backend.dataIdMap.get(indices.dataId);\n const indicesId = indicesData.id;\n const updatesData =
 backend.dataIdMap.get(updates.dataId);\n const updatesId = updatesData.id;\n const
 stridesBytes = new Uint8Array(new Int32Array(strides).buffer);\n const outId =
 backend.dataIdMap.get(out.dataId).id;\n wasmScatterNd(\n indicesId, updatesId, CppDType[updates.dtype],
 sliceRank, numUpdates,\n sliceSize, stridesBytes, outputSize, outId);\n return out;\n }\n\n export const
 scatterNdConfig: KernelConfig = {\n kernelName: ScatterNd,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: scatterNd as {} as KernelFunc\n };\n}
```



Found in path(s):

```
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/ScatterNd.js.map
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No license file was found, but licenses were detected in source scan.

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```

```
 * =====\n *\n * \n\nimport { KernelConfig, KernelFunc, TensorInfo, Transform, TransformAttrs, TransformInputs, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\n\nlet wasmTransform: (\n imageId: number, transformsId: number, isBatchTransform: boolean,\n batch: number, outHeight: number, outWidth: number, numChannels: number,\n imageWidth: number, imageHeight: number, strides: Uint8Array,\n stridesLength: number, interpolationModeId: number, fillModeId: number,\n fillValue: number, outId: number)
```

```

=> void;\n\nfunction setup(backend: BackendWasm): void {\n wasmTransform = backend.wasm.cwrap(Transform,
null /*void*/, [\n 'number', // imageId\n 'number', // transformsId\n 'bool', // isBatchTransform\n 'number', // batch\n 'number', // outHeight\n 'number', // outWidth\n 'number', // numChannels\n 'number', //
imageWidth\n 'number',
 // imageHeight\n 'array', // strides\n 'number', // stridesLength\n 'number', // interpolationModeId\n
'number', // fillModeId\n 'number', // fillValue\n 'number' // outId\n]);\n\nfunction transform(\n args:\n {backend: BackendWasm, inputs: TransformInputs, attrs: TransformAttrs}):\n TensorInfo {\n const {backend,
inputs, attrs} = args;\n const {image, transforms} = inputs;\n const {interpolation, fillMode, fillValue,
outputShape} = attrs;\n\n const [batch, imageHeight, imageWidth, numChannels] = image.shape;\n const
[outHeight, outWidth] =\n outputShape != null ? outputShape : [imageHeight, imageWidth];\n const outShape
=\n [batch, outHeight, outWidth,\n numChannels] as [number, number, number, number];\n const strides =\n new Uint8Array(new Int32Array(util.computeStrides(image.shape)).buffer);\n\n const out =
backend.makeOutput(outShape, image.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const
imageData = backend.dataIdMap.get(image.dataId);\n const imageId = imageData.id;\n\n const
transformsData = backend.dataIdMap.get(transforms.dataId);\n const transformsId = transformsData.id;\n\n const
interpolationModeId = interpolation === 'nearest' ? 1 : 2;\n let fillModeId;\n switch (fillMode) {\n case
'constant':\n fillModeId = 1;\n break;\n case 'reflect':\n fillModeId = 2;\n break;\n case 'wrap':\n
fillModeId = 3;\n break;\n case 'nearest':\n fillModeId = 4;\n break;\n default:\n fillModeId = 1;\n
break;\n }\n\n wasmTransform(\n imageId, transformsId, (transforms.shape[0] > 1), batch, outHeight,\n
outWidth, numChannels, imageWidth, imageHeight, strides,\n image.shape.length - 1, interpolationModeId,
fillModeId, fillValue,\n outId);\n\n return out;\n}\n\nexport const transformConfig: KernelConfig = {\n
kernelName: Transform,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc:
transform as {} as KernelFunc\n};\n"}

```

Found in path(s):

```

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
wasm/dist/kernels/Transform.js.map

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No license file was found, but licenses were detected in source scan.

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2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing
permissions and\n * limitations under the License.\n *
=====
*\n\nimport {KernelConfig, Multiply} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
'./binary_kernel';\n\nconst supportsFullBroadcast = true;\nexport const multiplyConfig: KernelConfig =\ncreateBinaryKernelConfig(Multiply, supportsFullBroadcast);\n"}

```

Found in path(s):

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* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
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```
=====\n
*/\n\nimport { ClipByValue, ClipByValueAttrs, ClipByValueInputs, KernelConfig, KernelFunc } from
 '@tensorflow/tfjs-core';\n\nimport { BackendWasm }
 from './backend_wasm';\n\nlet wasmClip: (xId: number, min: number, max: number, outId: number) =>
 void;\n\nfunction setup(backend: BackendWasm) {\n wasmClip = backend.wasm.cwrap(ClipByValue, null /* void
 */, [\n 'number', // x_id\n 'number', // min\n 'number', // max\n 'number' // out_id\n]);\n\n function
 clip(args: {\n inputs: ClipByValueInputs,\n backend: BackendWasm,\n attrs: ClipByValueAttrs\n }) {\n const
 {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {clipValueMin, clipValueMax} = attrs;\n const xId =
 backend.dataIdMap.get(x.dataId).id;\n const out = backend.makeOutput(x.shape, x.dtype);\n const outId =
 backend.dataIdMap.get(out.dataId).id;\n wasmClip(xId, clipValueMin, clipValueMax, outId);\n return
 out;\n }\n\n export const clipByValueConfig: KernelConfig = {\n kernelName: ClipByValue,\n backendName:
 'wasm',\n setupFunc: setup,\n kernelFunc: clip as {} as KernelFunc\n };
}
```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/ClipByValue.js.map

No license file was found, but licenses were detected in source scan.

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```
=====\n*\n\nimport { KernelConfig, KernelFunc, Sigmoid, SigmoidInputs, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\n\nlet wasmFunc:\n\n(xId: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(Sigmoid, null /* void */, ['number', 'number']);\n\n function sigmoid(args: { backend: BackendWasm, inputs: SigmoidInputs }):\n TensorInfo {\n const { backend, inputs: { x } } = args;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out = backend.makeOutput(x.shape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n // Short-circuit zero-sized tensors.\n if (util.sizeFromShape(out.shape) === 0) {\n return out;\n }\n\n wasmFunc(xId, outId);\n return out;\n }\n\n export const sigmoidConfig:\n KernelConfig = {\n kernelName: 'Sigmoid',\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: sigmoid\n } as KernelFunc;\n}"}\n\n}
```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Sigmoid.js.map

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,OAAO,CAAC,GAAG,CAAC,CAAC,CAAC,uCAAuC,IAAI,GAAG,CAAC,CAAC;aAC/D;YACD,QAAQ,CAAC,

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+BAA+B,CAAC,CAAC;KACID;IACD,OAAO,kBAaKB,CAAC;AAC5B,CAAC", "sourcesContent":["/*\n
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"AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n *
See the License for the specific language governing permissions and\n * limitations under the License.\n *
=====*\n
*/\nimport './flags_wasm';\n\nimport {backend_util, BackendTimingInfo, DataStorage, DataType, deprecationWarn,
engine, env, KernelBackend, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasmModule,
WasmFactoryConfig} from './wasm-out/tfjs-backend-wasm';\nimport {BackendWasmThreadedSimdModule} from
'./wasm-out/tfjs-backend-wasm-threaded-simd';\nimport wasmFactoryThreadedSimd from './wasm-out/tfjs-
backend-wasm-threaded-simd.js';\n// @ts-ignore\nimport {wasmWorkerContents} from './wasm-out/tfjs-backend-
wasm-threaded-simd.worker.js';\nimport wasmFactory from './wasm-out/tfjs-backend-wasm.js';\n\ninterface
TensorData {\n id: number;\n memoryOffset: number;\n shape: number[];\n dtype:
DataType;\n refCount: number;\n /** Only used for string tensors, storing encoded bytes. */\n stringBytes?:
Uint8Array[];\n}\n\nexport type DataId = object; // object instead of {} to force non-primitive.\n\nexport class
BackendWasm extends KernelBackend {\n // 0 is reserved for null data ids.\n private dataIdNextNumber = 1;\n dataIdMap: DataStorage<TensorData>;\n\n constructor(public wasm:
BackendWasmModule|BackendWasmThreadedSimdModule) {\n super();\n this.wasm.tfjs.initWithThreadsCount(threadsCount);\n actualThreadsCount = this.wasm.tfjs.getThreadsCount();\n this.dataIdMap = new DataStorage(this, engine());\n }\n\n write(values: backend_util.BackendValues, shape:
number[], dtype: DataType):\n DataId {\n const dataId = {id: this.dataIdNextNumber++};\n this.move(dataId, values, shape, dtype, 1);\n return dataId;\n }\n\n numDataIds(): number {\n return
this.dataIdMap.numDataIds();\n }\n\n async time(f: () => void): Promise<BackendTimingInfo>\n {\n const start = util.now();\n f();\n const kernelMs = util.now() - start;\n return {kernelMs};\n }\n\n move(\n dataId: DataId, values: backend_util.BackendValues, shape: number[],\n dtype: DataType, refCount:
number): void {\n const id = this.dataIdNextNumber++;\n if (dtype === 'string') {\n const stringBytes =
values as Uint8Array[];\n this.dataIdMap.set(\n dataId,\n {id, stringBytes, shape, dtype,
memoryOffset: null, refCount});\n return;\n }\n\n const size = util.sizeFromShape(shape);\n const
numBytes = size * util.bytesPerElement(dtype);\n const memoryOffset = this.wasm._malloc(numBytes);\n\n this.dataIdMap.set(dataId, {id, memoryOffset, shape, dtype, refCount});\n\n this.wasm.tfjs.registerTensor(id, size,
memoryOffset);\n\n if (values != null) {\n this.wasm.HEAPU8.set(\n new Uint8Array(\n (values

```

```

as backend_util.TypedArray).buffer,\n (values as backend_util.TypedArray).byteOffset,\n numBytes),\n memoryOffset);\n }\n }\n async read(dataId: DataId):
Promise<backend_util.BackendValues> {\n return this.readSync(dataId);\n }\n readSync(dataId: DataId):
backend_util.BackendValues {\n const {memoryOffset, dtype, shape, stringBytes} =\n this.dataIdMap.get(dataId);\n if (dtype === 'string') {\n return stringBytes;\n }\n const bytes =
this.wasm.HEAPU8.slice(\n memoryOffset,\n memoryOffset + util.sizeFromShape(shape) *
util.bytesPerElement(dtype));\n return typedArrayFromBuffer(bytes.buffer, dtype);\n }\n /**\n * Dispose the
memory if the dataId has 0 refCount. Return true if the memory\n * is released, false otherwise.\n * @param
dataId\n * @param force Optional, remove the data regardless of refCount\n */\n disposeData(dataId: DataId,
force = false): boolean {\n if (this.dataIdMap.has(dataId)) {\n const data = this.dataIdMap.get(dataId);\n data.refCount--;\n if (!force && data.refCount > 0) {\n return false;\n }\n this.wasm._free(data.memoryOffset);\n this.wasm.tfjs.disposeData(data.id);\n this.dataIdMap.delete(dataId);\n }\n return true;\n }\n /** Return
refCount of a `TensorData`. */\n refCount(dataId: DataId): number {\n if (this.dataIdMap.has(dataId)) {\n const tensorData = this.dataIdMap.get(dataId);\n return tensorData.refCount;\n }\n return 0;\n }\n incRef(dataId: DataId) {\n const data = this.dataIdMap.get(dataId);\n if (data != null) {\n data.refCount++;\n }\n }\n floatPrecision(): 32 {\n return 32;\n }\n // Returns the memory offset of a tensor. Useful for
debugging and unit\n // testing.\n getMemoryOffset(dataId: DataId): number {\n return
this.dataIdMap.get(dataId).memoryOffset;\n }\n dispose() {\n this.wasm.tfjs.dispose();\n if ('PThread' in
this.wasm) {\n this.wasm.PThread.terminateAllThreads();\n }\n this.wasm
= null;\n }\n memory() {\n return {unreliable: false};\n }\n /**\n * Make a tensor info for the output of an
op. If `memoryOffset` is not\n * present, this method allocates memory on the WASM heap. If `memoryOffset`\n * is present, the memory was allocated elsewhere (in c++) and we just record\n * the pointer where that memory
lives.\n */\n makeOutput(shape: number[], dtype: DataType, memoryOffset?: number):
TensorInfo {\n let
dataId: {};\n if (memoryOffset == null) {\n dataId = this.write(null /* values */, shape, dtype);\n } else {\n const id = this.dataIdNextNumber++;\n dataId = {id};\n this.dataIdMap.set(dataId, {id, memoryOffset, shape,
dtype, refCount: 1});\n const size = util.sizeFromShape(shape);\n this.wasm.tfjs.registerTensor(id, size,
memoryOffset);\n }\n return {dataId, shape, dtype};\n }\n typedArrayFromHeap({shape, dtype, dataId}:
TensorInfo):
backend_util.TypedArray {\n const buffer
= this.wasm.HEAPU8.buffer;\n const {memoryOffset} = this.dataIdMap.get(dataId);\n const size =
util.sizeFromShape(shape);\n switch (dtype) {\n case 'float32':\n return new Float32Array(buffer,
memoryOffset, size);\n case 'int32':\n return new Int32Array(buffer, memoryOffset, size);\n case 'bool':\n return new Uint8Array(buffer, memoryOffset, size);\n default:\n throw new Error(`Unknown dtype
${dtype}`);\n }\n }\n function createInstantiateWasmFunc(path: string) {\n // this will be replace by rollout
plugin patchWechatWebAssembly in\n // miniprogram's output.\n // tslint:disable-next-line:no-any\n return
(imports: any, callback: any) => {\n util.fetch(path, {credentials: 'same-origin'}).then((response) => {\n if
(!response['ok']) {\n imports.env.a(`failed to load wasm binary file at '${path}'`);\n }\n response.arrayBuffer().then(binary => {\n WebAssembly.instantiate(binary, imports).then(output
=> {\n callback(output.instance, output.module);\n });\n });\n });\n return {};\n });\n }\n /**\n * Returns the path of the WASM binary.\n * @param simdSupported whether SIMD is supported\n * @param
threadsSupported whether multithreading is supported\n * @param wasmModuleFolder the directory containing the
WASM binaries.\n */\n function getPathToWasmBinary(\n simdSupported: boolean, threadsSupported: boolean,\n wasmModuleFolder: string) {\n if (wasmPath != null) {\n // If wasmPath is defined, the user has supplied a full
path to\n // the vanilla .wasm binary.\n return wasmPath;\n }\n let path: WasmBinaryName = 'tfjs-backend-
wasm.wasm';\n if (simdSupported && threadsSupported) {\n path = 'tfjs-backend-wasm-threaded-simd.wasm';\n } else if (simdSupported) {\n path = 'tfjs-backend-wasm-simd.wasm';\n }\n if (wasmFileMap != null) {\n if
(wasmFileMap[path] != null) {\n return wasmFileMap[path];\n }\n }\n return

```



```

wasmModuleFolder + path;\n}\n\n/**\n * Initializes the wasm module and creates the js <--> wasm bridge.\n *\n * NOTE: We wrap the wasm module in a object with property 'wasm' instead of\n * returning Promise<BackendWasmModule> to avoid freezing Chrome (last tested\n * in Chrome 76).\n */\nexport async function init(): Promise<{wasm: BackendWasmModule}> {\n const [simdSupported, threadsSupported] = await Promise.all([\n env().getAsync('WASM_HAS_SIMD_SUPPORT'),\n env().getAsync('WASM_HAS_MULTITHREAD_SUPPORT')\n]);\n return new Promise((resolve, reject) => {\n const factoryConfig: WasmFactoryConfig = {};\n /**\n * This function overrides the Emscripten module locateFile utility.\n * @param path The relative path to the file that needs to be loaded.\n * @param prefix The path to the main JavaScript file's directory.\n */\n factoryConfig.locateFile = (path, prefix) => {\n if (path.endsWith('.worker.js')) {\n const response = wasmWorkerContents;\n const blob = new Blob([response], {type: 'application/javascript'});\n return URL.createObjectURL(blob);\n }\n if (path.endsWith('.wasm')) {\n return getPathToWasmBinary(\n simdSupported as boolean, threadsSupported as boolean,\n wasmPathPrefix != null ? wasmPathPrefix : prefix);\n }\n return prefix + path;\n };\n // Use the instantiateWasm override when system fetch is not available.\n // Reference:\n // https://github.com/emscripten-core/emscripten/blob/2bca083cbbd5a4133db61fbd74d04f7feecfa907/tests/manual_wasm_instantiate.html#L170\n if (customFetch) {\n factoryConfig.instantiateWasm =\n createInstantiateWasmFunc(getPathToWasmBinary(\n simdSupported as boolean, threadsSupported as boolean,\n wasmPathPrefix != null ? wasmPathPrefix : ''));\n }\n let initialized = false;\n factoryConfig.onAbort = () => {\n if (initialized) {\n // Emscripten already called console.warn so no need to double log.\n return;\n }\n if (initAborted) {\n // Emscripten calls `onAbort` twice, resulting in double error\n // messages.\n return;\n }\n initAborted = true;\n const rejectMsg =\n 'Make sure the server can serve the `.wasm` file relative to the '+\n 'bundled js file. For more details see https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-wasm/README.md#using-bundlers';\n reject({message: rejectMsg});\n };\n let wasm: Promise<BackendWasmModule>;\n // If `wasmPath` has been defined we must initialize the vanilla module.\n if (threadsSupported && simdSupported && wasmPath == null) {\n factoryConfig.mainScriptUrlOrBlob = new Blob([\n `var WasmBackendModuleThreadedSimd = ` +\n wasmFactoryThreadedSimd.toString(),\n {type: 'text/javascript'};\n]);\n wasm = wasmFactoryThreadedSimd(factoryConfig);\n } else {\n // The wasmFactory works for both vanilla and SIMD binaries.\n wasm = wasmFactory(factoryConfig);\n }\n // The WASM module has been successfully created by the factory.\n // Any error will be caught by the onAbort callback defined above.\n wasm.then((module) => {\n initialized = true;\n initAborted = false;\n const voidReturnType: string = null;\n // Using the tfjs namespace to avoid conflict with emscripten's API.\n module.tfjs = {\n init: module.cwrap('init', null, []),\n initWithThreadsCount:\n module.cwrap('init_with_threads_count', null, ['number']),\n getThreadsCount:\n module.cwrap('get_threads_count', 'number', []),\n registerTensor: module.cwrap(\n 'register_tensor', null, [\n 'number', // id\n 'number', // size\n 'number', // memoryOffset\n]),\n disposeData: module.cwrap('dispose_data', voidReturnType, ['number']),\n dispose: module.cwrap('dispose', voidReturnType, []),\n };\n resolve({wasm: module});\n });\n });\n}\n\nfunction typedArrayFromBuffer(\n buffer: ArrayBuffer, dtype: DataType): backend_util.TypedArray {\n switch (dtype) {\n case 'float32':\n return new Float32Array(buffer);\n case 'int32':\n return new Int32Array(buffer);\n case 'bool':\n return new Uint8Array(buffer);\n default:\n throw new Error(`Unknown dtype ${dtype}`);\n }\n}\n\nconst wasmBinaryNames = [\n 'tfjs-backend-wasm.wasm',\n 'tfjs-backend-wasm-simd.wasm',\n 'tfjs-backend-wasm-threaded-simd.wasm'\n] as const;\n\ninterface WasmBinaryName = typeof wasmBinaryNames[number];\n\nlet wasmPath: string = null;\nlet wasmPathPrefix: string = null;\nlet wasmFileMap: {[key in WasmBinaryName]?: string} = {};\nlet initAborted = false;\nlet customFetch = false;\n\n/**\n * @deprecated Use `setWasmPaths` instead.\n * Sets the path to the `.wasm` file which will be fetched

```

```

when the wasm\n * backend is initialized. See\n * https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-
wasm/README.md#using-bundlers\n * for more details.\n * @param path wasm file path or url\n * @param
usePlatformFetch optional boolean to use platform fetch to download\n * the wasm file, default to false.\n *\n *
@doc {heading: 'Environment', namespace: 'wasm'}\n *\nexport function setWasmPath(path: string,
usePlatformFetch = false): void {\n deprecationWarn(\n 'setWasmPath has been deprecated in favor of
setWasmPaths and '\n ' will be removed in a future release.);\n if (initAborted) {\n throw new Error(\n
'The WASM backend was already initialized. Make sure you call '\n 'setWasmPath()' before you call
`tf.setBackend()` or `tf.ready()`);\n }\n wasmPath = path;\n customFetch = usePlatformFetch;\n}\n\n/**\n *
Configures the locations of the WASM binaries.\n *\n * ``js\n * setWasmPaths({\n * 'tfjs-backend-wasm.wasm':
'renamed.wasm',\n * 'tfjs-backend-wasm-simd.wasm': 'renamed-simd.wasm',\n * 'tfjs-backend-wasm-threaded-simd.wasm': 'renamed-
threaded-simd.wasm'\n * });\n * tf.setBackend('wasm');\n * ``\n *\n * @param prefixOrFileMap This can be either
a string or object:\n * - (string) The path to the directory where the WASM binaries are located.\n * Note that this
prefix will be used to load each binary (vanilla,\n * SIMD-enabled, threading-enabled, etc.).\n * - (object)
Mapping from names of WASM binaries to custom\n * full paths specifying the locations of those binaries. This
is useful if\n * your WASM binaries are not all located in the same directory, or if your\n * WASM binaries
have been renamed.\n * @param usePlatformFetch optional boolean to use platform fetch to download\n * the
wasm file, default to false.\n *\n * @doc {heading: 'Environment', namespace: 'wasm'}\n *\nexport function
setWasmPaths(\n prefixOrFileMap: string|{[key in WasmBinaryName]?: string},\n usePlatformFetch
= false): void {\n if (initAborted) {\n throw new Error(\n 'The WASM backend was already initialized. Make
sure you call '\n 'setWasmPaths()' before you call `tf.setBackend()` or '\n `tf.ready()`);\n }\n if
(typeof prefixOrFileMap === 'string') {\n wasmPathPrefix = prefixOrFileMap;\n } else {\n wasmFileMap =
prefixOrFileMap;\n const missingPaths =\n wasmBinaryNames.filter(name => wasmFileMap[name] ==
null);\n if (missingPaths.length > 0) {\n throw new Error(\n `There were no entries found for the
following binaries: `\n `${missingPaths.join(',')}. Please either call setWasmPaths with a `\n `map
providing a path for each binary, or with a string indicating `\n `the directory where all the binaries can be
found.`);\n }\n }\n }\n }\n customFetch = usePlatformFetch;\n}\n\n/** Used in unit tests. *\nexport function
resetWasmPath(): void {\n wasmPath = null;\n wasmPathPrefix = null;\n wasmFileMap = {};\n customFetch = false;\n initAborted = false;\n}\n\nlet threadsCount = -1;\nlet
actualThreadsCount = -1;\n\n/**\n * Sets the number of threads that will be used by XNNPACK to create\n *
threadpool (default to the number of logical CPU cores).\n *\n * This must be called before calling
`tf.setBackend('wasm')`.\n *\nexport function setThreadsCount(numThreads: number) {\n threadsCount =
numThreads;\n}\n\n/**\n * Gets the actual threads count that is used by XNNPACK.\n *\n * It is set after the
backend is intialized.\n *\nexport function getThreadsCount(): number {\n if (actualThreadsCount === -1) {\n
throw new Error(`WASM backend not initialized.`);\n }\n return actualThreadsCount;\n}\n\n]]

```

Found in path(s):

```

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
wasm/dist/backend_wasm.js.map

```

No license file was found, but licenses were detected in source scan.

```

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AI,KAAC,CAAC,KAAC,CAAC,MAAM,CAAC;KAC5B;IAED,MAAM,UAAU,GAAG,KAAC,CAAC,KAAC,C
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```

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urcesContent":["/\*\*\n

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```
=====\n*\n\nimport { KernelConfig, KernelFunc, TensorInfo, Unpack, UnpackAttrs, UnpackInputs } from
'@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport { slice } from
'./Slice';\n\nfunction unpack(\n args: { inputs: UnpackInputs, backend: BackendWasm, attrs: UnpackAttrs }):\n TensorInfo[] {\n const { inputs, backend, attrs } = args;\n const { value } = inputs;\n let { axis } = attrs;\n if (axis <
0) {\n axis += value.shape.length;\n }\n const numOutputs = value.shape[axis];\n const rank =
value.shape.length;\n const outShape: number[] = new Array(rank
- 1);\n let outIndex = 0;\n for (let i = 0; i < rank; i++) {\n if (i !== axis) {\n outShape[outIndex++] =
value.shape[i];\n }\n }\n const outs: TensorInfo[] = new Array(numOutputs);\n const begin = new
Array(rank).fill(0);\n const size = value.shape.slice();\n size[axis] = 1;\n for (let i = 0; i < outs.length; i++) {\n begin[axis] = i;\n outs[i] = slice({ inputs: { x: value }, attrs: { begin, size }, backend});\n }\n return
outs.map(({ dataId, dtype }) => ({ dataId, dtype, shape: outShape }));\n}\n\nexport const unpackConfig: KernelConfig
= {\n kernelName: Unpack,\n backendName: 'wasm',\n kernelFunc: unpack as { } as KernelFunc,\n};\n\n}}
```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Unpack.js.map

No license file was found, but licenses were detected in source scan.

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O;QACP,QAAQ;QACR,QAAQ;QACR,QAAQ;KACT,CAAC,CAAC;AACL,CAAC;AAED,SAAS,IAAI,CAAC,I
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```

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```
=====\n*/\n\nimport {AddN, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport\n{BackendWasm} from '../backend_wasm';\nimport {CppType} from './types';\nlet wasmFunc:\n (inputIds:\n Uint8Array, inputIdsLen: number, dtype: number, outId: number) =>\n void;\nfunction setupFunc(backend:\n BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(AddN, null /* void */, [\n 'array', // input_ids\n 'number', // input_ids.length\n 'number', // dtype\n 'number', // out_id\n]);\n}\nfunction addn(args: {inputs:\n TensorInfo[], backend: BackendWasm}) {\n const {inputs, backend} = args;\n const out =\n backend.makeOutput(inputs[0].shape, inputs[0].dtype);\n\n // Short-circuit zero-sized tensors.\n if\n (util.sizeFromShape(out.shape) === 0) {\n return out;\n }\n\n const inputIds = inputs.map(x =>\n backend.dataIdMap.get(x.dataId).id);\n const inputIdsBytes = new Uint8Array(new Int32Array(inputIds).buffer);\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmFunc(inputIdsBytes, inputIds.length,\n CCppType[out.dtype], outId);\n return out;\n}\n\nexport const addNConfig: KernelConfig = {\n kernelName:\n AddN,\n backendName: 'wasm',\n setupFunc,\n kernelFunc: addn as { } as KernelFunc,\n};\n}
```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/AddN.js.map

No license file was found, but licenses were detected in source scan.

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AAU,GACnB,wBAAwB,CAAC,IAAI,EAAE,qBAAqB,EAAE,MAAM,CAAC,CAAC\",\"sourcesContent\":[\"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
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the specific language governing
permissions and\n * limitations under the License.\n *
```

```
=====\n*/\n\nimport {KernelConfig, Less} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from\n './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const lessConfig: KernelConfig =\n createBinaryKernelConfig(Less, supportsFullBroadcast, 'bool');\n}
```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Less.js.map

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```
{"version":3,"file":"SpaceToBatchND.js","sourceRoot":"","sources":["../src/kernels/SpaceToBatchND.ts"],"names":[],"mappings":"AAAA;;;;;;;;;;;GAeG;AAEH,OAAO,EAAC,YAAY,EAAyD,cAAc,EAA0F,IAAI,EAAC,MAAM,uBAAuB,CAAC;AAIxN,OAAO,EAAC,WAAW,EAAC,MAAM,SAAS,CAAC;AACpC,OAAO,EAAC,OAAO,EAAC,MAAM,WAAW,CAAC;AACIC,OAAO,EAAC,SAAS,EAAC,MAAM,aAAa,CAAC;AAEtC,SAAS,cAAc,CAAC,IAIvB;IACC,MAAM,EAAC,MAAM,EAAE,OAAO,EAAE,KAaK,EAAC,GAAG,IAAI,CAAC;IACtC,MAAM,EAAC,CAAC,EAAC,GAAG,MAAM,CAAC;IACnB,MAAM,EAAC,UAAU,EAAE,QAAQ,EAAC,GAAG,KAaK,CAAC;IAErC,MAAM,IAAI,GAAG,IAAI,CAAC,aAAa,CAAC,UAAU,CAAC,CAAC;IAE5C,MAAM,gBAAgB,GAA4B,CAAC,CAAC,CAAC,EAAE,CAAC,CAAC,CAAC,CAAC;IAC3D,gBAAgB,CAAC,IAAI,CAAC,GAAI,QAAoC,CAAC,CAAC;IAEhE,KAaK,IAAI,CAAC,GAAG,CAAC,GAAG,UAAU,CAAC,MAAM,EAAE,CAAC,GAAG,CAAC,CAAC,KAaK,CAAC,MAAM,EAAE,EAAE,CAAC,EAAE;QAC3D,gBAAgB,CAAC,IAAI,CAAC,CAAC,CAAC,EAAE,CAAC,CAAC,CAAC,CAAC;KAC/B;IAED,MAAM,OAAO,GAAG,WAAW,CAAC,UAAU,CAAC;QACrC,MAAM,EAAE,EAAC,CAAC,EAAC;QACX,OAAO;QACP,KAaK,EAAE,EAAC,QAAQ,EAAE,gBAAgB,EAAE,aAAa,EAAE,CAAC,EAAC;KACtD,CAAE,CAAC;IAEjB,MAAM,mBAAmB,GACrB,YAAY,CAAC,WAAW,CAAC,OAAO,CAAC,KAaK,EAAE,UAAU,EAAE,IAAI,EAAE,KAaK,CAAC,CAAC;IAErE,MAAM,iCAAiC,GAAG,YAAY,CAAC,WAAW,CAC9D,mBAAmB,CAAC,MAAM,EAAE,UAAU,CAAC,MAAM,EAAE,KAaK,CAAC,CAAC;IAEID,MAAM,YAAY,GACd,YAAY,CAAC,mBAAmB,CAAC,OAAO,CAAC,KAaK,EAAE,UAAU,EAAE,IAAI,EAAE,KAaK,CAAC,CAAC;IAE7E,MAAM,aAAa,GAaKB,EAAC,CAAC,EAAE,OAAO,EAAC,CAAC;IACID,MAAM,YAAY,GAAiB,EAAC,KAaK,EAAE,mBAAmB,EAAC,CAAC;IACHE,MAAM,eAAe,GACjB,OAAO,CAAC,EAAC,MAAM,EAAE,aAAa,EAAE,OAAO,EAAE,KAaK,EAAE,YAAY,EAAC,CAAC,CAAC;IAEnE,MAAM,eAAe,GAAoB,EAAC,CAAC,EAAE,eAAe,EAAC,CAAC;IAC9D,MAAM,cAAc,GACC,EAAc,IAAI,EAAE,iCAAiC,EAAC,CAAC;IAC/D,MAAM,QAAQ,GACV,SAAS,CAAC,EAAC,MAAM,EAAE,eAAe,EAAE,OAAO,EAAE,KAaK,EAAE,cAAc,EAAC,CAAC,CAAC;IAEzE,MAAM,mBAAmB,GAaKB,EAAC,CAAC,EAAE,QAAQ,EAAC,CAAC;IACzD,MAAM,kBAaKB,GAAiB,EAAC,KAaK,EAAE,YAAY,EAAC,CAAC;IAC/D,MAAM,MAAM,GAAG,OAAO,CACIB,EAAC,MAAM,EAAE,mBAAmB,EAAE,OAAO,EAAE,KAaK,EAAE,kBAaKB,EAAC,CAAC,CAAC;IAEvE,OAAO,CAAC,WAAW,CAAC,OAAO,CAAC,MAAM,CAAC,CAAC;IACpC,OAAO,CAAC,WAAW,CAAC,eAAe,CAAC,MAAM,CAAC,CAAC;IAC5C,OAAO,CAAC,WAAW,CAAC,QAAQ,CAAC,MAAM,CAAC,CAAC;IAErC,OAAO,MAAM,CAAC;AACkB,CAAC;AAED,MAAM,CAAC,MAAM,oBAAoB,GAAiB;IACHD,UAAU,EAAE,cAAc;IACIB,WAAW,EAAE,MAAM;IACnB,UAAU,EAAE,cAAc;CAC/C,CAAC","sourcesContent":["/**\n
```

```
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```

```
=====\n *\nimport {backend_util, KernelConfig, KernelFunc, ReshapeAttrs, ReshapeInputs, SpaceToBatchND, SpaceToBatchNDAttrs, SpaceToBatchNDInputs, TensorInfo, TransposeAttrs, TransposeInputs, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {padV2Config} from './PadV2';\nimport {reshape} from './Reshape';\nimport {transpose} from './Transpose';\nfunction\nspaceToBatchND(args: {\n inputs: SpaceToBatchNDInputs,\n backend: BackendWasm,\n attrs: SpaceToBatchNDAttrs\n}) {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {blockShape,
```

```

paddings } = attrs;\n\n const prod = util.sizeFromShape(blockShape);\n\n const completePaddings: Array<[number,
number]> = [[0, 0]];\n completePaddings.push(...(paddings as Array<[number, number]>));\n\n for (let i = 1 +
blockShape.length; i < x.shape.length; ++i) {\n completePaddings.push([0, 0]);\n }\n\n const paddedX =
padV2Config.kernelFunc({\n
 inputs: {x},\n backend,\n attrs: {paddings: completePaddings, constantValue: 0}\n }) as TensorInfo;\n\n
const reshapedPaddedShape =\n backend_util.getReshaped(paddedX.shape, blockShape, prod, false);\n\n const
permutedReshapedPaddedPermutation = backend_util.getPermuted(\n reshapedPaddedShape.length,
blockShape.length, false);\n\n const flattenShape =\n backend_util.getReshapedPermuted(paddedX.shape,
blockShape, prod, false);\n\n const reshapeInputs: ReshapeInputs = {x: paddedX};\n const reshapeAttrs:
ReshapeAttrs = {shape: reshapedPaddedShape};\n const paddedXReshaped =\n reshape({inputs: reshapeInputs,
backend, attrs: reshapeAttrs});\n\n const transposeInputs: TransposeInputs = {x: paddedXReshaped};\n const
transposeAttrs:\n TransposeAttrs = {perm: permutedReshapedPaddedPermutation};\n const paddedXT =\n transpose({inputs: transposeInputs, backend, attrs: transposeAttrs});\n\n const resultReshapeInputs: ReshapeInputs
= {x: paddedXT};\n
const resultReshapeAttrs: ReshapeAttrs = {shape: flattenShape};\n const result = reshape(\n {inputs:
resultReshapeInputs, backend, attrs: resultReshapeAttrs});\n\n backend.disposeData(paddedX.dataId);\n
backend.disposeData(paddedXReshaped.dataId);\n backend.disposeData(paddedXT.dataId);\n\n return
result;\n}\n\nexport const spaceToBatchNDConfig: KernelConfig = {\n kernelName: SpaceToBatchND,\n
backendName: 'wasm',\n kernelFunc: spaceToBatchND as {} as KernelFunc\n};\n"}

```

Found in path(s):

```

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
wasm/dist/kernels/SpaceToBatchND.js.map

```

No license file was found, but licenses were detected in source scan.

```

{"version":3,"file":"tf-backend-
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dentity.ts","../src/kernels/Transpose.ts","../src/kernels/kernel_utils.ts","../src/kernels/All.ts","../src/kernels/Any.ts","..
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backend-cpu/dist/kernels/Range_impl.js","../node_modules/@tensorflow/tfjs-backend-
cpu/dist/kernels/Slice.js","../src/kernels/Slice.ts","../src/kernels/BatchToSpaceND.ts","../src/kernels/Cast.ts","../src/k
ernels/Ceil.ts","../src/kernels/ClipByValue.ts","../src/kernels/Concat.ts","../src/kernels/Conv2D.ts","../src/kernels/Co
nv2DBackpropInput.ts","../src/kernels/Cos.ts","../src/kernels/Cosh.ts","../src/kernels/CropAndResize.ts","../src/kerne
ls/Cumsum.ts","../src/kernels/DepthToSpace.ts","../src/kernels/DepthwiseConv2dNative.ts","../src/kernels/Elu.ts","..
/src/kernels/Equal.ts","../src/kernels/Exp.ts","../src/kernels/ExpandDims.ts","../src/kernels/Fill.ts","../src/kernels/Flip
LeftRight.ts","../src/kernels/Floor.ts","../src/kernels/FloorDiv.ts","../src/kernels/FusedBatchNorm.ts","../src/kernels/
FusedConv2D.ts","../src/kernels/FusedDepthwiseConv2D.ts","../src/kernels/GatherNd.ts","../src/kernels/GatherV2.ts
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c/kernels/LessEqual.ts","../src/kernels/Log.ts","../src/kernels/LogicalAnd.ts","../src/kernels/Max.ts","../src/kernels/M
aximum.ts","../src/kernels/MaxPool.ts","../src/kernels/Mean.ts","../src/kernels/Min.ts","../src/kernels/Minimum.ts",".
../src/kernels/MirrorPad.ts","../src/kernels/Multiply.ts","../src/kernels/Neg.ts","../src/kernels/NonMaxSuppression_uti
l.ts","../src/kernels/NonMaxSuppressionV3.ts","../src/kernels/NonMaxSuppressionV4.ts","../src/kernels/NonMaxSu
ppressionV5.ts","../src/kernels/NotEqual.ts","../src/kernels/OneHot.ts","../src/kernels/OnesLike.ts","../src/kernels/Pa
ck.ts","../src/kernels/PadV2.ts","../src/kernels/Pow.ts","../src/kernels/Prelu.ts","../src/kernels/Prod.ts","../src/kernels/
Range.ts","../src/kernels/RealDiv.ts","../src/kernels/Relu.ts","../src/kernels/Relu6.ts","../src/kernels/ResizeBilinear.ts
","../src/kernels/Reverse.ts","../src/kernels/RotateWithOffset.ts","../src/kernels/Round.ts","../src/kernels/Rsqrt.ts","../

```

```

src/kernels/ScatterNd.ts", "../src/kernels/Select.ts", "../src/kernels/Sigmoid.ts", "../src/kernels/Sin.ts", "../src/kernels/Sof
tmax.ts", "../src/kernels/SpaceToBatchND.ts", "../src/kernels/SplitV.ts", "../src/kernels/Sqrt.ts", "../src/kernels/Square.ts
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src/kernels/Transform.ts", "../src/kernels/Unpack.ts", "../src/kernels/ZerosLike.ts", "../src/register_all_kernels.ts", "../sr
c/flags_wasm.ts", "../wasm-out/tfjs-backend-wasm-threaded-simd.js", "../wasm-out/tfjs-backend-wasm-threaded-
simd.worker.js", "../wasm-out/tfjs-backend-
wasm.js", "../src/backend_wasm.ts", "../src/version.ts", "../src/base.ts"], "sourcesContent": ["/**\n
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WITHOUT
WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
=====
*\n\n// This enum must align with the enum defined in cc/backend.h.\nexport enum CppDType {\n float32 = 0,\n
int32 = 1,\n bool = 2,\n string = 3,\n complex64 = 4\n}\n\n// Must match enum in cc/fusable_activations.h.\nexport
enum FusableActivation {\n linear = 0,\n relu = 1,\n relu6 = 2,\n prelu = 3,\n leakyrelu = 4,\n sigmoid = 5,\n elu
= 6\n}\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache
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may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required
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 * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR
CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing
permissions and\n * limitations under the License.\n *
=====
*\n\nimport { _FusedMatMul, _FusedMatMulAttrs, _FusedMatMulInputs, KernelConfig, KernelFunc } from
'@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { FusableActivation } from
'./types';\n\nlet wasmFusedMatMul: (\n aId: number, aShape: Uint8Array, aShapeSize: number, bId: number,\n
bShape: Uint8Array, bShapeSize: number, transposeA: boolean,\n transposeB: boolean, activation: number,\n
biasId: number,\n preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>\n
void;\n\nfunction setup(backend: BackendWasm) {\n wasmFusedMatMul = backend.wasm.cwrap(_FusedMatMul,\n
null /* void */, [\n 'number',\n
 // a_id\n 'array', // a_shape\n 'number', // a_shape.length\n 'number', // b_id\n 'array', // b_shape\n
'number', // b_shape.length\n 'number', // transpose_a\n 'number', // transpose_b\n 'number', // activation\n
'number', // biasId\n 'number', // preluActivationWeightsId\n 'number', // leakyreluAlpha\n 'number' //
out_id\n]);\n\nfunction fusedBatchMatMul(args: {\n inputs: _FusedMatMulInputs,\n backend:
BackendWasm,\n attrs: _FusedMatMulAttrs\n}) {\n const { inputs, backend, attrs } = args;\n const { a, b, bias,\n
preluActivationWeights } = inputs;\n\n if (a.dtype !== 'float32' || b.dtype !== 'float32') {\n throw new Error(\n
`_FusedMatMul for non non-float32 tensors not yet supported.`);\n }\n\n const { transposeA, transposeB,\n
activation, leakyreluAlpha } = attrs;\n const aId = backend.dataIdMap.get(a.dataId).id;\n const bId =
backend.dataIdMap.get(b.dataId).id;\n\n let biasId = 0;\n if (bias != null) {\n
 const biasData = backend.dataIdMap.get(bias.dataId);\n if (biasData.shape.length !== 1) {\n throw new
Error(\n ` _FusedMatMul only supports rank-1 bias but got ` +\n `rank ${biasData.shape.length}.`);\n
 }\n biasId = biasData.id;\n }\n const preluActivationWeightsId = preluActivationWeights == null ?\n 0 : \n
backend.dataIdMap.get(preluActivationWeights.dataId).id;\n const fusedActivation = \n
FusableActivation[activation as { } as keyof typeof FusableActivation];\n if (fusedActivation == null) {\n throw

```

```

new Error(`\${activation} activation not yet supported for FusedConv2D` + `in the wasm backend.`);
}

const leftDim = transposeA ? a.shape[2] : a.shape[1];
const rightDim = transposeB ? b.shape[1] :
b.shape[2];
const batchDim = a.shape[0];

const out = backend.makeOutput([batchDim, leftDim, rightDim],
a.dtype);
const outId = backend.dataIdMap.get(out.dataId).id;

const aShapeBytes = new Uint8Array(new
Int32Array(a.shape).buffer);
const bShapeBytes = new Uint8Array(new Int32Array(b.shape).buffer);

wasmFusedMatMul(aId, aShapeBytes, a.shape.length, bId, bShapeBytes, b.shape.length,
transposeA,
transposeB, fusedActivation, biasId, preluActivationWeightsId,
leakyreluAlpha || 0, outId);

return
out;

export const fusedMatMulConfig: KernelConfig = {
kernelName: '_FusedMatMul',
backendName:
'wasm',
setupFunc: setup,
kernelFunc: fusedBatchMatMul as { } as KernelFunc;
},
"/**
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 * governing permissions and
 * limitations under the License.
 */

=====

import {DataType, KernelConfig, TensorInfo, UnaryInputs, util} from '@tensorflow/tfjs-core';
import {BackendWasm} from '../backend_wasm';
import {CppType} from './types';
export function
createUnaryKernelConfig(kernelName: string, outType?: DataType): KernelConfig {
let wasmFunc: (xId:
number, dtype: number, outId: number) => void;

function setupFunc(backend: BackendWasm): void {
wasmFunc = backend.wasm.cwrap(kernelName, null /* void */, [
'number', // x_id
'number', // dtype
'number', // out_id
]);
}

function kernelFunc(args: {backend: BackendWasm, inputs: UnaryInputs}):
TensorInfo {
const {backend, inputs: {x}} = args;
const xId = backend.dataIdMap.get(x.dataId).id;
const out = backend.makeOutput(x.shape, outType || x.dtype);
const outId =
backend.dataIdMap.get(out.dataId).id;
// Short-circuit zero-sized tensors.
if (util.sizeFromShape(out.shape)
=== 0) {
return out;
}
wasmFunc(xId, CppDType[x.dtype], outId);
return out;
}

return
{kernelName, backendName: 'wasm', setupFunc, kernelFunc};
}

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 * OR CONDITIONS OF ANY KIND, either express or implied.
 * See the License for the specific language
 * governing permissions
 * and
 * limitations under the License.
 */

=====

import {Abs, KernelConfig} from '@tensorflow/tfjs-core';
import {createUnaryKernelConfig} from
'../unary_kernel';
export const absConfig: KernelConfig = createUnaryKernelConfig(Abs);
"/**
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 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
 * See the License for
 * the specific language governing permissions and
 * limitations under the License.
 */

=====

import {backend_util, BinaryInputs, DataType, KernelConfig, TensorInfo, util} from '@tensorflow/tfjs-
core';
import {BackendWasm} from '../backend_wasm';
import {CppType} from './types';
export
function createBinaryKernelConfig(kernelName: string, supportsFullBroadcast: boolean,
dtype?:

```



```

DataType): KernelConfig {\n let wasmFunc:\n (aId: number, aShape: Uint8Array, aShapeLen: number, bId:
number,\n bShape: Uint8Array, bShapeLen: number, dtype: number, outId: number) =>\n void;\n\nfunction setupFunc(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(kernelName, null /*
void */, [\n 'number', // a_id,\n 'array', // a_shape\n 'number', // a_shape.length\n 'number', // b_id\n 'array', // b_shape\n 'number', // b_shape.length\n 'number', // dtype\n 'number' // out_id\n]);\n\nfunction kernelFunc(args: {backend: BackendWasm, inputs: BinaryInputs}):\n TensorInfo {\n const {backend, inputs} = args;\n const {a, b} = inputs;\n const aId =
backend.dataIdMap.get(a.dataId).id;\n const bId = backend.dataIdMap.get(b.dataId).id;\n\n const outputType =
dtype != null ? dtype : a.dtype;\n const newShape = backend_util.assertAndGetBroadcastShape(a.shape,
b.shape);\n const out = backend.makeOutput(newShape, outputType);\n\n // Short-circuit zero-sized tensors.\n
if (util.sizeFromShape(newShape) === 0) {\n return out;\n }\n\n const aShapeBytes = new Uint8Array(new
Int32Array(a.shape).buffer);\n const bShapeBytes = new Uint8Array(new Int32Array(b.shape).buffer);\n const
outId = backend.dataIdMap.get(out.dataId).id;\n const kernelFunc = () => wasmFunc(\n aId, aShapeBytes,
a.shape.length, bId, bShapeBytes, b.shape.length,\n CppDType[a.dtype], outId);\n\n // Currently only some
float operations support full broadcast.\n if (supportsFullBroadcast && a.dtype === 'float32')
{\n kernelFunc();\n return out;\n }\n\n const aBroadcastDims = backend_util.getBroadcastDims(a.shape,
newShape);\n const bBroadcastDims = backend_util.getBroadcastDims(b.shape, newShape);\n const
loopsOverAllOfA = aBroadcastDims.every((v, i) => v === i);\n const loopsOverAllOfB =
bBroadcastDims.every((v, i) => v === i);\n if (loopsOverAllOfA && loopsOverAllOfB) {\n kernelFunc();\n
return out;\n } else {\n throw new Error(\n `Broadcasting along outer dims is not yet ` +\n
`supported for ${a.dtype} ${kernelName}.`);\n }\n\n return {kernelName, backendName: 'wasm', setupFunc,
kernelFunc};\n\n }, /**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
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BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
\n *=====\n
*\n\nimport {Add, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
'./binary_kernel';\n\nconst supportsFullBroadcast = true;\n\nexport const addConfig: KernelConfig =\ncreateBinaryKernelConfig(Add, supportsFullBroadcast);\n\n/**\n * @license\n * Copyright 2019 Google LLC. All
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file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
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the specific language governing permissions and\n * limitations under the License.\n *
\n *=====\n
*\n\nimport {AddN, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport
{BackendWasm} from '../backend_wasm';\nimport {CppType} from './types';\n\nlet wasmFunc:\n (inputIds:
Uint8Array, inputIdsLen: number, dtype: number, outId: number) =>\n void;\n\nfunction setupFunc(backend:
BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(AddN, null /* void */, [\n 'array', // input_ids\n
'number', // input_ids.length\n 'number', // dtype\n 'number', // out_id\n]);\n\nfunction addn(args: {inputs:
TensorInfo[], backend: BackendWasm}) {\n const {inputs,
backend} = args;\n const out = backend.makeOutput(inputs[0].shape, inputs[0].dtype);\n\n // Short-circuit zero-
sized tensors.\n if (util.sizeFromShape(out.shape) === 0) {\n return out;\n }\n\n const inputIds = inputs.map(x
=> backend.dataIdMap.get(x.dataId).id);\n const inputIdsBytes = new Uint8Array(new

```

```
Int32Array(inputIds).buffer);\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmFunc(inputIdsBytes,
inputIds.length, CppDType[out.dtype], outId);\n\n return out;\n}\n\nexport const addNConfig: KernelConfig = {\n
kernelName: AddN,\n backendName: 'wasm',\n setupFunc,\n kernelFunc: addn as {} as KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed
```

```
to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT
WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
```

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=====\n
*/\n\nimport {Identity, IdentityInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\nimport
{TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nexport function
identity(args: {inputs: IdentityInputs, backend: BackendWasm}):\n TensorInfo {\n const {inputs: {x}, backend} =
args;\n const out = backend.makeOutput(x.shape, x.dtype);\n const inVals = backend.typedArrayFromHeap(x);\n
const outVals = backend.typedArrayFromHeap(out);\n outVals.set(inVals);\n return out;\n}\n\nexport const
identityConfig: KernelConfig = {\n kernelName: Identity,\n backendName: 'wasm',\n
kernelFunc: identity as {} as KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
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=====\n
*/\n\nimport {KernelConfig, KernelFunc, TensorInfo, Transpose, TransposeAttrs, TransposeInputs} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {identity} from
'./Identity';\nimport {CppType}
from './types';\n\nlet wasmTranspose: (\n xId: number, xShape: Uint8Array, xShapeLength: number, dtype:
CppType,\n outId: number, perm: Uint8Array, permLength: number) => void;\n\nfunction setup(backend:
BackendWasm) {\n wasmTranspose = backend.wasm.cwrap(Transpose, null /* void */, [\n 'number', // xId\n
'array', // x.shape\n 'number', // x.shape.length\n 'number', // dtype\n 'number', // outId\n 'array', // perm\n
'number', // perm.length\n]);\n}\n\nexport function transpose(\n args:\n {inputs: TransposeInputs, backend:
BackendWasm, attrs: TransposeAttrs}): \n TensorInfo {\n const {inputs, backend, attrs} = args;\n // Reduce any
dimensions with size one. Lower-rank transpose kernel performs\n // better due to simpler memory access pattern.\n
const [reducedShape, perm] = removeOneSizeDims(inputs.x.shape, attrs.perm);\n\n let permIsNoOp = true;\n for
(let i = 0; i < perm.length; i++) {\n if (perm[i] !== i) {\n permIsNoOp
= false;\n }\n }\n const outShape = computeOutShape(inputs.x.shape, attrs.perm);\n const x = {\n dataId:
inputs.x.dataId,\n shape: reducedShape,\n dtype: inputs.x.dtype\n }; \n\n if (permIsNoOp) {\n const cloned =
identity({inputs, backend});\n cloned.shape = outShape;\n return cloned;\n }\n\n const out =
backend.makeOutput(outShape, x.dtype);\n const xId = backend.dataIdMap.get(x.dataId).id;\n const outId =
backend.dataIdMap.get(out.dataId).id;\n const permBytes = new Uint8Array(new Int32Array(perm).buffer);\n
const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n\n wasmTranspose(\n xId,
xShapeBytes, x.shape.length, CppDType[x.dtype], outId, permBytes,\n perm.length);\n return
out;\n}\n\nfunction computeOutShape(inShape: number[], perm: number[]): number[] {\n const outShape = new
Array(inShape.length);\n for (let i = 0; i < outShape.length; i++) {\n outShape[i] = inShape[perm[i]];\n }\n
return outShape;\n}\n\nfunction
```

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removeOneSizeDims(\n shape: number[], perm: number[]): [number[], number[]] {\n const newShape: number[] = [];\n const newPerm: number[] = [];\n for (let i = 0; i < shape.length; ++i) {\n if (shape[i] !== 1) {\n newShape.push(shape[i]);\n }\n if (shape[perm[i]] !== 1) {\n newPerm.push(perm[i]);\n }\n }\n for (let i = 0; i < newPerm.length; ++i) {\n let minValIdx = -1;\n for (let j = 0; j < newPerm.length; ++j) {\n if (newPerm[j] >= i && (minValIdx === -1 || newPerm[minValIdx] > newPerm[j])) {\n minValIdx = j;\n }\n }\n newPerm[minValIdx] = i;\n }\n return [newShape, newPerm];\n}\n\nexport const transposeConfig: KernelConfig = {\n kernelName: Transpose,\n backendName: 'wasm',\n kernelFunc: transpose as {} as KernelFunc,\n setupFunc: setup,\n};\n\n"/**\n * @license\n * Copyright 2020 Google Inc. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */

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*\n\nimport {backend_util, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {transpose} from './Transpose';\n\n/**\n * Compute permutation axes and do a transpose if necessary.\n * Used by reduction ops.\n * @param x input TensorInfo\n * @param axis reduction axes\n * @param backend wasm backend instance\n */\nexport function permuteAxesAndTranspose(\n x: TensorInfo,\n axis: number|number[],\n backend: BackendWasm): {\n transposed: TensorInfo|null,\n axes: number[],\n originalAxes: number[],\n inputWasTransposed: boolean\n} {\n const xShape = x.shape;\n const xRank = x.shape.length;\n\n const originalAxes = util.parseAxisParam(axis, xShape);\n let axes = originalAxes;\n const permutedAxes = backend_util.getAxesPermutation(axes, xRank);\n let xTransposed = null;\n let inputWasTransposed = false;\n\n if (permutedAxes !== null) {\n const newShape: number[] = new Array(xRank);\n for (let i = 0; i < newShape.length; i++) {\n newShape[i] = xShape[permutedAxes[i]];\n }\n\n axes = backend_util.getInnerMostAxes(axes.length, xRank);\n xTransposed =\n transpose({inputs: {x}, attrs: {perm: permutedAxes}, backend});\n\n const xId = backend.dataIdMap.get(x.dataId).id;\n const transposedId = backend.dataIdMap.get(xTransposed.dataId).id;\n if (transposedId !== xId) {\n inputWasTransposed = true;\n }\n }\n\n return {transposed: xTransposed,\n originalAxes, axes, inputWasTransposed};\n}\n\n"/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */

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*\n\nimport {All, AllAttrs, AllInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {permuteAxesAndTranspose} from './kernel_utils';\n\nlet\n wasmAll: (xId: number, reduceSize: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmAll = backend.wasm.cwrap(All, null /*void*/, ['number, number, number']);\n}\n\nfunction all(args: {\n backend: BackendWasm,\n inputs: AllInputs,\n attrs: AllAttrs\n}): TensorInfo {\n const {backend, inputs, attrs} = args;\n const {axis, keepDims} = attrs;\n const {x} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const {transposed, axes, originalAxes, inputWasTransposed} =\n permuteAxesAndTranspose(x, axis, backend);\n\n if (inputWasTransposed) {\n const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n input = transposed;\n inputId = transposedId;\n }\n\n const

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inputRank = input.shape.length;\n backend_util.assertAxesAreInnerMostDims('all', axes, inputRank);\n const
[outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, axes);\n
 const reduceSize = util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, x.dtype);\n
if (util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n
 wasmAll(inputId, reduceSize, outId);\n } \n\n if (inputWasTransposed) {\n // dispose of the transposed tensor.\n
 backend.disposeData(transposed.dataId);\n } \n\n if (keepDims) {\n // reshape\n const newShape =
 backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n } \n\n return
out;\n}\n\nexport const allConfig: KernelConfig = {\n kernelName: All,\n backendName: 'wasm',\n setupFunc:
 setup,\n kernelFunc: all as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2021 Google LLC. All Rights
 Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
 except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
 http://www.apache.org/licenses/LICENSE-2.0\n
 *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is
 distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
 express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
 the License.\n *
 =====\n
 *\n\nimport {Any, AnyAttrs, AnyInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util} from
 '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport
 {permuteAxesAndTranspose} from './kernel_utils';\n\nlet wasmAny: (xId: number, reduceSize: number, outId:
 number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmAny = backend.wasm.cwrap(Any,
 null /*void*/, [number, number, number]);\n}\n\nfunction any(args: {backend: BackendWasm, inputs: AnyInputs,
 attrs: AnyAttrs}):\n TensorInfo {\n const {backend, inputs,
 attrs} = args;\n const {axis, keepDims} = attrs;\n const {x} = inputs;\n const xId =
 backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const {transposed, axes, originalAxes,
 inputWasTransposed} =\n permuteAxesAndTranspose(x, axis, backend);\n\n if (inputWasTransposed) {\n
 const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n input = transposed;\n inputId =
 transposedId;\n } \n\n const inputRank = input.shape.length;\n backend_util.assertAxesAreInnerMostDims('any',
 axes, inputRank);\n const [outShape, reduceShape] =\n
 backend_util.computeOutAndReduceShapes(input.shape, axes);\n const reduceSize =
 util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, x.dtype);\n if
 (util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n
 wasmAny(inputId, reduceSize, outId);\n } \n\n if (inputWasTransposed) {\n // dispose of the transposed tensor.\n
 backend.disposeData(transposed.dataId);\n
 }\n\n if (keepDims) {\n // reshape\n const newShape = backend_util.expandShapeToKeepDim(out.shape,
 originalAxes);\n out.shape = newShape;\n } \n\n return out;\n}\n\nexport const anyConfig: KernelConfig = {\n
 kernelName: Any,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: any as {} as
 KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
 Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
 License.\n * You may obtain a copy of the License at\n * \n *
 http://www.apache.org/licenses/LICENSE-2.0\n * \n *
 Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
 on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
 implied.\n * See the License for the specific language governing permissions and\n * limitations under the
 License.\n
 *\n =====\n
 *\n\nimport {ArgMax, ArgMaxAttrs, ArgMaxInputs, KernelConfig, KernelFunc, util} from '@tensorflow/tfjs-
 core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {permuteAxesAndTranspose} from
 './kernel_utils';\n\nimport {CppType} from './types';\n\nlet wasmFunc: (\n xId: number, dtype: number, outerSize:

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number, innerSize: number,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmFunc = backend.wasm.cwrap(ArgMax, null /* void */, [\n 'number', // x_id\n 'number', // dtype\n 'number', // outer_size\n 'number', // inner_size\n 'number' // out_id\n]);\n}\n\nfunction argmax(\n args: {\n inputs: ArgMaxInputs, backend: BackendWasm, attrs: ArgMaxAttrs\n }) {\n const {backend, inputs, attrs} = args;\n const {axis} = attrs as {} as ArgMaxAttrs;\n const {x} = inputs as {} as ArgMaxInputs;\n const xId =\n backend.dataIdMap.get(x.dataId).id;\n let inputId\n = xId;\n let input = x;\n\n const {transposed, axes, inputWasTransposed} =\n permuteAxesAndTranspose(x,\n axis, backend);\n\n if (inputWasTransposed) {\n const transposedId =\n backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId !== xId) {\n // transpose was not a no-op. We\n // will need to dispose of this\n // once we are done.\n input = transposed;\n inputId = transposedId;\n }\n\n const outShape = input.shape.slice(0, -1);\n const out = backend.makeOutput(outShape, 'int32');\n const\n outId = backend.dataIdMap.get(out.dataId).id;\n const outerSize = util.sizeFromShape(out.shape);\n const\n innerSize = input.shape[axes[0]];\n wasmFunc(inputId, CppDType[input.dtype], outerSize, innerSize, outId);\n\n if\n (inputWasTransposed) {\n // dispose of the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n return out;\n }\n}\n\nexport const argMaxConfig: KernelConfig = {\n kernelName: ArgMax,\n backendName:\n 'wasm',\n kernelFunc: argmax as {} as KernelFunc,\n setupFunc: setup\n};\n\n"/**\n * @license\n * Copyright 2019 Google\n LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not\n use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n governing permissions and\n * limitations under the License.\n *\n *=====\n *\n\nimport {AvgPool, AvgPoolAttrs, AvgPoolInputs, backend_util, KernelConfig, KernelFunc, Tensor4D} from\n '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmAvgPool: (\n xId:\n number, batchSize: number, inputHeight: number, inputWidth: number,\n filterHeight: number, filterWidth:\n number, padTop: number, padRight: number,\n padBottom: number, padLeft: number, strideHeight: number,\n strideWidth: number, channels: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmAvgPool = backend.wasm.cwrap(AvgPool, null /* void */, [\n 'number', // xId\n 'number', // batchSize\n 'number', // inputHeight\n 'number', // inputWidth\n 'number', // filterHeight\n 'number', // filterWidth\n 'number', // padTop\n 'number', // padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', //\n strideHeight\n 'number', // strideWidth\n 'number', // channels\n 'number', // outId\n]);\n}\n\nfunction\n avgPool(\n args: {\n inputs: AvgPoolInputs, backend: BackendWasm, attrs: AvgPoolAttrs\n }) {\n const {inputs, attrs,\n backend} = args;\n\n const x = inputs.x as Tensor4D;\n const xId = backend.dataIdMap.get(x.dataId).id;\n\n const {filterSize, strides, pad, dimRoundingMode} = attrs;\n const convInfo =\n backend_util.computePool2DInfo(\n x.shape, filterSize, strides, 1 /* dilations */, pad, dimRoundingMode);\n\n const filterHeight = convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const padTop =\n convInfo.padInfo.top;\n const padRight = convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n const padLeft = convInfo.padInfo.left;\n const strideHeight = convInfo.strideHeight;\n const strideWidth =\n convInfo.strideWidth;\n const channels = convInfo.inChannels;\n\n if (convInfo.dataFormat !== 'channelsLast') {\n throw new Error(\n `wasm backend does not support dataFormat: "${convInfo.dataFormat}". Please\n use 'channelsLast'.`);\n }\n\n if (convInfo.dilationWidth !== 1 || convInfo.dilationHeight !== 1) {\n throw new\n Error(\n `was backend only supports average pooling with dilation = [1, 1],`\n `got [${convInfo.dilationHeight}, ${convInfo.dilationWidth}].`);\n }\n\n const out =\n backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n wasmAvgPool(\n xId, x.shape[0], x.shape[1], x.shape[2], filterHeight, filterWidth,\n padTop, padRight,\n padBottom, padLeft, strideHeight, strideWidth, channels,\n outId);\n\n return out;\n}\n\nexport const

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avgPoolConfig: KernelConfig = {\n kernelName: AvgPool,\n backendName: 'wasm',\n setupFunc: setup,\n
kernelFunc: avgPool as { } as KernelFunc\n};\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

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*\n\nimport { KernelConfig, KernelFunc, Reshape, ReshapeAttrs, ReshapeInputs, util } from '@tensorflow/tfjs-
core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nexport function reshape(\n args: { inputs:
ReshapeInputs, attrs: ReshapeAttrs, backend: BackendWasm }) {\n const { inputs, attrs } = args;\n const { x } =
inputs;\n const { shape } = attrs;\n const xSize = util.sizeFromShape(x.shape);\n const $shape =
util.inferFromImplicitShape(shape, xSize);\n util.assert(\n xSize === util.sizeFromShape($shape),\n () =>
`new shape: ${$shape}, old shape: ${x.shape}. New shape and old ` +\n `shape must have the same number of
elements.`);\n // Backend needs to track refCount
for the dataId for reshape op\n args.backend.incref(x.dataId);\n return { dataId: x.dataId, shape: $shape, dtype:
x.dtype};\n}\n\nexport const reshapeConfig: KernelConfig = {\n kernelName: Reshape,\n backendName: 'wasm',\n
kernelFunc: reshape as { } as KernelFunc\n};\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

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*\n\nimport
{ BatchMatMul, BatchMatMulAttrs, BatchMatMulInputs, KernelConfig, KernelFunc, util } from '@tensorflow/tfjs-
core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport { reshape } from './Reshape';\n\nlet
wasmBatchMatMul: (\n aId: number, aShape: Uint8Array, aShapeSize: number, bId: number,\n bShape:
Uint8Array, bShapeSize: number, transposeA: boolean,\n transposeB: boolean, outId: number) =>
void;\n\nfunction setup(backend: BackendWasm) {\n wasmBatchMatMul = backend.wasm.cwrap(BatchMatMul,
null /* void */, [\n 'number', // a_id\n 'array', // a_shape\n 'number', // a_shape.length\n 'number', // b_id\n 'array', // b_shape\n 'number', // b_shape.length\n 'number', // transpose_a\n 'number', // transpose_b\n 'number' // out_id\n]);\n}\n\nfunction batchMatMul(args: {\n inputs: BatchMatMulInputs,\n backend:
BackendWasm,\n attrs: BatchMatMulAttrs\n}) {\n const { inputs, backend, attrs } = args;\n const { a, b } = inputs;\n const
[transposeA, transposeB] = attrs;\n if (a.dtype !== 'float32' || b.dtype !== 'float32') {\n throw new Error(\n
`BatchMatMul for non non-float32 tensors not yet supported.`);\n }\n const aRank = a.shape.length;\n const
bRank = b.shape.length;\n const innerShapeA = transposeA ? a.shape[aRank - 2] : a.shape[aRank - 1];\n const
innerShapeB = transposeB ? b.shape[bRank - 1] : b.shape[bRank - 2];\n const outerShapeA = transposeA ?
a.shape[aRank - 1] : a.shape[aRank - 2];\n const outerShapeB = transposeB ? b.shape[bRank - 2] : b.shape[bRank -
1];\n const outerDimsA = a.shape.slice(0, -2);\n const outerDimsB = b.shape.slice(0, -2);\n const batchDimA =
util.sizeFromShape(outerDimsA);\n const batchDimB = util.sizeFromShape(outerDimsB);\n const
batchDimsCompatible =\n batchDimA === batchDimB || batchDimA === 1 || batchDimB === 1;\n util.assert(\n aRank >= 2 && bRank >= 2 && batchDimsCompatible,\n () => `Error in matMul: the input
batch dimensions

```













Y2UsIHNsaWNIX3V0aWwsIFNsaWNlQXR0cnMsIFNsaWNlSW5wdXRzLCBUZW5zb3JJbmZvLCBUeXBIZEF  
ycmF5LCB1dGlsfSBmcm9tICdAdGVuc29yZmxvdy90ZmpzLWNvcnUnO1xuXG5pbXBvcnQge01hdGhCYWNR  
ZW5kQ1BVfSBmcm9tICcuLi9iYWNRZW5kX2NwdSc7XG5pbXBvcnQge2Fzc2VydE5vdENvbXBsZXh9IGZyb2  
0gJy4uL2NwdV91dGlsJztcblxuZXhw3J0IGZ1bmN0aW9uIHNsaWNlSW1wbChcbiAgICB2YWxzOiBCYWNrZ  
W5kVmFsdWVzLCBiZWdpbjogbnVtYmVyW10sIHNpemU6IG51bWJlcltdLCBzaGFwZTogbnVtYmVyW10sXG  
4gICAgZHR5cGU6IERhdGFUeXBikTogQmFja2VuZGFzZHVlcYB7XG4gIGNvbnN0IGlzQ29udGlub3VzID0gc2  
xpY2VfdXRpbC5pc1NsaWNlQ29udGlub3VzKHNoYXBILCBiZWdpbiwgc2l6ZSk7XG4gIGNvbnN0IGxlbmd0aC  
A9IHV0aWwuc2l6ZUZyb21TaGFwZShzaXplKTtcbiAgY29uc3QgeFN0cmklZXMgPSB1dGlsLmNvbXB1dGVtd  
HJpZGVzKHNoYXBikTtcbiAgICBpZiAoaXNDb250aW5vdXMpIHtcbiAgICBjb25zdCBmbGF0T2Zmc2V0ID0gc  
2xpY2VfdXRpbC5jb21wdXRIRmxhdE9mZnNldChiZWdpbiwgcFN0cmklZXMpO1xuXG4gICAgYWYgKGR0eX  
BlID09PSAnc3RyaW5nJykgelxuICAgICAgcmV0dXJuICh2YWxzIGFzIFVpbnQ4QXJyYXlhbXSkuc2xpY2UoZmx  
hdE9mZnNldCwgZmxhdE9mZnNldCArIGxlbmd0aCk7XG4gICAgfVxuXG4gICAgcmV0dXJuICh2YWxzIGFzIF  
R5cGVkQXJyYXkpLnN1YmFycmF5KGZsYXRPZmZzZXQsIGZsYXRPZmZzZXQgKyBsZW5ndGppO1xuICB9  
XG5cbiAgY29uc3QgZGVjb2RIZERhdGEgPSBkdHlwZSA9PT0gJ3N0cmZyZycGp1xuICAgICAgYmFja2VuZGF91d  
GlsLmZyb21VaW50OFRvU3RyaW5nQXJyYXkodmFscyBhcyBvaW50OEFycmF5W10pIDpcbiAgICAgIHZhbH  
MgYXMGVHlwZWRBcnJheTtcbiAgICBjb25zdCBpbk1JiA9IGJ1ZmZlcihzaGFwZSwgZHR5cGU6IGRlY29kZW  
REYXRhKTtcbiAgY29uc3Qgb3V0QnVmID0gYnVmZmVyKHNoYWNpemU6IGR0eXBikTtcbiAgZm9yIChsZXQgaSA  
9IDA7IGkgPCBvdXRcdWYuc2l6ZTsgKypKSB7XG4gICAgY29uc3Qgb3V0TG9jID0gb3V0QnVmLmluZGV4V  
G9Mb2MoaSk7XG4gICAgY29uc3QgaW5Mb2MgPSBvdXRmb2MubWFWKChpZHG6IG51bWJlcjwgaikgPT4ga  
WR4ICsgYmVnaW5bal0pO1xuICAgICAgIG91dEJ1Zi5zZXQoaW5CdWYuZ2V0KC4uLmluTG9jKSwgLi4ub3V0TG9j  
KTtcbiAgfVxuXG4gIGlIChkdHlwZSA9PT0gJ3N0cmZyZycpIHtcbiAgICBzZXR1cm4gYmFja2VuZGF91dGlsLm  
Zyb21TdHJpbmdBcnJheVRvVWludDgob3V0QnVmLnZhbHVlcYBhcyBzdHJpbmdBXSsk7XG4gIH1cbiAgcmV0d  
XJuIG91dEJ1Zi52YWx1ZXMgYXMGVHlwZWRBcnJheTtcbiAgICBlxuZXhw3J0IGZ1bmN0aW9uIHNsaWNlKFxu  
ICAgIGFyZ3M6IHtpbnB1dHM6IFNsaWNlSW5wdXRzLCBiYWNRZW5kOiBNYXR0cmFja2VuZENVQVSwgYX  
R0cnM6IFNsaWNlQXR0cnN9KTpcbiAgICBUZW5zb3JJbmZvIHtcbiAgY29uc3Qge2lucHV0cywYmFja2VuZC  
wgYXR0cnN9ID0gYXJncztcblxuICAgY29uc3Qge3h9ID0gaW5wdXRzO1xuICBjb25zdCB7YmVnaW4sIHNpemV9ID  
0gYXR0cnM7XG5cbiAgYXNzZXJ0Tm90Q29tcGxleCh4LCAnc2xpY2UnKTtcbiAgICBjb25zdCBbJGJlZ2luLCAk  
c2l6ZV0gPSBzbGljZV91dGlsLnBhcnNlU2xpY2VQYXJhbXMoCwgYmVnaW4sIHNpemUpO1xuICBzbGljZV9  
1dGlsLmFzc2VydFBhcmFtc1ZhbGlkKHgsICRiZWdpbiwgJHNpemUpO1xuXG4gIGNvbnN0IHZhbHMgPSBiYW  
NRZW5kLmRhdGEuZ2V0KHguZGF0YUlkKS52YWx1ZXM7XG4gIGNvbnN0IG91dFZhbHMgPSBzbGljZUtlcG  
wodmFscywgJGJlZ2luLCAkc2l6ZSwgeC5zaGFwZSwgeC5kdHlwZSk7XG4gIHJldHVybiBiYWNRZW5kLm1ha2  
VUZW5zb3JJbmZvKCRzaXplLCB4LmR0eXBILCBvdXRWYWxzKTtcbiAgICBlxuZXhw3J0IGNvbnN0IHNsaWN  
lQ29uZmlnOiBLZXJuZWxDb25maWcgPSB7XG4gIGtlcm5lE5hbWU6IFNsaWNlFxuICBiYWNRZW5kTmFtZ  
TogJ2NwdScsXG4gIGtlcm5lEz1bmM6IHNsaWNlIGFzIHt9IGFzIEtlcm5lEz1bmNcbn07XG4iXX0=", "/\*\*\n  
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for the specific language governing permissions and\n \* limitations under the License.\n \*  
=====\n  
\*/\n\nimport { backend\_util, KernelConfig, KernelFunc, Slice, slice\_util, SliceAttrs, SliceInputs, TypedArray, util }  
from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from './backend\_wasm';\n\nimport { sliceImplCPU } from  
 './kernel\_utils/shared';\n\nexport function slice(\n args: { inputs: SliceInputs, attrs: SliceAttrs, backend:  
BackendWasm } ) {\n const { inputs: { x }, attrs: { begin, size }, backend } = args;\n const [begin\_, size\_] =  
 slice\_util.parseSliceParams(x, begin, size);\n const isContinuous = slice\_util.isSliceContinuous(x.shape, begin\_,  
 size\_);\n const xVals = backend.readSync(x.dataId);\n const out = backend.makeOutput(size\_, x.dtype);\n const  
 xStrides = util.computeStrides(x.shape);\n const outData = backend.dataIdMap.get(out.dataId);\n}

```

if (isContinuous) {\n const flatOffset = slice_util.computeFlatOffset(begin_, xStrides);\n\n if (x.dtype ===
'string') {\n outData.stringBytes =\n (xVals as Uint8Array[])\n .slice(flatOffset, flatOffset +
util.sizeFromShape(size_));\n } else {\n const outVals = backend.tensorArrayFromHeap(out);\n
outVals.set(\n (xVals as TypedArray)\n .subarray(flatOffset, flatOffset +
util.sizeFromShape(size_));\n }\n\n return out;\n }\n\n if (x.dtype === 'string') {\n const res =
sliceImplCPU(xVals, begin_, size_, x.shape, x.dtype);\n outData.stringBytes = res as Uint8Array[];\n return
out;\n }\n\n const outVals = backend.tensorArrayFromHeap(out);\n const rank = x.shape.length;\n if (rank === 2)
{\n slice2d(\n xVals as TypedArray, xStrides[0], outVals, begin_ as [number, number],\n size_ as
[number, number]);\n } else if (rank === 3) {\n slice3d(\n xVals
as TypedArray, xStrides[0], xStrides[1], outVals,\n begin_ as [number, number, number], size_ as [number,
number, number]);\n } else if (rank === 4) {\n slice4d(\n xVals as TypedArray, xStrides[0], xStrides[1],
xStrides[2], outVals,\n begin_ as [number, number, number, number],\n size_ as [number, number, number,
number]);\n } else {\n const res =\n sliceImplCPU(xVals, begin_, size_, x.shape, x.dtype) as TypedArray;\n
outVals.set(res);\n }\n\n return out;\n }\n\nfunction slice2d(\n xVals: backend_util.TypedArray, xStride:
number,\n outVals: backend_util.TypedArray, begin: [number, number],\n size: [number, number]): void {\n let
outOffset = 0;\n const beginI = begin[0];\n const beginJ = begin[1];\n const endI = beginI + size[0];\n for (let i =
beginI; i < endI; i++) {\n const xOffset = i * xStride + beginJ;\n outVals.set(xVals.subarray(xOffset, xOffset +
size[1]), outOffset);\n outOffset += size[1];\n }\n}\n\nfunction
slice3d(\n xVals: backend_util.TypedArray, xStride1: number, xStride2: number,\n outVals:
backend_util.TypedArray, begin: [number, number, number],\n size: [number, number, number]): void {\n let
outOffset = 0;\n const beginI = begin[0];\n const beginJ = begin[1];\n const beginK = begin[2];\n const endI =
beginI + size[0];\n const endJ = beginJ + size[1];\n for (let i = beginI; i < endI; i++) {\n for (let j = beginJ; j <
endJ; j++) {\n const xOffset = i * xStride1 + j * xStride2 + beginK;\n outVals.set(xVals.subarray(xOffset,
xOffset + size[2]), outOffset);\n outOffset += size[2];\n }\n }\n}\n\nfunction slice4d(\n xVals:
backend_util.TypedArray, xStride1: number, xStride2: number,\n xStride3: number, outVals:
backend_util.TypedArray,\n begin: [number, number, number, number],\n size: [number, number, number,
number]): void {\n let outOffset = 0;\n const beginI = begin[0];\n const beginJ = begin[1];\n const beginK =
begin[2];\n const endI = beginI + size[0];\n const endJ = beginJ + size[1];\n const endK = beginK + size[2];\n const beginL =
begin[3];\n for (let i = beginI; i < endI; i++) {\n for (let j = beginJ; j < endJ; j++) {\n for (let k = beginK; k <
endK; k++) {\n const xOffset = i * xStride1 + j * xStride2 + k * xStride3 + beginL;\n outVals.set(xVals.subarray(xOffset, xOffset + size[3]), outOffset);\n outOffset += size[3];\n }\n }\n }\n}\n\nexport const sliceConfig: KernelConfig = {\n kernelName: Slice,\n backendName: 'wasm',\n kernelFunc:
slice as {} as KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n *
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http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
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ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n *
limitations under the License.\n */\n\n
=====
*\n\nimport {backend_util, BatchToSpaceND, BatchToSpaceNDAttrs, BatchToSpaceNDInputs, KernelConfig,
KernelFunc} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport
{reshape} from './Reshape';\n\nimport {slice} from './Slice';\n\nimport {transpose} from './Transpose';\n\nfunction
batchToSpaceND(args: {\n inputs: BatchToSpaceNDInputs,\n backend: BackendWasm,\n attrs:
BatchToSpaceNDAttrs\n}) {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {blockShape,
crops} = attrs;\n\n const prod = blockShape.reduce((a, b) => a * b);\n\n const reshaped =

```

```

backend_util.getReshaped(x.shape, blockShape, prod);\n const
 permuted = backend_util.getPermuted(reshaped.length, blockShape.length);\n const reshapedPermuted =\n
backend_util.getReshapedPermuted(x.shape, blockShape, prod);\n const sliceBeginCoords =\n
backend_util.getSliceBeginCoords(crops, blockShape.length);\n const sliceSize =\n
backend_util.getSliceSize(reshapedPermuted, crops, blockShape.length);\n\n const xReshaped = reshape({inputs:
 {x}, backend, attrs: {shape: reshaped}});\n const xTransposed =\n transpose({inputs: {x: xReshaped}, backend,
 attrs: {perm: permuted}});\n const xTransposedReshaped = reshape(\n {inputs: {x: xTransposed}, backend,
 attrs: {shape: reshapedPermuted}});\n const result = slice({\n inputs: {x: xTransposedReshaped},\n backend,\n attrs: {begin: sliceBeginCoords, size: sliceSize}\n });\n\n backend.disposeData(xReshaped.dataId);\n
backend.disposeData(xTransposed.dataId);\n backend.disposeData(xReshaped.dataId);\n\n return
result;\n}\n\nexport const batchToSpaceNDConfig: KernelConfig
 = {\n kernelName: BatchToSpaceND,\n backendName: 'wasm',\n kernelFunc: batchToSpaceND as {} as
 KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
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 Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
 on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
 implied.\n * See the License for the specific language governing permissions and\n * limitations under the
 License.\n *
 =====\n
*\n\nimport {Cast, CastAttrs, CastInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\nimport
 {TensorInfo} from '@tensorflow/tfjs-core';\n\nimport
 {BackendWasm} from '../backend_wasm';\n\nexport function cast(\n args: {inputs: CastInputs, attrs: CastAttrs,
 backend: BackendWasm});\n TensorInfo {\n const {inputs: {x}, attrs: {dtype}, backend} = args;\n const out =
 backend.makeOutput(x.shape, dtype);\n const inVals = backend.typedArrayFromHeap(x);\n const outVals =
 backend.typedArrayFromHeap(out);\n outVals.set(inVals);\n return out;\n})\n\nexport const castConfig:
 KernelConfig = {\n kernelName: Cast,\n backendName: 'wasm',\n kernelFunc: cast as {} as
 KernelFunc\n};\n", "/*\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the
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 on an \"AS IS\" BASIS,\n
 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License
 for the specific language governing permissions and\n * limitations under the License.\n *
 =====\n
*\n\nimport {KernelConfig, Ceil} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
 './unary_kernel';\n\nexport const ceilConfig: KernelConfig = createUnaryKernelConfig(Ceil);\n", "/*\n *
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 * See the License for the specific language governing permissions and\n * limitations under the License.\n *
 =====\n
*\n\nimport {ClipByValue, ClipByValueAttrs, ClipByValueInputs, KernelConfig, KernelFunc} from
 '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmClip: (xId: number, min:
 number, max: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmClip =
 backend.wasm.cwrap(ClipByValue, null /* void */, [\n 'number', // x_id\n 'number', // min\n 'number', //
]

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max\n 'number' // out_id\n]);\n}\n\nfunction clip(args: {\n inputs: ClipByValueInputs,\n backend: BackendWasm,\n attrs: ClipByValueAttrs\n}) {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {clipValueMin, clipValueMax} = attrs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out = backend.makeOutput(x.shape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmClip(xId, clipValueMin, clipValueMax, outId);\n return out;\n}\n\nexport const clipByValueConfig: KernelConfig = {\n kernelName: ClipByValue,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: clip\n} as KernelConfig;\n";\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
=====\n
/\n\nimport\n {backend_util, Concat, ConcatAttrs, ConcatInputs, KernelConfig, KernelFunc, util} from '@tensorflow/tfjs-core';\n import {BackendWasm} from './backend_wasm';\n import {concatImplCPU} from './kernel_utils/shared';\n import {identity} from './Identity';\n import {reshape} from './Reshape';\n export function\n concat(\n args: {inputs: ConcatInputs, backend: BackendWasm, attrs: ConcatAttrs}) {\n const {inputs, backend} = args;\n const axis = util.parseAxisParam(args.attrs.axis, inputs[0].shape)[0];\n let outShape = backend_util.computeOutShape(inputs.map(t => t.shape), axis);\n // Keep only non-empty tensors (ignore tensors with 0 in their shape).\n const $inputs = inputs.filter(t => util.sizeFromShape(t.shape) > 0);\n if ($inputs.length === 1) {\n return identity({inputs: {x: $inputs[0]}, backend});\n }\n const out = backend.makeOutput(outShape, inputs[0].dtype);\n if (util.sizeFromShape(outShape) === 0) {\n return out;\n }\n const shapes = $inputs.map(t => t.shape);\n backend_util.assertParamsConsistent(shapes, axis);\n if ($inputs[0].dtype === 'string') {\n // Any concat of n-dimensional tensors across any axis can be reduced to\n // a concatenation of two-dimensional tensors across the axis 1 by first\n // partitioning the axes of the original tensors into those less than the\n // axis to be concatenated and the rest. Then reshape the tensors\n // into a two-dimensional tensor by collapsing these two sets of axes and\n // concatenate the resulting matrices across the axis 1, finally reshaping\n // the result to have the proper shape.\n const inputs2D = $inputs.map(t => {\n const innerSize = util.sizeFromShape(t.shape.slice(axis));\n const shape = [-1, innerSize];\n return reshape({inputs: {x: t}, backend, attrs: {shape}});\n });\n const inputsValShapes = inputs2D.map(t => {\n return {vals: backend.readSync(t.dataId), shape: t.shape};\n });\n // Concat 2d tensors along axis=1.\n outShape =\n backend_util.computeOutShape(inputs2D.map(t => t.shape), 1 / axis */);\n const simplyConcat = inputs2D[0].shape[0] === 1;\n const outVals = concatImplCPU(\n inputsValShapes, outShape, inputs[0].dtype,\n simplyConcat) as string[];\n const finalOutShape =\n backend_util.computeOutShape($inputs.map(t => t.shape), axis);\n out.shape = finalOutShape;\n const outData = backend.dataIdMap.get(out.dataId);\n outData.stringBytes =\n backend_util.fromStringArrayToUint8(outVals);\n inputs2D.forEach(t => backend.disposeData(t.dataId));\n return out;\n }\n const batchDim = util.sizeFromShape($inputs[0].shape.slice(0, axis));\n let sumInnerDims = 0;\n const innerDims = $inputs.map(input => {\n const innerDim = util.sizeFromShape(input.shape.slice(axis));\n sumInnerDims += innerDim;\n return innerDim;\n });\n const inVals = $inputs.map(input => backend.typedArrayFromHeap(input));\n const outVals = backend.typedArrayFromHeap(out);\n for (let b = 0; b < batchDim; b++) {\n let outOffset = b * sumInnerDims;\n for (let i = 0; i < inVals.length; i++) {\n const innerDim = innerDims[i];\n const inOffset = b * innerDim;\n const vals = inVals[i].subarray(inOffset, inOffset + innerDim);\n outVals.set(vals, outOffset);\n outOffset += innerDim;\n }\n }\n return out;\n }\n export const concatConfig: KernelConfig =

```

{\n kernelName: Concat,\n backendName: 'wasm',\n kernelFunc: concat as { } as KernelFunc,\n};\n"/\*\*\n \* @license\n \* Copyright 2019 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the "License");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \* http://www.apache.org/licenses/LICENSE-2.0\n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is

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```
=====\n*\n\nimport {backend_util, Conv2D, Conv2DAttrs, Conv2DInputs, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\n\nlet wasmConv2d: (\n xId: number, batchSize: number, inputHeight: number, inputWidth: number,\n filterId: number, filterHeight: number, filterWidth: number, padTop: number,\n padRight: number, padBottom: number, padLeft: number, isSamePad: number,\n dilationHeight: number, dilationWidth: number, strideHeight: number,\n strideWidth: number, inputChannels: number, outputChannels: number,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmConv2d = backend.wasm.cwrap(Conv2D, null /* void */, [\n 'number', // xId\n 'number', // batchSize\n 'number', // inputHeight\n 'number', // inputWidth\n 'number', // filterId\n 'number', // filterHeight\n 'number', // filterWidth\n 'number', // padTop\n 'number', // padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', // isSamePad\n 'number', // dilationHeight\n 'number', // dilationWidth\n 'number', // strideHeight\n 'number', // strideWidth\n 'number', // inputChannels\n 'number', // outputChannels\n 'number', // outId\n]);\n}\n\nfunction conv2d(\n args: {inputs: Conv2DInputs, backend: BackendWasm, attrs: Conv2DAttrs}) {\n const {inputs, attrs, backend} = args;\n const {x, filter} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const filterId = backend.dataIdMap.get(filter.dataId).id;\n const {strides, dilations, pad, dimRoundingMode, dataFormat} = attrs;\n const $dataFormat = backend_util.convertConv2DDataFormat(dataFormat);\n const convInfo = backend_util.computeConv2DInfo(\n (x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations,\n pad, dimRoundingMode, false, $dataFormat);\n const filterHeight = convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const padRight = convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n const padLeft = convInfo.padInfo.left;\n const dilationHeight = convInfo.dilationHeight;\n const dilationWidth = convInfo.dilationWidth;\n const strideHeight = convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n const inputChannels = convInfo.inChannels;\n const outputChannels = convInfo.outChannels;\n const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;\n if (convInfo.dataFormat !== 'channelsLast') {\n throw new Error(\n `wasm backend Conv2D does not support dataFormat: ` +\n `${convInfo.dataFormat}`. Please use 'channelsLast'.`);\n }\n const out = backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmConv2d(\n xId, x.shape[0], x.shape[1], x.shape[2], filterId, filterHeight,\n filterWidth, padTop, padRight, padBottom, padLeft, isSamePad,\n dilationHeight, dilationWidth, strideHeight, strideWidth, inputChannels,\n outputChannels, outId);\n return out;\n}\n\nexport const conv2DConfig: KernelConfig = {\n kernelName: Conv2D,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: conv2d as { } as KernelFunc\n};\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under
```

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```
=====\n
*\n\nimport { backend_util, Conv2DBackpropInput, Conv2DBackpropInputAttrs, Conv2DBackpropInputInputs,
KernelConfig, KernelFunc, TensorInfo, util } from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from
'./backend_wasm';\n\nlet wasmConv2DBackpropInput: (\n dyId: number, filterId: number, batchSize: number,
filterHeight: number,\n filterWidth: number, inHeight: number, inWidth: number, inChannels: number,\n outHeight: number, outWidth: number, outChannels: number,\n strideHeight: number, strideWidth: number,
topPad: number, leftPad: number,\n fltS0: number, fltS1: number, fltS2: number, xBatchStride: number,\n xRowStride: number, xColStride: number,
xChannelStride: number,\n yBatchStride: number, yRowStride: number, yColStride: number,\n yChannelStride:
number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n
wasmConv2DBackpropInput = backend.wasm.cwrap(Conv2DBackpropInput, null, [\n 'number', // dyId\n
'number', // filterId\n 'number', // batchSize\n 'number', // filterHeight\n 'number', // filterWidth\n 'number',
// inHeight\n 'number', // inWidth\n 'number', // inChannels\n 'number', // outHeight\n 'number', //
outWidth\n 'number', // outChannels\n 'number', // strideHeight\n 'number', // strideWidth\n 'number', //
topPad\n 'number', // leftPad\n 'number', // fltS0\n 'number', // fltS1\n 'number', // fltS2\n 'number', //
xBatchStride\n 'number', // xRowStride\n 'number', // xColStride\n 'number', // xChannelStride\n 'number',
// yBatchStride\n 'number', // yRowStride\n 'number', // yColStride\n
'number', // yChannelStride\n 'number', // outId\n]);\n\nfunction conv2DBackpropInput(args: {\n backend:
BackendWasm,\n inputs: Conv2DBackpropInputInputs,\n attrs: Conv2DBackpropInputAttrs\n}): TensorInfo {\n
const { backend, inputs, attrs } = args;\n const { dy, filter } = inputs;\n const { strides, pad, dataFormat,
dimRoundingMode, inputShape } = attrs;\n\n const dilations = 1;\n\n const $dataFormat =
backend_util.convertConv2DDataFormat(dataFormat);\n const convInfo = backend_util.computeConv2DInfo(\n
inputShape, filter.shape as [number, number, number, number], strides,\n dilations, pad, dimRoundingMode,
false /* depthwise */, $dataFormat);\n const {\n batchSize,\n filterHeight,\n filterWidth,\n inChannels,\n
inHeight,\n inWidth,\n outChannels,\n outHeight,\n outWidth,\n strideHeight,\n strideWidth\n } =
convInfo;\n\n const topPad = filterHeight - 1 - convInfo.padInfo.top;\n const leftPad = filterWidth - 1 -
convInfo.padInfo.left;\n\n
const isChannelsLast = convInfo.dataFormat === 'channelsLast';\n const dxStrides =
util.computeStrides(convInfo.inShape);\n const dyStrides = util.computeStrides(dy.shape);\n const [fltS0, fltS1,
fltS2] = util.computeStrides(filter.shape);\n const xBatchStride = dxStrides[0];\n const xRowStride =
isChannelsLast ? dxStrides[1] : dxStrides[2];\n const xColStride = isChannelsLast ? dxStrides[2] : 1;\n const
xChannelStride = isChannelsLast ? 1 : dxStrides[1];\n const yBatchStride = dyStrides[0];\n const yRowStride =
isChannelsLast ? dyStrides[1] : dyStrides[2];\n const yColStride = isChannelsLast ? dyStrides[2] : 1;\n const
yChannelStride = isChannelsLast ? 1 : dyStrides[1];\n\n const out = backend.makeOutput(convInfo.inShape,
'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n const dyId =
backend.dataIdMap.get(dy.dataId).id;\n const filterId = backend.dataIdMap.get(filter.dataId).id;\n\n
wasmConv2DBackpropInput(\n dyId, filterId, batchSize,\n filterHeight, filterWidth, inHeight, inWidth,\n inChannels, outHeight, outWidth, outChannels, strideHeight,
strideWidth,\n topPad, leftPad, fltS0, fltS1, fltS2, xBatchStride, xRowStride,\n xColStride, xChannelStride,
yBatchStride, yRowStride, yColStride,\n yChannelStride, outId);\n return out;\n}\n\nexport const
conv2DBackpropInputConfig: KernelConfig = {\n kernelName: Conv2DBackpropInput,\n backendName:
'wasm',\n setupFunc: setup,\n kernelFunc: conv2DBackpropInput as {} as KernelFunc\n};\n\n"/**\n * @license\n *
Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
'License');\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an 'AS IS' BASIS,\n *
WITHOUT WARRANTIES
```

OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n\n*\n\nimport { Cos, KernelConfig } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from './unary_kernel';\nexport const cosConfig: KernelConfig = createUnaryKernelConfig(Cos);\n"/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the\n * specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n\n*\n\nimport { Cosh, KernelConfig } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from './unary_kernel';\nexport const coshConfig: KernelConfig = createUnaryKernelConfig(Cosh);\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the\n * specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n\n*\n\nimport { CropAndResize, CropAndResizeAttrs, CropAndResizeInputs, KernelConfig, KernelFunc, TensorInfo } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport { cast } from './Cast';\n// Must match enum in CropAndResize.cc\nenum InterpolationMethod {\n bilinear = 0,\n nearest = 1\n}\n\nlet wasmCropAndResize: (\n imagesId: number, boxesId: number, boxIndId: number, numBoxes: number,\n imagesShape: Uint8Array, cropHeight: number, cropWidth: number,\n method: number, extrapolationValue: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmCropAndResize = backend.wasm.cwrap(CropAndResize, null /*void*/, [\n 'number', // imagesId\n 'number', // boxesId\n 'number', // boxIndId\n 'number', // numBoxes\n 'array', // images shape\n 'number', // cropHeight\n 'number', // cropWidth\n 'number', // method\n 'number', // extrapolation value\n 'number' // out id\n]);\n\n function cropAndResize(args: {\n backend: BackendWasm,\n inputs: CropAndResizeInputs,\n attrs: CropAndResizeAttrs\n }): TensorInfo {\n const { backend, inputs, attrs } = args;\n const { method, extrapolationValue, cropSize } = attrs;\n const { image, boxes, boxInd } = inputs;\n\n const numBoxes = boxes.shape[0];\n const [cropHeight, cropWidth] = cropSize as [number, number];\n const outShape = [numBoxes, cropHeight, cropWidth, image.shape[3]];\n\n let imagesData = backend.dataIdMap.get(image.dataId);\n let castedData;\n if (image.dtype !== 'float32') {\n castedData = cast({ backend, inputs: { x: image }, attrs: { dtype: 'float32' }});\n imagesData = backend.dataIdMap.get(castedData.dataId);\n }\n\n const imagesId = imagesData.id;\n const boxesId = backend.dataIdMap.get(boxes.dataId).id;\n const boxIndId = backend.dataIdMap.get(boxInd.dataId).id;\n const out = backend.makeOutput(outShape, 'float32');\n\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n wasmCropAndResize(\n imagesId, boxesId, boxIndId, numBoxes, imagesShapeBytes, cropHeight,\n cropWidth, InterpolationMethod[method as {}] as keyof typeof InterpolationMethod,\n extrapolationValue, outId);\n\n if (castedData !== null) {\n backend.disposeData(castedData.dataId);\n }\n\n return out;\n }\n\n export const cropAndResizeConfig: KernelConfig = {\n kernelName: CropAndResize,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: cropAndResize as {} as KernelFunc\n };\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights
```

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```
=====\n*\n\nimport { backend_util, KernelConfig, KernelFunc, Cumsum, CumsumAttrs, CumsumInputs, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { CppDType } from './types';\nimport { transpose } from './Transpose';\nlet wasmCumsum: (xId: number, exclusive: number, reverse: number, finalDim: number, outId: number, dtype: CppDType) => void;\nfunction setup(backend: BackendWasm) {\n wasmCumsum = backend.wasm.cwrap(Cumsum, null /* void */, [\n 'number', // x_id\n 'number', // exclusive\n 'number', // reverse\n 'number', // final_dim\n 'number', // out_id\n 'number' // dtype\n]);\n}\nexport function cumsum(\n args: { inputs: CumsumInputs, backend: BackendWasm, attrs: CumsumAttrs }): TensorInfo {\n const { inputs, backend, attrs } = args;\n const { x } = inputs;\n const { axis, exclusive, reverse } = attrs;\n const xRank = x.shape.length;\n util.assert(x.dtype === 'float32' || x.dtype === 'int32',\n () => `cumsum does not support ${x.dtype} tensors in the WASM backend`);\n // permute required axis to inner most axis\n const permutation = backend_util.getAxesPermutation([axis], xRank);\n let permutedX = x;\n if (permutation !== null) {\n permutedX = transpose({ inputs: { x }, attrs: { perm: permutation }, backend});\n }\n const permutedAxis = backend_util.getInnerMostAxes(1, xRank)[0];\n backend_util.assertAxesAreInnerMostDims('cumsum', [permutedAxis], xRank);\n const permutedOut = backend.makeOutput(permutedX.shape, permutedX.dtype);\n const finalDim = permutedX.shape[permutedAxis];\n const permutedXId =\n = backend.dataIdMap.get(permutedX.dataId).id;\n const permutedOutId =\n backend.dataIdMap.get(permutedOut.dataId).id;\n wasmCumsum(permutedXId, exclusive ? 1 : 0, reverse ? 1 : 0, finalDim, permutedOutId, CppDType[x.dtype]);\n // transpose data back if permuted\n let out = permutedOut;\n if (permutation !== null) {\n const undoPermutation =\n backend_util.getUndoAxesPermutation(permutation);\n out = transpose(\n { inputs: { x: permutedOut }, attrs: { perm: undoPermutation }, backend});\n }\n backend.disposeData(permutedX.dataId);\n backend.disposeData(permutedOut.dataId);\n return out;\n}\nexport const cumsumConfig: KernelConfig = {\n kernelName: Cumsum,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: cumsum as {\n KernelFunc\n },\n \"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n=====\n*\n\nimport { DepthToSpace, DepthToSpaceAttrs, DepthToSpaceInputs, KernelConfig, KernelFunc, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nlet wasmDepthToSpace: (\n xId: number, blockSize: number, channelsLast: number, xStrides: Uint8Array, xStridesLength: number, outputShape: Uint8Array, outputStrides: Uint8Array, outSize: number, outId: number) => void;\nfunction setup(backend: BackendWasm): void {\n wasmDepthToSpace = backend.wasm.cwrap(DepthToSpace, null /* void */, [\n 'number', // xId\n 'number', // blockSize\n 'number', // channelsLast\n 'array', // xStrides\n 'number', // xStridesLength\n 'array', // outputShape\n 'array', // outputStrides\n 'number', // outSize\n 'number', // outId\n]);\n}\nexport function depthToSpace(args: {\n backend: BackendWasm,\n inputs: DepthToSpaceInputs,\n attrs: DepthToSpaceAttrs\n}): TensorInfo {\n const
```

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{backend, inputs, attrs} = args;\n const {x} = inputs;\n const {blockSize, dataFormat} = attrs;\n\n const batchSize
= x.shape[0];\n const inputHeight = (dataFormat === 'NHWC') ? x.shape[1] : x.shape[2];\n const inputWidth =
(dataFormat === 'NHWC') ? x.shape[2] : x.shape[3];\n const inputDepth = (dataFormat === 'NHWC') ? x.shape[3]
: x.shape[1];\n\n const outputHeight = inputHeight * blockSize;\n const outputWidth = inputWidth * blockSize;\n
const outputDepth = inputDepth / (blockSize * blockSize);\n\n
const outputShape = (dataFormat === 'NHWC') ?\n [batchSize, outputHeight, outputWidth, outputDepth] :\n [batchSize, outputDepth, outputHeight, outputWidth];\n\n const out = backend.makeOutput(outputShape,
'float32');\n\n const xData = backend.dataIdMap.get(x.dataId);\n const xId = xData.id;\n const xStridesBytes =\n new Uint8Array(new Int32Array(util.computeStrides(x.shape)).buffer);\n\n const outputShapeBytes = new
Uint8Array(new Int32Array(outputShape).buffer);\n const outStridesBytes =\n new Uint8Array(new
Int32Array(util.computeStrides(outputShape)).buffer);\n\n const outId = backend.dataIdMap.get(out.dataId).id;\n
const channelsLast = dataFormat === 'NHWC' ? 1 : 0;\n wasmDepthToSpace(\n xId, blockSize, channelsLast,
xStridesBytes, x.shape.length - 1,\n outputShapeBytes, outStridesBytes, outputShape.length, outId);\n\n return
out;\n}\n\nexport const depthToSpaceConfig: KernelConfig = {\n kernelName: DepthToSpace,\n backendName:
'wasm',\n
setupFunc: setup,\n kernelFunc: depthToSpace as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019
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may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*/\n\nimport {backend_util, DepthwiseConv2dNative, DepthwiseConv2dNativeAttrs,
DepthwiseConv2dNativeInputs, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from
'./backend_wasm';\n\nlet wasmDepthwiseConv2d: (\n xId: number, batchSize: number, inputHeight: number,
inputWidth: number,\n filterId: number, filterHeight: number, filterWidth: number, padTop: number,\n
padRight: number, padBottom: number, padLeft: number, isSamePad: number,\n dilationHeight: number,
dilationWidth: number, strideHeight: number,\n strideWidth: number, inputChannels: number, outputChannels:
number,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmDepthwiseConv2d =\n backend.wasm.cwrap(DepthwiseConv2dNative, null /* void */, [\n 'number', // xId\n 'number', //
batchSize\n 'number', // inputHeight\n 'number', // inputWidth\n 'number', // filterId\n 'number', //
filterHeight\n 'number', // filterWidth\n 'number', // padTop\n 'number', // padRight\n 'number', //
padBottom\n 'number', // padLeft\n 'number', // isSamePad\n 'number',
// dilationHeight\n 'number', // dilationWidth\n 'number', // strideHeight\n 'number', // strideWidth\n
'number', // inputChannels\n 'number', // outputChannels\n 'number', // outId\n]);\n}\n\nfunction
depthwiseConv2d(args: {\n inputs: DepthwiseConv2dNativeInputs,\n backend: BackendWasm,\n attrs:
DepthwiseConv2dNativeAttrs\n}) {\n const {inputs, attrs, backend} = args;\n\n const {x, filter} = inputs;\n const
xId = backend.dataIdMap.get(x.dataId).id;\n const filterId = backend.dataIdMap.get(filter.dataId).id;\n\n const
{strides, dilations, pad, dimRoundingMode} = attrs;\n\n const $dilations = dilations === null ? [1, 1] : dilations;\n\n
const convInfo = backend_util.computeConv2DInfo(\n (x as Tensor4D).shape, (filter as Tensor4D).shape,
strides,\n ($dilations as number | [number, number]), pad, dimRoundingMode,\n true /* depthwise */);\n\n
const filterHeight = convInfo.filterHeight;\n const filterWidth
= convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const padRight = convInfo.padInfo.right;\n
const padBottom = convInfo.padInfo.bottom;\n const padLeft = convInfo.padInfo.left;\n const dilationHeight =
convInfo.dilationHeight;\n const dilationWidth = convInfo.dilationWidth;\n const strideHeight =
convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n const inputChannels =

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convInfo.inChannels;\n const outputChannels = convInfo.outChannels;\n const isSamePad = convInfo.padInfo.type
=== 'SAME' ? 1 : 0;\n\n if (convInfo.dataFormat !== 'channelsLast') {\n throw new Error(\n `wasm backend
DepthwiseConv2dNative does not support dataFormat:` +\n `${convInfo.dataFormat}`. Please use
'channelsLast.`);\n }\n\n const out = backend.makeOutput(convInfo.outShape, 'float32');\n const outId =
backend.dataIdMap.get(out.dataId).id;\n wasmDepthwiseConv2d(\n xId, x.shape[0], x.shape[1], x.shape[2],
filterId, filterHeight,\n filterWidth,
padTop, padRight, padBottom, padLeft, isSamePad,\n dilationHeight, dilationWidth, strideHeight, strideWidth,
inputChannels,\n outputChannels, outId);\n return out;\n}\n\nexport const depthwiseConv2dNativeConfig:
KernelConfig = {\n kernelName: DepthwiseConv2dNative,\n backendName: 'wasm',\n setupFunc: setup,\n
kernelFunc: depthwiseConv2d as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2021 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations
under the License.\n *
=====\n
*\nimport {Elu, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'/unary_kernel';\n\nexport const eluConfig: KernelConfig = createUnaryKernelConfig(Elu);\n", "/*\n * @license\n
* Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\nimport {Equal, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
'/binary_kernel';\n\nconst supportsFullBroadcast = false;\nexport const equalConfig: KernelConfig =\ncreateBinaryKernelConfig(Equal, supportsFullBroadcast, 'bool');\n", "/*\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*\nimport {Exp, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'/unary_kernel';\n\nexport const expConfig: KernelConfig = createUnaryKernelConfig(Exp, 'float32');\n", "/*\n *
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2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\nimport {ExpandDims, ExpandDimsAttrs, ExpandDimsInputs,

```

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KernelConfig, KernelFunc, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from
'./backend_wasm';\nimport {reshape} from './Reshape';\n\nexport function expandDims(args: {\n inputs:
ExpandDimsInputs,\n attrs: ExpandDimsAttrs,\n backend: BackendWasm\n}) {\n const {inputs, attrs, backend} =
args;\n const {input} = inputs;\n const {dim} = attrs;\n\n const inputRank = input.shape.length;\n const newShape
= input.shape.slice();\n let $dim = dim;\n if (dim < 0) {\n // Negative value is counted from the tail of rank.\n
util.assert(\n -(inputRank + 1) <= dim,\n () => `Axis must be in the interval [${- (inputRank + 1)}, ${\n
inputRank}]`);\n $dim = inputRank + dim + 1;\n }\n newShape.splice($dim, 0, 1);\n\n return reshape({inputs:
{x: input}, backend, attrs: {shape: newShape}});\n}\n\nexport const expandDimsConfig: KernelConfig = {\n
kernelName: ExpandDims,\n backendName: 'wasm',\n kernelFunc: expandDims as {} as KernelFunc,\n};\n"/**\n
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2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *

```

```

=====\n
*/\n\nimport {KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\nimport {Fill, FillAttrs} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nexport function fill(args: {attrs:
FillAttrs, backend: BackendWasm}) {\n const {attrs: {shape,
value, dtype}, backend} = args;\n const out = backend.makeOutput(shape, dtype);\n const outVals =
backend.typedArrayFromHeap(out);\n outVals.fill(value as number);\n return out;\n}\n\nexport const fillConfig:
KernelConfig = {\n kernelName: Fill,\n backendName: 'wasm',\n kernelFunc: fill as {} as
KernelFunc,\n};\n"/**\n
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Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n
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on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

```

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=====\n
*/\n\nimport {FlipLeftRight, FlipLeftRightInputs, KernelConfig, KernelFunc, TensorInfo} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from './backend_wasm';\n\nlet wasmFlipLeftRight: (\n xId: number, batch:
number, imageHeight: number, imageWidth: number,\n numChannels: number, outId: number) =>
void;\n\nfunction setup(backend: BackendWasm) {\n wasmFlipLeftRight = backend.wasm.cwrap(FlipLeftRight,
null /* void */, [\n 'number', // xId\n 'number', // batch\n 'number', // imageHeight\n 'number', //
imageWidth\n 'number', // numChannels\n 'number', // outId\n]);\n}\n\nexport function flipLeftRight(\n
args: {inputs: FlipLeftRightInputs, backend: BackendWasm}): TensorInfo {\n const {inputs, backend} = args;\n
const {image} = inputs;\n\n const out = backend.makeOutput(image.shape, image.dtype);\n const imageId =
backend.dataIdMap.get(image.dataId).id;\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n
const [batch, imageHeight, imageWidth, numChannels] = image.shape;\n\n wasmFlipLeftRight(\n imageId,
batch, imageHeight, imageWidth, numChannels, outId);\n return out;\n}\n\nexport const flipLeftRightConfig:
KernelConfig = {\n kernelName: FlipLeftRight,\n backendName: 'wasm',\n kernelFunc: flipLeftRight as {} as
KernelFunc,\n setupFunc: setup\n};\n"/**\n
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compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language

```

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```
=====\n\n*\nimport {Floor, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from\n './unary_kernel';\nexport const floorConfig: KernelConfig = createUnaryKernelConfig(Floor);\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a\n copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable\n law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n\n*\nimport {FloorDiv, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from\n './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const floorDivConfig: KernelConfig =\n createBinaryKernelConfig(FloorDiv, supportsFullBroadcast);\n", "/*\n * @license\n * Copyright 2019 Google\n LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not\n use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n governing permissions and\n * limitations under the License.\n *
```

```
=====\n\n*\nimport {FusedBatchNorm, FusedBatchNormAttrs, FusedBatchNormInputs, KernelConfig, KernelFunc,\n TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nlet\n wasmBatchNorm: (\n xId: number, meanId: number, varianceId: number, offsetId: number,\n scaleId: number,\n varianceEpsilon: number, outId: number) => void;\nfunction setup(backend: BackendWasm): void {\n wasmBatchNorm = backend.wasm.cwrap(\n FusedBatchNorm, null /* void */,\n ['number', 'number',\n 'number', 'number', 'number', 'number', 'number'];\n)\nfunction fusedBatchNorm(args: {\n backend:\n BackendWasm,\n inputs: FusedBatchNormInputs,\n attrs: FusedBatchNormAttrs\n}): TensorInfo {\n const\n {backend, inputs, attrs} = args;\n const {varianceEpsilon} = attrs;\n const {x, mean, variance, offset, scale} =\n inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const meanId =\n backend.dataIdMap.get(mean.dataId).id;\n const varianceId = backend.dataIdMap.get(variance.dataId).id;\n const offsetId = offset != null ? backend.dataIdMap.get(offset.dataId).id : 0;\n const scaleId = scale != null ?\n backend.dataIdMap.get(scale.dataId).id : 0;\n const out = backend.makeOutput(x.shape, x.dtype);\n // Short-\n circuit zero-sized tensors.\n if (util.sizeFromShape(x.shape) === 0) {\n return out;\n }\n const outId =\n backend.dataIdMap.get(out.dataId).id;\n wasmBatchNorm(\n xId, meanId, varianceId, offsetId, scaleId,\n varianceEpsilon, outId);\n return out;\n}\nexport const fusedBatchNormConfig: KernelConfig = {\n kernelName:\n FusedBatchNorm,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: fusedBatchNorm as {\n as\n KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the\n Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the\n License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is\n distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either\n express or implied.\n * See the License for the specific language governing permissions and\n * limitations under\n the License.\n *
```

```
=====\n\n*\nimport {backend_util, FusedConv2D, FusedConv2DAttrs, FusedConv2DInputs, KernelConfig, KernelFunc,\n Tensor4D} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport
```

```

{FusableActivation} from './types';\n\nlet wasmFusedConv2d:\n (xId: number, batchSize: number, inputHeight:\n number, inputWidth: number,\n filterId: number, filterHeight: number, filterWidth: number,\n biasId: number,\n padTop: number, padRight: number, padBottom: number,\n padLeft: number, isSamePad: number,\n dilationHeight: number,\n dilationWidth:\n number, strideHeight: number, strideWidth: number,\n inputChannels: number, outputChannels: number,\n activation: number,\n preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>\n void;\n\nfunction setup(backend: BackendWasm) {\n wasmFusedConv2d = backend.wasm.cwrap(FusedConv2D,\n null /* void */, [\n 'number', // xId\n 'number', // batchSize\n 'number', // inputHeight\n 'number', //\n inputWidth\n 'number', // filterId\n 'number', // filterHeight\n 'number', // filterWidth\n 'number', // biasId\n 'number', // padTop\n 'number', // padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', //\n isSamePad\n 'number', // dilationHeight\n 'number', // dilationWidth\n 'number', // strideHeight\n 'number',\n // strideWidth\n 'number', // inputChannels\n 'number', // outputChannels\n 'number', // activation\n 'number', // preluActivationWeightsId\n 'number', // leakyreluAlpha\n 'number', // outId\n]);\n}\n\nfunction fusedConv2d(args: {\n inputs: FusedConv2DInputs,\n backend:\n BackendWasm,\n attrs: FusedConv2DAttrs\n}) {\n const {inputs, attrs, backend} = args;\n const {x, filter, bias,\n preluActivationWeights} = inputs;\n const {\n strides,\n pad,\n dilations,\n dataFormat,\n dimRoundingMode,\n activation,\n leakyreluAlpha\n } = attrs;\n const convInfo =\n backend_util.computeConv2DInfo(\n (x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations,\n pad, dimRoundingMode);\n const fusedActivation =\n FusableActivation[activation as {}] as keyof typeof\n FusableActivation;\n if (fusedActivation == null) {\n throw new Error(\n `${activation} activation not yet\n supported for FusedConv2D` +\n `in the wasm backend.`);\n }\n const xId =\n backend.dataIdMap.get(x.dataId).id;\n const filterId = backend.dataIdMap.get(filter.dataId).id;\n const\n outputChannels = convInfo.outChannels;\n\n let biasId = 0;\n if (bias != null) {\n const biasData = backend.dataIdMap.get(bias.dataId);\n if\n (biasData.shape.length !== 1) {\n throw new Error(\n `FusedConv2D only supports rank-1 bias but got`\n +\n `rank ${biasData.shape.length}.`);\n }\n if (biasData.shape[0] !== outputChannels) {\n throw new\n Error(\n `FusedConv2D bias shape (${biasData.shape}) does not`\n +\n `match the number of output\n channels (${outputChannels}).`);\n }\n biasId = biasData.id;\n }\n const filterHeight =\n convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const\n padRight = convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n const padLeft =\n convInfo.padInfo.left;\n const dilationHeight = convInfo.dilationHeight;\n const dilationWidth =\n convInfo.dilationWidth;\n const strideHeight = convInfo.strideHeight;\n const strideWidth =\n convInfo.strideWidth;\n\n const inputChannels = convInfo.inChannels;\n const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;\n const batchSize = convInfo.batchSize;\n const inHeight = convInfo.inHeight;\n const inWidth =\n convInfo.inWidth;\n if (dataFormat !== 'NHWC') {\n throw new Error(\n `wasm backend FusedConv2D\n does not support dataFormat:` +\n `${dataFormat}. Please use 'NHWC'.`);\n }\n const out =\n backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n const\n preluActivationWeightsId = preluActivationWeights == null ?\n 0 :\n backend.dataIdMap.get(preluActivationWeights.dataId).id;\n wasmFusedConv2d(\n xId, batchSize, inHeight,\n inWidth, filterId, filterHeight, filterWidth,\n biasId, padTop, padRight, padBottom, padLeft, isSamePad,\n dilationHeight,\n dilationWidth, strideHeight, strideWidth, inputChannels, outputChannels,\n fusedActivation,\n preluActivationWeightsId, leakyreluAlpha |\n 0, outId);\n return out;\n}\n\nexport const fusedConv2DConfig: KernelConfig = {\n kernelName:\n FusedConv2D,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: fusedConv2d as {} as\n KernelFunc\n};\n\n/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the\n Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the\n License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *

```



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```
=====
*/
import { backend_util, FusedDepthwiseConv2D, FusedDepthwiseConv2DAttrs,
 FusedDepthwiseConv2DInputs, KernelConfig, KernelFunc, Tensor4D } from '@tensorflow/tfjs-core';
import { BackendWasm } from './backend_wasm';
import { FusibleActivation } from './types';

wasmFusedDepthwiseConv2d(xId: number, batchSize: number, inputHeight: number, inputWidth: number,
 filterId: number, filterHeight: number, filterWidth: number, biasId: number, padTop: number, padRight:
 number, padBottom: number, padLeft: number, isSamePad: number, dilationHeight: number,
 dilationWidth: number, strideHeight: number, strideWidth: number, inputChannels: number, outputChannels:
 number, activation: number, preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>
 void;

function setup(backend: BackendWasm) {
 const wasmFusedDepthwiseConv2d =
 backend.wasm.cwrap(FusedDepthwiseConv2D, null /* void */, [
 'number', // xId
 'number', // batchSize
 'number', // inputHeight
 'number', // inputWidth
 'number', // filterId
 'number', // filterHeight
 'number', // filterWidth
 'number', // biasId
 'number', // padTop
 'number', // padRight
 'number', // padBottom
 'number', // padLeft
 'number', // isSamePad
 'number', // dilationHeight
 'number', // dilationWidth
 'number', // strideHeight
 'number', // strideWidth
 'number', // inputChannels
 'number', // outputChannels
 'number', // activation
 'number', // preluActivationWeightsId
 'number', // leakyreluAlpha
 'number', // outId
]);

 function fusedDepthwiseConv2d(args: {
 inputs: FusedDepthwiseConv2DInputs,
 backend: BackendWasm,
 attrs: FusedDepthwiseConv2DAttrs
 }) {
 const { inputs, attrs, backend } = args;
 const { x, filter, bias, preluActivationWeights } = inputs;
 const {
 strides,
 pad,
 dilations,
 dataFormat,
 dimRoundingMode,
 activation,
 leakyreluAlpha
 } = attrs;

 const convInfo =
 backend_util.computeConv2DInfo(
 (x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations,
 pad, dimRoundingMode, true /* depthwise */
);

 const fusedActivation =
 FusibleActivation[activation as keyof typeof FusibleActivation];

 if (fusedActivation == null) {
 throw new Error(`${activation} activation not yet supported for FusedDepthwiseConv2D` +
 `in the wasm backend.`);
 }

 const xId = backend.dataIdMap.get(x.dataId).id;
 const filterId = backend.dataIdMap.get(filter.dataId).id;
 const outputChannels = convInfo.outChannels;

 let biasId = 0;
 if (bias != null) {
 const biasData = backend.dataIdMap.get(bias.dataId);
 if (biasData.shape.length !== 1) {
 throw new Error(`FusedDepthwiseConv2D only supports rank-1 bias but got` +
 `rank ${biasData.shape.length}`);
 }
 if (biasData.shape[0] !== outputChannels) {
 throw new Error(`FusedDepthwiseConv2D bias shape` +
 `(${biasData.shape}) does not` +
 `match the number of output channels (${outputChannels})`);
 }
 biasId = biasData.id;
 }

 const filterHeight = convInfo.filterHeight;
 const filterWidth = convInfo.filterWidth;
 const padTop = convInfo.padInfo.top;
 const padRight = convInfo.padInfo.right;
 const padBottom = convInfo.padInfo.bottom;
 const padLeft = convInfo.padInfo.left;
 const dilationHeight = convInfo.dilationHeight;
 const dilationWidth = convInfo.dilationWidth;
 const strideHeight = convInfo.strideHeight;
 const strideWidth = convInfo.strideWidth;
 const inputChannels = convInfo.inChannels;
 const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;
 const batchSize = convInfo.batchSize;
 const inHeight = convInfo.inHeight;
 const inWidth = convInfo.inWidth;

 if (dataFormat !== 'NHWC') {
 throw new Error(`wasm backend FusedDepthwiseConv2D does not support dataFormat:` +
 `${dataFormat}`);
 }

 const out = backend.makeOutput(convInfo.outShape, 'float32');
 const outId = backend.dataIdMap.get(out.dataId).id;
 const preluActivationWeightsId = preluActivationWeights == null ? 0 :
 backend.dataIdMap.get(preluActivationWeights.dataId).id;

 wasmFusedDepthwiseConv2d(xId,

```

```

batchSize, inHeight, inWidth, filterId, filterHeight, filterWidth,\n biasId, padTop, padRight, padBottom, padLeft,
isSamePad, dilationHeight,\n dilationWidth, strideHeight, strideWidth, inputChannels, outputChannels,\n fusedActivation, preluActivationWeightsId, leakyreluAlpha || 0, outId);\n\n return out;\n}\n\nexport const
fusedDepthwiseConv2DConfig: KernelConfig = {\n kernelName: FusedDepthwiseConv2D,\n backendName:
'wasm',\n setupFunc: setup,\n kernelFunc: fusedDepthwiseConv2d as {} as KernelFunc\n};\n\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
'License');\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an 'AS IS' BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *

```

```

=====\n
*\n\nimport {gather_util, GatherNd, GatherNdInputs, KernelConfig, TensorInfo} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {CppType} from './types';\n\nlet
wasmGatherNd: (\n xId: number, dtype: CppDType, indicesId: number, numSlices: number,\n sliceRank: number, sliceSize: number, strides: Uint8Array, outId: number) =>\n void;\n\nfunction
setup(backend: BackendWasm): void {\n wasmGatherNd = backend.wasm.cwrap(GatherNd, null /*void*/, [\n
'number', // xId\n 'number', // dtype\n 'number', // indicesId\n 'number', // numSlices\n 'number', //
sliceRank\n 'number', // sliceSize\n 'array', // strides\n 'number' // outId\n]);\n}\n\nfunction gatherNd(args:
{backend: BackendWasm, inputs: GatherNdInputs}):\n TensorInfo {\n const {backend, inputs} = args;\n const
{params, indices} = inputs;\n\n const [resultShape, numSlices, sliceSize, strides] =\n
gather_util.prepareAndValidate(params, indices);\n\n const out = backend.makeOutput(resultShape,
params.dtype);\n if (numSlices === 0) {\n return out;\n }\n\n const indicesShape = indices.shape;\n const
sliceRank = indicesShape[indicesShape.length - 1];\n\n const xData = backend.dataIdMap.get(params.dataId);\n
const xId = xData.id;\n\n const indicesData = backend.dataIdMap.get(indices.dataId);\n const indicesId = indicesData.id;\n\n const
stridesBytes = new Uint8Array(new Int32Array(strides).buffer);\n\n const outId =
backend.dataIdMap.get(out.dataId).id;\n wasmGatherNd(\n xId, CppDType[params.dtype], indicesId,
numSlices, sliceRank, sliceSize,\n stridesBytes, outId);\n\n return out;\n}\n\nexport const gatherNdConfig:
KernelConfig = {\n kernelName: GatherNd,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc:
gatherNd\n};\n\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the 'License');\n * you may not use this file except in compliance with the
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Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an 'AS IS' BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

```

```

=====\n
*\n\nimport {backend_util, GatherV2, GatherV2Attrs, GatherV2Inputs, KernelConfig, KernelFunc, Tensor,
TensorInfo, TypedArray, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from
'../backend_wasm';\n\nimport {reshape} from './Reshape';\n\nimport {CppType} from './types';\n\nlet wasmGather:
(\n xId: number, dtype: CppDType, xStrides: Uint8Array, stridesSize: number,\n indicesId: number, batchSize:
number, outStrides: Uint8Array,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n
 wasmGather = backend.wasm.cwrap('Gather', null /*void*/, [\n 'number', // xId\n 'number', // dtype\n
'array', // xStrides\n 'number', // stridesSize\n 'number', // indicesId\n 'number', // batchSize\n
'array', // outStrides\n 'number' // outId\n]);\n}\n\nfunction gatherV2(\n args: {backend: BackendWasm,
inputs: GatherV2Inputs, attrs: GatherV2Attrs}): \n TensorInfo {\n const {backend, inputs, attrs} = args;\n const
{x, indices} = inputs;\n const {axis, batchDims} = attrs;\n\n // Throw error when any index is out of bound.\n

```

```

const parsedAxis = util.parseAxisParam(axis, x.shape)[0];\n const indicesVals = backend.readSync(indices.dataId)
as TypedArray;\n const axisDim = x.shape[parsedAxis];\n for (let i = 0; i < indicesVals.length; ++i) {\n const
index = indicesVals[i];\n util.assert(\n index <= axisDim - 1 && index >= 0,\n () =>\n `GatherV2:
the index value ${index} is not in [0, ${axisDim - 1}]`);\n }\n\n const shapeInfo =
backend_util.segment_util.collectGatherOpShapeInfo(\n x as Tensor, indices as Tensor, parsedAxis,
batchDims);\n\n const flattenX = reshape({\n inputs: {x},\n attrs: {\n shape: [\n
shapeInfo.batchSize, shapeInfo.outerSize, shapeInfo.dimSize,\n shapeInfo.sliceSize\n]\n },\n backend\n
});\n const indicesSize = util.sizeFromShape(indices.shape);\n const flattenIndex = reshape({\n inputs: {x:
indices},\n attrs: {shape: [shapeInfo.batchSize, indicesSize / shapeInfo.batchSize]},\n backend\n });\n const
flattenOutputShape = [\n shapeInfo.batchSize, shapeInfo.outerSize, indicesSize / shapeInfo.batchSize,\n
shapeInfo.sliceSize\n];\n\n const out = backend.makeOutput(flattenOutputShape, x.dtype);\n if
(util.sizeFromShape(x.shape) === 0) {\n return out;\n }\n\n const stridesSize = flattenX.shape.length - 1;\n\n const
xData = backend.dataIdMap.get(flattenX.dataId);\n const xId = xData.id;\n\n const indicesData =
backend.dataIdMap.get(flattenIndex.dataId);\n const indicesId = indicesData.id;\n\n const outId =
backend.dataIdMap.get(out.dataId).id;\n\n const xStridesBytes = new Uint8Array(\n new
Int32Array(util.computeStrides(flattenX.shape)).buffer);\n
const outStridesBytes = new Uint8Array(\n new
Int32Array(util.computeStrides(flattenOutputShape)).buffer);\n\n wasmGather(\n xId, CppDType[x.dtype],
xStridesBytes, stridesSize, indicesId,\n shapeInfo.batchSize, outStridesBytes, outId);\n\n
backend.disposeData(flattenX.dataId);\n backend.disposeData(flattenIndex.dataId);\n\n // reshape\n out.shape =
shapeInfo.outputShape;\n return out;\n}\n\nexport const gatherV2Config: KernelConfig = {\n kernelName:
GatherV2,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: gatherV2 as { } as KernelFunc\n};\n\n"/**\n
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law or agreed to in writing, software\n * distributed
under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF
ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n *
limitations under the License.\n *
=====\n
*/\nimport {Greater, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
'/binary_kernel';\n\nconst supportsFullBroadcast = false;\nexport const greaterConfig: KernelConfig =\ncreateBinaryKernelConfig(Greater, supportsFullBroadcast, 'bool');\n\n"/**\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
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CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing
permissions and\n * limitations under the License.\n *
=====\n
*/\nimport {GreaterEqual, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig}
from '/binary_kernel';\n\nconst supportsFullBroadcast = false;\nexport const greaterEqualConfig: KernelConfig =\ncreateBinaryKernelConfig(GreaterEqual, supportsFullBroadcast, 'bool');\n\n"/**\n * @license\n * Copyright 2019
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in

```

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```
=====\n*\n\nimport { KernelConfig, KernelFunc, LeakyRelu, LeakyReluAttrs, LeakyReluInputs, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { CppDType } from './types';\n\nlet wasmFunc: (\n xId: number, dtype: number, leakyreluAlpha: number, outId: number) => void;\n\nfunction setupFunc(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(LeakyRelu, null /* void */, [\n 'number', // x_id\n 'number', // dtype\n 'number', // leakyrelu_alpha\n 'number', // out_id\n]);\n\n export function leakyRelu(\n args: {\n inputs: LeakyReluInputs, attrs: LeakyReluAttrs, backend: BackendWasm\n }):\n TensorInfo {\n const {inputs: {x}, attrs: {alpha}, backend} = args;\n const xId = backend.dataIdMap.get(x.dataId).id;\n // According to TF API, LeakyRelu returns float32 when input is either float32\n // or int32.\n const out = backend.makeOutput(x.shape, 'float32');\n if (util.sizeFromShape(x.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmFunc(xId, CppDType[x.dtype], alpha, outId);\n }\n return out;\n }\n\n export const leakyReluConfig: KernelConfig = {\n kernelName: LeakyRelu,\n backendName: 'wasm',\n setupFunc,\n kernelFunc: leakyRelu as {} as KernelFunc,\n }; \n /**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n}
```

```
=====\n*\n\nimport { KernelConfig, Less } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from './binary_kernel';\n\nconst supportsFullBroadcast = false;\nexport const lessConfig: KernelConfig =\n createBinaryKernelConfig(Less, supportsFullBroadcast, 'bool');\n /**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n}
```

```
=====\n*\n\nimport { KernelConfig, LessEqual } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from './binary_kernel';\n\nconst supportsFullBroadcast = false;\nexport const lessEqualConfig: KernelConfig =\n createBinaryKernelConfig(LessEqual, supportsFullBroadcast, 'bool');\n /**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n}
```

```
=====\n*\n\nimport { KernelConfig, Log } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from './unary_kernel';\n\nexport const logConfig: KernelConfig = createUnaryKernelConfig(Log);\n /**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
```

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on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\nimport {KernelConfig, LogicalAnd} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const logicalAndConfig: KernelConfig =\ncreateBinaryKernelConfig(LogicalAnd, supportsFullBroadcast, 'bool');\n"/**\n * @license\n * Copyright 2019\n * Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License\n * is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either\n * express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\nimport {backend_util, KernelConfig, KernelFunc, Max, MaxAttrs, MaxInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {permuteAxesAndTranspose} from './kernel_utils';\nimport {CppType} from './types';\n\nlet wasmMax: (xId: number, dtype: number, reduceSize: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmMax = backend.wasm.cwrap(Max, null /*void*/, [\n 'number', // x_id\n 'number', // dtype\n 'number', // reduce_size\n 'number', // out_id\n]);\n\n function max(args: {backend: BackendWasm, inputs: MaxInputs, attrs: MaxAttrs}): TensorInfo {\n const {backend, inputs, attrs} = args;\n const {reductionIndices: axis, keepDims} = attrs;\n const {x} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const {transposed, axes, originalAxes, inputWasTransposed} =\n permuteAxesAndTranspose(x, axis, backend);\n\n if (inputWasTransposed) {\n const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n input = transposed;\n inputId = transposedId;\n }\n\n const inputRank = input.shape.length;\n backend_util.assertAxesAreInnerMostDims('max', axes, inputRank);\n const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, axes);\n const reduceSize =\n util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, x.dtype);\n\n if (util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmMax(inputId, CCppType[x.dtype], reduceSize, outId);\n }\n\n if (inputWasTransposed) {\n // dispose of the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n return out;\n }\n\n export const maxConfig: KernelConfig = {\n kernelName: Max,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: max as {} as KernelFunc\n };\n}\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing\n * permissions and\n * limitations under the License.\n *
```

```
=====\n*\nimport {KernelConfig, Maximum} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const maximumConfig: KernelConfig =\ncreateBinaryKernelConfig(Maximum, supportsFullBroadcast);\n"/**\n * @license\n * Copyright 2019 Google
```

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and\n \* limitations under the License.\n \*

```
=====\n*\n\nimport {backend_util, KernelConfig, KernelFunc, MaxPool, MaxPoolAttrs, MaxPoolInputs, Tensor4D, util}\nfrom '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nlet wasmMaxPool: (\n xId:\n number, batchSize: number, inputHeight: number, inputWidth: number,\n filterHeight: number, filterWidth:\n number, padTop: number, padRight: number,\n padBottom: number, padLeft: number, dilationHeight: number,\n dilationWidth: number, strideHeight: number, strideWidth: number,\n inputChannels: number, outputChannels:\n number, outId: number) => void;\nfunction setup(backend: BackendWasm) {\n wasmMaxPool =\n backend.wasm.cwrap(MaxPool, null /* void */, [\n 'number', // xId\n 'number', // batchSize\n 'number', //\n inputHeight\n 'number', // inputWidth\n 'number', // filterHeight\n 'number', // filterWidth\n 'number', // padTop\n 'number', // padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', //\n dilationHeight\n 'number', // dilationWidth\n 'number', // strideHeight\n 'number', // strideWidth\n 'number', //\n inputChannels\n 'number', // outputChannels\n 'number', // outId\n]);\n}\nfunction maxPool(\n args:\n {inputs: MaxPoolInputs, backend: BackendWasm, attrs: MaxPoolAttrs}) {\n const {inputs, attrs, backend} =\n args;\n const x = inputs.x as Tensor4D;\n const xId = backend.dataIdMap.get(x.dataId).id;\n // TF API\n supports int32 input. CPU and WebGL backend also support int32\n // input. WASM backend doesn't support it\n because it uses xnpack which only\n // supports float32.\n // Add the following assert only for the WASM\n backend instead of at core op\n // level.\n // TODO: add support for int32 input.\n util.assert(\n x.dtype\n === 'float32',\n () =>\n `Error in MaxPool: only float32 input\n is supported. Got ${x.dtype}.`);\n const {filterSize, strides, pad, dimRoundingMode} = attrs;\n const convInfo =\n backend_util.computePool2DInfo(\n x.shape, filterSize, strides, 1 /* dilations */, pad, dimRoundingMode);\n const filterHeight = convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const padTop =\n convInfo.padInfo.top;\n const padRight = convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n const padLeft = convInfo.padInfo.left;\n const dilationHeight = convInfo.dilationHeight;\n const dilationWidth =\n convInfo.dilationWidth;\n const strideHeight = convInfo.strideHeight;\n const strideWidth =\n convInfo.strideWidth;\n const inputChannels = convInfo.inChannels;\n const outputChannels =\n convInfo.outChannels;\n if (convInfo.dataFormat !== 'channelsLast') {\n throw new Error(\n `wasm\n backend does not support dataFormat: ` +\n `${convInfo.dataFormat}`. Please use 'channelsLast'.`);\n }\n const out =\n backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmMaxPool(\n xId, x.shape[0], x.shape[1], x.shape[2], filterHeight, filterWidth,\n padTop, padRight,\n padBottom, padLeft, dilationHeight, dilationWidth,\n strideHeight, strideWidth, inputChannels, outputChannels,\n outId);\n return out;\n}\nexport const maxPoolConfig: KernelConfig = {\n kernelName: MaxPool,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: maxPool as { } as KernelFunc\n};\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n */\n=====\n\n
```

```
*/\n\nimport {backend_util, KernelConfig, KernelFunc, Mean, MeanAttrs, MeanInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {cast} from './Cast';\n\nimport
{permuteAxesAndTranspose} from './kernel_utils';\n\nlet wasmMean: (xId: number, reduceSize: number, outId:
number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmMean =\n
backend.wasm.cwrap(Mean, null /*void*/, ['number, number, number']);\n\n}\n\nexport function mean(\n args:
{backend: BackendWasm, inputs: MeanInputs, attrs: MeanAttrs});\n TensorInfo {\n const {backend, inputs,
attrs} = args;\n const {axis, keepDims} = attrs;\n const {x} = inputs;\n const xId =
backend.dataIdMap.get(x.dataId).id;\n
 let inputId = xId;\n let input = x;\n\n const {transposed, axes, originalAxes, inputWasTransposed} =\n
permuteAxesAndTranspose(x, axis, backend);\n\n let reductionAxes = axes;\n if (inputWasTransposed) {\n const
transposedId = backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId !== xId) {\n // transpose was
not a no-op. We will need to dispose of this\n // once we are done.\n input = transposed;\n inputId =
transposedId;\n reductionAxes = backend_util.getInnerMostAxes(\n reductionAxes.length,
input.shape.length);\n }\n }\n\n backend_util.assertAxesAreInnerMostDims(\n 'mean', reductionAxes,
input.shape.length);\n const [outShape, reduceShape] =\n
backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n const reduceSize =
util.sizeFromShape(reduceShape);\n let castedInput = input;\n if (input.dtype !== 'float32') {\n castedInput =\n
cast({backend, inputs: {x: input}, attrs: {dtype:
'float32'}});\n inputId = backend.dataIdMap.get(castedInput.dataId).id;\n }\n\n const out =
backend.makeOutput(outShape, 'float32');\n if (util.sizeFromShape(input.shape) !== 0) {\n const outId =
backend.dataIdMap.get(out.dataId).id;\n wasmMean(inputId, reduceSize, outId);\n }\n\n if
(inputWasTransposed) {\n // dispose of the transposed tensor.\n backend.disposeData(transposed.dataId);\n
}\n\n if (keepDims) {\n // reshape\n const newShape = backend_util.expandShapeToKeepDim(out.shape,
originalAxes);\n out.shape = newShape;\n }\n\n if (input.dtype !== 'float32') {\n
backend.disposeData(castedInput.dataId);\n }\n\n return out;\n}\n\nexport const meanConfig: KernelConfig = {\n
kernelName: Mean,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: mean as } as
KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *\n
=====\n\n*/\n\nimport {backend_util, KernelConfig, KernelFunc, Min, MinAttrs, MinInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport
{permuteAxesAndTranspose} from './kernel_utils';\n\nimport {CppType} from './types';\n\nlet wasmMin: (xId:
number, dtype: number, reduceSize: number, outId: number) =>\n void;\n\nfunction setup(backend:
BackendWasm): void {\n wasmMin = backend.wasm.cwrap(Min,
null /*void*/, [\n 'number', // x_id\n 'number', // dtype\n 'number', // reduce_size\n 'number', // out_id\n
]);\n\n}\n\nfunction min(args: {backend: BackendWasm, inputs: MinInputs, attrs: MinAttrs});\n TensorInfo {\n
const {backend, inputs, attrs} = args;\n const {axis, keepDims} = attrs;\n const {x} = inputs;\n const xId =
backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const {transposed, axes, originalAxes,
inputWasTransposed} =\n permuteAxesAndTranspose(x, axis, backend);\n\n if (inputWasTransposed) {\n
const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId !== xId) {\n // transpose
was not a no-op. We will need to dispose of this\n // once we are done.\n input = transposed;\n inputId =
transposedId;\n }\n }\n\n const inputRank = input.shape.length;\n\n backend_util.assertAxesAreInnerMostDims('min', axes, inputRank);\n const [outShape, reduceShape] =\n
```





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```
=====
*
* \n\nimport { KernelConfig, Multiply } from '@tensorflow/tfjs-core';
* \n\nimport { createBinaryKernelConfig } from
* './binary_kernel';
* \n\nconst supportsFullBroadcast = true;
* \n\nexport const multiplyConfig: KernelConfig =
* createBinaryKernelConfig(Multiply, supportsFullBroadcast);
* \n\n"/**
* @license
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* Licensed under the Apache License, Version 2.0 (the "License");
* you may not use this file except in compliance with the License.
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```

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```
=====
*
* \n\nimport { KernelConfig, Neg } from '@tensorflow/tfjs-core';
* \n\nimport { createUnaryKernelConfig } from
* './unary_kernel';
* \n\nexport const negConfig: KernelConfig = createUnaryKernelConfig(Neg);
* \n\n"/**
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* "License");
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* BASIS,
* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
* See the License for the specific language governing permissions and
* limitations under the License.
* \n\n
```

```
=====
*
* \n\nimport { BackendWasm } from './backend_wasm';
* \n\n// Analogous to `struct Result` in
* `non_max_suppression_impl.h`.
* \n\ninterface Result {
* pSelectedIndices: number;
* selectedSize: number;
* pSelectedScores: number;
* pValidOutputs: number;
* }
* \n\n/**
* Parse the result of the c++ method, which has the
* shape equivalent to
* `Result`.
* \n\nexport function parseResultStruct(
* backend: BackendWasm, resOffset:
* number): Result {
* const result = new Int32Array(backend.wasm.HEAPU8.buffer, resOffset, 4);
* const
* pSelectedIndices = result[0];
* const selectedSize = result[1];
* const pSelectedScores = result[2];
* const
* pValidOutputs = result[3];
* // Since the result was allocated on the heap, we have to delete it.
* backend.wasm._free(resOffset);
* return { pSelectedIndices, selectedSize,
* pSelectedScores, pValidOutputs };
* }
* \n\n"/**
* @license
* Copyright 2019 Google LLC. All Rights
* Reserved.
* Licensed under the Apache License, Version 2.0 (the "License");
* you may not use this file
* except in compliance with the License.
* You may obtain a copy of the License at
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* software distributed under the License is distributed on an "AS IS"
* BASIS,
* WITHOUT WARRANTIES
* OR CONDITIONS OF ANY KIND, either express or implied.
* See the License for the specific language
* governing permissions and
* limitations under the License.
* \n\n
```

```
=====
*
* \n\nimport { KernelConfig, KernelFunc, NonMaxSuppressionV3, NonMaxSuppressionV3Attrs,
* NonMaxSuppressionV3Inputs, TensorInfo } from '@tensorflow/tfjs-core';
* \n\nimport { BackendWasm } from
* './backend_wasm';
* \n\nimport { parseResultStruct } from
* './NonMaxSuppression_util';
* \n\nlet wasmFunc: (
* boxesId: number, scoresId: number, maxOutputSize:
* number,
* iouThreshold: number, scoreThreshold: number) => number;
* \n\nfunction setup(backend:
* BackendWasm): void {
* wasmFunc = backend.wasm.cwrap(
* NonMaxSuppressionV3,
* 'number', //
* Result*
* [
* 'number', // boxesId
* 'number', // scoresId
* 'number', // maxOutputSize
* 'number', // iouThreshold
* 'number', // scoreThreshold
*]);
* }
* \n\nfunction kernelFunc(args: {
* backend:
```

```

BackendWasm,\n inputs: NonMaxSuppressionV3Inputs,\n attrs: NonMaxSuppressionV3Attrs\n}): TensorInfo {\n
const {backend, inputs, attrs} = args;\n const {iouThreshold, maxOutputSize, scoreThreshold} = attrs;\n const
{boxes, scores} = inputs;\n\n const boxesId = backend.dataIdMap.get(boxes.dataId).id;\n const scoresId =
backend.dataIdMap.get(scores.dataId).id;\n\n const resOffset =\n wasmFunc(boxesId, scoresId, maxOutputSize,
iouThreshold,
scoreThreshold);\n\n const {pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs} =\n
parseResultStruct(backend, resOffset);\n\n // Since we are not using scores for V3, we have to delete it from the
heap.\n backend.wasm._free(pSelectedScores);\n backend.wasm._free(pValidOutputs);\n\n const
selectedIndicesTensor =\n backend.makeOutput([selectedSize], 'int32', pSelectedIndices);\n\n return
selectedIndicesTensor;\n}\n\nexport const nonMaxSuppressionV3Config: KernelConfig = {\n kernelName:
NonMaxSuppressionV3,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: kernelFunc as {} as
KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
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to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT
WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {KernelConfig, KernelFunc, NonMaxSuppressionV4, NonMaxSuppressionV4Attrs,
NonMaxSuppressionV4Inputs, TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from
'./backend_wasm';\n\nimport {parseResultStruct} from './NonMaxSuppression_util';\n\nlet wasmFunc: (\n
boxesId: number, scoresId: number, maxOutputSize: number,\n iouThreshold: number, scoreThreshold: number,\n
padToMaxOutputSize: boolean) => number;\n\nfunction setup(backend: BackendWasm): void {\n wasmFunc =
backend.wasm.cwrap(\n NonMaxSuppressionV4,\n 'number', // Result*\n [\n 'number', // boxesId\n
 'number',\n // scoresId\n 'number', // maxOutputSize\n 'number', // iouThreshold\n
 'number', // scoreThreshold\n 'bool', // padToMaxOutputSize\n]);\n}\n\nfunction nonMaxSuppressionV4(args: {\n backend:
BackendWasm,\n inputs: NonMaxSuppressionV4Inputs,\n attrs: NonMaxSuppressionV4Attrs\n}): TensorInfo[]
{\n const {backend, inputs, attrs} = args;\n const {iouThreshold, maxOutputSize, scoreThreshold,
padToMaxOutputSize} =\n attrs;\n const {boxes, scores} = inputs;\n\n const boxesId =
backend.dataIdMap.get(boxes.dataId).id;\n const scoresId = backend.dataIdMap.get(scores.dataId).id;\n\n const
resOffset = wasmFunc(\n boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold,\n
padToMaxOutputSize);\n\n const {pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs} =\n
parseResultStruct(backend, resOffset);\n\n // Since we are not using scores for V4, we have to delete it from the
heap.\n backend.wasm._free(pSelectedScores);\n\n
const selectedIndicesTensor =\n backend.makeOutput([selectedSize], 'int32', pSelectedIndices);\n\n const
validOutputsTensor = backend.makeOutput([], 'int32', pValidOutputs);\n\n return [selectedIndicesTensor,
validOutputsTensor];\n}\n\nexport const nonMaxSuppressionV4Config: KernelConfig = {\n kernelName:
NonMaxSuppressionV4,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: nonMaxSuppressionV4 as {}
as KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under
the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See
the License for the specific language governing permissions and\n * limitations under the License.\n *
=====\n

```

```

*\n\nimport { KernelConfig, KernelFunc, NonMaxSuppressionV5, NonMaxSuppressionV5Attrs,
NonMaxSuppressionV5Inputs, TensorInfo } from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from
'./backend_wasm';\n\nimport { parseResultStruct } from './NonMaxSuppression_util';\n\nlet wasmFunc:\n
(boxesId: number, scoresId: number, maxOutputSize: number,\n iouThreshold: number, scoreThreshold: number,
softNmsSigma: number) =>\n number;\n\nfunction setup(backend: BackendWasm): void {\n wasmFunc =
backend.wasm.cwrap(\n NonMaxSuppressionV5,\n 'number', // Result*\n [\n 'number', // boxesId\n 'number', // scoresId\n 'number', // maxOutputSize\n 'number', // iouThreshold\n 'number', //
scoreThreshold\n 'number', // softNmsSigma\n]);\n\n function
kernelFunc(args: {\n backend: BackendWasm,\n inputs: NonMaxSuppressionV5Inputs,\n attrs:
NonMaxSuppressionV5Attrs\n }): TensorInfo[] {\n const { backend, inputs, attrs } = args;\n const { iouThreshold,
maxOutputSize, scoreThreshold, softNmsSigma } = attrs;\n const { boxes, scores } = inputs;\n\n const boxesId =
backend.dataIdMap.get(boxes.dataId).id;\n const scoresId = backend.dataIdMap.get(scores.dataId).id;\n\n const
resOffset = wasmFunc(\n boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold,\n softNmsSigma);\n\n const { pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs } =\n parseResultStruct(backend, resOffset);\n\n // Since we are not using validOutputs for V5, we have to delete it from
the\n // heap.\n backend.wasm._free(pValidOutputs);\n\n const selectedIndicesTensor =\n backend.makeOutput([selectedSize], 'int32', pSelectedIndices);\n const selectedScoresTensor =\n backend.makeOutput([selectedSize], 'float32', pSelectedScores);\n\n return [selectedIndicesTensor, selectedScoresTensor];\n }\n\n export const nonMaxSuppressionV5Config:\n KernelConfig = {\n kernelName: NonMaxSuppressionV5,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: kernelFunc as { } as KernelFunc,\n };\n\n /**\n * @license\n * Copyright 2020 Google LLC. All Rights
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software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n */
\n =====\n\n *\n\nimport
{ KernelConfig, NotEqual } from '@tensorflow/tfjs-core';\n\nimport { createBinaryKernelConfig } from
'./binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const notEqualConfig: KernelConfig =\n createBinaryKernelConfig(NotEqual, supportsFullBroadcast, 'bool');\n\n /**\n * @license\n * Copyright 2020
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n */
\n =====\n\n *\n\nimport
{ KernelConfig, KernelFunc, OneHot, OneHotAttrs, OneHotInputs } from '@tensorflow/tfjs-core';\n\nimport
{ BackendWasm } from './backend_wasm';\n\nlet wasmOneHot: (\n indicesId: number, depth: number, onValue:
number, offValue: number,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n \n
wasmOneHot = backend.wasm.cwrap(OneHot, null /* void */, [\n 'number', // indices_id\n 'number', // depth,\n 'number', // onValue\n 'number', // offValue\n 'number' // out_id\n]);\n\n function oneHot(\n args:
{ inputs: OneHotInputs, attrs: OneHotAttrs, backend: BackendWasm }) {\n const { inputs, backend, attrs } = args;\n
 const { indices } = inputs;\n const { depth, onValue, offValue } = attrs;\n\n const out =
backend.makeOutput([...indices.shape, depth], 'int32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n

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const indicesData = backend.dataIdMap.get(indices.dataId);\n const indicesId = indicesData.id;\n\n
wasmOneHot(indicesId, depth,
 onValue, offValue, outId);\n\n return out;\n}\n\nexport const oneHotConfig: KernelConfig = {\n kernelName:
OneHot,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: oneHot as {} as KernelFunc,\n};\n\n", "/*\n *
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
\n\n
=====\n
*/\n\nimport { KernelConfig, KernelFunc, OnesLike, OnesLikeInputs } from
'@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nfunction onesLike(args: { inputs:
OnesLikeInputs, backend: BackendWasm }) {\n const { inputs: {x}, backend } = args;\n const out =
backend.makeOutput(x.shape, x.dtype);\n const outVals = backendtypedArrayFromHeap(out);\n outVals.fill(1);\n
return out;\n}\n\nexport const onesLikeConfig: KernelConfig = {\n kernelName: OnesLike,\n backendName:
'wasm',\n kernelFunc: onesLike as {} as KernelFunc,\n};\n\n", "/*\n * @license\n * Copyright 2020 Google LLC.
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OR CONDITIONS OF ANY KIND, either express
or implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
\n\n
=====\n
*/\n\nimport { KernelConfig, KernelFunc, Pack, PackAttrs, PackInputs, TensorInfo, util } from '@tensorflow/tfjs-
core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport { concat } from './Concat';\n\nimport
{ expandDims } from './ExpandDims';\n\nexport function pack(\n args: { inputs: PackInputs, backend:
BackendWasm, attrs: PackAttrs }):\n TensorInfo {\n const { inputs, backend, attrs } = args;\n const { axis } =
attrs;\n\n if (inputs.length === 1) {\n return expandDims(\n { inputs: {input: inputs[0]}, backend, attrs: {dim:
axis} });\n }\n\n const shape = inputs[0].shape;\n const dtype = inputs[0].dtype;\n\n inputs.forEach(t => {\n
util.assertShapesMatch(\n shape, t.shape,\n 'All tensors passed to stack must have matching shapes');\n
util.assert(\n
dtype === t.dtype,\n () => 'All tensors passed to stack must have matching dtypes');\n });\n\n const
intermediateTensorInfos: TensorInfo[] = [];\n const expandedTensors = inputs.map(t => {\n const expandedT =\n
expandDims({ inputs: {input: t}, backend, attrs: {dim: axis} });\n intermediateTensorInfos.push(expandedT);\n
return expandedT;\n });\n\n const result = concat({ inputs: expandedTensors, backend, attrs: {axis} });\n\n
intermediateTensorInfos.forEach(t => backend.disposeData(t.dataId));\n\n return result;\n}\n\nexport const
packConfig: KernelConfig = {\n kernelName: Pack,\n backendName: 'wasm',\n kernelFunc: pack as {} as
KernelFunc,\n};\n\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
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on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
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*/\n\nimport { KernelConfig, KernelFunc, PadV2, PadV2Attrs, PadV2Inputs, util } from '@tensorflow/tfjs-

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core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {fill} from './Fill';\n\nimport {CppType}
from './types';\n\nlet wasmPadV2: (\n xId: number, xShapeBytes: Uint8Array, xShapeLength: number, xDtype:
number,\n prePaddingsBytes: Uint8Array, postPaddingsBytes: Uint8Array,\n constantValue: number, outId:
number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmPadV2 = backend.wasm.cwrap(PadV2, null
/* void */, [\n 'number', // xId\n 'array', // x.shape\n
 'number', // x.shape.length\n 'number', // x.dtype\n 'array', // pre-paddings\n 'array', // post-paddings\n
 'number', // constantValue\n 'number', // outId\n]);\n}\n\nfunction pad(\n args: {inputs: PadV2Inputs, backend:
BackendWasm, attrs: PadV2Attrs}) {\n const {inputs: {x}, backend, attrs: {paddings, constantValue}} = args;\n\n
const outShape = paddings.map(\n (p, i) => p[0] /* beforePad */ + x.shape[i] + p[1] /* afterPad */);\n\n if
(util.sizeFromShape(x.shape) === 0) {\n // Short-circuit the computation, since x doesn't have value, only\n //
the shape is used to compute output shape to pad.\n return fill({\n backend,\n attrs: {shape: outShape, value:
constantValue, dtype: x.dtype}\n });\n }\n\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out =
backend.makeOutput(outShape, x.dtype);\n const outTensorData = backend.dataIdMap.get(out.dataId);\n const
outId = outTensorData.id;\n\n const xShapeBytes =
 new Uint8Array(new Int32Array(x.shape).buffer);\n\n const prePaddingsFlat = paddings.map(padTuple =>
padTuple[0]);\n const postPaddingsFlat = paddings.map(padTuple => padTuple[1]);\n const prePaddingsBytes =\n
 new Uint8Array(new Int32Array(prePaddingsFlat).buffer);\n const postPaddingsBytes =\n new
 Uint8Array(new Int32Array(postPaddingsFlat).buffer);\n\n wasmPadV2(\n xId, xShapeBytes, x.shape.length,
CppType[x.dtype], prePaddingsBytes,\n postPaddingsBytes, constantValue, outId);\n return out;\n}\n\nexport
const padV2Config: KernelConfig = {\n kernelName: PadV2,\n backendName: 'wasm',\n kernelFunc: pad as {} as
KernelFunc,\n setupFunc: setup\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n
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on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====\n
*/\n\nimport {KernelConfig, Pow} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from
'/binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const powConfig: KernelConfig =\n createBinaryKernelConfig(Pow, supportsFullBroadcast);\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
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http://www.apache.org/licenses/LICENSE-2.0\n *\n *\n
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BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
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*/\n\nimport {KernelConfig, KernelFunc, Prelu, PreluInputs} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from './backend_wasm';\n\nimport {cast} from './Cast';\n\nlet wasmPrelu: (xId: number,
weightsId: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmPrelu =
backend.wasm.cwrap(Prelu, null /* void */, [\n 'number', // x_id\n 'number', // weights_id\n 'number' //
out_id\n]);\n}\n\nfunction prelu(args: {inputs: PreluInputs, backend: BackendWasm}) {\n const {inputs, backend}
= args;\n const {x, alpha} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n
 const weightsId = backend.dataIdMap.get(alpha.dataId).id;\n let inputId = xId;\n const input = x;\n
 let castedInput = input;\n if (input.dtype !== 'float32') {\n castedInput = cast({backend, inputs: {x},
attrs: {dtype: 'float32'}});\n inputId = backend.dataIdMap.get(castedInput.dataId).id;\n }\n\n const out =

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backend.makeOutput(x.shape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmPrelu(inputId, weightsId, outId);\n\n if (input.dtype !== 'float32') {\n
backend.disposeData(castedInput.dataId);\n }\n return out;\n}\n\nexport const preluConfig: KernelConfig = {\n
kernelName: Prelu,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: prelu as {} as
KernelFunc\n};\n", "/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
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writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT
WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {backend_util, KernelConfig, KernelFunc, Prod, ProdAttrs, ProdInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport
{permuteAxesAndTranspose} from './kernel_utils';\n\nimport {CppType} from './types';\n\nlet wasmProd: (\n
xId: number, reduceSize: number,\n dtype: number, outId: number) => void;\n\nfunction setup(backend:
BackendWasm): void {\n wasmProd = backend.wasm.cwrap(Prod, null /*void*/, [\n 'number',\n 'number',\n 'number',\n 'number'\n]);\n}\n\nfunction prod(args: {\n backend: BackendWasm,\n inputs: ProdInputs,\n attrs: ProdAttrs\n}):
TensorInfo {\n const {backend, inputs, attrs} = args;\n const {axis, keepDims} = attrs;\n const {x} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n const {transposed, axes,
originalAxes, inputWasTransposed} =\n permuteAxesAndTranspose(x, axis, backend);\n let reductionAxes =
axes;\n if (inputWasTransposed) {\n const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n if
(transposedId !== xId) {\n // transpose was not a no-op. We will need to dispose of this\n // once we are
done.\n input = transposed;\n inputId = transposedId;\n reductionAxes =
backend_util.getInnerMostAxes(\n reductionAxes.length, input.shape.length);\n }\n }\n backend_util.assertAxesAreInnerMostDims(\n 'prod', reductionAxes, input.shape.length);\n const [outShape,
reduceShape]
 =\n backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n const reduceSize =
util.sizeFromShape(reduceShape);\n const out = backend.makeOutput(outShape, input.dtype);\n if
(util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmProd(inputId, reduceSize, CppDType[out.dtype], outId);\n }\n if (inputWasTransposed) {\n // dispose of
the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n if (keepDims) {\n // reshape\n const
newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n return out;\n}\n\nexport const prodConfig: KernelConfig = {\n kernelName: Prod,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: prod as {} as KernelFunc\n};\n", "/**\n * @license\n * Copyright 2020 Google
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {KernelConfig, KernelFunc, Range, RangeAttrs, TensorInfo} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from '../backend_wasm';\n\nimport {rangeImplCPU} from './kernel_utils/shared';\n\nexport const
range =\n (args: {backend: BackendWasm, attrs: RangeAttrs}): TensorInfo => {\n const {backend, attrs} =
args;\n const {start, stop, step, dtype} = attrs;\n const values = rangeImplCPU(start, stop, step, dtype);\n }\n}

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const
 out = backend.makeOutput([values.length], dtype);\n const outVals = backend.typedArrayFromHeap(out);\n outVals.set(values);\n return out;\n };\n\nexport const rangeConfig: KernelConfig = {\n kernelName: Range,\n backendName: 'wasm',\n kernelFunc: range as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019\n * Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you\n * may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n *\n *=====\n *\n *\\\nimport {KernelConfig, RealDiv} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from\n './binary_kernel';\nconst supportsFullBroadcast = true;\nexport const realDivConfig: KernelConfig =\n createBinaryKernelConfig(RealDiv, supportsFullBroadcast);\n", "/*\n * @license\n * Copyright 2019 Google LLC.\n * All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this\n * file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n *\n *=====\n *\n *\\\nimport {KernelConfig, Relu} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from\n './unary_kernel';\nexport const reluConfig: KernelConfig = createUnaryKernelConfig(Relu);\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * \n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n *\n *=====\n *\n *\\\nimport {KernelConfig, Relu6} from '@tensorflow/tfjs-core';\nimport\n {createUnaryKernelConfig} from './unary_kernel';\nexport const relu6Config: KernelConfig =\n createUnaryKernelConfig(Relu6);\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in\n * compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n *\n *=====\n *\n *\\\nimport {KernelConfig, KernelFunc, ResizeBilinear, ResizeBilinearAttrs, ResizeBilinearInputs, TensorInfo,\n util} from '@tensorflow/tfjs-core';\nimport\n {BackendWasm} from '../backend_wasm';\nimport {cast} from './Cast';\nlet wasmResizeBilinear: (\n xId:\n number, batch: number, oldHeight: number, oldWidth: number,\n numChannels: number, newHeight: number,\n newWidth: number,\n alignCorners: number, halfPixelCenters: number, outId: number) => void;\nfunction\n setup(backend: BackendWasm): void {\n wasmResizeBilinear = backend.wasm.cwrap(ResizeBilinear, null\n /*void*/, [\n 'number', // xId\n 'number', // batch\n 'number', // oldHeight\n 'number', // oldWidth\n 'number', // numChannels\n 'number', // newHeight\n 'number', // newWidth\n 'number', // alignCorners\n
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'number', // halfPixelCenters\n 'number' // outId\n]);\n\nfunction resizeBilinear(args: {\n backend:
BackendWasm,\n inputs: ResizeBilinearInputs,\n attrs: ResizeBilinearAttrs\n}): TensorInfo {\n const {backend,
inputs, attrs} = args;\n\n const {images} = inputs;\n const {alignCorners, halfPixelCenters, size}
= attrs;\n const [newHeight, newWidth] = size;\n\n const [batch, oldHeight, oldWidth, numChannels] =
images.shape;\n const outShape = [batch, newHeight, newWidth, numChannels];\n\n let xData =
backend.dataIdMap.get(images.dataId);\n let castedData;\n if (xData.dtype !== 'float32') {\n castedData =\n cast({backend, inputs: {x: images}, attrs: {dtype: 'float32'}});\n xData =
backend.dataIdMap.get(castedData.dataId);\n }\n\n const xId = xData.id;\n\n const out =
backend.makeOutput(outShape, 'float32');\n if (util.sizeFromShape(images.shape) === 0) {\n return out;\n }\n\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n wasmResizeBilinear(\n xId, batch, oldHeight,
oldWidth, numChannels, newHeight, newWidth,\n alignCorners ? 1 : 0, halfPixelCenters ? 1 : 0, outId);\n\n if
(castedData !== null) {\n backend.disposeData(castedData.dataId);\n }\n\n return out;\n\n}\n\nexport const
resizeBilinearConfig: KernelConfig = {\n kernelName: ResizeBilinear,\n
backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: resizeBilinear as {} as KernelFunc\n};\n\n"/**\n *
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law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {KernelConfig, KernelFunc, Reverse, ReverseAttrs, ReverseInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport
{identity} from './Identity';\n\nimport {reshape} from './Reshape';\n\nlet wasmReverse: (\n xId: number, axes:
Uint8Array, axesLength: number, outShape: Uint8Array,\n outShapeLength: number, outId: number) =>
void;\n\nfunction setup(backend: BackendWasm) {\n wasmReverse = backend.wasm.cwrap(Reverse, null, [\n
'number', // x_id\n 'array', // axes\n 'number', // axes_length\n 'array', // out_shape\n 'number', //
out_shape_length\n 'number' // out_id\n]);\n\n}\n\nexport function reverse(\n args: {inputs: ReverseInputs,
backend: BackendWasm, attrs: ReverseAttrs});\n\n TensorInfo {\n const {inputs, backend, attrs} = args;\n const
{x} = inputs;\n const {dims} = attrs;\n\n const axes = util.parseAxisParam(dims, x.shape);\n\n if (x.shape.length
=== 0) {\n return identity({inputs: {x}, backend});\n }\n\n const out = backend.makeOutput(x.shape, x.dtype);\n
const xId = backend.dataIdMap.get(x.dataId).id;\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n
const axesBytes = new Uint8Array(new Int32Array(axes).buffer);\n const outShapeBytes = new Uint8Array(new
Int32Array(x.shape).buffer);\n\n wasmReverse(\n xId, axesBytes, axes.length, outShapeBytes, x.shape.length,
outId);\n\n const reshaped =\n reshape({inputs: {x: out}, attrs: {shape: x.shape}, backend});\n\n
backend.disposeData(out.dataId);\n return reshaped;\n\n}\n\nexport const reverseConfig: KernelConfig = {\n
kernelName: Reverse,\n backendName: 'wasm',\n kernelFunc: reverse as {} as KernelFunc,\n setupFunc:
setup\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
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on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====\n
*\n\nimport {KernelConfig, KernelFunc, RotateWithOffset, RotateWithOffsetAttrs, RotateWithOffsetInputs,
TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {backend_util} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from './backend_wasm';\n\nlet wasmRotate: (\n xId: number, batch: number, imageHeight:

```



```

number, imageWidth: number,\n numChannels: number, radians: number, centerX: number, centerY: number,\n fillBytes: Uint8Array, fillLength: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmRotate = backend.wasm.cwrap(RotateWithOffset, null /* void */, [\n 'number', // xId\n 'number', // batch\n 'number', // imageHeight\n 'number', // imageWidth\n 'number', // numChannels\n 'number', // radians\n 'number', // centerX\n 'number', // centerY\n 'array', // fillBytes\n 'number', // fillLength\n 'number', // outId\n]);\n\n export function rotateWithOffset(args: {\n inputs: RotateWithOffsetInputs,\n backend: BackendWasm,\n attrs: RotateWithOffsetAttrs\n }): TensorInfo {\n const {inputs, backend, attrs} = args;\n const {image} = inputs;\n const {radians, fillValue, center} = attrs;\n\n const out = backend.makeOutput(image.shape, image.dtype);\n const imageId = backend.dataIdMap.get(image.dataId).id;\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const [batch, imageHeight, imageWidth, numChannels] = image.shape;\n\n const [centerX, centerY] =\n backend_util.getImageCenter(center, imageHeight, imageWidth);\n\n const fillIsBlack = fillValue === 0;\n const fullOpacityValue = 255;\n const fillValues = typeof fillValue === 'number' ?\n [fillValue, fillValue, fillValue, fillIsBlack ? 0 : fullOpacityValue] :\n [...fillValue, fullOpacityValue];\n const fillBytes = new Uint8Array(new Int32Array(fillValues).buffer);\n\n wasmRotate(\n imageId, batch, imageHeight, imageWidth, numChannels,\n radians, centerX,\n centerY, fillBytes, fillValues.length, outId);\n return out;\n }\n\n export const rotateWithOffsetConfig: KernelConfig = {\n kernelName: RotateWithOffset,\n backendName: 'wasm',\n kernelFunc: rotateWithOffset as {} as KernelFunc,\n setupFunc: setup\n };
}

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 */

=====
\n
*\nimport {KernelConfig, Round} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from './unary_kernel';\nexport const roundConfig: KernelConfig = createUnaryKernelConfig(Round);\n\n/**
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 */

=====
\n
*\nimport {KernelConfig, Rsqrt} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from './unary_kernel';\nexport const rsqrtConfig: KernelConfig = createUnaryKernelConfig(Rsqrt);\n\n/**
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 */

=====
\n
*\nimport {KernelConfig, KernelFunc, scatter_util, ScatterNd, ScatterNdAttrs, ScatterNdInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {CppType} from './types';\n\nlet wasmScatterNd: (\n indicesId: number, updatesId: number, dtype: CppDType, sliceRank:

```

```

number,\n numUpdates: number, sliceSize: number, strides: Uint8Array,\n outputSize: number, outId: number)
=> void;\n\nfunction setup(backend: BackendWasm): void {\n wasmScatterNd = backend.wasm.cwrap(ScatterNd,
null /*void*/, [\n 'number', // indicesId\n 'number', // updatesId\n 'number', // dtype\n 'number', //
sliceRank\n 'number', // numUpdates\n 'number', // sliceSize\n 'array', // strides\n 'number', // outputSize\n
'number' // outId\n]);\n}\n\nfunction scatterNd(\n args:\n { backend: BackendWasm, inputs:
ScatterNdInputs, attrs:
ScatterNdAttrs }):\n TensorInfo {\n const { backend, inputs, attrs } = args;\n const { indices, updates } = inputs;\n
const { shape } = attrs;\n\n const out = backend.makeOutput(shape, updates.dtype);\n if (util.sizeFromShape(shape)
=== 0) {\n return out;\n }\n\n const { sliceRank, numUpdates, sliceSize, strides, outputSize } =\n
scatter_util.calculateShapes(updates, indices, shape);\n\n const indicesData =
backend.dataIdMap.get(indices.dataId);\n const indicesId = indicesData.id;\n\n const updatesData =
backend.dataIdMap.get(updates.dataId);\n const updatesId = updatesData.id;\n\n const stridesBytes = new
Uint8Array(new Int32Array(strides).buffer);\n\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmscatterNd(\n indicesId, updatesId, CppDType[updates.dtype], sliceRank, numUpdates,\n sliceSize,
stridesBytes, outputSize, outId);\n\n return out;\n }\n\n nexport const scatterNdConfig: KernelConfig = {\n
kernelName: ScatterNd,\n backendName: 'wasm',\n
 setupFunc: setup,\n kernelFunc: scatterNd as { } as KernelFunc\n};\n\n", /**\n * @license\n * Copyright 2020
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=====\n
*/\n\nimport { KernelConfig, KernelFunc, Select, SelectInputs, util } from '@tensorflow/tfjs-core';\n\nimport
{ BackendWasm } from '../backend_wasm';\n\nlet wasmSelect: (\n conditionId: number, tId: number, eId:
number, offset: number,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmSelect
= backend.wasm.cwrap('SelectV2', null, [\n 'number', // conditionId\n 'number', // tId\n 'number', // eId\n
'number', // offset\n 'number', // outId\n]);\n}\n\nfunction select(args: { inputs: SelectInputs, backend:
BackendWasm }) {\n const { inputs, backend } = args;\n const { condition, t, e } = inputs;\n\n const conditionId =
backend.dataIdMap.get(condition.dataId).id;\n const tId = backend.dataIdMap.get(t.dataId).id;\n const eId =
backend.dataIdMap.get(e.dataId).id;\n const out = backend.makeOutput(t.shape, t.dtype);\n const outId =
backend.dataIdMap.get(out.dataId).id;\n\n const cRank = condition.shape.length;\n const tRank =
t.shape.length;\n\n const offset = cRank === 0 || cRank > 1 || tRank === 1 ?\n 1 : \n
util.sizeFromShape(t.shape.slice(1));\n\n wasmSelect(conditionId, tId, eId, offset, outId);\n return out;\n}\n\nexport
const selectConfig:
KernelConfig = {\n kernelName: Select,\n backendName: 'wasm',\n kernelFunc: select as { } as KernelFunc,\n
setupFunc: setup\n};\n\n", /**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed
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License.\n *
=====\n
*/\n\nimport { KernelConfig, KernelFunc, Sigmoid, SigmoidInputs, TensorInfo, util } from '@tensorflow/tfjs-
core';\n\nimport { BackendWasm }

```

```

from './backend_wasm';\n\nlet wasmFunc: (xId: number, outId: number) => void;\n\nfunction setup(backend:
BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(Sigmoid, null /* void */, ['number',
'number']);\n}\n\nfunction sigmoid(args: { backend: BackendWasm, inputs: SigmoidInputs }):\n TensorInfo {\n const { backend, inputs: { x } } = args;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out =
backend.makeOutput(x.shape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n \n // Short-circuit
zero-sized tensors.\n if (util.sizeFromShape(out.shape) === 0) {\n return out;\n }\n \n wasmFunc(xId, outId);\n return out;\n}\n\n\nexport const sigmoidConfig: KernelConfig = {\n kernelName: 'Sigmoid',\n backendName:
'wasm',\n setupFunc: setup,\n kernelFunc: sigmoid as {} as KernelFunc\n};\n\n", "/*\n * @license\n * Copyright
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=====\n
*/\n\nimport { KernelConfig, Sin } from '@tensorflow/tfjs-core';\n\nimport { createUnaryKernelConfig } from
'/unary_kernel';\n\nexport const sinConfig: KernelConfig = createUnaryKernelConfig(Sin);\n\n", "/*\n * @license\n *
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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=====\n
*/\n\nimport { KernelConfig, KernelFunc, Softmax, SoftmaxAttrs, SoftmaxInputs, TensorInfo, util } from
 '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from './backend_wasm';\n\nlet wasmFunc: (xId: number, outId:
number, channels: number, batch: number) =>\n void;\n\nfunction setup(backend: BackendWasm): void {\n
 wasmFunc = backend.wasm.cwrap(Softmax, null /* void */, [\n 'number', // xId\n 'number', // outId\n
 'number', // channels\n 'number' // batch\n]);\n}\n\nfunction softmax(\n args: { backend: BackendWasm,
 inputs: SoftmaxInputs, attrs: SoftmaxAttrs }):\n TensorInfo {\n const { backend, inputs: { logits }, attrs: { dim } } =
 args;\n const xId = backend.dataIdMap.get(logits.dataId).id;\n const out = backend.makeOutput(logits.shape,
 logits.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n const channels = logits.shape[dim];\n
 const batch = util.sizeFromShape(logits.shape) / channels;\n \n // Short-circuit zero-sized tensors.\n if
 (util.sizeFromShape(out.shape) === 0) {\n return out;\n }\n \n wasmFunc(xId, outId, channels, batch);\n return
 out;\n}\n\n\nexport const softmaxConfig: KernelConfig = {\n kernelName: Softmax,\n backendName: 'wasm',\n
 setupFunc: setup,\n kernelFunc: softmax as {} as KernelFunc\n};\n\n", "/*\n * @license\n * Copyright 2021 Google
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 OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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 =====\n
 */\n\nimport { backend_util, KernelConfig, KernelFunc, ReshapeAttrs, ReshapeInputs, SpaceToBatchND,
 SpaceToBatchNDAttrs, SpaceToBatchNDInputs, TensorInfo, TransposeAttrs, TransposeInputs, util } from
 '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from './backend_wasm';\n\nimport { padV2Config } from

```

```

./PadV2';\nimport {reshape} from './Reshape';\nimport {transpose} from './Transpose';\n\nfunction
spaceToBatchND(args: {\n inputs: SpaceToBatchNDInputs,\n backend: BackendWasm,\n attrs:
SpaceToBatchNDAttrs\n}) {\n const {inputs, backend,
attrs} = args;\n const {x} = inputs;\n const {blockShape, paddings} = attrs;\n\n const prod =
util.sizeFromShape(blockShape);\n\n const completePaddings: Array<[number, number]> = [[0, 0]];\n
completePaddings.push(...(paddings as Array<[number, number]>));\n\n for (let i = 1 + blockShape.length; i <
x.shape.length; ++i) {\n completePaddings.push([0, 0]);\n }\n\n const paddedX = padV2Config.kernelFunc({\n
inputs: {x},\n backend,\n attrs: {paddings: completePaddings, constantValue: 0}\n }) as TensorInfo;\n\n const
reshapedPaddedShape =\n backend_util.getReshaped(paddedX.shape, blockShape, prod, false);\n\n const
permutedReshapedPaddedPermutation = backend_util.getPermuted(\n reshapedPaddedShape.length,
blockShape.length, false);\n\n const flattenShape =\n backend_util.getReshapedPermuted(paddedX.shape,
blockShape, prod, false);\n\n const reshapeInputs: ReshapeInputs = {x: paddedX};\n const reshapeAttrs:
ReshapeAttrs = {shape: reshapedPaddedShape};\n
const paddedXReshaped =\n reshape({inputs: reshapeInputs, backend, attrs: reshapeAttrs});\n\n const
transposeInputs: TransposeInputs = {x: paddedXReshaped};\n const transposeAttrs:\n TransposeAttrs = {perm:
permutedReshapedPaddedPermutation};\n const paddedXT =\n transpose({inputs: transposeInputs, backend,
attrs: transposeAttrs});\n\n const resultReshapeInputs: ReshapeInputs = {x: paddedXT};\n const
resultReshapeAttrs: ReshapeAttrs = {shape: flattenShape};\n const result = reshape(\n {inputs:
resultReshapeInputs, backend, attrs: resultReshapeAttrs});\n\n backend.disposeData(paddedX.dataId);\n
backend.disposeData(paddedXReshaped.dataId);\n backend.disposeData(paddedXT.dataId);\n\n return
result;\n}\n\nexport const spaceToBatchNDConfig: KernelConfig = {\n kernelName: SpaceToBatchND,\n
backendName: 'wasm',\n kernelFunc: spaceToBatchND as { } as KernelFunc\n};\n\n"/**\n * @license\n *
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=====\n
*\n\nimport {KernelConfig, KernelFunc, SplitV, SplitVAttrs, SplitVInputs, util} from '@tensorflow/tfjs-
core';\nimport {backend_util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from
'./backend_wasm';\n\nimport {slice} from './Slice';\n\nexport function splitV(\n args: {inputs: SplitVInputs, attrs:
SplitVAttrs, backend: BackendWasm}) {\n const {inputs,
attrs, backend} = args;\n const {x} = inputs;\n const {numOrSizeSplits, axis} = attrs;\n\n const $axis =
util.parseAxisParam(axis, x.shape)[0];\n\n const splitSizes = backend_util.prepareSplitSize(x, numOrSizeSplits,
$axis);\n const begin = new Array(x.shape.length).fill(0);\n const size = x.shape.slice();\n return splitSizes.map(s
=> {\n const xSliceSize = [...size];\n xSliceSize[$axis] = s;\n const xSlice =\n slice({inputs: {x}, attrs:
{begin, size: xSliceSize}, backend});\n begin[$axis] += s;\n return xSlice;\n });\n}\n\nexport const
splitVConfig: KernelConfig = {\n kernelName: SplitV,\n backendName: 'wasm',\n kernelFunc: splitV as { } as
KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
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*\n\nimport {KernelConfig, Sqrt} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'./unary_kernel';\n\nexport const sqrtConfig: KernelConfig = createUnaryKernelConfig(Sqrt);\n", "/*\n * @license\n
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=====
*\n\nimport {KernelConfig, Square} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'./unary_kernel';\n\nexport const squareConfig: KernelConfig = createUnaryKernelConfig(Square);\n", "/*\n *
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=====
*\n\nimport {KernelConfig, SquaredDifference} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig}
from './binary_kernel';\n\nconst supportsFullBroadcast = true;\n\nexport const squaredDifferenceConfig: KernelConfig
=\n createBinaryKernelConfig(SquaredDifference, supportsFullBroadcast);\n", "/*\n * @license\n * Copyright
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=====
*\n\nimport {KernelConfig, KernelFunc, Step, StepAttrs, StepInputs, TensorInfo} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {CppType} from './types';\n\nlet wasmStep:
(xId: number, alpha: number, dtype: number, outId: number) =>\n void;\n\nfunction setup(backend:
BackendWasm): void {\n wasmStep = backend.wasm.cwrap(Step, null /*void*/, [\n 'number', // x_id\n
'number', // alpha\n 'number', // dtype\n 'number', // out_id\n]);\n}\n\nfunction step(\n args: {backend:
BackendWasm, inputs: StepInputs, attrs: StepAttrs}): \n TensorInfo {\n const {backend, inputs, attrs} = args;\n
const {alpha} = attrs;\n const {x} = inputs;\n const xId =
 backend.dataIdMap.get(x.dataId).id;\n\n const out = backend.makeOutput(x.shape, x.dtype);\n const outId =
 backend.dataIdMap.get(out.dataId).id;\n wasmStep(xId, alpha, CppDType[x.dtype], outId);\n return
out;\n}\n\nexport const stepConfig: KernelConfig = {\n kernelName: Step,\n backendName: 'wasm',\n setupFunc:
setup,\n kernelFunc: step as { } as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2021 Google LLC. All
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=====\n
*\n\nimport { KernelConfig, KernelFunc, slice_util, StridedSlice, StridedSliceAttrs, StridedSliceInputs, TensorInfo,
util } from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from './backend_wasm';\n\nimport { reshape } from
 './Reshape';\n\nimport { slice } from './Slice';\n\n\nlet wasmStridedSlice: (\n xId: number, xStridesBytes: Uint8Array,
xRank: number,\n beginBytes: Uint8Array, endBytes: Uint8Array, stridesBytes: Uint8Array,\n outShapeBytes:
 Uint8Array, outStridesBytes: Uint8Array,\n outShapeLength: number, outId: number) => void;\n\n\nfunction
 setup(backend: BackendWasm): void {\n wasmStridedSlice = backend.wasm.cwrap(StridedSlice, null /*void*/, [\n
 'number', // xId\n 'array', // xStrides\n 'number', // xRank\n 'array', // beginBytes\n 'array', // endBytes\n
 'array', // stridesBytes\n 'array', // outShapeBytes\n 'array', // outStridesBytes\n 'number',
 // outShapeLength\n 'number', // outId\n]);\n\n\n\nexport function stridedSlice(args: {\n backend:
 BackendWasm,\n inputs: StridedSliceInputs,\n attrs: StridedSliceAttrs\n}): TensorInfo {\n const { backend, inputs,
 attrs } = args;\n const { x } = inputs;\n\n const {\n begin,\n end,\n strides,\n beginMask,\n endMask,\n
 ellipsisMask,\n newAxisMask,\n shrinkAxisMask\n } = attrs;\n\n const {\n finalShapeSparse,\n
 finalShape,\n isIdentity,\n sliceDim0,\n isSimpleSlice,\n begin: $begin,\n end: $end,\n strides: $strides\n
 } =\n slice_util.sliceInfo(\n x.shape, begin, end, strides, beginMask, endMask, ellipsisMask,\n newAxisMask,
 shrinkAxisMask);\n\n let result;\n\n if (isIdentity) {\n // Optimization #1, slice is a no-op plus
 reshape\n result = reshape({ inputs: { x }, backend, attrs: { shape: finalShape } });\n } else if (sliceDim0 ||
 isSimpleSlice) {\n // Optimization #2, slice is memory contiguous
 (only occurs in dim 0)\n util.assert(\n x.shape.length >= 1,\n () => `Input must have rank at least 1, got:
 ${x.shape.length}`);\n\n const size = slice_util.computeOutShape($begin, $end, $strides);\n // To tolerate
 begin[0] > end[0] (a 0-output slice), we min(begin, end).\n const sliced = slice({ inputs: { x }, backend, attrs:
 { begin: $begin, size } });\n result =\n reshape({ inputs: { x: sliced }, backend, attrs: { shape: finalShape } });\n
 backend.disposeData(sliced.dataId);\n } else {\n const out = backend.makeOutput(finalShapeSparse,
 'float32');\n\n const xId = backend.dataIdMap.get(x.dataId).id;\n const xStridesBytes =\n new
 Uint8Array(new Int32Array(util.computeStrides(x.shape)).buffer);\n const beginBytes = new Uint8Array(new
 Int32Array($begin).buffer);\n const endBytes = new Uint8Array(new Int32Array($end).buffer);\n const
 stridesBytes = new Uint8Array(new Int32Array($strides).buffer);\n\n const outputShapeBytes =\n new
 Uint8Array(new Int32Array(finalShapeSparse).buffer);\n const outStridesBytes = new Uint8Array(\n
 new Int32Array(util.computeStrides(finalShapeSparse)).buffer);\n const outId =
 backend.dataIdMap.get(out.dataId).id;\n\n wasmStridedSlice(\n xId, xStridesBytes, x.shape.length,
 beginBytes, endBytes, stridesBytes,\n outputShapeBytes, outStridesBytes, finalShapeSparse.length, outId);\n\n
 result = reshape({ inputs: { x: out }, backend, attrs: { shape: finalShape } });\n\n backend.disposeData(out.dataId);\n
 }\n\n return result;\n}\n\n\nexport const stridedSliceConfig: KernelConfig = {\n kernelName: StridedSlice,\n
 backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: stridedSlice as { } as KernelFunc\n};\n\n"/**\n *
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 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
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 WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
 language governing permissions and\n * limitations under the License.\n */\n
 =====\n
*\n\nimport { KernelConfig, Sub } from '@tensorflow/tfjs-core';\n\nimport { createBinaryKernelConfig } from
 './binary_kernel';\n\nconst supportsFullBroadcast = true;\n\nexport const subConfig: KernelConfig =\n
 createBinaryKernelConfig(Sub, supportsFullBroadcast);\n\n"/**\n *
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 Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
 file except in compliance with the License.\n * You may obtain a copy of the License at\n */\n
 *
```

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```
=====
*
* \n\nimport {backend_util, KernelConfig, KernelFunc, Sum, SumAttrs, SumInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';
\n\nimport {BackendWasm} from '../backend_wasm';
\n\nimport
{permuteAxesAndTranspose} from './kernel_utils';
\n\nimport {CppType} from './types';
\n\nlet wasmSum: (xId:
number, reduceSize: number, dtype: number, outId: number) => void;
\n\nfunction setup(backend:
BackendWasm): void {
\n wasmSum = backend.wasm.cwrap(Sum, null /*void*/, [
 'number', // input_id
 'number', // reduce_size
 'number', // dtype
 'number', // out_id
]);
\n\n function sum(args: {backend: BackendWasm, inputs: SumInputs, attrs:
SumAttrs}): TensorInfo {
\n const {backend, inputs, attrs} = args;
\n const {axis, keepDims} = attrs;
\n const {x} = inputs;
\n const xId = backend.dataIdMap.get(x.dataId).id;
\n let inputId = xId;
\n let input = x;
\n const {transposed, axes, originalAxes, inputWasTransposed} =
permuteAxesAndTranspose(x, axis, backend);
\n let reductionAxes = axes;
\n if (inputWasTransposed) {
 const transposedId =
backend.dataIdMap.get(transposed.dataId).id;
\n if (transposedId !== xId) {
 // transpose was not a no-op. We
will need to dispose of this
 // once we are done.
 input = transposed;
 inputId = transposedId;
 reductionAxes = backend_util.getInnerMostAxes(
 reductionAxes.length, input.shape.length);
 }
 }
\n backend_util.assertAxesAreInnerMostDims(
 'sum', reductionAxes, input.shape.length);
\n const [outShape,
reduceShape]
=
backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);
\n const reduceSize =
util.sizeFromShape(reduceShape);
\n const out = backend.makeOutput(outShape, input.dtype);
\n if
(util.sizeFromShape(input.shape) !== 0) {
 const outId = backend.dataIdMap.get(out.dataId).id;
 wasmSum(inputId, reduceSize, CCppType[out.dtype], outId);
 }
\n if (inputWasTransposed) {
 // dispose of
the transposed tensor.
 backend.disposeData(transposed.dataId);
 }
\n if (keepDims) {
 // reshape
 const
newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);
 out.shape = newShape;
 }
\n return out;
 }
\n\n export const sumConfig: KernelConfig = {
 kernelName: Sum,
 backendName: 'wasm',
 setupFunc: setup,
 kernelFunc: sum as KernelFunc
 };
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 * software distributed under the License is distributed on an "AS IS"
 * BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express
 * or implied. See the License for the specific language governing
 * permissions and limitations under the License.
 */
}
=====
*
* \n\nimport {KernelConfig, Tan} from '@tensorflow/tfjs-core';
\n\nimport {createUnaryKernelConfig} from
'./unary_kernel';
\n\nexport const tanConfig: KernelConfig = createUnaryKernelConfig(Tan);
/**
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 * BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express
 * or implied. See the License for the specific language governing
 * permissions and limitations under the License.
 */
}
=====
```

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*\nimport {KernelConfig, Tanh} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'./unary_kernel';\nexport const tanhConfig: KernelConfig = createUnaryKernelConfig(Tanh);\n", "/*\n * @license\n
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the specific language governing permissions and\n * limitations under the License.\n *

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=====\n
*\n\nimport {KernelConfig, KernelFunc, Tile, TileAttrs, TileInputs} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from './backend_wasm';\n\nimport {CppType} from './types';\n\nlet wasmTile: (\n xId:
number, xShape: Uint8Array, xShapeSize: number, newShape: Uint8Array,\n newShapeSize: number, dtype:
number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmTile =
backend.wasm.cwrap(Tile, null /* void */, [\n 'number', // x_id\n 'array', // x_shape\n 'number', //
x_shape.length\n 'array', // new_shape\n 'number', // new_shape.length\n 'number' // out_id\n
]);\n\n function tile(\n args: {inputs: TileInputs, backend: BackendWasm, attrs: TileAttrs}) {\n const {inputs,
backend, attrs} = args;\n const {x} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const {reps} =
attrs;\n\n const newShape: number[] = new Array(x.shape.length);\n for (let i = 0; i < newShape.length; i++) {\n
newShape[i] = x.shape[i] * reps[i];\n }\n const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n
const newShapeBytes = new Uint8Array(new Int32Array(newShape).buffer);\n\n const out =
backend.makeOutput(newShape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmTile(\n
xId, xShapeBytes, x.shape.length, newShapeBytes, newShape.length,\n CppDType[out.dtype], outId);\n return
out;\n }\n\n export const tileConfig: KernelConfig = {\n kernelName: Tile,\n backendName: 'wasm',\n setupFunc:
setup,\n kernelFunc: tile as {} as KernelFunc\n };}\n", "/*\n * @license\n
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http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an 'AS IS' BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

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=====\n
*\n\nimport {KernelConfig, KernelFunc, TensorInfo, TopK, TopKAttrs, TopKInputs} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {CppType} from './types';\n\nlet wasmTopK:
(\n xId: number, xShapeBytes: Uint8Array, xShapeLength: number,\n xDtype: CppDType, k: number, sorted:
boolean, outValuesId:
number,\n outIndicesId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmTopK =
backend.wasm.cwrap(TopK, null /* void */, [\n 'number', // xId\n 'array', // x.shape\n 'number', //
x.shape.length\n 'number', // x.dtype\n 'number', // k\n 'bool', // sorted\n 'number', // outValuesId\n
'number', // outIndicesId\n]);\n\n export const topk:\n (args: {inputs: TopKInputs, backend: BackendWasm,
attrs: TopKAttrs}) =>\n TensorInfo[] | TensorInfo = ({inputs, backend, attrs}) => {\n const {x} = inputs;\n
const {k, sorted} = attrs;\n\n const xId = backend.dataIdMap.get(x.dataId).id;\n const xShapeBytes
= new Uint8Array(new Int32Array(x.shape).buffer);\n const outputShape = x.shape.slice();\n
outputShape[outputShape.length - 1] = k;\n const outValues = backend.makeOutput(outputShape, x.dtype);\n
const outValuesId = backend.dataIdMap.get(outValues.dataId).id;\n
const outIndices = backend.makeOutput(outputShape, 'int32');\n const outIndicesId =
backend.dataIdMap.get(outIndices.dataId).id;\n\n wasmTopK(\n xId, xShapeBytes, x.shape.length,
CppType[x.dtype], k, sorted,\n outValuesId, outIndicesId);\n return [outValues, outIndices];\n
};}\n\nexport const topKConfig: KernelConfig = {\n kernelName: TopK,\n backendName: 'wasm',\n setupFunc:

```



setup,\n kernelFunc: topk as { } as KernelFunc,\n};\n", "/\*\n \* @license\n \* Copyright 2021 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the \"License\");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \* \n \* http://www.apache.org/licenses/LICENSE-2.0\n \* \n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS

OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

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=====\n*\n\nimport { KernelConfig, KernelFunc, TensorInfo, Transform, TransformAttrs, TransformInputs, util } from\n '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\n\nlet wasmTransform: (\n imageId:\n number, transformsId: number, isBatchTransform: boolean,\n batch: number, outHeight: number, outWidth:\n number, numChannels: number,\n imageWidth: number, imageHeight: number, strides: Uint8Array,\n stridesLength: number, interpolationModeId: number, fillModeId: number,\n fillValue: number, outId: number)\n=> void;\n\nfunction setup(backend: BackendWasm): void {\n wasmTransform = backend.wasm.cwrap(Transform,\n null /*void*/, [\n 'number', // imageId\n 'number', // transformsId\n 'bool', // isBatchTransform\n 'number', // batch\n 'number', // outHeight\n 'number', // outWidth\n 'number', // numChannels\n 'number', // imageWidth\n 'number', // imageHeight\n 'array', // strides\n 'number', // stridesLength\n 'number', // interpolationModeId\n 'number', // fillModeId\n 'number', // fillValue\n 'number' // outId\n]);\n\n function transform(\n args: {\n backend: BackendWasm, inputs: TransformInputs, attrs:\n TransformAttrs\n }):\n TensorInfo {\n const { backend, inputs, attrs } = args;\n const { image, transforms } = inputs;\n const { interpolation, fillMode, fillValue, outputShape } = attrs;\n const [batch, imageHeight, imageWidth, numChannels] = image.shape;\n const [outHeight, outWidth] =\n outputShape != null ? outputShape :\n [imageHeight, imageWidth];\n const outShape =\n [batch, outHeight, outWidth,\n numChannels] as\n [number, number, number, number];\n const strides =\n new Uint8Array(new\n Int32Array(util.computeStrides(image.shape)).buffer);\n\n const out = backend.makeOutput(outShape, image.dtype);\n const outId =\n backend.dataIdMap.get(out.dataId).id;\n\n const imageData = backend.dataIdMap.get(image.dataId);\n const\n imageId = imageData.id;\n\n const transformsData = backend.dataIdMap.get(transforms.dataId);\n const\n transformsId = transformsData.id;\n\n const interpolationModeId = interpolation === 'nearest' ? 1 : 2;\n let\n fillModeId;\n\n switch (fillMode) {\n case 'constant':\n fillModeId = 1;\n break;\n case 'reflect':\n fillModeId = 2;\n break;\n case 'wrap':\n fillModeId = 3;\n break;\n case 'nearest':\n fillModeId =\n 4;\n break;\n default:\n fillModeId = 1;\n break;\n }\n\n wasmTransform(\n imageId, transformsId,\n (transforms.shape[0] > 1), batch, outHeight,\n outWidth, numChannels, imageWidth, imageHeight, strides,\n image.shape.length - 1, interpolationModeId, fillModeId, fillValue,\n outId);\n\n return out;\n }\n\n export const transformConfig: KernelConfig = {\n kernelName: Transform,\n backendName:\n 'wasm',\n setupFunc: setup,\n kernelFunc: transform as { } as KernelFunc\n };\n\n", "/*\n * @license\n * Copyright\n 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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```
=====\n*\n\nimport { KernelConfig, KernelFunc, TensorInfo, Unpack, UnpackAttrs, UnpackInputs }\n from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { slice } from\n './Slice';\n\nfunction unpack(\n args: { inputs: UnpackInputs, backend: BackendWasm, attrs: UnpackAttrs }):\n TensorInfo[] {\n const { inputs, backend, attrs } = args;\n const { value } = inputs;\n let { axis } = attrs;\n if (axis <
```

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0) {\n axis += value.shape.length;\n }\n\n const numOutputs = value.shape[axis];\n const rank =
value.shape.length;\n const outShape: number[] = new Array(rank - 1);\n let outIndex = 0;\n for (let i = 0; i < rank;
i++) {\n if (i !== axis) {\n outShape[outIndex++] = value.shape[i];\n }\n }\n const outs: TensorInfo[] = new
Array(numOutputs);\n const begin = new Array(rank).fill(0);\n const size = value.shape.slice();\n size[axis] = 1;\n
for (let i = 0; i < outs.length; i++) {\n begin[axis] = i;\n outs[i] = slice({inputs: {x: value}, attrs: {begin, size},
backend});\n }\n return outs.map(({dataId, dtype}) => ({dataId, dtype,
shape: outShape}));\n}\n\nexport const unpackConfig: KernelConfig = {\n kernelName: Unpack,\n backendName:
'wasm',\n kernelFunc: unpack as { } as KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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=====\n
*\n\nimport {KernelConfig, KernelFunc, ZerosLike, ZerosLikeInputs} from '@tensorflow/tfjs-core';\nimport
{BackendWasm}
from './backend_wasm';\n\nfunction zerosLike(args: {inputs: ZerosLikeInputs, backend: BackendWasm}) {\n
const {inputs: {x}, backend} = args;\n const out = backend.makeOutput(x.shape, x.dtype);\n const outVals =
backend.typedArrayFromHeap(out);\n outVals.fill(0);\n return out;\n}\n\nexport const zerosLikeConfig:
KernelConfig = {\n kernelName: ZerosLike,\n backendName: 'wasm',\n kernelFunc: zerosLike as { } as
KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
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the specific language governing permissions and\n * limitations under the License.\n *

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=====\n *\n\nWe explicitly import the modular kernels so they get registered in the\n// global registry when we compile the
library. A modular build would replace\n// the contents of this file and import only the kernels that are
needed.\nimport {KernelConfig, registerKernel} from '@tensorflow/tfjs-core';\nimport {fusedMatMulConfig}
from './kernels/_FusedMatMul';\nimport {absConfig} from './kernels/Abs';\nimport {addConfig} from
 './kernels/Add';\nimport {addNConfig} from './kernels/AddN';\nimport {allConfig} from './kernels/All';\nimport
{anyConfig} from './kernels/Any';\nimport {argMaxConfig} from './kernels/ArgMax';\nimport {avgPoolConfig}
from './kernels/AvgPool';\nimport {batchMatMulConfig} from './kernels/BatchMatMul';\nimport
{batchToSpaceNDConfig} from './kernels/BatchToSpaceND';\nimport {castConfig} from './kernels/Cast';\nimport
{ceilConfig} from './kernels/Ceil';\nimport {clipByValueConfig} from './kernels/ClipByValue';\nimport
{concatConfig} from './kernels/Concat';\nimport {conv2DConfig} from './kernels/Conv2D';\nimport
{conv2DBackpropInputConfig} from './kernels/Conv2DBackpropInput';\nimport {cosConfig} from
 './kernels/Cos';\nimport {coshConfig} from './kernels/Cosh';\nimport {cropAndResizeConfig} from
 './kernels/CropAndResize';\nimport {cumsumConfig} from './kernels/Cumsum';\nimport {depthToSpaceConfig}
from './kernels/DepthToSpace';\nimport {depthwiseConv2dNativeConfig} from
 './kernels/DepthwiseConv2dNative';\nimport {eluConfig} from './kernels/Elu';\nimport {equalConfig} from
 './kernels/Equal';\nimport {expConfig} from './kernels/Exp';\nimport {expandDimsConfig} from
 './kernels/ExpandDims';\nimport {fillConfig} from './kernels/Fill';\nimport {flipLeftRightConfig} from
 './kernels/FlipLeftRight';\nimport {floorConfig} from './kernels/Floor';\nimport {floorDivConfig} from
 './kernels/FloorDiv';\nimport

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{fusedBatchNormConfig} from './kernels/FusedBatchNorm';\nimport {fusedConv2DConfig} from
 './kernels/FusedConv2D';\nimport {fusedDepthwiseConv2DConfig} from
 './kernels/FusedDepthwiseConv2D';\nimport {gatherNdConfig} from './kernels/GatherNd';\nimport
 {gatherV2Config} from './kernels/GatherV2';\nimport {greaterConfig} from './kernels/Greater';\nimport
 {greaterEqualConfig} from './kernels/GreaterEqual';\nimport {identityConfig} from './kernels/Identity';\nimport
 {leakyReluConfig} from './kernels/LeakyRelu';\nimport {lessConfig} from './kernels/Less';\nimport
 {lessEqualConfig} from './kernels/LessEqual';\nimport {logConfig} from './kernels/Log';\nimport
 {logicalAndConfig} from './kernels/LogicalAnd';\nimport {maxConfig} from './kernels/Max';\nimport
 {maximumConfig} from './kernels/Maximum';\nimport {maxPoolConfig} from './kernels/MaxPool';\nimport
 {meanConfig} from './kernels/Mean';\nimport {minConfig} from './kernels/Min';\nimport {minimumConfig} from
 './kernels/Minimum';\nimport
 {mirrorPadConfig} from './kernels/MirrorPad';\nimport {multiplyConfig} from './kernels/Multiply';\nimport
 {negConfig} from './kernels/Neg';\nimport {nonMaxSuppressionV3Config} from
 './kernels/NonMaxSuppressionV3';\nimport {nonMaxSuppressionV4Config} from
 './kernels/NonMaxSuppressionV4';\nimport {nonMaxSuppressionV5Config} from
 './kernels/NonMaxSuppressionV5';\nimport {notEqualConfig} from './kernels/NotEqual';\nimport {oneHotConfig}
 from './kernels/OneHot';\nimport {onesLikeConfig} from './kernels/OnesLike';\nimport {packConfig} from
 './kernels/Pack';\nimport {padV2Config} from './kernels/PadV2';\nimport {powConfig} from
 './kernels/Pow';\nimport {preluConfig} from './kernels/Prelu';\nimport {prodConfig} from './kernels/Prod';\nimport
 {rangeConfig} from './kernels/Range';\nimport {realDivConfig} from './kernels/RealDiv';\nimport {reluConfig}
 from './kernels/Relu';\nimport {relu6Config} from './kernels/Relu6';\nimport {reshapeConfig} from
 './kernels/Reshape';\nimport {resizeBilinearConfig}
 from './kernels/ResizeBilinear';\nimport {reverseConfig} from './kernels/Reverse';\nimport
 {rotateWithOffsetConfig} from './kernels/RotateWithOffset';\nimport {roundConfig} from
 './kernels/Round';\nimport {rsqrtConfig} from './kernels/Rsqrt';\nimport {scatterNdConfig} from
 './kernels/ScatterNd';\nimport {selectConfig} from './kernels/Select';\nimport {sigmoidConfig} from
 './kernels/Sigmoid';\nimport {sinConfig} from './kernels/Sin';\nimport {sliceConfig} from './kernels/Slice';\nimport
 {softmaxConfig} from './kernels/Softmax';\nimport {spaceToBatchNDConfig} from
 './kernels/SpaceToBatchND';\nimport {splitVConfig} from './kernels/SplitV';\nimport {sqrtConfig} from
 './kernels/Sqrt';\nimport {squareConfig} from './kernels/Square';\nimport {squaredDifferenceConfig} from
 './kernels/SquaredDifference';\nimport {stepConfig} from './kernels/Step';\nimport {stridedSliceConfig} from
 './kernels/StridedSlice';\nimport {subConfig} from './kernels/Sub';\nimport {sumConfig} from
 './kernels/Sum';\nimport
 {tanConfig} from './kernels/Tan';\nimport {tanhConfig} from './kernels/Tanh';\nimport {tileConfig} from
 './kernels/Tile';\nimport {topKConfig} from './kernels/TopK';\nimport {transformConfig} from
 './kernels/Transform';\nimport {transposeConfig} from './kernels/Transpose';\nimport {unpackConfig} from
 './kernels/Unpack';\nimport {zerosLikeConfig} from './kernels/ZerosLike';\n\n// List all kernel configs here\nconst
 kernelConfigs: KernelConfig[] = [\n absConfig,\n addConfig,\n addNConfig,\n allConfig,\n anyConfig,\n argMaxConfig,\n avgPoolConfig,\n batchMatMulConfig,\n batchToSpaceNDConfig,\n castConfig,\n ceilConfig,\n clipByValueConfig,\n concatConfig,\n conv2DConfig,\n conv2DBackpropInputConfig,\n cosConfig,\n coshConfig,\n cropAndResizeConfig,\n cumsumConfig,\n depthToSpaceConfig,\n depthwiseConv2dNativeConfig,\n eluConfig,\n equalConfig,\n expConfig,\n expandDimsConfig,\n fillConfig,\n flipLeftRightConfig,\n floorConfig,\n floorDivConfig,\n fusedMatMulConfig,\n fusedBatchNormConfig,\n fusedConv2DConfig,\n fusedDepthwiseConv2DConfig,\n gatherNdConfig,\n gatherV2Config,\n greaterConfig,\n greaterEqualConfig,\n identityConfig,\n leakyReluConfig,\n lessConfig,\n lessEqualConfig,\n logConfig,\n logicalAndConfig,\n maxConfig,\n maximumConfig,\n maxPoolConfig,\n meanConfig,\n minConfig,\n minimumConfig,\n mirrorPadConfig,\n multiplyConfig,\n negConfig,\n nonMaxSuppressionV3Config,\n nonMaxSuppressionV4Config,\n nonMaxSuppressionV5Config,\n

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notEqualConfig,\n oneHotConfig,\n onesLikeConfig,\n packConfig,\n padV2Config,\n powConfig,\n
preluConfig,\n prodConfig,\n rangeConfig,\n realDivConfig,\n reluConfig,\n relu6Config,\n reshapeConfig,\n
resizeBilinearConfig,\n reverseConfig,\n rotateWithOffsetConfig,\n rsqrtConfig,\n roundConfig,\n
scatterNdConfig,\n selectConfig,\n sigmoidConfig,\n sinConfig,\n sliceConfig,\n softmaxConfig,\n
spaceToBatchNDConfig,\n splitVConfig,\n sqrtConfig,\n
squareConfig,\n squaredDifferenceConfig,\n stepConfig,\n stridedSliceConfig,\n subConfig,\n sumConfig,\n
tanConfig,\n tanhConfig,\n tileConfig,\n topKConfig,\n transformConfig,\n transposeConfig,\n unpackConfig,\n
zerosLikeConfig\n];\n\nfor (const kernelConfig of kernelConfigs) {\n registerKernel(kernelConfig);\n}\n", "/*\n *
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the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {env} from '@tensorflow/tfjs-core';\n\nconst ENV = env();\n\n/**\n * True if SIMD is supported.\n
*\n// From: https://github.com/GoogleChromeLabs/wasm-feature-detect\nENV.registerFlag(\n // This typed array
passed in to WebAssembly.validate is WebAssembly binary\n // code. In this case it is a small program that
contains SIMD\n // instructions.\n 'WASM_HAS_SIMD_SUPPORT', async () => WebAssembly.validate(new
Uint8Array([\n 0, 97, 115, 109, 1, 0, 0, 0, 1, 4, 1, 96, 0, 0, 3,\n 2, 1, 0, 10, 9, 1, 7, 0, 65, 0, 253, 15, 26,
11\n]));\n\n/**\n * True if threads are supported.\n *\n// From: https://github.com/GoogleChromeLabs/wasm-
feature-detect\nENV.registerFlag('WASM_HAS_MULTITHREAD_SUPPORT', async () => {\n //
TODO(annxingyuan): Enable node support once this is resolved:\n //
https://github.com/tensorflow/tfjs/issues/3830\n if (ENV.get('IS_NODE')) {\n return false;\n }\n\n try {\n
// Test for transferability of SABs (needed for Firefox)\n //
https://groups.google.com/forum/#!msg/mozilla.dev.platform/IHkBZIHETpA/dwsMNchWEQAJ\n new
MessageChannel().port1.postMessage(new SharedArrayBuffer(1));\n // This typed array is a WebAssembly
program containing threaded\n // instructions.\n return WebAssembly.validate(new Uint8Array([\n 0, 97,
115, 109, 1, 0, 0, 0, 1, 4, 1, 96, 0, 0, 3, 2, 1, 0, 5,\n 4, 1, 3, 1, 1, 10, 11, 1, 9, 0, 65, 0, 254, 16, 2, 0, 26,
11\n]));\n } catch (e) {\n return false;\n }\n});\n\n", "\nvar WasmBackendModuleThreadedSimd = (function() {\n
var _scriptDir = typeof document !== 'undefined' && document.currentScript ? document.currentScript.src :
undefined;\n if (typeof __filename !== 'undefined') _scriptDir = _scriptDir || __filename;\n return
(function(WasmBackendModuleThreadedSimd) {\n WasmBackendModuleThreadedSimd =
WasmBackendModuleThreadedSimd || {};\n\nfunction
GROWABLE_HEAP_I8(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}
return
HEAP8}function
GROWABLE_HEAP_U8(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}
return HEAPU8}function
GROWABLE_HEAP_I32(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}
return HEAP32}function
GROWABLE_HEAP_U32(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}
return HEAPU32}function
GROWABLE_HEAP_F64(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}
return HEAPF64}var Module=typeof
WasmBackendModuleThreadedSimd!="undefined"?WasmBackendModuleThreadedSimd: {};var
readyPromiseResolve,readyPromiseReject;Module["ready"]=new
Promise(function(resolve,reject){readyPromiseResolve=resolve;readyPromiseReject=reject});var

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moduleOverrides={ };var key;for(key in
Module){if(Module.hasOwnProperty(key)){ moduleOverrides[key]=Module[key] }}var arguments_=[];var
thisProgram=\.this.program\;var quit_=function(status,toThrow){throw
toThrow};var ENVIRONMENT_IS_WEB=false;var ENVIRONMENT_IS_WORKER=false;var
ENVIRONMENT_IS_NODE=false;var ENVIRONMENT_IS_SHELL=false;ENVIRONMENT_IS_WEB=typeof
window===\object\;ENVIRONMENT_IS_WORKER=typeof
importScripts===\function\;ENVIRONMENT_IS_NODE=typeof process===\object\&&typeof
process.versions===\object\&&typeof
process.versions.node===\string\;ENVIRONMENT_IS_SHELL=!ENVIRONMENT_IS_WEB&&!ENVIRONM
ENT_IS_NODE&&!ENVIRONMENT_IS_WORKER;var
ENVIRONMENT_IS_PTHREAD=Module[\ENVIRONMENT_IS_PTHREAD\]||false;if(ENVIRONMENT_IS_P
THREAD){buffer=Module[\buffer\]}var scriptDirectory=\;function
locateFile(path){if(Module[\locateFile\]){return Module[\locateFile\](path,scriptDirectory)}return
scriptDirectory+path}var read_,readAsync,readBinary,setWindowTitle;var nodeFS;var
nodePath;if(ENVIRONMENT_IS_NODE){if(ENVIRONMENT_IS_WORKER){scriptDirectory=require(\path\).
dirname(scriptDirectory)+\^\}else{scriptDirectory=__dirname+\^\}read_=function
shell_read(filename,binary){if(!nodeFS)nodeFS=require(\fs\);if(!nodePath)nodePath=require(\path\);filename=n
odePath[\normalize\](filename);return
nodeFS[\readFileSync\](filename,binary?null:\utf8\)};readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret};if(process[\argv\].length>1){thisProgram=process[\argv\][1].replace(/\\/g,\^)}arguments_=process[\arg
v\].slice(2);process[\on\](\uncaughtException\,function(ex){if(!(ex instanceof ExitStatus)){throw
ex}});process[\on\](\unhandledRejection\,abort);quit_=function(status){process[\exit\](status)};Module[\insp
ect\]=function(){return[Emscripten Module object\]};var
nodeWorkerThreads;try{nodeWorkerThreads=require(\worker_threads\)}catch(e){console.error(The
\worker_threads\ module is not supported in this node.js build - perhaps a newer version is needed?);throw
e}global.Worker=nodeWorkerThreads.Worker}else if(ENVIRONMENT_IS_SHELL){if(typeof
read!=\undefined\){read_=function shell_read(f){return read(f)} }readBinary=function readBinary(f){var
data;if(typeof readbuffer===\function\){return new
Uint8Array(readbuffer(f))}data=read(f,\binary\);assert(typeof data===\object\);return data};if(typeof
scriptArgs!=\undefined\){arguments_=scriptArgs}else if(typeof
arguments!=\undefined\){arguments_=arguments}if(typeof
quit===\function\){quit_=function(status){quit(status)}}if(typeof print!=\undefined\){if(typeof
console===\undefined\)console={};console.log=print;console.warn=console.error=typeof
printErr!=\undefined\?printErr:print} }else
if(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER){if(ENVIRONMENT_IS_WORKER){scriptDire
ctory=self.location.href}else if(typeof
document!=\undefined\&&document.currentScript){scriptDirectory=document.currentScript.src}if(typeof
_scriptDir !=\undefined\ &&
_scriptDir){scriptDirectory=_scriptDir}if(scriptDirectory.indexOf(\blob:\)!=0){scriptDirectory=scriptDirectory.s
ubstr(0,scriptDirectory.lastIndexOf(\^")+1)}else{scriptDirectory=\} }if(ENVIRONMENT_IS_NODE){read_=fun
ction
shell_read(filename,binary){if(!nodeFS)nodeFS=require(\fs\);if(!nodePath)nodePath=require(\path\);filename=n
odePath[\normalize\](filename);return
nodeFS[\readFileSync\](filename,binary?null:\utf8\)};readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret} }else{read_=function(url){var xhr=new XMLHttpRequest;xhr.open(\GET\,url,false);xhr.send(null);return
xhr.responseText};if(ENVIRONMENT_IS_WORKER){readBinary=function(url){var xhr=new

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XMLHttpRequest;xhr.open(\ "GET",url,false);xhr.responseType=\ "arraybuffer";xhr.send(null);return new
Uint8Array(xhr.response)} }readAsync=function(url,onload,onerror){var xhr=new
XMLHttpRequest;xhr.open(\ "GET",url,true);xhr.responseType=\ "arraybuffer";xhr.onload=function(){if(xhr.status
==200||xhr.status==0&&xhr.response){onload(xhr.response);return }onerror();}xhr.onerror=onerror;xhr.send(null)}
}setWindowTitle=function(title){document.title=title }else{ }if(ENVIRONMENT_IS_NODE){if(typeof
performance===\ "undefined"){global.performance=require(\ "perf_hooks").performance } }var
out=Module[\ "print"]||console.log.bind(console);var err=Module[\ "printErr"]||console.warn.bind(console);for(key
in
moduleOverrides){if(moduleOverrides.hasOwnProperty(key)){Module[key]=moduleOverrides[key]} }moduleOverr
ides=null;if(Module[\ "arguments"]){arguments_=Module[\ "arguments"];if(Module[\ "thisProgram"]){thisProgram=
Module[\ "thisProgram"];if(Module[\ "quit"]){quit_=Module[\ "quit"];function
warnOnce(text){if(!warnOnce.shown)warnOnce.shown={ };if(!warnOnce.shown[text]){ warnOnce.shown[text]=1;er
r(text) } }var Atomics_load=Atomics.load;var Atomics_store=Atomics.store;var
Atomics_compareExchange=Atomics.compareExchange;var
wasmBinary;if(Module[\ "wasmBinary"]){wasmBinary=Module[\ "wasmBinary"];var
noExitRuntime=Module[\ "noExitRuntime"]||true;if(typeof WebAssembly!=="object"){ abort(\ "no
native wasm support detected") }var wasmMemory;var wasmModule;var ABORT=false;var
EXITSTATUS;function assert(condition,text){if(!condition){ abort(\ "Assertion failed: \"+text) } }function
getCFunc(ident){ var func=Module[\ "_" +ident];assert(func,\ "Cannot call unknown function \"+ident+\ ", make sure
it is exported");return func }function ccall(ident,returnType,argTypes,args,opts){ var
toC={\ "string":function(str){ var ret=0;if(str!==null&&str!==undefined&&str!==0){ var
len=(str.length<<2)+1;ret=stackAlloc(len);stringToUTF8(str,ret,len) }return ret},\ "array":function(arr){ var
ret=stackAlloc(arr.length);writeArrayToMemory(arr,ret);return ret } };function
convertReturnValue(ret){if(returnType===\ "string")return UTF8ToString(ret);if(returnType===\ "boolean")return
Boolean(ret);return ret }var func=getCFunc(ident);var cArgs=[];var stack=0;if(args){ for(var
i=0;i<args.length;i++){ var
converter=toC[argTypes[i]];if(converter){if(stack===0)stack=stackSave();cArgs[i]=converter(args[i]) }else{ cArgs[i
]=args[i] } } }var
ret=func.apply(null,cArgs);ret=convertReturnValue(ret);if(stack!==0)stackRestore(stack);return ret }function
cwrap(ident,returnType,argTypes,opts){ argTypes=argTypes||[];var
numericArgs=argTypes.every(function(type){ return type===\ "number" });var
numericRet=returnType!=="string";if(numericRet&&numericArgs&&!opts){ return getCFunc(ident) }return
function(){ return ccall(ident,returnType,argTypes,arguments,opts) } }function
UTF8ArrayToString(heap,idx,maxBytesToRead){ var endIdx=idx+maxBytesToRead;var
str=\ "";while(!(idx>=endIdx)){ var u0=heap[idx++];if(!u0)return
str;if(!(u0&128)){ str+=String.fromCharCode(u0);continue }var
u1=heap[idx++]&63;if((u0&224)==192){ str+=String.fromCharCode((u0&31)<<6|u1);continue }var
u2=heap[idx++]&63;if((u0&240)==224){ u0=(u0&15)<<12|u1<<6|u2 }else{ u0=(u0&7)<<18|u1<<12|u2<<6|heap[id
x++]&63 }if(u0<65536){ str+=String.fromCharCode(u0) }else{ var ch=u0-
65536;str+=String.fromCharCode(55296|ch>>10,56320|ch&1023) } }return str }function
UTF8ToString(ptr,maxBytesToRead){ return
ptr?UTF8ArrayToString(GROWABLE_HEAP_U8(),ptr,maxBytesToRead):\ "" }function
stringToUTF8Array(str,heap,outIdx,maxBytesToWrite){ if(!(maxBytesToWrite>0))return 0;var startIdx=outIdx;var
endIdx=outIdx+maxBytesToWrite-1;for(var i=0;i<str.length;++i){ var
u=str.charCodeAt(i);if(u>=55296&&u<=57343){ var
u1=str.charCodeAt(++i);u=65536+((u&1023)<<10|u1&1023) }if(u<=127){ if(outIdx>=endIdx)break;heap[outIdx++]
=u }else if(u<=2047){ if(outIdx+1>=endIdx)break;heap[outIdx++]=192|u>>6;heap[outIdx++]=128|u&63 }else
if(u<=65535){ if(outIdx+2>=endIdx)break;heap[outIdx++]=224|u>>12;heap[outIdx++]=128|u>>6&63;heap[outIdx

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++|=128|u&63}else{if(outIdx+3>=endIdx)break;heap[outIdx++]=240|u>>18;heap[outIdx++]=128|u>>12&63;heap[
outIdx++]=128|u>>6&63;heap[outIdx++]=128|u&63}}heap[outIdx]=0;return outIdx-startIdx}function
stringToUTF8(str,outPtr,maxBytesToWrite){return
stringToUTF8Array(str,GROWABLE_HEAP_U8(),outPtr,maxBytesToWrite)}function lengthBytesUTF8(str){var
len=0;for(var i=0;i<str.length;++i){var
u=str.charCodeAt(i);if(u>=55296&&u<=57343)u=65536+((u&1023)<<10)|str.charCodeAt(++i)&1023;if(u<=127)+
+len;else if(u<=2047)len+=2;else if(u<=65535)len+=3;else len+=4}return len}function
writeArrayToMemory(array,buffer){GROWABLE_HEAP_I8().set(array,buffer)}function
alignUp(x,multiple){if(x%multiple>0){x+=multiple-x%multiple}return x}var
buffer,HEAP8,HEAPU8,HEAP16,HEAPU16,HEAP32,HEAPU32,HEAPF32,HEAPF64;function
updateGlobalBufferAndViews(buf){buffer=buf;Module["HEAP8"]=HEAP8=new
Int8Array(buf);Module["HEAP16"]=HEAP16=new Int16Array(buf);Module["HEAP32"]=HEAP32=new
Int32Array(buf);Module["HEAPU8"]=HEAPU8=new Uint8Array(buf);Module["HEAPU16"]=HEAPU16=new
Uint16Array(buf);Module["HEAPU32"]=HEAPU32=new
Uint32Array(buf);Module["HEAPF32"]=HEAPF32=new
Float32Array(buf);Module["HEAPF64"]=HEAPF64=new Float64Array(buf)}var
INITIAL_MEMORY=Module["INITIAL_MEMORY"]||16777216;if(ENVIRONMENT_IS_PTHREAD){wasmM
emory=Module["wasmMemory"];buffer=Module["buffer"]}else{if(Module["wasmMemory"]){wasmMemory=
Module["wasmMemory"]}else{wasmMemory=new
WebAssembly.Memory({"initial":INITIAL_MEMORY/65536,"maximum":2147483648/65536,"shared":true});
if(!(wasmMemory.buffer instanceof SharedArrayBuffer)){err("requested a shared WebAssembly.Memory but the
returned buffer is not a SharedArrayBuffer, indicating that while the browser has SharedArrayBuffer it does not
have WebAssembly threads support - you may need to set a
flag");if(ENVIRONMENT_IS_NODE){console.log("(on node you may need: --experimental-wasm-threads --
experimental-wasm-bulk-memory and also use a recent version)")}throw Error("bad
memory")}}if(wasmMemory){buffer=wasmMemory.buffer}INITIAL_MEMORY=buffer.byteLength;updateGlob
alBufferAndViews(buffer);var wasmTable;var __ATPRERUN__=[];var __ATINIT__=[];var __ATMAIN__=[];var
__ATEXIT__=[];var __ATPOSTRUN__=[];var runtimeInitialized=false;var
runtimeExited=false;if(!ENVIRONMENT_IS_PTHREAD)__ATINIT__.push({func:function(){__wasm_call_ctor
s()}});function
preRun(){if(ENVIRONMENT_IS_PTHREAD)return;if(Module["preRun"]){if(typeof
Module["preRun"]="function")Module["preRun"]=[Module["preRun"]];while(Module["preRun"].length){a
ddOnPreRun(Module["preRun"].shift())}callRuntimeCallbacks(__ATPRERUN__)}function
initRuntime(){runtimeInitialized=true;if(ENVIRONMENT_IS_PTHREAD)return;callRuntimeCallbacks(__ATINIT
__)}function
preMain(){if(ENVIRONMENT_IS_PTHREAD)return;callRuntimeCallbacks(__ATMAIN__)}function
exitRuntime(){if(ENVIRONMENT_IS_PTHREAD)return;runtimeExited=true}function
postRun(){if(ENVIRONMENT_IS_PTHREAD)return;if(Module["postRun"]){if(typeof
Module["postRun"]="function")Module["postRun"]=[Module["postRun"]];while(Module["postRun"].lengt
h){addOnPostRun(Module["postRun"].shift())}callRuntimeCallbacks(__ATPOSTRUN__)}function
addOnPreRun(cb){__ATPRERUN__.unshift(cb)}function addOnPostRun(cb){__ATPOSTRUN__.unshift(cb)}var
runDependencies=0;var runDependencyWatcher=null;var dependenciesFulfilled=null;function
addRunDependency(id){assert(!ENVIRONMENT_IS_PTHREAD,"addRunDependency cannot be used in a
pthread
worker");runDependencies++;if(Module["monitorRunDependencies"]){Module["monitorRunDependencies"](ru
nDependencies)}}function removeRunDependency(id){runDependencies--
;if(Module["monitorRunDependencies"]){Module["monitorRunDependencies"](runDependencies)}if(runDepend
encies==0){if(runDependencyWatcher!==null){clearInterval(runDependencyWatcher);runDependencyWatcher=nul

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}if(dependenciesFulfilled){ var
callback=dependenciesFulfilled;dependenciesFulfilled=null;callback()}}Module["preloadedImages"]={};Module
["preloadedAudios"]={};function
abort(what){if(Module["onAbort"]){Module["onAbort"](what)}if(ENVIRONMENT_IS_PTHREAD)console.err
or("\Pthread aborting at "+(new
Error).stack);what+="\";err(what);ABORT=true;EXITSTATUS=1;what="\abort(\"+what+\"). Build with -s
ASSERTIONS=1 for more info.";var e=new WebAssembly.RuntimeError(what);readyPromiseReject(e);throw
e}function hasPrefix(str,prefix){return
String.prototype.startsWith?str.startsWith(prefix):str.indexOf(prefix)===0}var
dataURIPrefix="data:application/octet-stream;base64,";function isDataURI(filename){return
hasPrefix(filename,dataURIPrefix)}var fileURIPrefix="file://^";function isFileURI(filename){return
hasPrefix(filename,fileURIPrefix)}var wasmBinaryFile="tfjs-backend-wasm-threaded-
simd.wasm";if(!isDataURI(wasmBinaryFile)){wasmBinaryFile=locateFile(wasmBinaryFile)}function
getBinary(file){try{if(file===wasmBinaryFile&&wasmBinary){return new
Uint8Array(wasmBinary)}if(readBinary){return readBinary(file)}else{throw"\both async and sync fetching of the
wasm failed"}catch(err){abort(err)}}function
getBinaryPromise(){if(!wasmBinary&&(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER)){if(typeof
fetch===\function\&&!isFileURI(wasmBinaryFile)){return fetch(wasmBinaryFile,{credentials:\same-
origin\}).then(function(response){if(!response["ok"]){throw"\failed to load wasm binary file at
"+wasmBinaryFile+"\"})return
response["arrayBuffer"]()).catch(function(){return getBinary(wasmBinaryFile)})}else{if(readAsync){return new
Promise(function(resolve,reject){readAsync(wasmBinaryFile,function(response){resolve(new
Uint8Array(response)),reject}))})}return Promise.resolve().then(function(){return
getBinary(wasmBinaryFile)})}function createWasm(){var info={\a":asmLibraryArg};function
receiveInstance(instance,module){var
exports=instance.exports;Module["asm"]=exports;wasmTable=Module["asm"]["I"];wasmModule=module;if(!E
NVIRONMENT_IS_PTHREAD){var
numWorkersToLoad=PThread.unusedWorkers.length;PThread.unusedWorkers.forEach(function(w){PThread.load
WasmModuleToWorker(w,function(){if(!--numWorkersToLoad)removeRunDependency("\wasm-
instantiate\");}))}if(!ENVIRONMENT_IS_PTHREAD){addRunDependency("\wasm-instantiate")}function
receiveInstantiatedSource(output){receiveInstance(output["instance"],output["module"])}function
instantiateArrayBuffer(receiver){return getBinaryPromise().then(function(binary){return
WebAssembly.instantiate(binary,info)}).then(receiver,function(reason){err("\failed to asynchronously prepare
wasm: "+reason);abort(reason)})}function instantiateAsync(){if(!wasmBinary&&typeof
WebAssembly.instantiateStreaming===\function\&&!isDataURI(wasmBinaryFile)&&!isFileURI(wasmBinaryFil
e)&&typeof fetch===\function\"){return fetch(wasmBinaryFile,{credentials:\same-
origin\}).then(function(response){var result=WebAssembly.instantiateStreaming(response,info);return
result.then(receiveInstantiatedSource,function(reason){err("\wasm streaming compile failed: "+reason);err("\falling
back to ArrayBuffer instantiation");return instantiateArrayBuffer(receiveInstantiatedSource)})})}else{return
instantiateArrayBuffer(receiveInstantiatedSource)}if(Module["instantiateWasm"]){try{var
exports=Module["instantiateWasm"](info,receiveInstance);return exports}catch(e){err("\Module.instantiateWasm
callback failed with error: "+e);return false}}instantiateAsync().catch(readyPromiseReject);return{}}var
ASM_CONSTS={10520:function(){throw"Canceled!";},10538:function($0,$1){setTimeout(function(){__emscript
en_do_dispatch_to_thread($0,$1),0});};function initPthreadsJS(){PThread.initRuntime()}function
callRuntimeCallbacks(callbacks){while(callbacks.length>0){var callback=callbacks.shift();if(typeof
callback===\function\){callback(Module);continue}var func=callback.func;if(typeof
func===\number\){if(callback.arg===undefined){wasmTable.get(func)}else{wasmTable.get(func)(callback.arg)
}}else{func(callback.arg===undefined?null:callback.arg)}}}var

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ERRNO_CODES={EPERM:63,ENOENT:44,ESRCH:71,EINTR:27,EIO:29,ENXIO:60,E2BIG:1,ENOEXEC:45,EBADFD:8,ECHILD:12,EAGAIN:6,EWOULDBLOCK:6,ENOMEM:48,EACCES:2,EFAULT:21,ENOTBLK:105,EBUSY:10,EEXIST:20,EXDEV:75,ENODEV:43,ENOTDIR:54,EISDIR:31,EINVAL:28,ENFILE:41,EMFILE:33,ENOTTY:59,ETXTBSY:74,EFBIG:22,ENOSPC:51,ESPIPE:70,EROFS:69,EMLINK:34,EPIPE:64,EDOM:18,ERANGE:68,ENOMSG:49,EIDRM:24,ECHRNG:106,EL2NSYNC:156,EL3HLT:107,EL3RST:108,ELNRNG:109,EUNATCH:110,ENOSIG:111,EL2HLT:112,EDEADLK:16,ENOLCK:46,EBADFD:113,EBADR:114,EXFULL:115,ENOANO:104,EBADRQC:103,EBADSLT:102,EDEADLOCK:16,EBFONT:101,ENOSTR:100,ENODATA:116,ETIME:117,ENOSR:118,ENONET:119,ENOPKG:120,EREMOTE:121,ENOLINK:47,EADV:122,ESRMNT:123,ECOMM:124,EPROTO:65,EMULTIHOP:36,EDOTDOT:125,EBADMSG:9,ENOTUNIQ:126,EBADFD:127,EREMCHG:128,ELIBACC:129,ELIBBAD:130,ELIBSCN:131,ELIBMAX:132,ELIBEXEC:133,ENOSYS:52,ENOTEMPTY:55,ENAMETOOLONG:37,ELOOP:32,EOPNOTSUPP:138,EPFNOSUPPORT:139,ECONNRESET:15,ENOBUFS:42,EAFNOSUPPORT:5,EPROTOTYPE:67,ENOTSOCK:57,ENOPROTOOPT:50,ESHUTDOWN:140,ECONNREFUSED:14,EADDRINUSE:3,ECONNABORTED:13,ENETUNREACH:40,ENETDOWN:38,ETIMEDOUT:73,EHOSTDOWN:142,EHOSTUNREACH:23,EINPROGRESS:26,EALREADY:7,EDESTADDRREQ:17,EMSGSIZE:35,EPROTONOSUPPORT:66,ESOCKTNOSUPPORT:137,EADDRNOTAVAIL:4,ENETRESET:39,EISCONN:30,ENOTCONN:53,ETOOMANYREFS:141,EUSERS:136,EDQUOT:19,ESTALE:72,ENOTSUP:138,ENOMEDIUM:148,EILSEQ:25,E_OVERFLOW:61,ECANCELED:11,ENOTRECOVERABLE:56,EOWNERDEAD:62,ESTRPIPE:135};function
_emsripten_futex_wake(addr,count){if(addr<=0||addr>GROWABLE_HEAP_I8().length||addr&3!=0||count<0)return -28;if(count==0)return 0;if(count>=2147483647)count=Infinity;var
mainThreadWaitAddress=Atomics.load(GROWABLE_HEAP_I32(),_emsripten_main_thread_futex>>2);var
mainThreadWoken=0;if(mainThreadWaitAddress==addr){var
loadedAddr=Atomics.compareExchange(GROWABLE_HEAP_I32(),_emsripten_main_thread_futex>>2,mainThreadWaitAddress,0);if(loadedAddr==mainThreadWaitAddress){--count;mainThreadWoken=1;if(count<=0)return 1}}var ret=Atomics.notify(GROWABLE_HEAP_I32(),addr>>2,count);if(ret>=0)return
ret+mainThreadWoken;throw`Atomics.notify returned an unexpected value
`+ret}Module["_emsripten_futex_wake"]=_emsripten_futex_wake;function
killThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw`Internal Error! killThread() can only ever be
called from main application thread!`;if(!pthread_ptr)throw`Internal Error! Null pthread_ptr in
killThread!`;GROWABLE_HEAP_I32()[pthread_ptr+12>>2]=0;var
pthread=PThread.threads[pthread_ptr];pthread.worker.terminate();PThread.freeThreadData(pthread);PThread.runni
ngWorkers.splice(PThread.runningWorkers.indexOf(pthread.worker),1);pthread.worker pthread=undefined}functio
n cancelThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw`Internal Error! cancelThread() can only
ever be called from main application thread!`;if(!pthread_ptr)throw`Internal Error! Null pthread_ptr in
cancelThread!`;var
pthread=PThread.threads[pthread_ptr];pthread.worker.postMessage({"cmd":"cancel"})}function
cleanupThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw`Internal Error! cleanupThread() can only
ever be called from main application thread!`;if(!pthread_ptr)throw`Internal Error! Null pthread_ptr in
cleanupThread!`;var
pthread=PThread.threads[pthread_ptr];if(pthread){GROWABLE_HEAP_I32()[pthread_ptr+12>>2]=0;var
worker=pthread.worker;PThread.returnWorkerToPool(worker)}}var
PThread={unusedWorkers:[],runningWorkers:[],initMainThreadBlock:function(){var
pthreadPoolSize=8;for(var
i=0;i<pthreadPoolSize;++i){PThread.allocateUnusedWorker()}};initRuntime:function(){var
tb=_malloc(228);for(var
i=0;i<228/4;++i)GROWABLE_HEAP_U32()[tb/4+i]=0;GROWABLE_HEAP_I32()[tb+12>>2]=tb;var
headPtr=tb+152;GROWABLE_HEAP_I32()[headPtr>>2]=headPtr;var tlsMemory=_malloc(512);for(var
i=0;i<128;++i)GROWABLE_HEAP_U32()[tlsMemory/4+i]=0;Atomics.store(GROWABLE_HEAP_U32(),tb+100

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>>2, tlsMemory); Atomics.store(GROWABLE_HEAP_U32(), tb+40>>2, tb); __emscripten_thread_init(tb, !ENVIRON
MENT_IS_WORKER, 1); __emscripten_register_main_browser_thread_id(tb); initWorker: function() { }, pthreads: { }, t
hreadExitHandlers: [], setThreadStatus: function() { }, runExitHandlers: function() { while(PThread.threadExitHandlers.l
ength>0) { PThread.threadExitHandlers.pop() }; if(ENVIRONMENT_IS_PTHREAD && _pthread_self()) __pthread
_tsd_run_dtors(); runExitHandlersAndDeinitThread: function(tb, exitCode) { Atomics.store(GROWABLE_HEAP_U
32(), tb+56>>2, 1); Atomics.store(GROWABLE_HEAP_U32(), tb+60>>2, 0); PThread.runExitHandlers(); Atomics.stor
e(GROWABLE_HEAP_U32(), tb+4>>2, exitCode); Atomics.store(GROWABLE_HEAP_U32(), tb+0>>2, 1); __emscri
pten_futex_wake(tb+0, 2147483647); __emscripten_thread_init(0, 0, 0); threadExit: function(exitCode) { var
tb = _pthread_self(); if(tb) { PThread.runExitHandlersAndDeinitThread(tb, exitCode); if(ENVIRONMENT_IS_PTHRE
AD) { postMessage({"cmd": "exit"}) }; }, threadCancel: function() { PThread.runExitHandlersAndDeinitThread(_pthr
ead_self(), -1); postMessage({"cmd": "cancelDone"}) }, terminateAllThreads: function() { for(var t in
PThread.pthreads) { var
pthread = PThread.pthreads[t]; if(pthread && pthread.worker) { PThread.returnWorkerToPool(pthread.worker) } PThre
ad.pthreads = { }; for(var i=0; i<PThread.unusedWorkers.length; ++i) { var
worker = PThread.unusedWorkers[i]; worker.terminate() } PThread.unusedWorkers = []; for(var
i=0; i<PThread.runningWorkers.length; ++i) { var worker = PThread.runningWorkers[i]; var
pthread = worker.pthread; PThread.freeThreadData(pthread); worker.terminate() } PThread.runningWorkers = [], freeTh
readData: function(pthread) { if(!pthread) return; if(pthread.threadInfoStruct) { var
tlsMemory = GROWABLE_HEAP_I32()[pthread.threadInfoStruct+100>>2]; GROWABLE_HEAP_I32()[pthread.thr
eadInfoStruct+100>>2] = 0; _free(tlsMemory); _free(pthread.threadInfoStruct) } pthread.threadInfoStruct = 0; if(pthread.
allocatedOwnStack && pthread.stackBase) _free(pthread.stackBase); pthread.stackBase = 0; if(pthread.worker) pthread.
worker.pthread = null }, returnWorkerToPool: function(worker) { PThread.runWithoutMainThreadQueuedCalls(funcio
n() { delete
PThread.pthreads[worker.pthread.threadInfoStruct]; PThread.unusedWorkers.push(worker); PThread.runningWorker
s.splice(PThread.runningWorkers.indexOf(worker), 1); PThread.freeThreadData(worker.pthread); worker.pthread = un
defined }), runWithoutMainThreadQueuedCalls: function(func) { GROWABLE_HEAP_I32()[__emscripten_allow_main_runti
me_queued_calls>>2] = 0; try { func() } finally { GROWABLE_HEAP_I32()[__emscripten_allow_main_runti
me_queued_calls>>2] = 1 } }, receiveObjectTransfer: function(data) { }, loadWasmModuleToWorker: function(worker, o
nFinishedLoading) { worker.onmessage = function(e) { var
d = e["data"]; var
cmd = d["cmd"]; if(worker.pthread) PThread.currentProxiedOperationCallerThread = worker.pthread.threadInfoStruct;
if(d["targetThread"] && d["targetThread"] != _pthread_self()) { var
thread = PThread.pthreads[d.targetThread]; if(thread) { thread.worker.postMessage(e.data, d["transferList"]) } else { con
sole.error('Internal error! Worker sent a message \''+cmd+'\" to target pthread '+d["targetThread"]+'\", but that
thread no longer
exists!') } } PThread.currentProxiedOperationCallerThread = undefined; return } if(cmd === "processQueuedMainThread
Work") { __emscripten_main_thread_process_queued_calls() } else
if(cmd === "spawnThread") { spawnThread(e.data) } else
if(cmd === "cleanupThread") { cleanupThread(d["thread"]) } else
if(cmd === "killThread") { killThread(d["thread"]) } else
if(cmd === "cancelThread") { cancelThread(d["thread"]) } else
if(cmd === "loaded") { worker.loaded = true; if(onFinishedLoading) onFinishedLoading(worker); if(worker.runPthread)
{ worker.runPthread(); delete
worker.runPthread } } else if(cmd === "print") { out("Thread \" + d["threadId"] + \": \" + d["text"]) } else
if(cmd === "printErr") { err("Thread \" + d["threadId"] + \": \" + d["text"]) } else if(cmd === "alert") { alert("Thread
\" + d["threadId"] + \": \" + d["text"]) } else if(cmd === "exit") { var
detached = worker.pthread && Atomics.load(GROWABLE_HEAP_U32(), worker.pthread.threadInfoStruct+64>>2); if
(detached) { PThread.returnWorkerToPool(worker) } } else

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if(cmd===\ "exitProcess\"){try{exit(d[\ "returnCode\"]) }catch(e){if(e instanceof ExitStatus)return;throw e } }else
if(cmd===\ "cancelDone\"){PThread.returnWorkerToPool(worker)}else
if(cmd===\ "objectTransfer\"){PThread.receiveObjectTransfer(e.data)}else
if(e.data.target===\ "setimmediate\"){worker.postMessage(e.data)}else{err(\ "worker sent an unknown command
\ "+cmd)}PThread.currentProxiedOperationCallerThread=undefined};worker.onerror=function(e){err(\ "pthread sent
an error! \ "+e.filename+\ ":"+e.lineno+\ ":
\ "+e.message)};if(ENVIRONMENT_IS_NODE){worker.on(\ "message",function(data){worker.onmessage({data:d
ata})});worker.on(\ "error",function(data){worker.onerror(data)});worker.on(\ "exit",function(data){})}worker.post
Message({\ "cmd":\ "load",\ "urlOrBlob":Module[\ "mainScriptUrlOrBlob\"]|_scriptDir,\ "wasmMemory":wasmMe
memory,\ "wasmModule":wasmModule}),allocateUnusedWorker:function(){var
pthreadMainJs=locateFile(\ "tfjs-backend-wasm-threaded-simd.worker.js");PThread.unusedWorkers.push(new
Worker(pthreadMainJs)),getNewWorker:function(){if(PThread.unusedWorkers.length==0){PThread.allocateUnus
edWorker();PThread.loadWasmModuleToWorker(PThread.unusedWorkers[0])}if(PThread.unusedWorkers.length>
0)return PThread.unusedWorkers.pop();else return null},busySpinWait:function(msecs){var
t=performance.now()+msecs;while(performance.now()<t){}}};function
establishStackSpace(stackTop,stackMax){_emscripten_stack_set_limits(stackTop,stackMax);stackRestore(stackTop
)}Module[\ "establishStackSpace\"]=establishStackSpace;function getNoExitRuntime(){return
noExitRuntime}Module[\ "getNoExitRuntime\"]=getNoExitRuntime;function invokeEntryPoint(ptr,arg){return
wasmTable.get(ptr)(arg)}Module[\ "invokeEntryPoint\"]=invokeEntryPoint;function
__assert_fail(condition,filename,line,func){abort(\ "Assertion failed: \ "+UTF8ToString(condition)+"", at:
\ "+[filename?UTF8ToString(filename):\ "unknown filename",line,func?UTF8ToString(func):\ "unknown
function"])}function __call_main(argc,argv){var returnCode=_main(argc,argv)}var
_emscripten_get_now;if(ENVIRONMENT_IS_NODE){_emscripten_get_now=function(){var
t=process[\ "hrtime\"];return t[0]*1e3+t[1]/1e6 } }else
if(ENVIRONMENT_IS_PTHREAD){_emscripten_get_now=function(){return performance.now()-
Module[\ "__performance_now_clock_drift\"]} }else if(typeof
dateNow!=="undefined"){_emscripten_get_now=dateNow}else _emscripten_get_now=function(){return
performance.now()};function setErrNo(value){GROWABLE_HEAP_I32()[__errno_location()>>2]=value;return
value}function _atexit(func,arg){if(ENVIRONMENT_IS_PTHREAD)return
_emscripten_proxy_to_main_thread_js(1,1,func,arg)}function
__emscripten_notify_thread_queue(targetThreadId,mainThreadId){if(targetThreadId==mainThreadId){postMessag
e({\ "cmd":\ "processQueuedMainThreadWork\"})} }else
if(ENVIRONMENT_IS_PTHREAD){postMessage({\ "targetThread":targetThreadId,\ "cmd":\ "processThreadQueue
e\"})} }else {var pthread=PThread pthreads[targetThreadId];var
worker=pthread&&pthread.worker;if(!worker){return}worker.postMessage({\ "cmd":\ "processThreadQueue\"})}ret
urn 1}function _abort(){abort()}function _emscripten_asm_const_int(code,sigPtr,argbuf){var
args=readAsmConstArgs(sigPtr,argbuf);return ASM_CONSTS[code].apply(null,args)}function
_emscripten_conditional_set_current_thread_status(expectedStatus,newStatus){}function
_emscripten_futex_wait(addr,val,timeout){if(addr<=0||addr>GROWABLE_HEAP_I8().length||addr&3!=0)return-
28;if(!ENVIRONMENT_IS_WEB){var
ret=Atomics.wait(GROWABLE_HEAP_I32(),addr>>2,val,timeout);if(ret===\ "timed-out\"){return-
73;if(ret===\ "not-equal\"){return-6;if(ret===\ "ok\"){return
0;throw\ "Atomics.wait returned an unexpected value
\ "+ret} }else {if(Atomics.load(GROWABLE_HEAP_I32(),addr>>2)!=val){return-6}var
tNow=performance.now();var tEnd=tNow+timeout;var
lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2,addr);while(1){tNo
w=performance.now();if(tNow>tEnd){lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emscripten_mai
n_thread_futex>>2,0);return-

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73}lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2,0);if(lastAddr==
0){break}_emscripten_main_thread_process_queued_calls();if(Atomics.load(GROWABLE_HEAP_I32()),addr>>2)!
=val){return-
6}lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2,addr)}return
0}}function
_emscripten_memcpy_big(dest,src,num){GROWABLE_HEAP_U8().copyWithin(dest,src,src+num)}function
_emscripten_num_logical_cores(){if(ENVIRONMENT_IS_NODE)return require("\os").cpus().length;return
navigator["hardwareConcurrency"]}function
_emscripten_proxy_to_main_thread_js(index,sync){var numCallArgs=arguments.length-2;var
stack=stackSave();var serializedNumCallArgs=numCallArgs;var args=stackAlloc(serializedNumCallArgs*8);var
b=args>>3;for(var i=0;i<numCallArgs;i++){var arg=arguments[2+i];GROWABLE_HEAP_F64()[b+i]=arg}var
ret=_emscripten_run_in_main_runtime_thread_js(index,serializedNumCallArgs,args,sync);stackRestore(stack);retur
n ret}var _emscripten_receive_on_main_thread_js_callArgs=[];var readAsmConstArgsArray=[];function
readAsmConstArgs(sigPtr,buf){readAsmConstArgsArray.length=0;var
ch;buf>>=2;while(ch=GROWABLE_HEAP_U8()[sigPtr++){var
double=ch<105;if(double&&buf&&1)buf++;readAsmConstArgsArray.push(double?GROWABLE_HEAP_F64()[b+i]>>1]:GROWABLE_HEAP_I32()[buf]);++buf}return readAsmConstArgsArray}function
_emscripten_receive_on_main_thread_js(index,numCallArgs,args){_emscripten_receive_on_main_thread_js_callA
rgs.length=numCallArgs;var b=args>>3;for(var
i=0;i<numCallArgs;i++){_emscripten_receive_on_main_thread_js_callArgs[i]=GROWABLE_HEAP_F64()[b+i]}v
ar
isEmAsmConst=index<0;var func=!isEmAsmConst?proxiedFunctionTable[index]:ASM_CONSTS[-index-
1];return func.apply(null,_emscripten_receive_on_main_thread_js_callArgs)}function
_emscripten_get_heap_size(){return GROWABLE_HEAP_U8().length}function
emscripten_realloc_buffer(size){try{wasmmemory.grow(size-
buffer.byteLength+65535>>>16);updateGlobalBufferAndViews(wasmmemory.buffer);return
1}catch(e){}}function _emscripten_resize_heap(requestedSize){var
oldSize=_emscripten_get_heap_size();if(requestedSize<=oldSize){return false}var
maxHeapSize=2147483648;if(requestedSize>maxHeapSize){return false}for(var
cutDown=1;cutDown<=4;cutDown*=2){var
overGrownHeapSize=oldSize*(1+.2/cutDown);overGrownHeapSize=Math.min(overGrownHeapSize,requestedSize
+100663296);var
newSize=Math.min(maxHeapSize,alignUp(Math.max(requestedSize,overGrownHeapSize),65536));var
replacement=emscripten_realloc_buffer(newSize);if(replacement){return true}}return false}var
JSEvents={inEventHandler:0,removeAllEventListeners:function(){for(var
i=JSEvents.eventHandlers.length-1;i>=0;--
i){JSEvents._removeHandler(i)}JSEvents.eventHandlers=[];JSEvents.deferredCalls=[]},registerRemoveEventListen
ers:function(){if(!JSEvents.removeEventListenersRegistered){__ATEXIT__.push(JSEvents.removeAllEventListene
rs);JSEvents.removeEventListenersRegistered=true}},deferredCalls:[],deferCall:function(targetFunction,precedence
,argsList){function arraysHaveEqualContent(arrA,arrB){if(arrA.length!=arrB.length)return false;for(var i in
arrA){if(arrA[i]!=arrB[i])return false}return true}for(var i in JSEvents.deferredCalls){var
call=JSEvents.deferredCalls[i];if(call.targetFunction==targetFunction&&arraysHaveEqualContent(call.argsList,args
List)){return}}JSEvents.deferredCalls.push({targetFunction:targetFunction,precedence:precedence,argsList:argsList
});JSEvents.deferredCalls.sort(function(x,y){return
x.precedence<y.precedence}),removeDeferredCalls:function(targetFunction){for(var
i=0;i<JSEvents.deferredCalls.length;++i){if(JSEvents.deferredCalls[i].targetFunction==targetFunction){JSEvents.d
eferredCalls.splice(i,1);--i}},canPerformEventHandlerRequests:function(){return

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JSEvents.inEventHandler&&JSEvents.currentEventHandler.allowsDeferredCalls},runDeferredCalls:function(){if(!J
SEvents.canPerformEventHandlerRequests()){return}for(var i=0;i<JSEvents.deferredCalls.length;++i){ var
call=JSEvents.deferredCalls[i];JSEvents.deferredCalls.splice(i,1);--
i;call.targetFunction.apply(null,call.argsList)},eventHandlers:[],removeAllHandlersOnTarget:function(target,event
TypeString){for(var
i=0;i<JSEvents.eventHandlers.length;++i){if(JSEvents.eventHandlers[i].target==target&&(!eventTypeString||event
TypeString==JSEvents.eventHandlers[i].eventTypeString)){JSEvents._removeHandler(i--
)}}},_removeHandler:function(i){ var
h=JSEvents.eventHandlers[i];h.target.removeEventListener(h.eventTypeString,h.eventListenerFunc,h.useCapture);J
SEvents.eventHandlers.splice(i,1)},registerOrRemoveHandler:function(eventHandler){ var
jsEventHandler=function
jsEventHandler(event){++JSEvents.inEventHandler;JSEvents.currentEventHandler=eventHandler;JSEvents.runDef
erredCalls();eventHandler.handlerFunc(event);JSEvents.runDeferredCalls();--
JSEvents.inEventHandler};if(eventHandler.callbackfunc){ eventHandler.eventListenerFunc=jsEventHandler;eventH
andler.target.addEventListener(eventHandler.eventTypeString,jsEventHandler,eventHandler.useCapture);JSEvents.e
ventHandlers.push(eventHandler);JSEvents.registerRemoveEventListeners()}else{for(var
i=0;i<JSEvents.eventHandlers.length;++i){if(JSEvents.eventHandlers[i].target==eventHandler.target&&JSEvents.e
ventHandlers[i].eventTypeString==eventHandler.eventTypeString){JSEvents._removeHandler(i--
)}}},queueEventHandlerOnThread_iiii:function(targetThread,eventHandlerFunc,eventTypeId,eventData,userData)
{ var stackTop=stackSave();var
varargs=stackAlloc(12);GROWABLE_HEAP_I32()[varargs>>2]=eventTypeId;GROWABLE_HEAP_I32()[varargs
+4>>2]=eventData;GROWABLE_HEAP_I32()[varargs+8>>2]=userData;__emscripten_call_on_thread(0,targetThre
ad,637534208,eventHandlerFunc,eventData,varargs);stackRestore(stackTop)},getTargetThreadForEventCallback:f
unction(targetThread){ switch(targetThread){ case
1:return 0;case 2:return PThread.currentProxiedOperationCallerThread;default:return
targetThread}},getNodeNameForTarget:function(target){if(!target)return"";if(target==window)return"#window";
if(target==screen)return"#screen";return
target&&target.nodeName?target.nodeName:""},fullscreenEnabled:function(){return
document.fullscreenEnabled||document.webkitFullscreenEnabled}};function stringToNewUTF8(jsString){ var
length=lengthBytesUTF8(jsString)+1;var cString=_malloc(length);stringToUTF8(jsString,cString,length);return
cString}function
_emscripten_set_offscreencanvas_size_on_target_thread_js(targetThread,targetCanvas,width,height){ var
stackTop=stackSave();var varargs=stackAlloc(12);var
targetCanvasPtr=0;if(targetCanvas){targetCanvasPtr=stringToNewUTF8(targetCanvas)}GROWABLE_HEAP_I32(
)[varargs>>2]=targetCanvasPtr;GROWABLE_HEAP_I32()[varargs+4>>2]=width;GROWABLE_HEAP_I32()[var
args+8>>2]=height;__emscripten_call_on_thread(0,targetThread,657457152,0,targetCanvasPtr,varargs);stackRestor
e(stackTop)}function
_emscripten_set_offscreencanvas_size_on_target_thread(targetThread,targetCanvas,width,height){targetCanvas=tar
getCanvas?UTF8ToString(targetCanvas):"";_emscripten_set_offscreencanvas_size_on_target_thread_js(targetThre
ad,targetCanvas,width,height)}function maybeCStringToJsString(cString){ return
cString>2?UTF8ToString(cString):cString}var specialHTMLTargets=[0,typeof
document!=="undefined"?document:0,typeof window!=="undefined"?window:0];function
findEventTarget(target){ target=maybeCStringToJsString(target);var
domElement=specialHTMLTargets[target]||(typeof
document!=="undefined"?document.querySelector(target):undefined);return domElement}function
findCanvasEventTarget(target){return findEventTarget(target)}function
_emscripten_set_canvas_element_size_calling_thread(target,width,height){ var

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canvas=findCanvasEventTarget(target);if(!canvas)return-
4;if(canvas.canvasSharedPtr){GROWABLE_HEAP_I32()[canvas.canvasSharedPtr>>2]=width;GROWABLE_HEA
P_I32()[canvas.canvasSharedPtr+4>>2]=height;if(canvas.offscreenCanvas||!canvas.controlTransferredOffscreen){if
(canvas.offscreenCanvas)canvas=canvas.offscreenCanvas;var
autoResizeViewport=false;if(canvas.GLctxObject&&canvas.GLctxObject.GLctx){var
prevViewport=canvas.GLctxObject.GLctx.getParameter(2978);autoResizeViewport=prevViewport[0]===0&&prev
Viewport[1]===0&&prevViewport[2]===canvas.width&&prevViewport[3]===canvas.height}canvas.width=width;
canvas.height=height;if(autoResizeViewport){canvas.GLctxObject.GLctx.viewport(0,0,width,height)}}else
if(canvas.canvasSharedPtr){var
targetThread=GROWABLE_HEAP_I32()[canvas.canvasSharedPtr+8>>2];_emscripten_set_offscreencanvas_size_o
n_target_thread(targetThread,target,width,height);return 1}else{return-4}return 0}function
_emscripten_set_canvas_element_size_main_thread(target,width,height){if(ENVIRONMENT_IS_PTHREAD)retur
n
_emscripten_proxy_to_main_thread_js(2,1,target,width,height);return
_emscripten_set_canvas_element_size_calling_thread(target,width,height)}function
_emscripten_set_canvas_element_size(target,width,height){var
canvas=findCanvasEventTarget(target);if(canvas){return
_emscripten_set_canvas_element_size_calling_thread(target,width,height)}else{return
_emscripten_set_canvas_element_size_main_thread(target,width,height)}}function
_emscripten_set_current_thread_status(newStatus){}function
_emscripten_set_thread_name(threadId,name){}function __webgl_enable_ANGLE_instanced_arrays(ctx){var
ext=ctx.getExtension("\ANGLE_instanced_arrays");if(ext){ctx["vertexAttribDivisor"]=function(index,divisor){ex
t["vertexAttribDivisorANGLE"](index,divisor)};ctx["drawArraysInstanced"]=function(mode,first,count,primcou
nt){ext["drawArraysInstancedANGLE"](mode,first,count,primcount)};ctx["drawElementsInstanced"]=function(
mode,count,type,indices,primcount){ext["drawElementsInstancedANGLE"](mode,count,type,indices,primcount)};
return
1}}function __webgl_enable_OES_vertex_array_object(ctx){var
ext=ctx.getExtension("\OES_vertex_array_object");if(ext){ctx["createVertexArray"]=function(){return
ext["createVertexArrayOES"]();ctx["deleteVertexArray"]=function(vao){ext["deleteVertexArrayOES"](vao)};
ctx["bindVertexArray"]=function(vao){ext["bindVertexArrayOES"](vao)};ctx["isVertexArray"]=function(vao)
{return ext["isVertexArrayOES"](vao)};return 1}}function __webgl_enable_WEBGL_draw_buffers(ctx){var
ext=ctx.getExtension("\WEBGL_draw_buffers");if(ext){ctx["drawBuffers"]=function(n,bufs){ext["drawBuffers
WEBGL"](n,bufs)};return 1}}function
__webgl_enable_WEBGL_multi_draw(ctx){return!(ctx.multiDrawWebgl=ctx.getExtension("\WEBGL_multi_dra
w"))}var
GL={counter:1,buffers:[],programs:[],framebuffers:[],renderbuffers:[],textures:[],uniforms:[],shaders:[],vaos:[],cont
exts:{},offscreenCanvases:{},timerQueriesEXT:[],programInfos:{},stringCache:{},unpackAlignment:4,recordError:
function
recordError(errorCode){if(!GL.lastError){GL.lastError=errorCode}},getNewId:function(table){var
ret=GL.counter++;for(var i=table.length;i<ret;i++){table[i]=null}return
ret},getSource:function(shader,count,string,length){var source="";for(var i=0;i<count;++i){var
len=length?GROWABLE_HEAP_I32()[length+i*4>>2]:-
1;source+=UTF8ToString(GROWABLE_HEAP_I32()[string+i*4>>2],len<0?undefined:len)}return
source},createContext:function(canvas,webGLContextAttributes){var
ctx=canvas.getContext("\webgl",webGLContextAttributes);if(!ctx)return 0;var
handle=GL.registerContext(ctx,webGLContextAttributes);return
handle},registerContext:function(ctx,webGLContextAttributes){var
handle=_malloc(8);GROWABLE_HEAP_I32()[handle+4>>2]=_pthread_self();var

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context={ handle:handle,attributes:webGLContextAttributes,version:webGLContextAttributes.majorVersion,GLctx:
ctx };if(ctx.canvas)ctx.canvas.GLctxObject=context;GL.contexts[handle]=context;if(typeof
webGLContextAttributes.enableExtensionsByDefault===undefined||webGLContextAttributes.enableExtensions
ByDefault){GL.initExtensions(context)}return
handle},makeContextCurrent:function(contextHandle){GL.currentContext=GL.contexts[contextHandle];Module.ctx
=GLctx=GL.currentContext&&GL.currentContext.GLctx;return!(contextHandle&&!GLctx)},getContext:function(c
ontextHandle){return
GL.contexts[contextHandle]},deleteContext:function(contextHandle){if(GL.currentContext===GL.contexts[context
Handle])GL.currentContext=null;if(typeof
JSEvents===undefined||JSEvents.removeAllHandlersOnTarget(GL.contexts[contextHandle].GLctx.canvas);if(GL.co
ntexts[contextHandle]&&GL.contexts[contextHandle].GLctx.canvas)GL.contexts[contextHandle].GLctx.canvas.GL
ctxObject=undefined;_free(GL.contexts[contextHandle].handle);GL.contexts[contextHandle]=null},initExtensions:f
unction(context){if(!context)context=GL.currentContext;if(context.initExtensionsDone)return;context.initExtension
sDone=true;var
GLctx=context.GLctx;__webgl_enable_ANGLE_instanced_arrays(GLctx);__webgl_enable_OES_vertex_array_obj
ect(GLctx);__webgl_enable_WEBGL_draw_buffers(GLctx);GLctx.disjointTimerQueryExt=GLctx.getExtension("
EXT_disjoint_timer_query");__webgl_enable_WEBGL_multi_draw(GLctx);var
exts=GLctx.getSupportedExtensions()||[];exts.forEach(function(ext){if(ext.indexOf("lose_context")<0&&ext.inde
xOf("debug")<0){GLctx.getExtension(ext)}}),populateUniformTable:function(program){var
p=GL.programs[program];var
ptable=GL.programInfos[program]={ uniforms: {},maxUniformLength:0,maxAttributeLength:-
1,maxUniformBlockNameLength:-1 };var utable=ptable.uniforms;var
numUniforms=GLctx.getProgramParameter(p,35718);for(var i=0;i<numUniforms;++i){ var
u=GLctx.getActiveUniform(p,i);var
name=u.name;ptable.maxUniformLength=Math.max(ptable.maxUniformLength,name.length+1);if(name.slice(-
1)=="\"){ name=name.slice(0,name.lastIndexOf("\\"))}var loc=GLctx.getUniformLocation(p,name);if(loc){ var
id=GL.getNewId(GL.uniforms);utable[name]=[u.size,id];GL.uniforms[id]=loc;for(var
j=1;j<u.size;++j){ var
n=name+"\\"+j+"\\";loc=GLctx.getUniformLocation(p,n);id=GL.getNewId(GL.uniforms);GL.uniforms[id]=loc } }
};var __emscripten_webgl_power_preferences=["default","low-power","high-performance"];function
__emscripten_webgl_do_create_context(target,attributes){ var a=attributes>>2;var
powerPreference=GROWABLE_HEAP_I32()[a+(24>>2)];var
contextAttributes={"alpha":!!GROWABLE_HEAP_I32()[a+(0>>2)],"depth":!!GROWABLE_HEAP_I32()[a+(4
>>2)],"stencil":!!GROWABLE_HEAP_I32()[a+(8>>2)],"antialias":!!GROWABLE_HEAP_I32()[a+(12>>2)],"p
remultipliedAlpha":!!GROWABLE_HEAP_I32()[a+(16>>2)],"preserveDrawingBuffer":!!GROWABLE_HEAP_
I32()[a+(20>>2)],"powerPreference":__emscripten_webgl_power_preferences[powerPreference],"failIfMajorPerf
ormanceCaveat":!!GROWABLE_HEAP_I32()[a+(28>>2)],majorVersion:GROWABLE_HEAP_I32()[a+(32>>2)],
minorVersion:GROWABLE_HEAP_I32()[a+(36>>2)],enableExtensionsByDefault:GROWABLE_HEAP_I32()[a+(
40>>2)],explicitSwapControl:GROWABLE_HEAP_I32()[a+(44>>2)],proxyContextToMainThread:GROWABLE_
HEAP_I32()[a+(48>>2)],renderViaOffscreenBackBuffer:GROWABLE_HEAP_I32()[a+(52>>2)]};var
canvas=findCanvasEventTarget(target);if(!canvas){return 0}if(contextAttributes.explicitSwapControl){return
0}var contextHandle=GL.createContext(canvas,contextAttributes);return contextHandle}function
__emscripten_webgl_create_context(a0,a1){return __emscripten_webgl_do_create_context(a0,a1)}var
SYSCALLS={ mappings: {},buffers:[null,[],[]],printChar:function(stream,curr){ var
buffer=SYSCALLS.buffers[stream];if(curr===0||curr===10){(stream===1?out:err)(UTF8ArrayToString(buffer,0));
buffer.length=0}else{buffer.push(curr)}},varargs:undefined,get:function(){SYSCALLS.varargs+=4;var
ret=GROWABLE_HEAP_I32()[SYSCALLS.varargs-4>>2];return ret},getStr:function(ptr){ var
ret=UTF8ToString(ptr);return ret},get64:function(low,high){return low }};function

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_fd_close(fd){if(ENVIRONMENT_IS_PTHREAD)return _emscripten_proxy_to_main_thread_js(3,1,fd);return
0}function _fd_seek(fd,offset_low,offset_high,whence,newOffset){if(ENVIRONMENT_IS_PTHREAD)return
_emscripten_proxy_to_main_thread_js(4,1,fd,offset_low,offset_high,whence,newOffset)}function
_fd_write(fd,iiov,iiovcnt,pnum){if(ENVIRONMENT_IS_PTHREAD)return
_emscripten_proxy_to_main_thread_js(5,1,fd,iiov,iiovcnt,pnum);var num=0;for(var i=0;i<iiovcnt;i++){var
ptr=GROWABLE_HEAP_I32()[iiov+i*8>>2];var len=GROWABLE_HEAP_I32()[iiov+(i*8+4)>>2];for(var
j=0;j<len;j++){SYSCALLS.printChar(fd,GROWABLE_HEAP_U8()[ptr+j])}num+=len}GROWABLE_HEAP_I32
()[pnum>>2]=num;return 0}function _pthread_cleanup_pop(execute){var
routine=PThread.threadExitHandlers.pop();if(execute)routine()}function
_pthread_cleanup_push(routine,arg){PThread.threadExitHandlers.push(function(){ wasmTable.get(routine)(arg)})}f
unction spawnThread(threadParams){if(ENVIRONMENT_IS_PTHREAD)throw`Internal Error! spawnThread()
can only ever be called from main application thread!`;var
worker=PThread.getNewWorker();if(worker.pthread!==undefined)throw`Internal
error!`;if(!threadParams.pthread_ptr)throw`Internal
error, no pthread ptr!`;PThread.runningWorkers.push(worker);var tlsMemory=_malloc(128*4);for(var
i=0;i<128;++i){GROWABLE_HEAP_I32()[tlsMemory+i*4>>2]=0}var
stackHigh=threadParams.stackBase+threadParams.stackSize;var
pthread=PThread.pthreads[threadParams.pthread_ptr]={ worker:worker,stackBase:threadParams.stackBase,stackSize
:threadParams.stackSize,allocatedOwnStack:threadParams.allocatedOwnStack,threadInfoStruct:threadParams.pthrea
d_ptr};var
tis=pthread.threadInfoStruct>>2;Atomics.store(GROWABLE_HEAP_U32(),tis+(64>>2),threadParams.detached);A
tomics.store(GROWABLE_HEAP_U32(),tis+(100>>2),tlsMemory);Atomics.store(GROWABLE_HEAP_U32(),tis
+(40>>2),pthread.threadInfoStruct);Atomics.store(GROWABLE_HEAP_U32(),tis+(80>>2),threadParams.stackSiz
e);Atomics.store(GROWABLE_HEAP_U32(),tis+(76>>2),stackHigh);Atomics.store(GROWABLE_HEAP_U32(),t
is+(104>>2),threadParams.stackSize);Atomics.store(GROWABLE_HEAP_U32(),tis+(104+8>>2),stackHigh);Atom
ics.store(GROWABLE_HEAP_U32(),tis+(104+12>>2),threadParams.detached);var
global_libc=_emscripten_get_global_libc();var
global_locale=global_libc+40;Atomics.store(GROWABLE_HEAP_U32(),tis+(172>>2),global_locale);worker.pthr
ead=pthread;var
msg={"cmd":"run","start_routine":threadParams.startRoutine,"arg":threadParams.arg,"threadInfoStruct":thre
adParams.pthread_ptr,"stackBase":threadParams.stackBase,"stackSize":threadParams.stackSize};worker.runPthr
ead=function(){msg.time=performance.now();worker.postMessage(msg,threadParams.transferList)};if(worker.loaded
){worker.runPthread();delete worker.runPthread}}function
_pthread_create(pthread_ptr,attr,start_routine,arg){if(typeof SharedArrayBuffer===`undefined`){err(`Current
environment does not support SharedArrayBuffer, pthreads are not available!`);return
6}if(!pthread_ptr){err(`pthread_create called with a null thread pointer!`);return 28}var transferList=[];var
error=0;if(ENVIRONMENT_IS_PTHREAD&&(transferList.length===0||error)){return
_emscripten_sync_run_in_main_thread_4(687865856,pthread_ptr,attr,start_routine,arg)}if(error)return
error;var stackSize=0;var stackBase=0;var detached=0;if(attr&&attr!=-
1){stackSize=GROWABLE_HEAP_I32()[attr>>2];stackSize+=81920;stackBase=GROWABLE_HEAP_I32()[attr+
8>>2];detached=GROWABLE_HEAP_I32()[attr+12>>2]!==0}else{stackSize=2097152}var
allocatedOwnStack=stackBase===0;if(allocatedOwnStack){stackBase=_memalign(16,stackSize)}else{stackBase=
stackSize;assert(stackBase>0)}var threadInfoStruct=_malloc(228);for(var
i=0;i<228>>2;++i)GROWABLE_HEAP_U32()[threadInfoStruct>>2+i]=0;GROWABLE_HEAP_I32()[pthread_p
tr>>2]=threadInfoStruct;GROWABLE_HEAP_I32()[threadInfoStruct+12>>2]=threadInfoStruct;var
headPtr=threadInfoStruct+152;GROWABLE_HEAP_I32()[headPtr>>2]=headPtr;var
threadParams={stackBase:stackBase,stackSize:stackSize,allocatedOwnStack:allocatedOwnStack,detached:detached
,startRoutine:start_routine,pthread_ptr:threadInfoStruct,arg:arg,transferList:transferList};if(ENVIRONMENT_IS_P

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THREAD){threadParams.cmd="\spawnThread";postMessage(threadParams,transferList)}else{spawnThread(thread
Params)}return
0}function __pthread_testcancel_js(){if(!ENVIRONMENT_IS_PTHREAD)return;var
tb=__pthread_self();if(!tb)return;var
cancelDisabled=Atomics.load(GROWABLE_HEAP_U32(),tb+56>>2);if(cancelDisabled)return;var
canceled=Atomics.load(GROWABLE_HEAP_U32(),tb+0>>2);if(canceled==2)throw\Canceled!\}function
_emscripten_check_blocking_allowed(){if(ENVIRONMENT_IS_NODE)return;if(ENVIRONMENT_IS_WORKE
R)return;warnOnce(\Blocking on the main thread is very dangerous, see
https://emscripten.org/docs/porting/pthreads.html#blocking-on-the-main-browser-thread\)}function
__emscripten_do_pthread_join(thread,status,block){if(!thread){err(\pthread_join attempted on a null thread
pointer!\);return
ERRNO_CODES.ESRCH}if(ENVIRONMENT_IS_PTHREAD&&__pthread_self()==thread){err(\PThread
\'+thread+\'' is attempting to join to itself!\);return ERRNO_CODES.EDEADLK}else
if(!ENVIRONMENT_IS_PTHREAD&&__emscripten_main_browser_thread_id()==thread){err(\Main
thread \'+thread+\'' is attempting to join to itself!\);return ERRNO_CODES.EDEADLK}var
self=GROWABLE_HEAP_I32()[thread+12>>2];if(self!=thread){err(\pthread_join attempted on thread
\'+thread+\', which does not point to a valid thread, or does not exist anymore!\);return
ERRNO_CODES.ESRCH}var
detached=Atomics.load(GROWABLE_HEAP_U32(),thread+64>>2);if(detached){err(\Attempted to join thread
\'+thread+\', which was already detached!\);return
ERRNO_CODES.EINVAL}if(block){_emscripten_check_blocking_allowed()}for(;;){var
threadStatus=Atomics.load(GROWABLE_HEAP_U32(),thread+0>>2);if(threadStatus==1){var
threadExitCode=Atomics.load(GROWABLE_HEAP_U32(),thread+4>>2);if(status)GROWABLE_HEAP_I32()[sta
tus>>2]=threadExitCode;Atomics.store(GROWABLE_HEAP_U32(),thread+64>>2,1);if(!ENVIRONMENT_IS_PT
HREAD)cleanupThread(thread);else postMessage({\cmd\":"cleanupThread\","thread\":thread});return
0}if(!block){return
ERRNO_CODES.EBUSY}}__pthread_testcancel_js();if(!ENVIRONMENT_IS_PTHREAD)_emscripten_main_thre
ad_process_queued_calls();_emscripten_futex_wait(thread+0,threadStatus,ENVIRONMENT_IS_PTHREAD?100:1
))}function
__pthread_join(thread,status){return __emscripten_do_pthread_join(thread,status,true)}function
__sysconf(name){if(ENVIRONMENT_IS_PTHREAD)return
__emscripten_proxy_to_main_thread_js(6,1,name);switch(name){case 30:return 16384;case 85:var
maxHeapSize=2147483648;return maxHeapSize/16384;case 132:case 133:case 12:case 137:case 138:case 15:case
235:case 16:case 17:case 18:case 19:case 20:case 149:case 13:case 10:case 236:case 153:case 9:case 21:case 22:case
159:case 154:case 14:case 77:case 78:case 139:case 82:case 68:case 67:case 164:case 11:case 29:case 47:case
48:case 95:case 52:case 51:case 46:return 200809;case 27:case 246:case 127:case 128:case 23:case 24:case 160:case
161:case 181:case 182:case 242:case 183:case 184:case 243:case 244:case 245:case 165:case 178:case 179:case
49:case 50:case 168:case 169:case 175:case 170:case 171:case 172:case
97:case 76:case 32:case 173:case 35:case 80:case 81:case 79:return-1;case 176:case 177:case 7:case 155:case 8:case
157:case 125:case 126:case 92:case 93:case 129:case 130:case 131:case 94:case 91:return 1;case 74:case 60:case
69:case 70:case 4:return 1024;case 31:case 42:case 72:return 32;case 87:case 26:case 33:return 2147483647;case
34:case 1:return 47839;case 38:case 36:return 99;case 43:case 37:return 2048;case 0:return 2097152;case 3:return
65536;case 28:return 32768;case 44:return 32767;case 75:return 16384;case 39:return 1e3;case 89:return 700;case
71:return 256;case 40:return 255;case 2:return 100;case 180:return 64;case 25:return 20;case 5:return 16;case
6:return 6;case 73:return 4;case 84:{if(typeof navigator===\object\)return
navigator[\hardwareConcurrency\]|1;return 1}}setErrNo(28);return-
1}if(!ENVIRONMENT_IS_PTHREAD)PThread.initMainThreadBlock();var GLctx;var
proxiedFunctionTable=[null,_atexit,_emscripten_set_canvas_element_size_main_thread,_fd_close,_fd_seek,_fd_wr

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ite,_sysconf];var
asmLibraryArg={\"e\":__assert_fail,\"r\":__call_main,\"x\":__emscripten_notify_thread_queue,\"b\":_abort,\"y\":
_ emscripten_asm_const_int,\"j\":_emscripten_conditional_set_current_thread_status,\"d\":_emscripten_futex_wait,\"
c\":_emscripten_futex_wake,\"f\":_emscripten_get_now,\"p\":_emscripten_memcpy_big,\"A\":_emscripten_num_l
ogical_cores,\"u\":_emscripten_receive_on_main_thread_js,\"q\":_emscripten_resize_heap,\"v\":_emscripten_set_ca
nvas_element_size,\"i\":_emscripten_set_current_thread_status,\"s\":_emscripten_set_thread_name,\"w\":_emscript
en_webgl_create_context,\"l\":_fd_close,\"n\":_fd_seek,\"g\":_fd_write,\"o\":initPthreadsJS,\"a\":wasmMemory|Mo
dule[\"wasmMemory\"],\"z\":_pthread_cleanup_pop,\"k\":_pthread_cleanup_push,\"h\":_pthread_create,\"m\":_pthr
ead_join,\"t\":_sysconf};var asm=createWasm();var
__wasm_call_ctors=Module[\"__wasm_call_ctors\"]=function(){return(__wasm_call_ctors=Module[\"__wasm
_call_ctors\"]=Module[\"asm\"][\"B\"]).apply(null,arguments)};var
_init=Module[\"_init\"]=function(){return(_init=Module[\"_init\"]=Module[\"asm\"][\"C\"]).apply(null,arguments)};
var
_init_with_threads_count=Module[\"_init_with_threads_count\"]=function(){return(_init_with_threads_count=Mod
ule[\"_init_with_threads_count\"]=Module[\"asm\"][\"D\"]).apply(null,arguments)};var
_get_threads_count=Module[\"_get_threads_count\"]=function(){return(_get_threads_count=Module[\"_get_threads
_count\"]=Module[\"asm\"][\"E\"]).apply(null,arguments)};var
_register_tensor=Module[\"_register_tensor\"]=function(){return(_register_tensor=Module[\"_register_tensor\"]=M
odule[\"asm\"][\"F\"]).apply(null,arguments)};var
_dispose_data=Module[\"_dispose_data\"]=function(){return(_dispose_data=Module[\"_dispose_data\"]=Module[\"
asm\"][\"G\"]).apply(null,arguments)};var
_dispose=Module[\"_dispose\"]=function(){return(_dispose=Module[\"_dispose\"]=Module[\"asm\"][\"H\"]).apply(
null,arguments)};var
_Abs=Module[\"_Abs\"]=function(){return(_Abs=Module[\"_Abs\"]=Module[\"asm\"][\"J\"]).apply(null,arguments
)};var
_Add=Module[\"_Add\"]=function(){return(_Add=Module[\"_Add\"]=Module[\"asm\"][\"K\"]).apply(null,argumen
ts)};var
_AddN=Module[\"_AddN\"]=function(){return(_AddN=Module[\"_AddN\"]=Module[\"asm\"][\"L\"]).apply(null,ar
guments)};var
_All=Module[\"_All\"]=function(){return(_All=Module[\"_All\"]=Module[\"asm\"][\"M\"]).apply(null,arguments)};
var
_Any=Module[\"_Any\"]=function(){return(_Any=Module[\"_Any\"]=Module[\"asm\"][\"N\"]).apply(null,argumen
ts)};var
_ArgMax=Module[\"_ArgMax\"]=function(){return(_ArgMax=Module[\"_ArgMax\"]=Module[\"asm\"][\"O\"]).ap
ply(null,arguments)};var
_AvgPool=Module[\"_AvgPool\"]=function(){return(_AvgPool=Module[\"_AvgPool\"]=Module[\"asm\"][\"P\"]).a
pply(null,arguments)};var
_BatchMatMul=Module[\"_BatchMatMul\"]=function(){return(_BatchMatMul=Module[\"_BatchMatMul\"]=Modu
le[\"asm\"][\"Q\"]).apply(null,arguments)};var
_Ceil=Module[\"_Ceil\"]=function(){return(_Ceil=Module[\"_Ceil\"]=Module[\"asm\"][\"R\"]).apply(null,argument
s)};var
_ClipByValue=Module[\"_ClipByValue\"]=function(){return(_ClipByValue=Module[\"_ClipByValue\"]=Module[\"
asm\"][\"S\"]).apply(null,arguments)};var
_Conv2D=Module[\"_Conv2D\"]=function(){return(_Conv2D=Module[\"_Conv2D\"]=Module[\"asm\"][\"T\"]).app
ly(null,arguments)};var
_Conv2DBackpropInput=Module[\"_Conv2DBackpropInput\"]=function(){return(_Conv2DBackpropInput=Modul
e[\"_Conv2DBackpropInput\"]=Module[\"asm\"][\"U\"]).apply(null,arguments)};var
_Cos=Module[\"_Cos\"]=function(){return(_Cos=Module[\"_Cos\"]=Module[\"asm\"][\"V\"]).apply(null,arguments

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});var
_Cosh=Module["_Cosh"]=function(){return(_Cosh=Module["_Cosh"]=Module["asm"]["W"]).apply(null,arguments)};var
_CropAndResize=Module["_CropAndResize"]=function(){return(_CropAndResize=Module["_CropAndResize"]=Module["asm"]["X"]).apply(null,arguments)};var
_Cumsum=Module["_Cumsum"]=function(){return(_Cumsum=Module["_Cumsum"]=Module["asm"]["Y"]).apply(null,arguments)};var
_DepthToSpace=Module["_DepthToSpace"]=function(){return(_DepthToSpace=Module["_DepthToSpace"]=Module["asm"]["Z"]).apply(null,arguments)};var
_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=function(){return(_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=Module["asm"]["_"]).apply(null,arguments)};var
_Elu=Module["_Elu"]=function(){return(_Elu=Module["_Elu"]=Module["asm"]["$"]).apply(null,arguments)};var
_Equal=Module["_Equal"]=function(){return(_Equal=Module["_Equal"]=Module["asm"]["aa"]).apply(null,arguments)};var
_Exp=Module["_Exp"]=function(){return(_Exp=Module["_Exp"]=Module["asm"]["ba"]).apply(null,arguments)};var
_FlipLeftRight=Module["_FlipLeftRight"]=function(){return(_FlipLeftRight=Module["_FlipLeftRight"]=Module["asm"]["ca"]).apply(null,arguments)};var
_Floor=Module["_Floor"]=function(){return(_Floor=Module["_Floor"]=Module["asm"]["da"]).apply(null,arguments)};var
_FloorDiv=Module["_FloorDiv"]=function(){return(_FloorDiv=Module["_FloorDiv"]=Module["asm"]["ea"]).apply(null,arguments)};var
_FusedBatchNorm=Module["_FusedBatchNorm"]=function(){return(_FusedBatchNorm=Module["_FusedBatchNorm"]=Module["asm"]["fa"]).apply(null,arguments)};var
_FusedConv2D=Module["_FusedConv2D"]=function(){return(_FusedConv2D=Module["_FusedConv2D"]=Module["asm"]["ga"]).apply(null,arguments)};var
_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=function(){return(_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=Module["asm"]["ha"]).apply(null,arguments)};var
_Gather=Module["_Gather"]=function(){return(_Gather=Module["_Gather"]=Module["asm"]["ia"]).apply(null,arguments)};var
_GatherNd=Module["_GatherNd"]=function(){return(_GatherNd=Module["_GatherNd"]=Module["asm"]["ja"]).apply(null,arguments)};var
_Greater=Module["_Greater"]=function(){return(_Greater=Module["_Greater"]=Module["asm"]["ka"]).apply(null,arguments)};var
_GreaterEqual=Module["_GreaterEqual"]=function(){return(_GreaterEqual=Module["_GreaterEqual"]=Module["asm"]["la"]).apply(null,arguments)};var
_LeakyRelu=Module["_LeakyRelu"]=function(){return(_LeakyRelu=Module["_LeakyRelu"]=Module["asm"]["ma"]).apply(null,arguments)};var
_Less=Module["_Less"]=function(){return(_Less=Module["_Less"]=Module["asm"]["na"]).apply(null,arguments)};var
_LessEqual=Module["_LessEqual"]=function(){return(_LessEqual=Module["_LessEqual"]=Module["asm"]["oa"]).apply(null,arguments)};var
_Log=Module["_Log"]=function(){return(_Log=Module["_Log"]=Module["asm"]["pa"]).apply(null,arguments)};var
_LogicalAnd=Module["_LogicalAnd"]=function(){return(_LogicalAnd=Module["_LogicalAnd"]=Module["asm"]["qa"]).apply(null,arguments)};var
_Max=Module["_Max"]=function(){return(_Max=Module["_Max"]=Module["asm"]["ra"]).apply(null,arguments)};

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nts));var
_MaxPool=Module["_MaxPool"]=function(){return(_MaxPool=Module["_MaxPool"]=Module["asm"][\sa]).
apply(null,arguments)};var
_Maximum=Module["_Maximum"]=function(){return(_Maximum=Module["_Maximum"]=Module["asm"][\ta
a]).apply(null,arguments)};var
_Mean=Module["_Mean"]=function(){return(_Mean=Module["_Mean"]=Module["asm"][\ua]).apply(null,ar
guments)};var
_Min=Module["_Min"]=function(){return(_Min=Module["_Min"]=Module["asm"][\va]).apply(null,argumen
ts)};var
_Minimum=Module["_Minimum"]=function(){return(_Minimum=Module["_Minimum"]=Module["asm"][\wa
]).apply(null,arguments)};var
_MirrorPad=Module["_MirrorPad"]=function(){return(_MirrorPad=Module["_MirrorPad"]=Module["asm"][\xa
a]).apply(null,arguments)};var
_Multiply=Module["_Multiply"]=function(){return(_Multiply=Module["_Multiply"]=Module["asm"][\ya]).a
pply(null,arguments)};var
_Neg=Module["_Neg"]=function(){return(_Neg=Module["_Neg"]=Module["asm"][\za]).apply(null,argumen
ts)};var
_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=function(){return(_NonMaxSuppressionV3=Mod
ule["_NonMaxSuppressionV3"]=Module["asm"][\Aa]).apply(null,arguments)};var
_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=function(){return(_NonMaxSuppressionV4=Mod
ule["_NonMaxSuppressionV4"]=Module["asm"][\Ba]).apply(null,arguments)};var
_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=function(){return(_NonMaxSuppressionV5=Mod
ule["_NonMaxSuppressionV5"]=Module["asm"][\Ca]).apply(null,arguments)};var
_NotEqual=Module["_NotEqual"]=function(){return(_NotEqual=Module["_NotEqual"]=Module["asm"][\Da
]).apply(null,arguments)};var
_OneHot=Module["_OneHot"]=function(){return(_OneHot=Module["_OneHot"]=Module["asm"][\Ea]).appl
y(null,arguments)};var
_PadV2=Module["_PadV2"]=function(){return(_PadV2=Module["_PadV2"]=Module["asm"][\Fa]).apply(nu
ll,arguments)};var
_Pow=Module["_Pow"]=function(){return(_Pow=Module["_Pow"]=Module["asm"][\Ga]).apply(null,argume
nts)};var
_Prelu=Module["_Prelu"]=function(){return(_Prelu=Module["_Prelu"]=Module["asm"][\Ha]).apply(null,arg
uments)};var
_Prod=Module["_Prod"]=function(){return(_Prod=Module["_Prod"]=Module["asm"][\Ia]).apply(null,argum
ents)};var
_RealDiv=Module["_RealDiv"]=function(){return(_RealDiv=Module["_RealDiv"]=Module["asm"][\Ja]).app
ly(null,arguments)};var
_RelU=Module["_Relu"]=function(){return(_Relu=Module["_Relu"]=Module["asm"][\Ka]).apply(null,argum
ents)};var
_RelU6=Module["_Relu6"]=function(){return(_Relu6=Module["_Relu6"]=Module["asm"][\La]).apply(null,a
rguments)};var
_ResizeBilinear=Module["_ResizeBilinear"]=function(){return(_ResizeBilinear=Module["_ResizeBilinear"]=Mo
dule["asm"][\Ma]).apply(null,arguments)};var
_Reverse=Module["_Reverse"]=function(){return(_Reverse=Module["_Reverse"]=Module["asm"][\Na]).app
ly(null,arguments)};var
_RotateWithOffset=Module["_RotateWithOffset"]=function(){return(_RotateWithOffset=Module["_RotateWith
Offset"]=Module["asm"][\Oa]).apply(null,arguments)};var
_Round=Module["_Round"]=function(){return(_Round=Module["_Round"]=Module["asm"][\Pa]).apply(nul

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l,arguments));var
_Rsqrt=Module["_Rsqrt"]=function(){return(_Rsqrt=Module["_Rsqrt"]=Module["asm"]["Qa"]).apply(null,arguments));var
_ScatterNd=Module["_ScatterNd"]=function(){return(_ScatterNd=Module["_ScatterNd"]=Module["asm"]["Ra"]).apply(null,arguments);var
_SelectV2=Module["_SelectV2"]=function(){return(_SelectV2=Module["_SelectV2"]=Module["asm"]["Sa"]).apply(null,arguments);var
_Sigmoid=Module["_Sigmoid"]=function(){return(_Sigmoid=Module["_Sigmoid"]=Module["asm"]["Ta"]).apply(null,arguments);var
_Sin=Module["_Sin"]=function(){return(_Sin=Module["_Sin"]=Module["asm"]["Ua"]).apply(null,arguments);var
_Softmax=Module["_Softmax"]=function(){return(_Softmax=Module["_Softmax"]=Module["asm"]["Va"]).apply(null,arguments);var
_Sqrt=Module["_Sqrt"]=function(){return(_Sqrt=Module["_Sqrt"]=Module["asm"]["Wa"]).apply(null,arguments);var
_Square=Module["_Square"]=function(){return(_Square=Module["_Square"]=Module["asm"]["Xa"]).apply(null,arguments);var
_SquaredDifference=Module["_SquaredDifference"]=function(){return(_SquaredDifference=Module["_SquaredDifference"]=Module["asm"]["Ya"]).apply(null,arguments);var
_Step=Module["_Step"]=function(){return(_Step=Module["_Step"]=Module["asm"]["Za"]).apply(null,arguments);var
_StridedSlice=Module["_StridedSlice"]=function(){return(_StridedSlice=Module["_StridedSlice"]=Module["asm"]["_a"]).apply(null,arguments);var
_Sub=Module["_Sub"]=function(){return(_Sub=Module["_Sub"]=Module["asm"]["$a"]).apply(null,arguments);var
_Sum=Module["_Sum"]=function(){return(_Sum=Module["_Sum"]=Module["asm"]["ab"]).apply(null,arguments);var
_Tan=Module["_Tan"]=function(){return(_Tan=Module["_Tan"]=Module["asm"]["bb"]).apply(null,arguments);var
_Tanh=Module["_Tanh"]=function(){return(_Tanh=Module["_Tanh"]=Module["asm"]["cb"]).apply(null,arguments);var
_Tile=Module["_Tile"]=function(){return(_Tile=Module["_Tile"]=Module["asm"]["db"]).apply(null,arguments);var
_TopK=Module["_TopK"]=function(){return(_TopK=Module["_TopK"]=Module["asm"]["eb"]).apply(null,arguments);var
_Transform=Module["_Transform"]=function(){return(_Transform=Module["_Transform"]=Module["asm"]["fb"]).apply(null,arguments);var
_Transpose=Module["_Transpose"]=function(){return(_Transpose=Module["_Transpose"]=Module["asm"]["gb"]).apply(null,arguments);var
__FusedMatMul=Module["__FusedMatMul"]=function(){return(__FusedMatMul=Module["__FusedMatMul"]=Module["asm"]["hb"]).apply(null,arguments);var
_malloc=Module["_malloc"]=function(){return(_malloc=Module["_malloc"]=Module["asm"]["ib"]).apply(null,arguments);var
_free=Module["_free"]=function(){return(_free=Module["_free"]=Module["asm"]["jb"]).apply(null,arguments);var
__errno_location=Module["__errno_location"]=function(){return(__errno_location=Module["__errno_location"]=Module["asm"]["kb"]).apply(null,arguments);var

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_emsripten_get_global_libc=Module["_emsripten_get_global_libc"]=function(){return(_emsripten_get_global
_libc=Module["_emsripten_get_global_libc"]=Module["asm"]["lb"]).apply(null,arguments)};var
_thread_self=Module["_thread_self"]=function(){return(_thread_self=Module["_thread_self"]=Module["as
m"]["mb"]).apply(null,arguments)};var
__pthread_tsd_run_dtors=Module["__pthread_tsd_run_dtors"]=function(){return(__pthread_tsd_run_dtors=M
odule["__pthread_tsd_run_dtors"]=Module["asm"]["nb"]).apply(null,arguments)};var
_emsripten_main_thread_process_queued_calls=Module["_emsripten_main_thread_process_queued_calls"]=fu
nction(){return(_emsripten_main_thread_process_queued_calls=Module["_emsripten_main_thread_process_que
ued_calls"]=Module["asm"]["ob"]).apply(null,arguments)};var
_emsripten_current_thread_process_queued_calls=Module["_emsripten_current_thread_process_queued_calls"]
=function(){return(_emsripten_current_thread_process_queued_calls=Module["_emsripten_current_thread_proc
ess_queued_calls"]=Module["asm"]["pb"]).apply(null,arguments)};var
_emsripten_register_main_browser_thread_id=Module["_emsripten_register_main_browser_thread_id"]=functi
on(){return(_emsripten_register_main_browser_thread_id=Module["_emsripten_register_main_browser_thread
_id"]=Module["asm"]["qb"]).apply(null,arguments)};var
_emsripten_main_browser_thread_id=Module["_emsripten_main_browser_thread_id"]=function(){return(_ems
ripten_main_browser_thread_id=Module["_emsripten_main_browser_thread_id"]=Module["asm"]["rb"]).app
ly(null,arguments)};var
__emsripten_do_dispatch_to_thread=Module["__emsripten_do_dispatch_to_thread"]=function(){return(__ems
ripten_do_dispatch_to_thread=Module["__emsripten_do_dispatch_to_thread"]=Module["asm"]["sb"]).apply(n
ull,arguments)};var
_emsripten_sync_run_in_main_thread_4=Module["_emsripten_sync_run_in_main_thread_4"]=function(){retur
n(_emsripten_sync_run_in_main_thread_4=Module["_emsripten_sync_run_in_main_thread_4"]=Module["asm\
"]["tb"]).apply(null,arguments)};var
_emsripten_run_in_main_runtime_thread_js=Module["_emsripten_run_in_main_runtime_thread_js"]=function(
){return(_emsripten_run_in_main_runtime_thread_js=Module["_emsripten_run_in_main_runtime_thread_js"]=
Module["asm"]["ub"]).apply(null,arguments)};var
__emsripten_call_on_thread=Module["__emsripten_call_on_thread"]=function(){return(__emsripten_call_on_t
hread=Module["__emsripten_call_on_thread"]=Module["asm"]["vb"]).apply(null,arguments)};var
_emsripten_tls_init=Module["_emsripten_tls_init"]=function(){return(_emsripten_tls_init=Module["_emsript
en_tls_init"]=Module["asm"]["wb"]).apply(null,arguments)};var
__emsripten_thread_init=Module["__emsripten_thread_init"]=function(){return(__emsripten_thread_init=Mod
ule["_emsripten_thread_init"]=Module["asm"]["xb"]).apply(null,arguments)};var
stackSave=Module["stackSave"]=function(){return(stackSave=Module["stackSave"]=Module["asm"]["yb"]).a
pply(null,arguments)};var
stackRestore=Module["stackRestore"]=function(){return(stackRestore=Module["stackRestore"]=Module["asm\
"]["zb"]).apply(null,arguments)};var
stackAlloc=Module["stackAlloc"]=function(){return(stackAlloc=Module["stackAlloc"]=Module["asm"]["Ab\
"]).apply(null,arguments)};var
_emsripten_stack_set_limits=Module["_emsripten_stack_set_limits"]=function(){return(_emsripten_stack_set_
limits=Module["_emsripten_stack_set_limits"]=Module["asm"]["Bb"]).apply(null,arguments)};var
_memalign=Module["_memalign"]=function(){return(_memalign=Module["_memalign"]=Module["asm"]["Cb\
"]).apply(null,arguments)};var
__emsripten_allow_main_runtime_queued_calls=Module["__emsripten_allow_main_runtime_queued_calls"]=1
0512;var
__emsripten_main_thread_futex=Module["__emsripten_main_thread_futex"]=12148;Module["cwrap"]=cwrap
;Module["PThread"]=PThread;Module["PThread"]=PThread;Module["wasmMemory"]=wasmMemory;Module
["ExitStatus"]=ExitStatus;var

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calledRun;function ExitStatus(status){this.name=\'ExitStatus\';this.message=\'Program terminated with
exit(\'+status+\')\';this.status=status}dependenciesFulfilled=function
runCaller(){if(!calledRun)run();if(!calledRun)dependenciesFulfilled=runCaller};function
run(args){args=args||arguments_;if(runDependencies>0){return}if(ENVIRONMENT_IS_PTHREAD){readyPromis
eResolve(Module);initRuntime();postMessage({\'cmd\':\'loaded\'});return}preRun();if(runDependencies>0){retur
n}function
doRun(){if(calledRun)return;calledRun=true;Module[\'calledRun\']=true;if(ABORT)return;initRuntime();preMain(
);readyPromiseResolve(Module);if(Module[\'onRuntimeInitialized\'])Module[\'onRuntimeInitialized\']();postRun(
)}if(Module[\'setStatus\']){Module[\'setStatus\'](\'Running...\');setTimeout(function(){setTimeout(function(){Mo
dule[\'setStatus\'](\'\'),1});doRun()},1)}else{doRun()}}Module[\'run\']=run;function
exit(status,implicit){if(implicit&&noExitRuntime&&status===0){return}if(!implicit){if(ENVIRONMENT_IS_PT
HREAD){postMessage({\'cmd\':\'exitProcess\',\'returnCode\':status});throw
new
ExitStatus(status)}else{}}if(noExitRuntime){}else{PThread.terminateAllThreads();EXITSTATUS=status;exitRunti
me();if(Module[\'onExit\'])Module[\'onExit\'](status);ABORT=true}quit_(status,new
ExitStatus(status))}if(Module[\'preInit\']){if(typeof
Module[\'preInit\']===\'function\')Module[\'preInit\']=[Module[\'preInit\']];while(Module[\'preInit\'].length>0){
Module[\'preInit\'].pop()}if(ENVIRONMENT_IS_PTHREAD){noExitRuntime=false;PThread.initWorker()}run
();\n\n\n return WasmBackendModuleThreadedSimd.ready\n\n\n);nif (typeof exports === \'object\' && typeof
module === \'object\')\n module.exports = WasmBackendModuleThreadedSimd;\nelse if (typeof define ===
\'function\' && define[\'amd\'])\n define([], function() { return WasmBackendModuleThreadedSimd; });\nelse if
(typeof exports === \'object\')\n exports[\'WasmBackendModuleThreadedSimd\']
= WasmBackendModuleThreadedSimd;\n","export const wasmWorkerContents = \'var Module={};function
threadPrintErr(){var text=Array.prototype.slice.call(arguments).join(\' \');console.error(text)}function
threadAlert(){var text=Array.prototype.slice.call(arguments).join(
\');postMessage({cmd:"alert",text:text,threadId:Module[\'_pthread_self\']()})}var
err=threadPrintErr;this.alert=threadAlert;Module[\'instantiateWasm\']=function(info,receiveInstance){var
instance=new
WebAssembly.Instance(Module[\'wasmModule\'],info);Module[\'wasmModule\']=null;receiveInstance(instance);r
eturn instance.exports};function
moduleLoaded(){this.onmessage=function(e){try{if(e.data.cmd===\'load\'){Module[\'wasmModule\']=e.data.wa
smModule;Module[\'wasmMemory\']=e.data.wasmMemory;Module[\'buffer\']=Module[\'wasmMemory\'].buffer;
Module[\'ENVIRONMENT_IS_PTHREAD\']=true;if(typeof
e.data.urlOrBlob===\'string\'){importScripts(e.data.urlOrBlob)}else{var
objectUrl=URL.createObjectURL(e.data.urlOrBlob);importScripts(objectUrl);URL.revokeObjectURL(objectUrl)}
WasmBackendModuleThreadedSimd(Module).then(function(instance){Module=instance;moduleLoaded()})}else
if(e.data.cmd===\'objectTransfer\'){Module[\'PThread\'].receiveObjectTransfer(e.data)}else
if(e.data.cmd===\'run\'){Module[\'__performance_now_clock_drift\']=performance.now()-
e.data.time;Module[\'__emscripten_thread_init\'](e.data.threadInfoStruct,0,0);var max=e.data.stackBase;var
top=e.data.stackBase+e.data.stackSize;Module[\'establishStackSpace\'](top,max);Module[\'_emscripten_tls_init\'](
);Module[\'PThread\'].receiveObjectTransfer(e.data);Module[\'PThread\'].setThreadStatus(Module[\'_pthread_self
\'](),1);try{var
result=Module[\'invokeEntryPoint\'](e.data.start_routine,e.data.arg);if(!Module[\'getNoExitRuntime\']())Module[
\'PThread\'].threadExit(result)}catch(ex){if(ex===\'Canceled!\'){Module[\'PThread\'].threadCancel()}else
if(ex!=\'unwind\'){if(ex instanceof
Module[\'ExitStatus\']){if(Module[\'getNoExitRuntime\']()){}else{Module[\'PThread\'].threadExit(ex.status)}}el
se{Module[\'PThread\'].threadExit(-2);throw

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ex}}}]else
if(e.data.cmd===\"cancel\"){if(Module[\"_pthread_self\"]()){Module[\"PThread\"];threadCancel()} }else
if(e.data.target===\"setimmediate\")} }else
if(e.data.cmd===\"processThreadQueue\"){if(Module[\"_pthread_self\"]()){Module[\"_emscripten_current_thread_
process_queued_calls\"]()} }else{err(\"worker.js received unknown command
\"+e.data.cmd);err(e.data)} }catch(ex){err(\"worker.js onmessage() captured an uncaught exception:
\"+ex);if(ex&&ex.stack)err(ex.stack);throw ex } };if(typeof process===\"object\"&&typeof
process.versions===\"object\"&&typeof process.versions.node===\"string\"){self={location:{href: __filename}}};var
onmessage=this.onmessage;var
nodeWorkerThreads=require(\"worker_threads\");global.Worker=nodeWorkerThreads.Worker;var
parentPort=nodeWorkerThreads.parentPort;parentPort.on(\"message\",function(data){ onmessage({ data:data})});var
nodeFS=require(\"fs\");var nodeRead=function(filename){return
nodeFS.readFileSync(filename,\"utf8\");};function
globalEval(x){global.require=require;global.Module=Module;eval.call(null,x)}importScripts=function(f){globalEva
l(nodeRead(f));postMessage=function(msg){parentPort.postMessage(msg)};if(typeof
performance===\"undefined\"){performance={now:function(){return Date.now()}}};\", \"\nvar
WasmBackendModule = (function() {\n var _scriptId = typeof document !== 'undefined' &&
document.currentScript ? document.currentScript.src : undefined;\n if (typeof __filename !== 'undefined')
_scriptId = _scriptId || __filename;\n return (\nfunction(WasmBackendModule) {\n WasmBackendModule =
WasmBackendModule || {};\n\nvar Module=typeof
WasmBackendModule!==\"undefined\"?WasmBackendModule: {} };var
readyPromiseResolve,readyPromiseReject;Module[\"ready\"]=new
Promise(function(resolve,reject){readyPromiseResolve=resolve;readyPromiseReject=reject});var
moduleOverrides={ };var key;for(key in
Module){if(Module.hasOwnProperty(key)){moduleOverrides[key]=Module[key]} }var
arguments_=[];var thisProgram= \"/this.program\";var quit_=function(status,toThrow){throw toThrow };var
ENVIRONMENT_IS_WEB=false;var ENVIRONMENT_IS_WORKER=false;var
ENVIRONMENT_IS_NODE=false;var ENVIRONMENT_IS_SHELL=false;ENVIRONMENT_IS_WEB=typeof
window===\"object\";ENVIRONMENT_IS_WORKER=typeof
importScripts===\"function\";ENVIRONMENT_IS_NODE=typeof process===\"object\"&&typeof
process.versions===\"object\"&&typeof
process.versions.node===\"string\";ENVIRONMENT_IS_SHELL=!ENVIRONMENT_IS_WEB&&!ENVIRONM
ENT_IS_NODE&&!ENVIRONMENT_IS_WORKER;var scriptDirectory=\"\";function
locateFile(path){if(Module[\"locateFile\"]){return Module[\"locateFile\"](path,scriptDirectory)}return
scriptDirectory+path}var read_,readAsync,readBinary,setWindowTitle;var nodeFS;var
nodePath;if(ENVIRONMENT_IS_NODE){if(ENVIRONMENT_IS_WORKER){scriptDirectory=require(\"path\").
dirname(scriptDirectory)+\"^\"}else{scriptDirectory=__dirname+\"^\"}read_=function
shell_read(filename,binary){if(!nodeFS)nodeFS=require(\"fs\");if(!nodePath)nodePath=require(\"path\");filename=n
odePath[\"normalize\"](filename);return
nodeFS[\"readFileSync\"](filename,binary?null:\"utf8\");}readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret};if(process[\"argv\"].length>1){thisProgram=process[\"argv\"][1].replace(/\\\\\\\\g,\"^\"))}arguments_=process[\"arg
v\"];slice(2);process[\"on\"](\"uncaughtException\",function(ex){if(!(ex instanceof ExitStatus)){throw
ex } });process[\"on\"](\"unhandledRejection\",abort);quit_=function(status){process[\"exit\"](status)};Module[\"insp
ect\"]=function(){return\"[Emscripten Module object]\"} }else if(ENVIRONMENT_IS_SHELL){if(typeof
read!=\"undefined\"){read_=function shell_read(f){return read(f)} }readBinary=function readBinary(f){var
data;if(typeof readbuffer===\"function\"){return new
Uint8Array(readbuffer(f))}data=read(f,\"binary\");assert(typeof data===\"object\");return data };if(typeof

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scriptArgs!=="undefined"){arguments_=scriptArgs}else
if(typeof arguments!=="undefined"){arguments_=arguments}if(typeof
quit===\function\){quit_=function(status){quit(status)}}if(typeof print!=="undefined"){if(typeof
console===\undefined\){console={};console.log=print;console.warn=console.error=typeof
printErr!=="undefined"?printErr:print}}else
if(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER){if(ENVIRONMENT_IS_WORKER){scriptDire
ctory=self.location.href}else if(typeof
document!=="undefined"&&document.currentScript){scriptDirectory=document.currentScript.src}if(!_scriptDir){s
criptDirectory=_scriptDir}if(scriptDirectory.indexOf(\blob:\")!=0){scriptDirectory=scriptDirectory.substr(0,script
Directory.lastIndexOf(\^")+1)}else{scriptDirectory=""}}{read_=function(url){var xhr=new
XMLHttpRequest;xhr.open(\GET",url,false);xhr.send(null);return
xhr.responseText};if(ENVIRONMENT_IS_WORKER){readBinary=function(url){var xhr=new
XMLHttpRequest;xhr.open(\GET",url,false);xhr.responseType="arraybuffer";xhr.send(null);return
new Uint8Array(xhr.response)}}readAsync=function(url,onload,onerror){var xhr=new
XMLHttpRequest;xhr.open(\GET",url,true);xhr.responseType="arraybuffer";xhr.onload=function(){if(xhr.status
==200||xhr.status==0&&xhr.response){onload(xhr.response);return}onerror();}xhr.onerror=onerror;xhr.send(null)}
}setWindowTitle=function(title){document.title=title}}else{var
out=Module[\print"]||console.log.bind(console);var err=Module[\printErr"]||console.warn.bind(console);for(key
in
moduleOverrides){if(moduleOverrides.hasOwnProperty(key)){Module[key]=moduleOverrides[key]}}moduleOverr
ides=null;if(Module[\arguments\"])arguments_=Module[\arguments\"];if(Module[\thisProgram\"])thisProgram=
Module[\thisProgram\"];if(Module[\quit\"])quit_=Module[\quit\"];var
wasmBinary;if(Module[\wasmBinary\"])wasmBinary=Module[\wasmBinary\"];var
noExitRuntime=Module[\noExitRuntime\"]||true;if(typeof WebAssembly!=="object"){abort(\no native wasm
support detected\)}var wasmMemory;var
ABORT=false;var EXITSTATUS;function assert(condition,text){if(!condition){abort(\Assertion failed:
"+text)}}function getCFunc(ident){var func=Module[_"+ident];assert(func,\Cannot call unknown function
"+ident+", make sure it is exported");return func}function ccall(ident,returnType,argTypes,args,opts){var
toC={\string":function(str){var ret=0;if(str===null&&str===undefined&&str===0){var
len=(str.length<<2)+1;ret=stackAlloc(len);stringToUTF8(str,ret,len)}return ret},\array":function(arr){var
ret=stackAlloc(arr.length);writeArrayToMemory(arr,ret);return ret}};function
convertReturnValue(ret){if(returnType===\string")return UTF8ToString(ret);if(returnType===\boolean")return
Boolean(ret);return ret}var func=getCFunc(ident);var cArgs=[];var stack=0;if(args){for(var
i=0;i<args.length;i++){var
converter=toC[argTypes[i]];if(converter){if(stack===0)stack=stackSave();cArgs[i]=converter(args[i])}else{cArgs[i
]=args[i]}}var ret=func.apply(null,cArgs);ret=convertReturnValue(ret);if(stack!==0)stackRestore(stack);return
ret}function cwrap(ident,returnType,argTypes,opts){argTypes=argTypes||[];var
numericArgs=argTypes.every(function(type){return type===\number"});var
numericRet=returnType!=="string";if(numericRet&&numericArgs&&!opts){return getCFunc(ident)}return
function(){return ccall(ident,returnType,argTypes,arguments,opts)}}var UTF8Decoder=typeof
TextDecoder!=="undefined"?new TextDecoder(\utf8\"):undefined;function
UTF8ArrayToString(heap,idx,maxBytesToRead){var endIdx=idx+maxBytesToRead;var
endPtr=idx;while(heap[endPtr]&&!(endPtr>=endIdx))++endPtr;if(endPtr-
idx>16&&heap.subarray&&UTF8Decoder){return UTF8Decoder.decode(heap.subarray(idx,endPtr))}else{var
str="";while(idx<endPtr){var u0=heap[idx++];if(!(u0&128)){str+=String.fromCharCode(u0);continue}var
u1=heap[idx++]&63;if((u0&224)==192){str+=String.fromCharCode((u0&31)<<6|u1);continue}var
u2=heap[idx++]&63;if((u0&240)==224){u0=(u0&15)<<12|u1<<6|u2}else{u0=(u0&7)<<18|u1<<12|u2<<6|heap[id
x++]&63}if(u0<65536){str+=String.fromCharCode(u0)}else{var

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ch=u0-65536;str+=String.fromCharCode(55296|ch>>10,56320|ch&1023)} }return str}function
UTF8ToString(ptr,maxBytesToRead){return
ptr?UTF8ArrayToString(HEAPU8,ptr,maxBytesToRead):\""}function
stringToUTF8Array(str,heap,outIdx,maxBytesToWrite){if(!(maxBytesToWrite>0))return 0;var startIdx=outIdx;var
endIdx=outIdx+maxBytesToWrite-1;for(var i=0;i<str.length;++i){var
u=str.charCodeAt(i);if(u>=55296&&u<=57343){var
u1=str.charCodeAt(++i);u=65536+((u&1023)<<10)|u1&1023}if(u<=127){if(outIdx>=endIdx)break;heap[outIdx++]=
u}else if(u<=2047){if(outIdx+1>=endIdx)break;heap[outIdx++]=192|u>>6;heap[outIdx++]=128|u&63}else
if(u<=65535){if(outIdx+2>=endIdx)break;heap[outIdx++]=224|u>>12;heap[outIdx++]=128|u>>6&63;heap[outIdx
++]=128|u&63}else{if(outIdx+3>=endIdx)break;heap[outIdx++]=240|u>>18;heap[outIdx++]=128|u>>12&63;heap[
outIdx++]=128|u>>6&63;heap[outIdx++]=128|u&63}}heap[outIdx]=0;return outIdx-startIdx}function
stringToUTF8(str,outPtr,maxBytesToWrite){return
stringToUTF8Array(str,HEAPU8,outPtr,maxBytesToWrite)}function
writeArrayToMemory(array,buffer){HEAP8.set(array,buffer)}function
alignUp(x,multiple){if(x%multiple>0){x+=multiple-x%multiple}return x}var
buffer,HEAP8,HEAPU8,HEAP16,HEAPU16,HEAP32,HEAPU32,HEAPF32,HEAPF64;function
updateGlobalBufferAndViews(buf){buffer=buf;Module[\"HEAP8\"]=HEAP8=new
Int8Array(buf);Module[\"HEAP16\"]=HEAP16=new Int16Array(buf);Module[\"HEAP32\"]=HEAP32=new
Int32Array(buf);Module[\"HEAPU8\"]=HEAPU8=new Uint8Array(buf);Module[\"HEAPU16\"]=HEAPU16=new
Uint16Array(buf);Module[\"HEAPU32\"]=HEAPU32=new
Uint32Array(buf);Module[\"HEAPF32\"]=HEAPF32=new
Float32Array(buf);Module[\"HEAPF64\"]=HEAPF64=new Float64Array(buf)}var
INITIAL_MEMORY=Module[\"INITIAL_MEMORY\"]||16777216;var wasmTable;var __ATPRERUN__=[];var
__ATINIT__=[];var __ATMAIN__=[];var __ATPOSTRUN__=[];var
runtimeInitialized=false;__ATINIT__.push({func:function(){__wasm_call_ctors()}});function
preRun(){if(Module[\"preRun\"]){if(typeof
Module[\"preRun\"]===\"function\")Module[\"preRun\"]=[Module[\"preRun\"]];while(Module[\"preRun\"].length){a
ddOnPreRun(Module[\"preRun\"].shift())}callRuntimeCallbacks(__ATPRERUN__)}function
initRuntime(){runtimeInitialized=true;callRuntimeCallbacks(__ATINIT__)}function
preMain(){callRuntimeCallbacks(__ATMAIN__)}function postRun(){if(Module[\"postRun\"]){if(typeof
Module[\"postRun\"]===\"function\")Module[\"postRun\"]=[Module[\"postRun\"]];while(Module[\"postRun\"].lengt
h){addOnPostRun(Module[\"postRun\"].shift())}callRuntimeCallbacks(__ATPOSTRUN__)}function
addOnPreRun(cb){__ATPRERUN__.unshift(cb)}function addOnPostRun(cb){__ATPOSTRUN__.unshift(cb)}var
runDependencies=0;var runDependencyWatcher=null;var dependenciesFulfilled=null;function
addRunDependency(id){runDependencies++;if(Module[\"monitorRunDependencies\"]){Module[\"monitorRunDep
endencies\"](runDependencies)}function removeRunDependency(id){runDependencies--
;if(Module[\"monitorRunDependencies\"]){Module[\"monitorRunDependencies\"](runDependencies)}if(runDepend
encies==0){if(runDependencyWatcher!==null){clearInterval(runDependencyWatcher);runDependencyWatcher=null
}if(dependenciesFulfilled){var
callback=dependenciesFulfilled;dependenciesFulfilled=null;callback()}}Module[\"preloadedImages\"]={};Module
[\"preloadedAudios\"]={};function
abort(what){if(Module[\"onAbort\"]){Module[\"onAbort\"](what)}what+=\"\":err(what);ABORT=true;EXITSTAT
US=1;what=\"abort(\\'+what+\\')\". Build with -s ASSERTIONS=1 for more info.\";var e=new
WebAssembly.RuntimeError(what);readyPromiseReject(e);throw e}function hasPrefix(str,prefix){return
String.prototype.startsWith?str.startsWith(prefix):str.indexOf(prefix)===0}var
dataURIPrefix=\"data:application/octet-stream;base64,\";function isDataURI(filename){return
hasPrefix(filename,dataURIPrefix)}var fileURIPrefix=\"file://\";function isFileURI(filename){return
hasPrefix(filename,fileURIPrefix)}var wasmBinaryFile=\"tfjs-backend-

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wasm.wasm\";if(!isDataURI(wasmBinaryFile)){wasmBinaryFile=locateFile(wasmBinaryFile)}function
getBinary(file){try{if(file==wasmBinaryFile&&wasmBinary){return new
Uint8Array(wasmBinary)}if(readBinary){return readBinary(file)}else{throw\"both async and sync fetching of the
wasm failed\"}}catch(err){abort(err)}}function
getBinaryPromise(){if(!wasmBinary&&(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER)){if(typeof
fetch===\"function\"&&!isFileURI(wasmBinaryFile)){return fetch(wasmBinaryFile,{credentials:\"same-
origin\"}).then(function(response){if(!response[\"ok\"]){throw\"failed to load wasm binary file at
\"+wasmBinaryFile+\"\"}return response[\"arrayBuffer\"]()).catch(function(){return
getBinary(wasmBinaryFile)})}else{if(readAsync){return new
Promise(function(resolve,reject){readAsync(wasmBinaryFile,function(response){resolve(new
Uint8Array(response)),reject}))})}return Promise.resolve().then(function(){return
getBinary(wasmBinaryFile)})}function createWasm(){var info={\"a\":asmLibraryArg};function
receiveInstance(instance,module){var
exports=instance.exports;Module[\"asm\"]=exports;wasmMemory=Module[\"asm\"][\"j\"];updateGlobalBufferAnd
Views(wasmMemory.buffer);wasmTable=Module[\"asm\"][\"r\"];removeRunDependency(\"wasm-
instantiate\")}addRunDependency(\"wasm-instantiate\");function
receiveInstantiatedSource(output){receiveInstance(output[\"instance\"])}function
instantiateArrayBuffer(receiver){return getBinaryPromise().then(function(binary){return
WebAssembly.instantiate(binary,info)}).then(receiver,function(reason){err(\"failed to asynchronously prepare
wasm: \"+reason);abort(reason)})}function instantiateAsync(){if(!wasmBinary&&typeof
WebAssembly.instantiateStreaming===\"function\"&&!isDataURI(wasmBinaryFile)&&!isFileURI(wasmBinaryFil
e)&&typeof fetch===\"function\"){return fetch(wasmBinaryFile,{credentials:\"same-
origin\"}).then(function(response){var result=WebAssembly.instantiateStreaming(response,info);return
result.then(receiveInstantiatedSource,function(reason){err(\"wasm streaming compile failed: \"+reason);err(\"falling
back to ArrayBuffer
instantiate\")});return instantiateArrayBuffer(receiveInstantiatedSource)})}else{return
instantiateArrayBuffer(receiveInstantiatedSource)}if(Module[\"instantiateWasm\"]){try{var
exports=Module[\"instantiateWasm\"](info,receiveInstance);return exports}catch(e){err(\"Module.instantiateWasm
callback failed with error: \"+e);return false}}instantiateAsync().catch(readyPromiseReject);return{}}function
callRuntimeCallbacks(callbacks){while(callbacks.length>0){var callback=callbacks.shift();if(typeof
callback===\"function\"){callback(Module);continue}var func=callback.func;if(typeof
func===\"number\"){if(callback.arg===undefined){wasmTable.get(func)}else{wasmTable.get(func)(callback.arg)
}}else{func(callback.arg===undefined?null:callback.arg)}}function _abort(){abort()}function
_emscripten_memcpy_big(dest,src,num){HEAPU8.copyWithin(dest,src,src+num)}function
_emscripten_get_heap_size(){return HEAPU8.length}function
emscripten_realloc_buffer(size){try{wasmMemory.grow(size-
buffer.byteLength+65535>>>16);updateGlobalBufferAndViews(wasmMemory.buffer);return
1}catch(e){}}function _emscripten_resize_heap(requestedSize){var oldSize=_emscripten_get_heap_size();var
maxHeapSize=2147483648;if(requestedSize>maxHeapSize){return false}for(var
cutDown=1;cutDown<=4;cutDown*=2){var
overGrownHeapSize=oldSize*(1+.2/cutDown);overGrownHeapSize=Math.min(overGrownHeapSize,requestedSize
+100663296);var
newSize=Math.min(maxHeapSize,alignUp(Math.max(requestedSize,overGrownHeapSize),65536));var
replacement=emscripten_realloc_buffer(newSize);if(replacement){return true}}return false}var
SYSCALLS={mappings:{},buffers:[null,[],[]],printChar:function(stream,curr){var
buffer=SYSCALLS.buffers[stream];if(curr===0||curr===10){(stream===1?out:err)(UTF8ArrayToString(buffer,0));
buffer.length=0}else{buffer.push(curr)}},varargs:undefined,get:function(){SYSCALLS.varargs+=4;var
ret=HEAP32[SYSCALLS.varargs-4>>2];return ret},getStr:function(ptr){var ret=UTF8ToString(ptr);return

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ret},get64:function(low,high){return
low}};function _fd_close(fd){return 0}function _fd_seek(fd,offset_low,offset_high,whence,newOffset){}function
_fd_write(fd,iiov,iiovcnt,pnum){var num=0;for(var i=0;i<iiovcnt;i++){var ptr=HEAP32[iiov+i*8>>2];var
len=HEAP32[iiov+(i*8+4)>>2];for(var
j=0;j<len;j++){SYSCALLS.printChar(fd,HEAPU8[ptr+j])}num+=len}HEAP32[pnum>>2]=num;return 0}function
_thread_create(){return 6}function _pthread_join(){return 28}function
setErrNo(value){HEAP32[___errno_location()>>2]=value;return value}function
_sysconf(name){switch(name){case 30:return 16384;case 85:var maxHeapSize=2147483648;return
maxHeapSize/16384;case 132:case 133:case 12:case 137:case 138:case 15:case 235:case 16:case 17:case 18:case
19:case 20:case 149:case 13:case 10:case 236:case 153:case 9:case 21:case 22:case 159:case 154:case 14:case
77:case 78:case 139:case 82:case 68:case 67:case 164:case 11:case 29:case 47:case 48:case 95:case 52:case 51:case
46:return 200809;case 27:case 246:case 127:case 128:case 23:case 24:case 160:case
161:case 181:case 182:case 242:case 183:case 184:case 243:case 244:case 245:case 165:case 178:case 179:case
49:case 50:case 168:case 169:case 175:case 170:case 171:case 172:case 97:case 76:case 32:case 173:case 35:case
80:case 81:case 79:return-1;case 176:case 177:case 7:case 155:case 8:case 157:case 125:case 126:case 92:case
93:case 129:case 130:case 131:case 94:case 91:return 1;case 74:case 60:case 69:case 70:case 4:return 1024;case
31:case 42:case 72:return 32;case 87:case 26:case 33:return 2147483647;case 34:case 1:return 47839;case 38:case
36:return 99;case 43:case 37:return 2048;case 0:return 2097152;case 3:return 65536;case 28:return 32768;case
44:return 32767;case 75:return 16384;case 39:return 1e3;case 89:return 700;case 71:return 256;case 40:return
255;case 2:return 100;case 180:return 64;case 25:return 20;case 5:return 16;case 6:return 6;case 73:return 4;case
84:{if(typeof navigator===\"object\")return navigator[\"hardwareConcurrency\"]||1;return 1}}setErrNo(28);return-
1}var
asmLibraryArg={\"a\":_abort,\"d\":_emscripten_memcpy_big,\"e\":_emscripten_resize_heap,\"f\":_fd_close,\"c\":_f
d_seek,\"b\":_fd_write,\"h\":_pthread_create,\"g\":_pthread_join,\"i\":_sysconf};var asm=createWasm();var
___wasm_call_ctors=Module[\"___wasm_call_ctors\"]=function(){return(___wasm_call_ctors=Module[\"___wasm
_call_ctors\"]=Module[\"asm\"][\"k\"]).apply(null,arguments)};var
_init=Module[\"_init\"]=function(){return(_init=Module[\"_init\"]=Module[\"asm\"][\"l\"]).apply(null,arguments)};
var
_init_with_threads_count=Module[\"_init_with_threads_count\"]=function(){return(_init_with_threads_count=Mod
ule[\"_init_with_threads_count\"]=Module[\"asm\"][\"m\"]).apply(null,arguments)};var
_get_threads_count=Module[\"_get_threads_count\"]=function(){return(_get_threads_count=Module[\"_get_threads
_count\"]=Module[\"asm\"][\"n\"]).apply(null,arguments)};var
_register_tensor=Module[\"_register_tensor\"]=function(){return(_register_tensor=Module[\"_register_tensor\"]=M
odule[\"asm\"][\"o\"]).apply(null,arguments)};var
_dispose_data=Module[\"_dispose_data\"]=function(){return(_dispose_data=Module[\"_dispose_data\"]=Module[\"
asm\"][\"p\"]).apply(null,arguments)};var
_dispose=Module[\"_dispose\"]=function(){return(_dispose=Module[\"_dispose\"]=Module[\"asm\"][\"q\"]).apply(n
ull,arguments)};var
_Abs=Module[\"_Abs\"]=function(){return(_Abs=Module[\"_Abs\"]=Module[\"asm\"][\"s\"]).apply(null,arguments
)};var
_Add=Module[\"_Add\"]=function(){return(_Add=Module[\"_Add\"]=Module[\"asm\"][\"t\"]).apply(null,argument
s)};var
_AddN=Module[\"_AddN\"]=function(){return(_AddN=Module[\"_AddN\"]=Module[\"asm\"][\"u\"]).apply(null,ar
guments)};var
_All=Module[\"_All\"]=function(){return(_All=Module[\"_All\"]=Module[\"asm\"][\"v\"]).apply(null,arguments)};
var
_Any=Module[\"_Any\"]=function(){return(_Any=Module[\"_Any\"]=Module[\"asm\"][\"w\"]).apply(null,argumen
ts)};var

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_ArgMax=Module["_ArgMax"]=function(){return(_ArgMax=Module["_ArgMax"]=Module["asm"][["x"]]).apply(null,arguments)};var
_AvgPool=Module["_AvgPool"]=function(){return(_AvgPool=Module["_AvgPool"]=Module["asm"][["y"]]).apply(null,arguments)};var
_BatchMatMul=Module["_BatchMatMul"]=function(){return(_BatchMatMul=Module["_BatchMatMul"]=Module["asm"][["z"]]).apply(null,arguments)};var
_Ceil=Module["_Ceil"]=function(){return(_Ceil=Module["_Ceil"]=Module["asm"][["A"]]).apply(null,arguments)};var
_ClipByValue=Module["_ClipByValue"]=function(){return(_ClipByValue=Module["_ClipByValue"]=Module["asm"][["B"]]).apply(null,arguments)};var
_Conv2D=Module["_Conv2D"]=function(){return(_Conv2D=Module["_Conv2D"]=Module["asm"][["C"]]).apply(null,arguments)};var
_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=function(){return(_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=Module["asm"][["D"]]).apply(null,arguments)};var
_Cos=Module["_Cos"]=function(){return(_Cos=Module["_Cos"]=Module["asm"][["E"]]).apply(null,arguments)};var
_Cosh=Module["_Cosh"]=function(){return(_Cosh=Module["_Cosh"]=Module["asm"][["F"]]).apply(null,arguments)};var
_CropAndResize=Module["_CropAndResize"]=function(){return(_CropAndResize=Module["_CropAndResize"]=Module["asm"][["G"]]).apply(null,arguments)};var
_Cumsum=Module["_Cumsum"]=function(){return(_Cumsum=Module["_Cumsum"]=Module["asm"][["H"]]).apply(null,arguments)};var
_DepthToSpace=Module["_DepthToSpace"]=function(){return(_DepthToSpace=Module["_DepthToSpace"]=Module["asm"][["I"]]).apply(null,arguments)};var
_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=function(){return(_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=Module["asm"][["J"]]).apply(null,arguments)};var
_Elu=Module["_Elu"]=function(){return(_Elu=Module["_Elu"]=Module["asm"][["K"]]).apply(null,arguments)};var
_Equal=Module["_Equal"]=function(){return(_Equal=Module["_Equal"]=Module["asm"][["L"]]).apply(null,arguments)};var
_Exp=Module["_Exp"]=function(){return(_Exp=Module["_Exp"]=Module["asm"][["M"]]).apply(null,arguments)};var
_FlipLeftRight=Module["_FlipLeftRight"]=function(){return(_FlipLeftRight=Module["_FlipLeftRight"]=Module["asm"][["N"]]).apply(null,arguments)};var
_Floor=Module["_Floor"]=function(){return(_Floor=Module["_Floor"]=Module["asm"][["O"]]).apply(null,arguments)};var
_FloorDiv=Module["_FloorDiv"]=function(){return(_FloorDiv=Module["_FloorDiv"]=Module["asm"][["P"]]).apply(null,arguments)};var
_FusedBatchNorm=Module["_FusedBatchNorm"]=function(){return(_FusedBatchNorm=Module["_FusedBatchNorm"]=Module["asm"][["Q"]]).apply(null,arguments)};var
_FusedConv2D=Module["_FusedConv2D"]=function(){return(_FusedConv2D=Module["_FusedConv2D"]=Module["asm"][["R"]]).apply(null,arguments)};var
_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=function(){return(_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=Module["asm"][["S"]]).apply(null,arguments)};var
_Gather=Module["_Gather"]=function(){return(_Gather=Module["_Gather"]=Module["asm"][["T"]]).apply(null,arguments)};var
_GatherNd=Module["_GatherNd"]=function(){return(_GatherNd=Module["_GatherNd"]=Module["asm"][["U"]]).apply(null,arguments)};var

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_Greater=Module["_Greater"]=function(){return(_Greater=Module["_Greater"]=Module["asm"][_"V"]).apply(
null,arguments)};var
_GreaterEqual=Module["_GreaterEqual"]=function(){return(_GreaterEqual=Module["_GreaterEqual"]=Module["asm"][_"W"]).apply(null,arguments)};var
_LeakyRelu=Module["_LeakyRelu"]=function(){return(_LeakyRelu=Module["_LeakyRelu"]=Module["asm"][_"X"]).apply(null,arguments)};var
_Less=Module["_Less"]=function(){return(_Less=Module["_Less"]=Module["asm"][_"Y"]).apply(null,arguments)};var
_LessEqual=Module["_LessEqual"]=function(){return(_LessEqual=Module["_LessEqual"]=Module["asm"][_"Z"]).apply(null,arguments)};var
_Log=Module["_Log"]=function(){return(_Log=Module["_Log"]=Module["asm"][_" _"]).apply(null,arguments)};var
_LogicalAnd=Module["_LogicalAnd"]=function(){return(_LogicalAnd=Module["_LogicalAnd"]=Module["asm"][_"$"]).apply(null,arguments)};var
_Max=Module["_Max"]=function(){return(_Max=Module["_Max"]=Module["asm"][_"aa"]).apply(null,arguments)};var
_MaxPool=Module["_MaxPool"]=function(){return(_MaxPool=Module["_MaxPool"]=Module["asm"][_"ba"]).apply(null,arguments)};var
_Maximum=Module["_Maximum"]=function(){return(_Maximum=Module["_Maximum"]=Module["asm"][_"ca"]).apply(null,arguments)};var
_Mean=Module["_Mean"]=function(){return(_Mean=Module["_Mean"]=Module["asm"][_"da"]).apply(null,arguments)};var
_Min=Module["_Min"]=function(){return(_Min=Module["_Min"]=Module["asm"][_"ea"]).apply(null,arguments)};var
_Minimum=Module["_Minimum"]=function(){return(_Minimum=Module["_Minimum"]=Module["asm"][_"fa"]).apply(null,arguments)};var
_MirrorPad=Module["_MirrorPad"]=function(){return(_MirrorPad=Module["_MirrorPad"]=Module["asm"][_"ga"]).apply(null,arguments)};var
_Multiply=Module["_Multiply"]=function(){return(_Multiply=Module["_Multiply"]=Module["asm"][_"ha"]).apply(null,arguments)};var
_Neg=Module["_Neg"]=function(){return(_Neg=Module["_Neg"]=Module["asm"][_"ia"]).apply(null,arguments)};var
_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=function(){return(_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=Module["asm"][_"ja"]).apply(null,arguments)};var
_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=function(){return(_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=Module["asm"][_"ka"]).apply(null,arguments)};var
_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=function(){return(_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=Module["asm"][_"la"]).apply(null,arguments)};var
_NotEqual=Module["_NotEqual"]=function(){return(_NotEqual=Module["_NotEqual"]=Module["asm"][_"ma"]).apply(null,arguments)};var
_OneHot=Module["_OneHot"]=function(){return(_OneHot=Module["_OneHot"]=Module["asm"][_"na"]).apply(null,arguments)};var
_PadV2=Module["_PadV2"]=function(){return(_PadV2=Module["_PadV2"]=Module["asm"][_"oa"]).apply(null,arguments)};var
_Pow=Module["_Pow"]=function(){return(_Pow=Module["_Pow"]=Module["asm"][_"pa"]).apply(null,arguments)};var
_Prelu=Module["_Prelu"]=function(){return(_Prelu=Module["_Prelu"]=Module["asm"][_"qa"]).apply(null,arguments)};var

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_Prod=Module["_Prod"]=function(){return(_Prod=Module["_Prod"]=Module["asm"]["ra"]).apply(null,arguments)};var
_RealDiv=Module["_RealDiv"]=function(){return(_RealDiv=Module["_RealDiv"]=Module["asm"]["sa"]).apply(null,arguments)};var
_RelU=Module["_Relu"]=function(){return(_Relu=Module["_Relu"]=Module["asm"]["ta"]).apply(null,arguments)};var
_RelU6=Module["_Relu6"]=function(){return(_Relu6=Module["_Relu6"]=Module["asm"]["ua"]).apply(null,arguments)};var
_ResizeBilinear=Module["_ResizeBilinear"]=function(){return(_ResizeBilinear=Module["_ResizeBilinear"]=Module["asm"]["va"]).apply(null,arguments)};var
_Reverse=Module["_Reverse"]=function(){return(_Reverse=Module["_Reverse"]=Module["asm"]["wa"]).apply(null,arguments)};var
_RotateWithOffset=Module["_RotateWithOffset"]=function(){return(_RotateWithOffset=Module["_RotateWithOffset"]=Module["asm"]["xa"]).apply(null,arguments)};var
_Round=Module["_Round"]=function(){return(_Round=Module["_Round"]=Module["asm"]["ya"]).apply(null,arguments)};var
_Rsqrt=Module["_Rsqrt"]=function(){return(_Rsqrt=Module["_Rsqrt"]=Module["asm"]["za"]).apply(null,arguments)};var
_ScatterNd=Module["_ScatterNd"]=function(){return(_ScatterNd=Module["_ScatterNd"]=Module["asm"]["Aa"]).apply(null,arguments)};var
_SelectV2=Module["_SelectV2"]=function(){return(_SelectV2=Module["_SelectV2"]=Module["asm"]["Ba"]).apply(null,arguments)};var
_Sigmoid=Module["_Sigmoid"]=function(){return(_Sigmoid=Module["_Sigmoid"]=Module["asm"]["Ca"]).apply(null,arguments)};var
_Sin=Module["_Sin"]=function(){return(_Sin=Module["_Sin"]=Module["asm"]["Da"]).apply(null,arguments)};var
_Softmax=Module["_Softmax"]=function(){return(_Softmax=Module["_Softmax"]=Module["asm"]["Ea"]).apply(null,arguments)};var
_Sqrt=Module["_Sqrt"]=function(){return(_Sqrt=Module["_Sqrt"]=Module["asm"]["Fa"]).apply(null,arguments)};var
_Square=Module["_Square"]=function(){return(_Square=Module["_Square"]=Module["asm"]["Ga"]).apply(null,arguments)};var
_SquaredDifference=Module["_SquaredDifference"]=function(){return(_SquaredDifference=Module["_SquaredDifference"]=Module["asm"]["Ha"]).apply(null,arguments)};var
_Step=Module["_Step"]=function(){return(_Step=Module["_Step"]=Module["asm"]["Ia"]).apply(null,arguments)};var
_StridedSlice=Module["_StridedSlice"]=function(){return(_StridedSlice=Module["_StridedSlice"]=Module["asm"]["Ja"]).apply(null,arguments)};var
_Sub=Module["_Sub"]=function(){return(_Sub=Module["_Sub"]=Module["asm"]["Ka"]).apply(null,arguments)};var
_Sum=Module["_Sum"]=function(){return(_Sum=Module["_Sum"]=Module["asm"]["La"]).apply(null,arguments)};var
_Tan=Module["_Tan"]=function(){return(_Tan=Module["_Tan"]=Module["asm"]["Ma"]).apply(null,arguments)};var
_Tanh=Module["_Tanh"]=function(){return(_Tanh=Module["_Tanh"]=Module["asm"]["Na"]).apply(null,arguments)};var
_Tile=Module["_Tile"]=function(){return(_Tile=Module["_Tile"]=Module["asm"]["Oa"]).apply(null,arguments)};var

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_TopK=Module["_TopK"]=function(){return(_TopK=Module["_TopK"]=Module["asm\"][["Pa\"]]).apply(null,arguments)};var
_Transform=Module["_Transform"]=function(){return(_Transform=Module["_Transform"]=Module["asm\"][["Qa\"]]).apply(null,arguments)};var
_Transpose=Module["_Transpose"]=function(){return(_Transpose=Module["_Transpose"]=Module["asm\"][["Ra\"]]).apply(null,arguments)};var
__FusedMatMul=Module["__FusedMatMul"]=function(){return(__FusedMatMul=Module["__FusedMatMul"]=Module["asm\"][["Sa\"]]).apply(null,arguments)};var
_malloc=Module["_malloc"]=function(){return(_malloc=Module["_malloc"]=Module["asm\"][["Ta\"]]).apply(null,arguments)};var
_free=Module["_free"]=function(){return(_free=Module["_free"]=Module["asm\"][["Ua\"]]).apply(null,arguments)};var
__errno_location=Module["__errno_location"]=function(){return(__errno_location=Module["__errno_location"]=Module["asm\"][["Va\"]]).apply(null,arguments)};var
stackSave=Module["stackSave"]=function(){return(stackSave=Module["stackSave"]=Module["asm\"][["Wa\"]]).apply(null,arguments)};var
stackRestore=Module["stackRestore"]=function(){return(stackRestore=Module["stackRestore"]=Module["asm\"][["Xa\"]]).apply(null,arguments)};var
stackAlloc=Module["stackAlloc"]=function(){return(stackAlloc=Module["stackAlloc"]=Module["asm\"][["Ya\"]]).apply(null,arguments)};Module["cwrap"]=cwrap;var calledRun;function
ExitStatus(status){this.name="ExitStatus";this.message="Program terminated with
exit("+status+")";this.status=status}dependenciesFulfilled=function
runCaller(){if(!calledRun)run();if(!calledRun)dependenciesFulfilled=runCaller};function
run(args){args=args||arguments_;if(runDependencies>0){return}preRun();if(runDependencies>0){return}function
doRun(){if(calledRun)return;calledRun=true;Module["calledRun"]=true;if(ABORT)return;initRuntime();preMain(
);readyPromiseResolve(Module);if(Module["onRuntimeInitialized"])Module["onRuntimeInitialized"]();postRun(
)}if(Module["setStatus"]){Module["setStatus"]("\Running..");setTimeout(function(){setTimeout(function(){Module["setStatus"]("\n"),1);doRun(),1})else{doRun()}}Module["run"]=run;if(Module["preInit"]){if(typeof
Module["preInit"]=="function")Module["preInit"]=Module["preInit"];while(Module["preInit"].length>0){
Module["preInit"].pop()}run();\n\n\n return WasmBackendModule.ready\n\n\n);nif (typeof exports ===
'object' && typeof module === 'object')\n module.exports = WasmBackendModule;\nelse if (typeof define ===
'function' && define['amd'])\n define([], function() { return WasmBackendModule; });\nelse if (typeof exports ===
'object')\n exports["WasmBackendModule"] = WasmBackendModule;\n"/**\n * @license\n * Copyright 2019
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\nimport './flags_wasm';\nimport {backend_util, BackendTimingInfo, DataStorage, DataType, deprecationWarn,
engine, env, KernelBackend, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasmModule,
WasmFactoryConfig} from './wasm-out/tfjs-backend-wasm';\nimport {BackendWasmThreadedSimdModule} from
'./wasm-out/tfjs-backend-wasm-threaded-simd';\nimport wasmFactoryThreadedSimd from './wasm-out/tfjs-
backend-wasm-threaded-simd.js';\n// @ts-ignore\nimport {wasmWorkerContents} from './wasm-out/tfjs-backend-
wasm-threaded-simd.worker.js';\nimport wasmFactory from './wasm-out/tfjs-backend-wasm.js';\n\ninterface
TensorData {\n id: number;\n memoryOffset: number;\n shape: number[];\n dtype: DataType;\n refCount:
number;\n /** Only used for string tensors, storing encoded bytes. */\n stringBytes?: Uint8Array[];\n}\n\nexport

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type DataId = object; // object instead of {} to force non-primitive.\n\nexport class BackendWasm extends
KernelBackend {\n // 0 is reserved for null data ids.\n private dataIdNextNumber = 1;\n dataIdMap:
DataStorage<TensorData>;\n\n constructor(public
wasm: BackendWasmModule|BackendWasmThreadedSimdModule) {\n super();\n
this.wasm.tfjs.initWithThreadsCount(threadsCount);\n actualThreadsCount = this.wasm.tfjs.getThreadsCount();\n
this.dataIdMap = new DataStorage(this, engine());\n }\n\n write(values: backend_util.BackendValues, shape:
number[], dtype: DataType):\n DataId {\n const dataId = {id: this.dataIdNextNumber++};\n
this.move(dataId, values, shape, dtype, 1);\n return dataId;\n }\n\n numDataIds(): number {\n return
this.dataIdMap.numDataIds();\n }\n\n async time(f: () => void): Promise<BackendTimingInfo> {\n const start =
util.now();\n f();\n const kernelMs = util.now() - start;\n return {kernelMs};\n }\n\n move(\n dataId:
DataId, values: backend_util.BackendValues, shape: number[],\n dtype: DataType, refCount: number): void {\n
const id = this.dataIdNextNumber++;\n if (dtype === 'string') {\n const stringBytes = values as Uint8Array[];\n
this.dataIdMap.set(\n
dataId,\n {id, stringBytes, shape, dtype, memoryOffset: null, refCount});\n return;\n }\n\n const
size = util.sizeFromShape(shape);\n const numBytes = size * util.bytesPerElement(dtype);\n const
memoryOffset = this.wasm._malloc(numBytes);\n this.dataIdMap.set(dataId, {id, memoryOffset, shape, dtype,
refCount});\n this.wasm.tfjs.registerTensor(id, size, memoryOffset);\n if (values != null) {\n
this.wasm.HEAPU8.set(\n new Uint8Array(\n (values as backend_util.TypedArray).buffer,\n
(values as backend_util.TypedArray).byteOffset, numBytes),\n memoryOffset);\n }\n }\n\n async
read(dataId: DataId): Promise<backend_util.BackendValues> {\n return this.readSync(dataId);\n }\n\n
readSync(dataId: DataId): backend_util.BackendValues {\n const {memoryOffset, dtype, shape, stringBytes} =\n
this.dataIdMap.get(dataId);\n if (dtype === 'string') {\n return
stringBytes;\n }\n const bytes = this.wasm.HEAPU8.slice(\n memoryOffset,\n memoryOffset +
util.sizeFromShape(shape) * util.bytesPerElement(dtype));\n return typedArrayFromBuffer(bytes.buffer, dtype);\n
}\n\n /**\n * Dispose the memory if the dataId has 0 refCount. Return true if the memory\n * is released, false
otherwise.\n * @param dataId\n * @oaram force Optional, remove the data regardless of refCount\n */\n
disposeData(dataId: DataId, force = false): boolean {\n if (this.dataIdMap.has(dataId)) {\n const data =
this.dataIdMap.get(dataId);\n data.refCount--;\n if (!force && data.refCount > 0) {\n return false;\n
}\n\n this.wasm._free(data.memoryOffset);\n this.wasm.tfjs.disposeData(data.id);\n
this.dataIdMap.delete(dataId);\n }\n return true;\n }\n\n /** Return refCount of a `TensorData`. */\n
refCount(dataId: DataId): number {\n if (this.dataIdMap.has(dataId)) {\n const tensorData =
this.dataIdMap.get(dataId);\n
return tensorData.refCount;\n }\n return 0;\n }\n\n incRef(dataId: DataId) {\n const data =
this.dataIdMap.get(dataId);\n if (data != null) {\n data.refCount++;\n }\n }\n\n floatPrecision(): 32 {\n
return 32;\n }\n\n // Returns the memory offset of a tensor. Useful for debugging and unit\n // testing.\n
getMemoryOffset(dataId: DataId): number {\n return this.dataIdMap.get(dataId).memoryOffset;\n }\n\n
dispose() {\n this.wasm.tfjs.dispose();\n if ('PThread' in this.wasm) {\n
this.wasm.PThread.terminateAllThreads();\n }\n this.wasm = null;\n }\n\n memory() {\n return {unreliable:
false};\n }\n\n /**\n * Make a tensor info for the output of an op. If `memoryOffset` is not\n * present, this
method allocates memory on the WASM heap. If `memoryOffset`\n * is present, the memory was allocated
elsewhere (in c++) and we just record\n * the pointer where that memory lives.\n */\n
makeOutput(shape:
number[], dtype: DataType, memoryOffset?: number):\n TensorInfo {\n let dataId: {};\n if (memoryOffset
== null) {\n dataId = this.write(null /* values */, shape, dtype);\n } else {\n const id =
this.dataIdNextNumber++;\n dataId = {id};\n this.dataIdMap.set(dataId, {id, memoryOffset, shape, dtype,
refCount: 1});\n const size = util.sizeFromShape(shape);\n this.wasm.tfjs.registerTensor(id, size,
memoryOffset);\n }\n return {dataId, shape, dtype};\n }\n\n typedArrayFromHeap({shape, dtype, dataId}:
TensorInfo):\n backend_util.TypedArray {\n const buffer = this.wasm.HEAPU8.buffer;\n const
{memoryOffset} = this.dataIdMap.get(dataId);\n const size = util.sizeFromShape(shape);\n switch (dtype) {\n

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case 'float32':\n return new Float32Array(buffer, memoryOffset, size);\n case 'int32':\n return new
Int32Array(buffer, memoryOffset, size);\n case 'bool':\n return new Uint8Array(buffer, memoryOffset,
size);\n default:\n throw new Error('Unknown dtype ${dtype}');\n }\n}\n\nfunction
createInstantiateWasmFunc(path: string) {\n // this will be replace by rollup plugin patchWechatWebAssembly in\n
// miniprogram's output.\n // tslint:disable-next-line:no-any\n return (imports: any, callback: any) => {\n
util.fetch(path, {credentials: 'same-origin'}).then((response) => {\n if (!response['ok']) {\n
imports.env.a(^failed to load wasm binary file at '${path}'));\n }\n response.arrayBuffer().then(binary => {\n
 WebAssembly.instantiate(binary, imports).then(output => {\n callback(output.instance, output.module);\n
 });\n });\n });\n return {};\n });\n}\n\n/**\n * Returns the path of the WASM binary.\n * @param
simdSupported whether SIMD is supported\n * @param threadsSupported whether multithreading is supported\n *
@param wasmModuleFolder the directory containing the WASM binaries.\n */\nfunction getPathToWasmBinary(\n
 simdSupported: boolean, threadsSupported: boolean,\n wasmModuleFolder: string) {\n if (wasmPath != null)
{\n // If wasmPath is defined, the user has supplied a full path to\n // the vanilla .wasm binary.\n return
wasmPath;\n }\n let path: WasmBinaryName = 'tfjs-backend-wasm.wasm';\n if (simdSupported &&
threadsSupported) {\n path = 'tfjs-backend-wasm-threaded-simd.wasm';\n } else if (simdSupported) {\n path =
'tfjs-backend-wasm-simd.wasm';\n }\n if (wasmFileMap != null) {\n if (wasmFileMap[path] != null) {\n
return wasmFileMap[path];\n }\n }\n return wasmModuleFolder + path;\n }\n\n/**\n * Initializes the wasm
module and creates the js <--> wasm bridge.\n * @param NOTE: We wrap the wasm module in a object with property
'wasm' instead of\n * returning Promise<BackendWasmModule> to avoid freezing Chrome (last tested\n * in
Chrome 76).\n */\nexport async function init(): Promise<{wasm: BackendWasmModule}> {\n const
[simdSupported,\n threadsSupported] = await Promise.all([\n env().getAsync('WASM_HAS_SIMD_SUPPORT'),\n
env().getAsync('WASM_HAS_MULTITHREAD_SUPPORT')\n]);\n return new Promise((resolve, reject) =>
{\n const factoryConfig: WasmFactoryConfig = {};\n /**\n * This function overrides the Emscripten
module locateFile utility.\n * @param path The relative path to the file that needs to be loaded.\n * @param
prefix The path to the main JavaScript file's directory.\n */\n factoryConfig.locateFile = (path, prefix) => {\n
if (path.endsWith('.worker.js')) {\n const response = wasmWorkerContents;\n const blob = new
Blob([response], {type: 'application/javascript'});\n return URL.createObjectURL(blob);\n }\n if
(path.endsWith('.wasm')) {\n return getPathToWasmBinary(\n simdSupported as boolean,\n
threadsSupported as boolean,\n wasmPathPrefix != null ? wasmPathPrefix : prefix);\n }\n return prefix
+ path;\n };\n // Use the instantiateWasm override when system fetch is not available.\n // Reference:\n //
https://github.com/emscripten-core/emscripten/blob/2bca083cbbd5a4133db61fbd74d04f7feecfa907/tests/manual_wasm_instantiate.html#L170\n
if (customFetch) {\n factoryConfig.instantiateWasm =\n
createInstantiateWasmFunc(getPathToWasmBinary(\n simdSupported as boolean, threadsSupported as
boolean,\n wasmPathPrefix != null ? wasmPathPrefix : ''));\n }\n let initialized = false;\n
factoryConfig.onAbort = () => {\n if (initialized) {\n // Emscripten already called console.warn so no need to
double log.\n return;\n }\n if (initAborted) {\n // Emscripten calls `onAbort` twice, resulting in double
error\n // messages.\n return;\n }\n initAborted = true;\n const rejectMsg =\n 'Make sure the
server can serve the `.wasm` file relative to the ' +\n 'bundled
js file. For more details see https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-wasm/README.md#using-bundlers';\n
reject({message: rejectMsg});\n };\n let wasm: Promise<BackendWasmModule>;\n // If
`wasmPath` has been defined we must initialize the vanilla module.\n if (threadsSupported && simdSupported
&& wasmPath == null) {\n factoryConfig.mainScriptUrlOrBlob = new Blob([\n [var
WasmBackendModuleThreadedSimd = ` +\n wasmFactoryThreadedSimd.toString()],\n {type:
'text/javascript'});\n wasm = wasmFactoryThreadedSimd(factoryConfig);\n } else {\n // The wasmFactory
works for both vanilla and SIMD binaries.\n wasm = wasmFactory(factoryConfig);\n }\n // The WASM

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module has been successfully created by the factory.\n // Any error will be caught by the onAbort callback defined
above.\n wasm.then((module) => {\n initialized = true;\n initAborted = false;\n\n const voidReturnType:
string
= null;\n // Using the tfjs namespace to avoid conflict with emscripten's API.\n module.tfjs = {\n init:
module.cwrap('init', null, []),\n initWithThreadCount:\n module.cwrap('init_with_threads_count', null,
['number']),\n getThreadCount: module.cwrap('get_threads_count', 'number', []),\n registerTensor:
module.cwrap(\n 'register_tensor', null,\n [\n 'number', // id\n 'number', // size\n
'number', // memoryOffset\n]),\n disposeData: module.cwrap('dispose_data', voidReturnType,
['number']),\n dispose: module.cwrap('dispose', voidReturnType, []),\n }; \n\n resolve({ wasm: module });\n
});\n });\n\nfunction typedArrayFromBuffer(\n buffer: ArrayBuffer, dtype: DataType):
backend_util.TypedArray {\n switch (dtype) {\n case 'float32':\n return new Float32Array(buffer);\n case
'int32':\n return new Int32Array(buffer);\n
 case 'bool':\n return new Uint8Array(buffer);\n default:\n throw new Error(`Unknown dtype ${dtype}`);\n
 }\n }\n\nconst wasmBinaryNames = [\n 'tfjs-backend-wasm.wasm', 'tfjs-backend-wasm-simd.wasm',\n 'tfjs-backend-wasm-threaded-simd.wasm'\n] as const ;\n\nexport type WasmBinaryName = typeof
wasmBinaryNames[number];\n\nlet wasmPath: string = null;\nlet wasmPathPrefix: string = null;\nlet wasmFileMap:
{[key in WasmBinaryName]?: string} = {};\nlet initAborted = false;\nlet customFetch = false;\n\n/**\n *
@deprecated Use `setWasmPaths` instead.\n * Sets the path to the `.wasm` file which will be fetched when the
wasm\n * backend is initialized. See\n * https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-wasm/README.md#using-bundlers\n * for more details.\n * @param path wasm file path or url\n * @param
usePlatformFetch optional boolean to use platform fetch to download\n * the wasm file, default to false.\n *\n *
@doc {heading: 'Environment', namespace: 'wasm'}\n */\n\nexport
function setWasmPath(path: string, usePlatformFetch = false): void {\n deprecationWarn(\n 'setWasmPath has
been deprecated in favor of setWasmPaths and ' +\n ' will be removed in a future release.);\n if (initAborted) {\n
throw new Error(\n 'The WASM backend was already initialized. Make sure you call ' +\n `setWasmPath()`
before you call `tf.setBackend()` or `tf.ready()`);\n }\n wasmPath = path;\n customFetch =
usePlatformFetch;\n }\n\n/**\n * Configures the locations of the WASM binaries.\n *\n * ```js\n * setWasmPaths({\n *
'tfjs-backend-wasm.wasm': 'renamed.wasm',\n * 'tfjs-backend-wasm-simd.wasm': 'renamed-simd.wasm',\n *
'tfjs-backend-wasm-threaded-simd.wasm': 'renamed-threaded-simd.wasm'\n * });\n * tf.setBackend('wasm');\n *
```\n *\n * @param prefixOrFileMap This can be either a string or object:\n * - (string) The path to the directory
where the WASM binaries are located.\n * Note that this prefix will be used to load each binary
(vanilla,\n * SIMD-enabled, threading-enabled, etc.).\n * - (object) Mapping from names of WASM binaries to
custom\n * full paths specifying the locations of those binaries. This is useful if\n * your WASM binaries are
not all located in the same directory, or if your\n * WASM binaries have been renamed.\n * @param
usePlatformFetch optional boolean to use platform fetch to download\n * the wasm file, default to false.\n *\n *
@doc {heading: 'Environment', namespace: 'wasm'}\n */\n\nexport function setWasmPaths(\n   prefixOrFileMap:
string|{[key in WasmBinaryName]?: string},\n   usePlatformFetch = false): void {\n   if (initAborted) {\n
throw new Error(\n       'The WASM backend was already initialized. Make sure you call ' +\n       `setWasmPaths()`
before you call `tf.setBackend()` or ' +\n       `tf.ready()`);\n   }\n\n   if (typeof prefixOrFileMap === 'string') {\n
wasmPathPrefix = prefixOrFileMap;\n   } else {\n       wasmFileMap = prefixOrFileMap;\n
   }\n\n   const missingPaths =\n       wasmBinaryNames.filter(name => wasmFileMap[name] === null);\n   if
(missingPaths.length > 0) {\n       throw new Error(\n       `There were no entries found for the following binaries: `
+\n       `${missingPaths.join(',')}. Please either call setWasmPaths with a ` +\n       `map providing a path for
each binary, or with a string indicating ` +\n       `the directory where all the binaries can be found.`);\n   }\n }\n\n
customFetch = usePlatformFetch;\n }\n\n/**\n * Used in unit tests. *\n\nexport function resetWasmPath(): void {\n
wasmPath = null;\n   wasmPathPrefix = null;\n   wasmFileMap = {};\n   customFetch = false;\n   initAborted =
false;\n }\n\nlet threadsCount = -1;\nlet actualThreadsCount = -1;\n\n/**\n * Sets the number of threads that will be
used by XNNPACK to create\n * threadpool (default to the number of logical CPU cores).\n *\n * This must be

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called before calling `tf.setBackend('wasm')`.
\n * \nexport function setThreadsCount(numThreads:
number) {\n threadsCount = numThreads;\n}\n\n/**\n * Gets the actual threads count that is used by
XNNPACK.\n * \n * It is set after the backend is initialized.\n * \nexport function getThreadsCount(): number {\n if
(actualThreadsCount === -1) {\n throw new Error(`WASM backend not initialized.`);\n }\n return
actualThreadsCount;\n}\n\n", "/* @license See the LICENSE file. *\n\n// This code is auto-generated, do not modify
this file!\nconst version = '3.11.0';\nexport {version};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *

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===== \n
*\n\nimport './flags_wasm';\n\nimport {registerBackend} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm,
init} from './backend_wasm';\n\nexport {BackendWasm, getThreadsCount, setThreadsCount, setWasmPath,
setWasmPaths} from './backend_wasm';\n\nexport {version as version_wasm} from './version';\n\nconst
WASM_PRIORITY = 2;\nregisterBackend('wasm', async () => {\n const {wasm} = await init();\n return new
BackendWasm(wasm);\n},
WASM_PRIORITY);\n}], "names": ["setup", "wasmFunc", "sliceImplCPU", "concatImplCPU", "supportsFullBroadcas
t", "setupFunc", "kernelFunc", "rangeImplCPU", "require$$0", "require$$1", "require$$2", "global", "require$$3", "requir
e$$4", "wasmFactoryThreadedSimd", "wasmFactory"], "mappings": ";;;;;;;;;;;;;AAAA;;;;;;;;;;;;;AAiBA;AAC
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R,2CAAU,CAAA;IACV,iDAAa,CAAA;AACf,CAAC,EANW,QAAQ,KAAR,QAAQ,QAMnB;AAED;AACa,IAA
Y,iBAQX;AARD,WAAY,iBAAiB;IAC3B,6DAAU,CAAA;IACV,yDAAQ,CAAA;IACR,2DAAS,CAAA;IAC
T,2D
AAS,CAAA;IACt,mEAAa,CAAA;IACb,+DAAW,CAAA;IACX,uDAAO,CAAA;AACT,CAAC,EARW,iBAAiB,
KAAjB,iBAAiB;AC3B7B;;;;;;;;;;;;;AAuBA,IAAI,eAKQ,CAAC;AAEb,SAAS,KAAC,CAAC,OAAoB;IAcJc,eA
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ACP,QAAQ;QACR,QAAQ;QACR,OAAO;QACP,QAAQ;QACR,QAAQ;QACR,QAAQ;QACR,QAAQ;QACR,Q
AAQ;QACR,QAAQ;QACR,QAAQ;QACR,QAAQ;KACT,CAAC,CAAC;AACL,CAAC;AAED,SAAS,gBAAgB,C
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CAAC,KAAC,KAAC,SAAS,IAAI,CAAC,CAAC,KAAC,KAAC,SAAS,EAAE;QACID,MAAM,IAAI,KAAC,CA
CX,6DAA6D,CAAC,CAAC;KACpE;IAED,MAAM,EAAC,UAAU,EAAE,UAAU,EAAE,UAAU,EAAE,cAAc,EA
AC,GAAG,KAAC,CAAC;IACnE,MAAM,GAAG,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,CAAC,CA
AC,MAAM,CAAC,CAAC,EAAE,CAAC;IAC/C,MAAM,GAAG,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CA
AC,CAAC,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;IAE/C,IAAI,MAAM,GAAG,CAAC,CAAC;IACf,IAAI,I
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CvC;QACD,MAAM,GAAG,QAAQ,CAAC,EAAE,CAAC;KACTB;IACD,MAAM,wBAAwB,GAAG,sBAAsB,IAA
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C,EAAE,CAAC;IAC5D,MAAM,eAAe,GACjB,iBAAiB,CAAC,UAAkD,CAAC,CAAC;IACIE,IAAI,eAAe,IAAI,I
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```

C,QAAQ,EAAE,OAAO,EAAE,QAAQ,CAAC,EAAE,CAAC,CAAC,KAAK,CAAC,CAAC;IACvE,MAAM,KAA
K,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,GAAG,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;IAEn
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hC,OAAO,GAAG,CAAC;AACb,CAAC;AAEM,MAAM,iBAAiB,GAAiB;IAC7C,UAAU,EAAE,YAAY;IACxB,W
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YACR,QAAQ;YACR,QAAQ;SACT,CAAC,CAAC;KACJ;IAED,SAAS,UAAU,CAAC,IAAiD;QAEEnE,MAAM,E
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G,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,CAAC,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;QAC/C,MAA
M,GAAG,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,CAAC,CAAC,MAAM,CAAC,CAAC,EAAE,CAA
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,MAAM,QAAQ,GAAG,YAAY,CAAC,0BAA0B,CAAC,CAAC,CAAC,KAAK,EAAE,CAAC,CAAC,KAAK,CAA
C,CAAC;QAC3E,MAAM,GAAG,GAAG,OAAO,CAAC,UAAU,CAAC,QAAQ,EAAE,UAAU,CAAC,CAAC;;QA
GrD,IAAI,IAAI,CAAC,aAAa,CAAC,QAAQ,CAAC,KAAK,CAAC,EAAE;YACtC,OAAO,GAAG,CAAC;SACZ;
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AAM,CAAC,CAAC;QACnE,MAAM,WAAW,GAAG,IAAI,UAAU,CAAC,IAAI,UAAU,CAAC,CAAC,CAAC,K
AAK,CAAC,CAAC,MAAM,CAAC,CAAC;QACnE,MAAM,KAAK,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,
CAAC,GAAG,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;QACnD,MAAM,UAAU,GAAG,MAAM,QAAQ,CAC
7B,GAAG,EAAE,WAAW,EAAE,CAAC,CAAC,KAAK,CAAC,MAAM,EAAE,GAAG,EAAE,WAAW,EAAE,CA
AC,CAAC,KAAK,CAAC,MAAM,EACIE,QAAQ,CAAC,CAAC,CAAC,KAAK,CAAC,EAAE,KAAK,CAAC,CA
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=====\n*\n\nimport { BatchMatMul, BatchMatMulAttrs, BatchMatMulInputs, KernelConfig, KernelFunc, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { reshape } from './Reshape';\n\nlet wasmBatchMatMul: (\n  aId: number, aShape: Uint8Array, aShapeSize: number, bId: number,\n  bShape: Uint8Array, bShapeSize: number, transposeA: boolean,\n  transposeB: boolean, outId: number) =>\n  void;\n\nfunction setup(backend: BackendWasm) {\n  wasmBatchMatMul = backend.wasm.cwrap(BatchMatMul, null /* void */, [\n    'number', // a_id\n    'array', // a_shape\n    'number', // a_shape.length\n    'number', // b_id\n    'array', // b_shape\n    'number', // b_shape.length\n    'number', // transpose_a\n    'number', // transpose_b\n    'number' // out_id\n  ]);\n\n  function batchMatMul(args: {\n    inputs: BatchMatMulInputs,\n    backend: BackendWasm,\n    attrs: BatchMatMulAttrs\n  }) {\n    const { inputs, backend, attrs } = args;\n    const { a, b } = inputs;\n    const { transposeA, transposeB } = attrs;\n\n    if (a.dtype !== 'float32' || b.dtype !== 'float32') {\n      throw new Error(`BatchMatMul for non float32 tensors not yet supported.`);\n    }\n\n    const aRank = a.shape.length;\n    const bRank = b.shape.length;\n\n    const innerShapeA = transposeA ? a.shape[aRank - 2] : a.shape[aRank - 1];\n    const innerShapeB = transposeB ? b.shape[bRank - 1] : b.shape[bRank - 2];\n\n    const outerShapeA = transposeA ?
```



```

a.shape[aRank - 1] : a.shape[aRank - 2];\n  const outerShapeB = transposeB ? b.shape[bRank - 2] : b.shape[bRank -
1];\n\n  const outerDimsA = a.shape.slice(0, -2);\n  const outerDimsB = b.shape.slice(0, -2);\n\n  const batchDimA =
util.sizeFromShape(outerDimsA);\n  const batchDimB = util.sizeFromShape(outerDimsB);\n\n  const
batchDimsCompatible =\n    batchDimA === batchDimB || batchDimA === 1 || batchDimB === 1;\n\n  util.assert(\n
    aRank >= 2 && bRank >= 2 && batchDimsCompatible,\n    () => `Error in matMul: the input batch
dimensions must either be the ` +\n      `same or at least one input batch dimension must be 1. Got input ` +\n
`batch dimensions of (${outerDimsA}) and (${outerDimsB}).`);\n\n  const outShapeOuterDims =\n    batchDimA
> batchDimB ? a.shape.slice(0, -2) : b.shape.slice(0, -2);\n  const outShape =
outShapeOuterDims.concat([outerShapeA, outerShapeB]);\n\n  util.assert(\n    innerShapeA === innerShapeB,\n    () => `Error in matMul: inner shapes (${innerShapeA}) and ` +\n      `${innerShapeB}` of Tensors with shapes
${a.shape} and ` +\n      `${b.shape} and transposeA=${transposeA}` +\n      ` and transposeB=${transposeB}
must match.`);\n\n  const a3dShape = transposeA ? [batchDimA, innerShapeA, outerShapeA] :\n    [batchDimA,
outerShapeA, innerShapeA];\n  const b3dShape = transposeB ? [batchDimB, outerShapeB,
innerShapeB] :\n    [batchDimB, innerShapeB, outerShapeB];\n\n  // The rest of the implementation is designed to
operate on rank-3 tensors\n  const a3d = reshape({inputs: {x: a}, backend, attrs: {shape: a3dShape}});\n  const b3d
= reshape({inputs: {x: b}, backend, attrs: {shape: b3dShape}});\n\n  const a3dId =
backend.dataIdMap.get(a3d.dataId).id;\n  const b3dId = backend.dataIdMap.get(b3d.dataId).id;\n\n  const leftDim =
transposeA ? a3d.shape[2] : a3d.shape[1];\n  const rightDim = transposeB ? b3d.shape[1] : b3d.shape[2];\n  const
batchDim = Math.max(batchDimA, batchDimB);\n\n  const out = backend.makeOutput([batchDim, leftDim,
rightDim], a3d.dtype);\n  const outId = backend.dataIdMap.get(out.dataId).id;\n\n  const aShapeBytes = new
Uint8Array(new Int32Array(a3d.shape).buffer);\n  const bShapeBytes = new Uint8Array(new
Int32Array(b3d.shape).buffer);\n\n  wasmBatchMatMul(\n    a3dId, aShapeBytes, a3d.shape.length, b3dId,
bShapeBytes,\n    b3d.shape.length, transposeA, transposeB,
outId);\n\n  backend.disposeData(a3d.dataId);\n  backend.disposeData(b3d.dataId);\n  out.shape = outShape;\n
return out;\n}\n\nexport const batchMatMulConfig: KernelConfig = {\n  kernelName: BatchMatMul,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: batchMatMul as {} as KernelFunc\n};\n"}

```

Found in path(s):

```

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
wasm/dist/kernels/BatchMatMul.js.map

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No license file was found, but licenses were detected in source scan.

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ntent":["/**\n

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the specific language governing permissions and\n * limitations under the License.\n *

```
=====\n*\n\nimport {KernelConfig, KernelFunc, ResizeBilinear, ResizeBilinearAttrs, ResizeBilinearInputs, TensorInfo,  
util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport  
{cast} from './Cast';\n\nlet wasmResizeBilinear: (\n  xId: number, batch: number, oldHeight: number, oldWidth:  
number,\n  numChannels: number, newHeight: number, newWidth: number,\n  alignCorners: number,  
halfPixelCenters: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n  wasmResizeBilinear = backend.wasm.cwrap(ResizeBilinear, null /*void*/, [\n    'number', // xId\n    'number', //  
batch\n    'number', // oldHeight\n    'number', // oldWidth\n    'number', // numChannels\n    'number', //  
newHeight\n    'number', // newWidth\n    'number', // alignCorners\n    'number', // halfPixelCenters\n    'number'  
// outId\n  ]);\n\n  function resizeBilinear(args: {\n    backend: BackendWasm,\n    inputs: ResizeBilinearInputs,\n    attrs: ResizeBilinearAttrs\n  }): TensorInfo {\n    const {backend, inputs, attrs} = args;\n\n    const {images} = inputs;\n    const {alignCorners, halfPixelCenters, size} = attrs;\n    const [newHeight, newWidth] = size;\n\n    const [batch, oldHeight, oldWidth, numChannels] = images.shape;\n    const outShape = [batch, newHeight, newWidth,  
numChannels];\n\n    let xData = backend.dataIdMap.get(images.dataId);\n    let castedData;\n    if (xData.dtype !==  
'float32') {\n      castedData =\n        cast({backend, inputs: {x: images}, attrs: {dtype: 'float32'}});\n      xData =  
backend.dataIdMap.get(castedData.dataId);\n    }\n    const xId = xData.id;\n\n    const out =  
backend.makeOutput(outShape, 'float32');\n    if (util.sizeFromShape(images.shape) === 0) {\n      return out;\n    }\n    const outId = backend.dataIdMap.get(out.dataId).id;\n\n    wasmResizeBilinear(\n      xId, batch, oldHeight,  
oldWidth, numChannels, newHeight, newWidth,\n      alignCorners ? 1 : 0, halfPixelCenters ? 1 : 0, outId);\n\n    if (castedData !== null) {\n      backend.disposeData(castedData.dataId);\n    }\n\n    return out;\n  }\n\n  export const  
resizeBilinearConfig: KernelConfig = {\n    kernelName: ResizeBilinear,\n    backendName: 'wasm',\n    setupFunc:  
setup,\n    kernelFunc:  
resizeBilinear as {} as KernelFunc\n  };\n}
```

Found in path(s):

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/ResizeBilinear.js.map

No license file was found, but licenses were detected in source scan.

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```

```
* =====\n*\nimport { Cos, KernelConfig } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from './unary_kernel';\nexport const cosConfig: KernelConfig = createUnaryKernelConfig(Cos);\n}}
```

Found in path(s):

```
*/opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Cos.js.map
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No license file was found, but licenses were detected in source scan.

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```

```
* =====\n*\nimport { Cosh, KernelConfig } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from './unary_kernel';\nexport const coshConfig: KernelConfig = createUnaryKernelConfig(Cosh);\n}}
```

Found in path(s):

```
*/opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Cosh.js.map
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copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n
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distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *

```
=====\n
*\n\nimport {gather_util, GatherNd, GatherNdInputs, KernelConfig, TensorInfo} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {CppType} from './types';\n\nlet
wasmGatherNd: (\n  xId: number, dtype: CCppType, indicesId: number, numSlices: number,\n  sliceRank:
number, sliceSize: number, strides: Uint8Array, outId: number) =>\n  void;\n\nfunction setup(backend:
BackendWasm): void {\n  wasmGatherNd = backend.wasm.cwrap(GatherNd, null /*void*/, [\n  'number', // xId\n
'number', // dtype\n  'number',
// indicesId\n  'number', // numSlices\n  'number', // sliceRank\n  'number', // sliceSize\n  'array', // strides\n
'number' // outId\n  ]);\n}\n\nfunction gatherNd(args: {backend: BackendWasm, inputs: GatherNdInputs}): \n
TensorInfo {\n  const {backend, inputs} = args;\n  const {params, indices} = inputs;\n\n  const [resultShape,
numSlices, sliceSize, strides] =\n    gather_util.prepareAndValidate(params, indices);\n\n  const out =
backend.makeOutput(resultShape, params.dtype);\n  if (numSlices === 0) {\n    return out;\n  }\n\n  const
indicesShape = indices.shape;\n  const sliceRank = indicesShape[indicesShape.length - 1];\n\n  const xData =
backend.dataIdMap.get(params.dataId);\n  const xId = xData.id;\n  const indicesData =
backend.dataIdMap.get(indices.dataId);\n  const indicesId = indicesData.id;\n\n  const stridesBytes = new
Uint8Array(new Int32Array(strides).buffer);\n\n  const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmGatherNd(\n  xId,
CppType[params.dtype], indicesId, numSlices, sliceRank, sliceSize,\n  stridesBytes, outId);\n\n  return
out;\n}\n\nexport const gatherNdConfig: KernelConfig = {\n  kernelName: GatherNd,\n  backendName: 'wasm',\n
setupFunc: setup,\n  kernelFunc: gatherNd\n};\n\n}}
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Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
wasm/dist/kernels/GatherNd.js.map
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```

Found in path(s):

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Reshape.js.map

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=====\n *\n\nimport {backend_util, Concat, ConcatAttrs, ConcatInputs, KernelConfig, KernelFunc, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {concatImplCPU} from '../kernel_utils/shared';\nimport {identity} from './Identity';\nimport {reshape} from './Reshape';\n\nexport function concat(\n args: {inputs: ConcatInputs, backend: BackendWasm, attrs: ConcatAttrs}) {\n const {inputs,

```

backend} = args;\n\n const axis = util.parseAxisParam(args.attrs.axis, inputs[0].shape)[0];\n\n let outShape =
backend_util.computeOutShape(inputs.map(t => t.shape), axis);\n\n // Keep only non-empty tensors (ignore tensors
with 0 in their shape).\n const $inputs = inputs.filter(t => util.sizeFromShape(t.shape) > 0);\n if ($inputs.length ===
1) {\n return identity({inputs: {x: $inputs[0]}, backend});\n }\n\n\n const out = backend.makeOutput(outShape,
inputs[0].dtype);\n\n if (util.sizeFromShape(outShape) === 0) {\n return out;\n }\n\n\n const shapes =
$inputs.map(t => t.shape);\n backend_util.assertParamsConsistent(shapes, axis);\n\n if ($inputs[0].dtype ===
'string') {\n // Any concat of n-dimensional tensors across any axis can be reduced to\n // a concatenation of two-
dimensional tensors across the axis 1 by first\n // partitioning the axes of the original tensors into those less than
the\n // axis to be concatenated and the rest. Then reshape the tensors\n
// into a two-dimensional tensor by collapsing these two sets of axes and\n // concatenate the resulting matrices
across the axis 1, finally reshaping\n // the result to have the proper shape.\n const inputs2D = $inputs.map(t =>
{\n const innerSize = util.sizeFromShape(t.shape.slice(axis));\n const shape = [-1, innerSize];\n return
reshape({inputs: {x: t}, backend, attrs: {shape}});\n });\n\n\n const inputsValShapes = inputs2D.map(t => {\n
return {vals: backend.readSync(t.dataId), shape: t.shape};\n });\n\n\n // Concat 2d tensors along axis=1.\n
outShape =\n backend_util.computeOutShape(inputs2D.map(t => t.shape), 1 /* axis */);\n const simplyConcat
= inputs2D[0].shape[0] === 1;\n const outVals = concatImplCPU(\n inputsValShapes, outShape,
inputs[0].dtype,\n simplyConcat) as string[];\n\n const finalOutShape =\n backend_util.computeOutShape($inputs.map(t => t.shape),
axis);\n\n out.shape = finalOutShape;\n const outData = backend.dataIdMap.get(out.dataId);\n
outData.stringBytes = backend_util.fromStringArrayToUint8(outVals);\n\n inputs2D.forEach(t =>
backend.disposeData(t.dataId));\n\n return out;\n }\n\n\n const batchDim =
util.sizeFromShape($inputs[0].shape.slice(0, axis));\n let sumInnerDims = 0;\n const innerDims =
$inputs.map(input => {\n const innerDim = util.sizeFromShape(input.shape.slice(axis));\n sumInnerDims +=
innerDim;\n return innerDim;\n });\n const inVals = $inputs.map(input =>
backend.typedArrayFromHeap(input));\n const outVals = backend.typedArrayFromHeap(out);\n for (let b = 0; b <
batchDim; b++) {\n let outOffset = b * sumInnerDims;\n for (let i = 0; i < inVals.length; i++) {\n const
innerDim = innerDims[i];\n const inOffset = b * innerDim;\n const vals = inVals[i].subarray(inOffset,
inOffset + innerDim);\n outVals.set(vals, outOffset);\n outOffset += innerDim;\n }\n
}\n\n return out;\n }\n\n\nexport const concatConfig: KernelConfig = {\n kernelName: Concat,\n backendName:
'wasm',\n kernelFunc: concat as {} as KernelFunc,\n};\n"}

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Found in path(s):

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* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
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```
=====\n*\n\nimport { KernelConfig, KernelFunc, Select, SelectInputs, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\n\nlet wasmSelect: (\n  conditionId: number, tId: number, eId: number, offset: number,\n  outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n  wasmSelect = backend.wasm.cwrap('SelectV2', null, [\n    'number', // conditionId\n    'number', // tId\n    'number', // eId\n    'number', // offset\n    'number', // outId\n  ]);\n\n  function select(args: { inputs: SelectInputs, backend: BackendWasm }) {\n    const { inputs, backend } = args;\n    const { condition, t, e } = inputs;\n    const conditionId = backend.dataIdMap.get(condition.dataId).id;\n    const tId = backend.dataIdMap.get(t.dataId).id;\n    const eId = backend.dataIdMap.get(e.dataId).id;\n    const out = backend.makeOutput(t.shape, t.dtype);\n    const outId = backend.dataIdMap.get(out.dataId).id;\n    const cRank = condition.shape.length;\n    const tRank = t.shape.length;\n    const offset = cRank === 0 || cRank > 1 || tRank === 1\n      ?\n        1 :\n        util.sizeFromShape(t.shape.slice(1));\n    wasmSelect(conditionId, tId, eId, offset, outId);\n    return out;\n  }\n\n  export const selectConfig: KernelConfig = {\n    kernelName: Select,\n    backendName: 'wasm',\n    kernelFunc: select as {} as KernelFunc,\n    setupFunc: setup\n  };\n}
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Found in path(s):

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* =====*/

Found in path(s):

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ourcesContent":["/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
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under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF
ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n *
limitations under the License.\n *
===== \n
*\n\n// This enum must align with the enum defined in cc/backend.h.\nexport enum CppDType {\n float32 = 0,\n int32 = 1,\n bool = 2,\n string = 3,\n complex64 = 4\n}\n\n// Must match enum in cc/fusable_activations.h.\nexport
enum FusableActivation {\n linear = 0,\n relu = 1,\n relu6 = 2,\n prelu = 3,\n leakyrelu = 4,\n sigmoid = 5,\n elu
= 6\n}\n"}

```

Found in path(s):

```

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
wasm/dist/kernels/types.js.map
No license file was found, but licenses were detected in source scan.

```

```

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```

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```
=====\n*\n\nimport { KernelConfig, RealDiv } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from './binary_kernel';\n\nconst supportsFullBroadcast = true;\nexport const realDivConfig: KernelConfig =\n  createBinaryKernelConfig(RealDiv, supportsFullBroadcast);
```

Found in path(s):

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/RealDiv.js.map

No license file was found, but licenses were detected in source scan.

{"version":3,"file":"GreaterEqual.js","sourceRoot":"","sources":["../../src/kernels/GreaterEqual.ts"],"names":[],"mappings":"AAAA;;;;;;;;;;GAeG;AACH,OAAO,EAAC,YAA Y,EAAe,MAAM,uBAAuB,CAAC;AAEjE,OAAO,EAAC,wBAAwB,EAAC,MAAM,iBAaIB,CAAC;AAEzD,MAAM,qBAAqB,GAAG,KAAK,CAAC;AACpC,MAAM,CAAC,MAAM,kBAakB,GAC3B,wBAAwB,CAAC,YAA Y,EAAE,qBAAqB,EAAE,MAAM,CAAC,CAAC", "sourcesContent":["/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```
=====\n*\n\nimport { GreaterEqual, KernelConfig } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from './binary_kernel';\n\nconst supportsFullBroadcast = false;\nexport const greaterEqualConfig: KernelConfig =\n  createBinaryKernelConfig(GreaterEqual, supportsFullBroadcast, 'bool');
```

Found in path(s):

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/GreaterEqual.js.map

No license file was found, but licenses were detected in source scan.

{"version":3,"file":"FusedBatchNorm.js","sourceRoot":"","sources":["../../src/kernels/FusedBatchNorm.ts"],"names":[],"mappings":"AAAA;;;;;;;;;;GAeG;AAEH,OAAO,EAAC,cAAc,EAAMf,IAAI,EAAC,MAAM,uBAAuB,CAAC;AAI5I,IAAI,aAEgE,CAAC;AAErE,SAAS,KAAK,CAAC,OAAoB;IACjC,aAAa,GAAG,OAAO,CAAC,IAAI,CAAC,KAAK,CAC9B,cAAc,EAAE,IAAI,CAAC,UAAU,EAC/B,CAAC,QAAQ,EAAE,QAAQ,EAAE,QAAQ,EAAE,QAAQ,EAAE,QAAQ,EAAE,QAAQ,CAAC,CAAC,CAAC;AAC9E,CAAC;AAED,SAAS,cAAc,CAAC,IAIvB;IACC,MAAM,EAAC,OAAO,EAAE,MAAM,EAAE,KAAK,EAAC,GAAG,IAAI,CAAC;IACiC,MAAM,EAAC,eAAe,EAAC,GAAG,KAAK,CAAC;IAC hC,MAAM,EAAC,CAAC,EAAE,IAAI,EAAE,QAAQ,EAAE,MAAM,EAAE,KAAK,EAAC,GAAG,MAAM,CAAC;IACID,MAAM,GAAG,GAAG,OAAO,CAAC,SAAS,CAAC

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```
=====\n*\n\nimport { FusedBatchNorm, FusedBatchNormAttrs, FusedBatchNormInputs, KernelConfig, KernelFunc,  
TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nlet  
wasmBatchNorm: (\n  xId: number, meanId: number, varianceId: number, offsetId: number,\n  scaleId: number,  
varianceEpsilon: number, outId: number) => void;\nfunction setup(backend: BackendWasm): void {\n  wasmBatchNorm = backend.wasm.cwrap(\n    FusedBatchNorm, null /* void */,\n    ['number',  
'number', 'number', 'number', 'number', 'number', 'number']);\n}\nfunction fusedBatchNorm(args: {\n  backend:  
BackendWasm,\n  inputs: FusedBatchNormInputs,\n  attrs: FusedBatchNormAttrs\n}): TensorInfo {\n  const  
{ backend, inputs, attrs } = args;\n  const { varianceEpsilon } = attrs;\n  const { x, mean, variance, offset, scale } =  
inputs;\n  const xId = backend.dataIdMap.get(x.dataId).id;\n  const meanId =  
backend.dataIdMap.get(mean.dataId).id;\n  const varianceId = backend.dataIdMap.get(variance.dataId).id;\n  const  
offsetId = offset != null ? backend.dataIdMap.get(offset.dataId).id : 0;\n  const scaleId = scale != null ?  
backend.dataIdMap.get(scale.dataId).id : 0;\n  const out = backend.makeOutput(x.shape, x.dtype);\n  // Short-  
circuit zero-sized tensors.\n  if (util.sizeFromShape(x.shape) === 0) {\n    return out;\n  }\n  const outId =  
backend.dataIdMap.get(out.dataId).id;\n  wasmBatchNorm(\n    xId, meanId, varianceId, offsetId, scaleId,  
varianceEpsilon, outId);\n  return  
out;\n}\nexport const fusedBatchNormConfig: KernelConfig = {\n  kernelName: FusedBatchNorm,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: fusedBatchNorm as { } as KernelFunc\n};\n}]]
```

Found in path(s):

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
wasm/dist/kernels/FusedBatchNorm.js.map

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 * =====
 */

Found in path(s):

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/test_node.ts
 * /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/test_node.d.ts
 *
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 No license file was found, but licenses were detected in source scan.

```
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on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n
* =====\n
*\n\nimport {KernelConfig, Sqrt} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'./unary_kernel';\n\nexport const sqrtConfig: KernelConfig = createUnaryKernelConfig(Sqrt);\n"]}
```

Found in path(s):

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Sqrt.js.map
 No license file was found, but licenses were detected in source scan.

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CAAC","sourcesContent":["/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
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```
=====\n\n*\n\nimport {Identity, IdentityInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\nimport\n{TensorInfo} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nexport function\nidentity(args: {inputs: IdentityInputs, backend: BackendWasm}):\n  TensorInfo {\n    const {inputs: {x}, backend} =\n    args;\n    const out = backend.makeOutput(x.shape, x.dtype);\n    const inVals = backend.typedArrayFromHeap(x);\n    const outVals = backend.typedArrayFromHeap(out);\n    outVals.set(inVals);\n    return\n    out;\n  }\n\nexport const identityConfig: KernelConfig = {\n  kernelName: Identity,\n  backendName: 'wasm',\n  kernelFunc: identity as { } as KernelFunc;\n};\n\n}
```

Found in path(s):

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Identity.js.map

No license file was found, but licenses were detected in source scan.

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```

```
=====\n\n*\n\n// Import shared functionality from tfjs-backend-cpu without triggering\n// side effects.\n// tslint:disable-next-line: no-imports-from-dist\nimport {concatImpl as concatImplCPU} from '@tensorflow/tfjs-backend-cpu/dist/shared';\n// tslint:disable-next-line: no-imports-from-dist\nimport {sliceImpl as sliceImplCPU} from '@tensorflow/tfjs-backend-cpu/dist/shared';\n// tslint:disable-next-line: no-imports-from-dist\nimport {rangeImpl as rangeImplCPU} from '@tensorflow/tfjs-backend-cpu/dist/shared';\nexport {concatImplCPU, rangeImplCPU, sliceImplCPU};\n\n}
```

Found in path(s):

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernel_utils/shared.js.map

No license file was found, but licenses were detected in source scan.

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```

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=====\n
*/\n\nimport {backend_util, DepthwiseConv2dNative, DepthwiseConv2dNativeAttrs,
DepthwiseConv2dNativeInputs, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';\nimport
{BackendWasm} from './backend_wasm';\n\nlet wasmDepthwiseConv2d: (\n xId: number, batchSize: number,
inputHeight: number, inputWidth: number,\n filterId: number, filterHeight: number, filterWidth: number, padTop:
number,\n padRight: number, padBottom: number, padLeft: number, isSamePad: number,\n dilationHeight:
number, dilationWidth: number, strideHeight: number,\n strideWidth: number, inputChannels: number,
outputChannels:
number,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmDepthwiseConv2d =\n backend.wasm.cwrap(DepthwiseConv2dNative, null /* void */, [\n 'number', // xId\n 'number', //
batchSize\n 'number', // inputHeight\n 'number', // inputWidth\n 'number', // filterId\n 'number', //
filterHeight\n 'number', // filterWidth\n 'number', // padTop\n 'number', // padRight\n 'number', //
padBottom\n 'number', // padLeft\n 'number', // isSamePad\n 'number', // dilationHeight\n 'number', // dilationWidth\n 'number', // strideHeight\n 'number', // strideWidth\n 'number', // inputChannels\n 'number', // outputChannels\n 'number', // outId\n]);\n}

```

padBottom\n    'number', // padLeft\n    'number', // isSamePad\n    'number', // dilationHeight\n    'number', // dilationWidth\n    'number', // strideHeight\n    'number', // strideWidth\n    'number', //
inputChannels\n    'number', // outputChannels\n    'number', // outId\n    ]);\n}\n\nfunction
depthwiseConv2d(args: {\n inputs: DepthwiseConv2dNativeInputs,\n backend: BackendWasm,\n attrs:
DepthwiseConv2dNativeAttrs\n}) {\n const {inputs, attrs,
backend} = args;\n\n const {x, filter} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const filterId
= backend.dataIdMap.get(filter.dataId).id;\n\n const {strides, dilations, pad, dimRoundingMode} = attrs;\n\n const
$dilations = dilations == null ? [1, 1] : dilations;\n\n const convInfo = backend_util.computeConv2DInfo(\n    (x as
Tensor4D).shape, (filter as Tensor4D).shape, strides,\n    ($dilations as number | [number, number]), pad,
dimRoundingMode,\n    true /* depthwise */);\n\n const filterHeight = convInfo.filterHeight;\n const filterWidth =
convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const padRight = convInfo.padInfo.right;\n const
padBottom = convInfo.padInfo.bottom;\n const padLeft = convInfo.padInfo.left;\n const dilationHeight =
convInfo.dilationHeight;\n const dilationWidth = convInfo.dilationWidth;\n const strideHeight =
convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n const inputChannels =
convInfo.inChannels;\n const outputChannels = convInfo.outChannels;\n const isSamePad =
convInfo.padInfo.type === 'SAME' ? 1 : 0;\n\n if (convInfo.dataFormat !== 'channelsLast') {\n    throw new
Error(\n        `wasm backend DepthwiseConv2dNative does not support dataFormat:` +\n
`${convInfo.dataFormat}`. Please use 'channelsLast'.`);\n    }\n\n const out =
backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmDepthwiseConv2d(\n    xId, x.shape[0], x.shape[1], x.shape[2], filterId, filterHeight,\n    filterWidth,
padTop, padRight, padBottom, padLeft, isSamePad,\n    dilationHeight, dilationWidth, strideHeight, strideWidth,
inputChannels,\n    outputChannels, outId);\n return out;\n}\n\nexport const depthwiseConv2dNativeConfig:
KernelConfig = {\n kernelName: DepthwiseConv2dNative,\n backendName: 'wasm',\n setupFunc: setup,\n
kernelFunc: depthwiseConv2d as {} as KernelFunc\n};\n"}

```

Found in path(s):

```

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
wasm/dist/kernels/DepthwiseConv2dNative.js.map

```

No license file was found, but licenses were detected in source scan.

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CAAC","sourcesContent":["/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
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implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n
 * =====\n
*\nimport {Floor, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'./unary_kernel';\nexport const floorConfig: KernelConfig = createUnaryKernelConfig(Floor);\n"}

```

Found in path(s):

```

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
wasm/dist/kernels/Floor.js.map

```


No license file was found, but licenses were detected in source scan.

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AAwB;CACrC,CAAC","sourcesContent":["/*\n * @license\n * Copyright 2019 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {Cast, CastAttrs, CastInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\nimport
{TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nexport function
cast(\n  args: {inputs: CastInputs, attrs: CastAttrs, backend: BackendWasm});\n  TensorInfo {\n    const {inputs:
{x}, attrs: {dtype}, backend} = args;\n    const out = backend.makeOutput(x.shape, dtype);\n    const inVals =
backend.typedArrayFromHeap(x);\n    const outVals = backend.typedArrayFromHeap(out);\n
    outVals.set(inVals);\n    return out;\n  }\n\nexport const castConfig: KernelConfig = {\n  kernelName: Cast,\n
backendName: 'wasm',\n  kernelFunc: cast as {} as KernelFunc,\n};\n"]}
```

Found in path(s):

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Cast.js.map

No license file was found, but licenses were detected in source scan.

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```
=====\n*\n\nimport {backend_util, BinaryInputs, DataType, KernelConfig, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {CppType} from './types';\nexport function createBinaryKernelConfig(\n  kernelName: string, supportsFullBroadcast: boolean,\n  dtype?:\n  DataType): KernelConfig {\n  let wasmFunc:\n    (aId: number, aShape: Uint8Array, aShapeLen: number, bId:\n    number,\n    bShape: Uint8Array, bShapeLen: number, dtype: number, outId: number) =>\n    void;\n\n  function setupFunc(backend: BackendWasm): void {\n    wasmFunc = backend.wasm.cwrap(kernelName, null /*\n    void */, [\n      'number', // a_id,\n      'array', // a_shape\n      'number', // a_shape.length\n      'number', // b_id\n      'array', // b_shape\n      'number',\n      // b_shape.length\n      'number', // dtype\n      'number' // out_id\n    ]);\n\n    function kernelFunc(args:\n    {backend: BackendWasm, inputs: BinaryInputs}): TensorInfo {\n      const {backend, inputs} = args;\n      const {a, b} = inputs;\n      const aId = backend.dataIdMap.get(a.dataId).id;\n      const bId =\n      backend.dataIdMap.get(b.dataId).id;\n      const outputType = dtype != null ? dtype : a.dtype;\n      const newShape =\n      backend_util.assertAndGetBroadcastShape(a.shape, b.shape);\n      const out = backend.makeOutput(newShape,\n      outputType);\n      // Short-circuit zero-sized tensors.\n      if (util.sizeFromShape(newShape) === 0) {\n        return\n        out;\n      }\n      const aShapeBytes = new Uint8Array(new Int32Array(a.shape).buffer);\n      const bShapeBytes =\n      new Uint8Array(new Int32Array(b.shape).buffer);\n      const outId = backend.dataIdMap.get(out.dataId).id;\n      const kernelFunc = () => wasmFunc(\n        aId, aShapeBytes, a.shape.length, bId, bShapeBytes, b.shape.length,\n        CCppType[a.dtype], outId);\n      // Currently only some float operations support full broadcast.\n      if\n      (supportsFullBroadcast && a.dtype === 'float32') {\n        kernelFunc();\n        return out;\n      }\n      const\n      aBroadcastDims = backend_util.getBroadcastDims(a.shape, newShape);\n      const bBroadcastDims =\n      backend_util.getBroadcastDims(b.shape, newShape);\n      const loopsOverAllOfA = aBroadcastDims.every((v, i) =>\n      v === i);\n      const loopsOverAllOfB = bBroadcastDims.every((v, i) => v === i);\n      if (loopsOverAllOfA &&\n      loopsOverAllOfB) {\n        kernelFunc();\n        return out;\n      } else {\n        throw new Error(\n          `Broadcasting\n          along outer dims is not yet ` +\n          `supported for ${a.dtype} ${kernelName}.`);\n      }\n      return\n      {kernelName, backendName: 'wasm', setupFunc, kernelFunc};\n    }\n  }\n}
```

Found in path(s):

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/binary_kernel.js.map

No license file was found, but licenses were detected in source scan.

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AAS,EAAE,KAAK;IAChB,UAAU,EAAE,GAAuB;CACpC,CAAC","sourcesContent":["/**\n
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  the specific language governing permissions and\n * limitations under the License.\n *
  =====\n
  *\n\nimport { Any, AnyAttrs, AnyInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util } from
 '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport
 { permuteAxesAndTranspose } from './kernel_utils';\n\nlet
 wasmAny: (xId: number, reduceSize: number, outId: number) => void;\n\nfunction setup(backend:
 BackendWasm): void {\n  wasmAny = backend.wasm.cwrap(Any, null /*void*/, ['number, number,
  number']);\n}\n\nfunction any(args: { backend: BackendWasm, inputs: AnyInputs, attrs: AnyAttrs }):\n  TensorInfo
 {\n  const { backend, inputs, attrs } = args;\n  const { axis, keepDims } = attrs;\n  const { x } = inputs;\n  const xId =
  backend.dataIdMap.get(x.dataId).id;\n  let inputId = xId;\n  let input = x;\n\n  const { transposed, axes, originalAxes,
  inputWasTransposed } =\n    permuteAxesAndTranspose(x, axis, backend);\n\n  if (inputWasTransposed) {\n
  const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n  input = transposed;\n  inputId =
  transposedId;\n  }\n\n  const inputRank = input.shape.length;\n  backend_util.assertAxesAreInnerMostDims('any',
  axes, inputRank);\n  const [outShape, reduceShape] =\n
```

```

backend_util.computeOutAndReduceShapes(input.shape, axes);\n const reduceSize
= util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, x.dtype);\n if
(util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmAny(inputId, reduceSize, outId);\n }\n\n if (inputWasTransposed) {\n // dispose of the transposed tensor.\n
backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const newShape =
backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n return
out;\n}\n\nexport const anyConfig: KernelConfig = {\n kernelName: Any,\n backendName: 'wasm',\n setupFunc:
setup,\n kernelFunc: any as {} as KernelFunc\n};\n"}

```

Found in path(s):

```

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
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No license file was found, but licenses were detected in source scan.

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AC,CAAC","sourcesContent":["/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n *
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governing permissions and\n * limitations under the License.\n
*\n * =====\n
*\nimport {KernelConfig, Round} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'/unary_kernel';\nexport const roundConfig: KernelConfig = createUnaryKernelConfig(Round);\n"}

```

Found in path(s):

```

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
wasm/dist/kernels/Round.js.map

```

No license file was found, but licenses were detected in source scan.

```

{"version":3,"file":"Relu.js","sourceRoot":"","sources":["../../src/kernels/Relu.ts"],"names":[],"mappings":"AAAA;;
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","sourcesContent":["/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under
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on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n
*\n * =====\n
*\nimport {KernelConfig, Relu} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'/unary_kernel';\nexport const reluConfig: KernelConfig = createUnaryKernelConfig(Relu);\n"}

```

Found in path(s):

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Relu.js.map

No license file was found, but licenses were detected in source scan.

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{"version":3,"file":"Exp.js","sourceRoot":"","sources":["../../src/kernels/Exp.ts"],"names":[],"mappings":"AAAA;;;;
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AS,CAAC,CAAC","sourcesContent":["/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n *
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the
License.\n *
```

```
=====\n
*\nimport {Exp, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'./unary_kernel';\n\nexport const expConfig: KernelConfig = createUnaryKernelConfig(Exp, 'float32');\n"]}
```

Found in path(s):

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Exp.js.map

No license file was found, but licenses were detected in source scan.

```
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License for the specific language
governing permissions and\n * limitations under the License.\n *
```

```
=====\n
*\nimport {Greater, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
'./binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const greaterConfig: KernelConfig =\ncreateBinaryKernelConfig(Greater, supportsFullBroadcast, 'bool');\n"]}
```

Found in path(s):

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Greater.js.map

No license file was found, but licenses were detected in source scan.

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```

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,EAAC,MAAM,EAAE,EAAC,CAAC,EAAE,GAAG,EAAC,EAAE,KAAK,EAAE,EAAC,KAAK,EAAE,CAAC,C
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IACzC,UAAU,EAAE,OAAO;IACnB,WAAW,EAAE,MAAM;IACnB,UAAU,EAAE,OAA2B;IACvC,SAAS,EAA
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=====\n

```
*/\n\nimport { KernelConfig, KernelFunc, Reverse, ReverseAttrs, ReverseInputs, TensorInfo, util } from  
'@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport { identity } from  
'./Identity';\n\nimport { reshape } from './Reshape';\n\nlet wasmReverse: (\n  xId: number, axes: Uint8Array,  
axesLength: number, outShape: Uint8Array,\n  outShapeLength: number, outId: number) => void;\n\nfunction  
setup(backend:  
  BackendWasm) {\n  wasmReverse = backend.wasm.cwrap(Reverse, null, [\n    'number', // x_id\n    'array', //  
axes\n    'number', // axes_length\n    'array', // out_shape\n    'number', // out_shape_length\n    'number' //  
out_id\n  ]);\n\n  export function reverse(\n    args: { inputs: ReverseInputs, backend: BackendWasm, attrs:  
ReverseAttrs }):\n    TensorInfo {\n    const { inputs, backend, attrs } = args;\n    const { x } = inputs;\n    const { dims } =  
attrs;\n\n    const axes = util.parseAxisParam(dims, x.shape);\n\n    if (x.shape.length === 0) {\n      return  
identity({ inputs: { x }, backend });\n    }\n\n    const out = backend.makeOutput(x.shape, x.dtype);\n    const xId =  
backend.dataIdMap.get(x.dataId).id;\n    const outId = backend.dataIdMap.get(out.dataId).id;\n\n    const axesBytes =  
new Uint8Array(new Int32Array(axes).buffer);\n    const outShapeBytes = new Uint8Array(new  
Int32Array(x.shape).buffer);\n\n    wasmReverse(\n      xId, axesBytes, axes.length, outShapeBytes, x.shape.length,  
outId);\n\n    const reshaped =\n      reshape({ inputs: { x: out }, attrs: { shape: x.shape }, backend});\n\n    backend.disposeData(out.dataId);\n    return reshaped;\n  }\n\n  export const reverseConfig: KernelConfig = {\n    kernelName: Reverse,\n    backendName: 'wasm',\n    kernelFunc: reverse as { } as KernelFunc,\n    setupFunc:  
setup\n  };"}\n
```

Found in path(s):

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Reverse.js.map

No license file was found, but licenses were detected in source scan.

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```

```
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```

```
=====\n*\n\nimport { KernelConfig, KernelFunc, NonMaxSuppressionV5, NonMaxSuppressionV5Attrs, NonMaxSuppressionV5Inputs, TensorInfo } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport { parseResultStruct } from './NonMaxSuppression_util';\n\nlet wasmFunc:\n  (boxesId: number, scoresId: number, maxOutputSize: number,\n    iouThreshold: number, scoreThreshold: number, softNmsSigma: number) =>\n    number;\n\nfunction setup(backend: BackendWasm): void {\n  wasmFunc = backend.wasm.cwrap(\n    NonMaxSuppressionV5,\n    'number', // Result*\n    [\n      'number', // boxesId\n      'number', // scoresId\n      'number', // maxOutputSize\n      'number', // iouThreshold\n      'number', // scoreThreshold\n      'number', // softNmsSigma\n    ]);\n}\n\nfunction kernelFunc(args: {\n  backend: BackendWasm,\n  inputs: NonMaxSuppressionV5Inputs,\n  attrs: NonMaxSuppressionV5Attrs\n}): TensorInfo[] {\n  const { backend, inputs, attrs } = args;\n  const { iouThreshold, maxOutputSize, scoreThreshold, softNmsSigma } = attrs;\n  const { boxes, scores } = inputs;\n  const boxesId = backend.dataIdMap.get(boxes.dataId).id;\n  const scoresId = backend.dataIdMap.get(scores.dataId).id;\n  const resOffset = wasmFunc(\n    boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold,\n    softNmsSigma);\n  const { pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs } =\n    parseResultStruct(backend, resOffset);\n  // Since we are not using validOutputs for V5, we have to delete it from\n  // the // heap.\n  backend.wasm._free(pValidOutputs);\n  const selectedIndicesTensor =\n
```

```
backend.makeOutput([selectedSize], 'int32',
  pSelectedIndices);\n const selectedScoresTensor =\n  backend.makeOutput([selectedSize], 'float32',
  pSelectedScores);\n\n return [selectedIndicesTensor, selectedScoresTensor];\n}\n\nexport const
nonMaxSuppressionV5Config: KernelConfig = {\n  kernelName: NonMaxSuppressionV5,\n  backendName:
'wasm',\n  setupFunc: setup,\n  kernelFunc: kernelFunc as {} as KernelFunc,\n};\n}}}
```

Found in path(s):

```
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
wasm/dist/kernels/NonMaxSuppressionV5.js.map
```

No license file was found, but licenses were detected in source scan.

```
{"version":3,"file":"Relu6.js","sourceRoot":"","sources":["../../src/kernels/Relu6.ts"],"names":[],"mappings":"AAA
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B,EAAC,MAAM,gBAAgB,CAAC;AACvD,MAAM,CAAC,MAAM,WAAW,GAAiB,uBAAuB,CAAC,KAAC,CA
AC,CAAC","sourcesContent":["/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n *
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* =====\n
*\nimport {KernelConfig, Relu6} from 'tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'./unary_kernel';\nexport const relu6Config: KernelConfig = createUnaryKernelConfig(Relu6);\n"]}]}
```

Found in path(s):

```
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
wasm/dist/kernels/Relu6.js.map
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No license file was found, but licenses were detected in source scan.

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gB,EAAE,YAAY,EAAE,eAAe,EAAE,aAAa,EAAC,CAAC;AAC1E,CAAC","sourcesContent":["/**\n *
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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* =====\n
*\nimport {BackendWasm} from '../backend_wasm';\n\n// Analogous to `struct Result` in
`non_max_suppression_impl.h`\ninterface Result {\n  pSelectedIndices: number;\n  selectedSize: number;\n}
```



```
pSelectedScores: number;\n pValidOutputs: number;\n}\n\n**\n * Parse the result of the c++ method, which has the  
shape equivalent to\n * `Result`.\n * ^\nexport function parseResultStruct(\n backend: BackendWasm, resOffset:  
number): Result {\n const result = new Int32Array(backend.wasm.HEAPU8.buffer, resOffset, 4);\n const  
pSelectedIndices  
= result[0];\n const selectedSize = result[1];\n const pSelectedScores = result[2];\n const pValidOutputs =  
result[3];\n // Since the result was allocated on the heap, we have to delete it.\n backend.wasm._free(resOffset);\n return {pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs};\n}\n\n}}
```

Found in path(s):

```
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-  
wasm/dist/kernels/NonMaxSuppression_util.js.map
```

No license file was found, but licenses were detected in source scan.

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AC;IAC/C,MAAM,GAAG,GAAG,OAAO,CAAC,UAAU,CAAC,QAAQ,EAAE,CAAC,CAAC,KAAK,CAAC,CA  
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```
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BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for  
the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n\n*\n\nimport {KernelConfig, KernelFunc, MirrorPad, MirrorPadAttrs, MirrorPadInputs} from '@tensorflow/tfjs-  
core';\nimport {BackendWasm} from './backend_wasm';\nimport {CppType} from './types';\n// Must match  
enum in MirrorPad.cc\nenum MirrorPaddingMode {\n reflect
```

```

= 0,\n symmetric = 1\n}\n\nlet wasmMirrorPad: (\n  xId: number, xShapeBytes: Uint8Array, xShapeLength:
number, xDtype: number,\n  prePaddingsBytes: Uint8Array, postPaddingsBytes: Uint8Array, mode: number,\n
outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n  wasmMirrorPad =
backend.wasm.cwrap(MirrorPad, null /* void */, [\n  'number', // xId\n  'array', // x.shape\n  'number', //
x.shape.length\n  'number', // x.dtype\n  'array', // pre-paddings\n  'array', // post-paddings\n  'number', //
mode\n  'number', // outId\n  ]);\n}\n\nfunction mirrorPad(args: {\n  inputs: MirrorPadInputs,\n  backend:
BackendWasm,\n  attrs: MirrorPadAttrs\n}) {\n  const {inputs: {x}, backend, attrs: {paddings, mode}} = args;\n\n
const outShape = paddings.map(\n  (p, i) => p[0] /* beforePad */ + x.shape[i] + p[1] /* afterPad */);\n  const xId =
backend.dataIdMap.get(x.dataId).id;\n  const out = backend.makeOutput(outShape, x.dtype);\n  const outId =
backend.dataIdMap.get(out.dataId).id;\n  const xShapeBytes = new Uint8Array(new
Int32Array(x.shape).buffer);\n\n  const prePaddingsFlat = paddings.map(padTuple => padTuple[0]);\n  const
postPaddingsFlat = paddings.map(padTuple => padTuple[1]);\n  const prePaddingsBytes =\n  new
Uint8Array(new Int32Array(prePaddingsFlat).buffer);\n  const postPaddingsBytes =\n  new Uint8Array(new
Int32Array(postPaddingsFlat).buffer);\n\n  wasmMirrorPad(\n    xId, xShapeBytes, x.shape.length,
CppType[x.dtype], prePaddingsBytes,\n    postPaddingsBytes, MirrorPaddingMode[mode], outId);\n  return
out;\n}\n\nexport const mirrorPadConfig: KernelConfig = {\n  kernelName: MirrorPad,\n  backendName: 'wasm',\n
kernelFunc: mirrorPad as {} as KernelFunc,\n  setupFunc: setup\n};\n"}

```

Found in path(s):

```

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
wasm/dist/kernels/MirrorPad.js.map

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No license file was found, but licenses were detected in source scan.

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AC","sourcesContent":["/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed
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on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
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License.\n
 * =====\n
 */\n\nimport { Abs, KernelConfig } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from
'/unary_kernel';\n\nexport const absConfig: KernelConfig = createUnaryKernelConfig(Abs);\n"}

```

Found in path(s):

```

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
wasm/dist/kernels/Abs.js.map

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No license file was found, but licenses were detected in source scan.

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```


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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

```
=====\n*\n\nimport { backend_util, FusedDepthwiseConv2D, FusedDepthwiseConv2DAttrs,  
FusedDepthwiseConv2DInputs, KernelConfig, KernelFunc, Tensor4D } from '@tensorflow/tfjs-core';\nimport  
{ BackendWasm } from './backend_wasm';\nimport { FusibleActivation } from './types';\n\nlet  
wasmFusedDepthwiseConv2d:\n  (xId: number, batchSize: number, inputHeight: number, inputWidth: number,\n  filterId: number, filterHeight: number, filterWidth: number,\n  biasId: number, padTop: number, padRight:  
number, padBottom: number,\n  padLeft: number, isSamePad: number, dilationHeight: number,\n  dilationWidth: number, strideHeight: number, strideWidth: number,\n  inputChannels: number, outputChannels:  
number, activation: number,\n  preluActivationWeightsId:  
number, leakyreluAlpha: number, outId: number) =>\n  void;\n\nfunction setup(backend: BackendWasm) {\n  wasmFusedDepthwiseConv2d =\n    backend.wasm.cwrap(FusedDepthwiseConv2D, null /* void */, [\n  'number', // xId\n  'number', // batchSize\n  'number', // inputHeight\n  'number', // inputWidth\n  'number', // filterId\n  'number', // filterHeight\n  'number', // filterWidth\n  'number', // biasId\n  'number', // padTop\n  'number', // padRight\n  'number', // padBottom\n  'number', // padLeft\n  'number', // isSamePad\n  'number', // dilationHeight\n  'number', // dilationWidth\n  'number', //  
strideHeight\n  'number', // strideWidth\n  'number', // inputChannels\n  'number', // outputChannels\n  'number', // activation\n  'number', // preluActivationWeightsId\n  'number', // leakyreluAlpha\n  'number',  
  // outId\n  ]);\n\n  function fusedDepthwiseConv2d(args: {\n    inputs: FusedDepthwiseConv2DInputs,\n    backend: BackendWasm,\n    attrs: FusedDepthwiseConv2DAttrs\n  }) {\n    const { inputs, attrs, backend } = args;\n    const { x, filter, bias, preluActivationWeights } = inputs;\n    const {\n      strides,\n      pad,\n      dilations,\n      dataFormat,\n      dimRoundingMode,\n      activation,\n      leakyreluAlpha\n    } = attrs;\n\n    const convInfo =  
      backend_util.computeConv2DInfo(\n        (x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations,\n        pad, dimRoundingMode, true /* depthwise */);\n\n    const fusedActivation =\n      FusibleActivation[activation as {\n        as keyof typeof FusibleActivation\n      }];\n    if (fusedActivation == null) {\n      throw new Error(\n        `${activation}\n        activation not yet supported for FusedDepthwiseConv2D ` +\n        `in the wasm backend.`);\n    }\n\n    const xId =  
      backend.dataIdMap.get(x.dataId).id;\n    const filterId = backend.dataIdMap.get(filter.dataId).id;\n\n    const outputChannels = convInfo.outChannels;\n\n    let biasId = 0;\n    if (bias != null) {\n      const biasData =  
        backend.dataIdMap.get(bias.dataId);\n      if (biasData.shape.length !== 1) {\n        throw new Error(\n          `FusedDepthwiseConv2D only supports rank-1 bias but got ` +\n          `rank ${biasData.shape.length}.`);\n      }\n\n      if (biasData.shape[0] !== outputChannels) {\n        throw new Error(\n          `FusedDepthwiseConv2D bias shape\n          (${biasData.shape}) does not ` +\n          `match the number of output channels (${outputChannels}).`);\n      }\n\n      biasId = biasData.id;\n    }\n\n    const filterHeight = convInfo.filterHeight;\n    const filterWidth =  
      convInfo.filterWidth;\n    const padTop = convInfo.padInfo.top;\n    const padRight = convInfo.padInfo.right;\n    const  
padBottom = convInfo.padInfo.bottom;\n    const padLeft = convInfo.padInfo.left;\n    const dilationHeight =
```

```

convInfo.dilationHeight;\n const dilationWidth = convInfo.dilationWidth;\n const strideHeight =
convInfo.strideHeight;\n
const strideWidth = convInfo.strideWidth;\n const inputChannels = convInfo.inChannels;\n const isSamePad =
convInfo.padInfo.type === 'SAME' ? 1 : 0;\n const batchSize = convInfo.batchSize;\n const inHeight =
convInfo.inHeight;\n const inWidth = convInfo.inWidth;\n\n if (dataFormat !== 'NHWC') {\n throw new Error(\n
`wasm backend FusedDepthwiseConv2D does not support dataFormat: ` +\n ` ${dataFormat}'. Please use
'NHWC'.`);\n }\n\n const out = backend.makeOutput(convInfo.outShape, 'float32');\n const outId =
backend.dataIdMap.get(out.dataId).id;\n const preluActivationWeightsId = preluActivationWeights === null ?\n 0
:\n backend.dataIdMap.get(preluActivationWeights.dataId).id;\n\n wasmFusedDepthwiseConv2d(\n xId,
batchSize, inHeight, inWidth, filterId, filterHeight, filterWidth,\n biasId, padTop, padRight, padBottom, padLeft,
isSamePad, dilationHeight,\n dilationWidth, strideHeight, strideWidth, inputChannels, outputChannels,\n
fusedActivation, preluActivationWeightsId, leakyreluAlpha || 0, outId);\n\n return out;\n}\n\nexport const
fusedDepthwiseConv2DConfig: KernelConfig = {\n kernelName: FusedDepthwiseConv2D,\n backendName:
'wasm',\n setupFunc: setup,\n kernelFunc: fusedDepthwiseConv2d as { } as KernelFunc\n};\n"}

```

Found in path(s):

```

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
wasm/dist/kernels/FusedDepthwiseConv2D.js.map

```

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=====\n
*\n\nimport {FloorDiv, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from
'/binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const floorDivConfig: KernelConfig =\ncreateBinaryKernelConfig(FloorDiv, supportsFullBroadcast);\n\n"]}

```

Found in path(s):

```

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
wasm/dist/kernels/FloorDiv.js.map

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* =====
*/

Found in path(s):

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- *
/opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/BatchToSpaceND.ts
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- *
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- * /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/BatchToSpaceND.d.ts
- * /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Elu.js
- * /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Cosh.ts
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- *
/opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/SpaceToBatchND.d.ts
- * /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Ceil.ts

```

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*
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No license file was found, but licenses were detected in source scan.

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and\n * limitations under the License.\n *
=====
*\nimport {KernelConfig, Sub} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
'/binary_kernel';\nconst supportsFullBroadcast = true;\nexport const subConfig: KernelConfig =\ncreateBinaryKernelConfig(Sub, supportsFullBroadcast);\n"]}

```

Found in path(s):

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* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
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=====\n
*/\n\nimport {backend_util, KernelConfig, KernelFunc, Min, MinAttrs, MinInputs,
TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport
{permuteAxesAndTranspose} from './kernel_utils';\n\nimport {CppType} from './types';\n\nlet wasmMin: (xId:
number, dtype: number, reduceSize: number, outId: number) =>\n  void;\n\nfunction setup(backend:
BackendWasm): void {\n  wasmMin = backend.wasm.cwrap(Min, null /*void*/, [\n    'number', // x_id\n
'number', // dtype\n    'number', // reduce_size\n    'number', // out_id\n  ]);\n\n  function min(args: {backend:
BackendWasm, inputs: MinInputs, attrs: MinAttrs}): \n    TensorInfo {\n    const {backend, inputs, attrs} = args;\n
const {axis, keepDims} = attrs;\n    const {x} = inputs;\n    const xId = backend.dataIdMap.get(x.dataId).id;\n
let\n    inputId = xId;\n    let input = x;\n    const {transposed, axes, originalAxes, inputWasTransposed} =\n
permuteAxesAndTranspose(x, axis, backend);\n\n    if (inputWasTransposed) {\n      const transposedId =
backend.dataIdMap.get(transposed.dataId).id;\n
```



```

    if (transposedId !== xId) {
      // transpose was not a no-op. We will need to dispose of this // once we are
      done.
      input = transposed;
      inputId = transposedId;
    }
    const inputRank = input.shape.length;
    backend_util.assertAxesAreInnerMostDims('min', axes, inputRank);
    const [outShape, reduceShape] =
      backend_util.computeOutAndReduceShapes(input.shape, axes);
    const reduceSize =
      util.sizeFromShape(reduceShape);
    const out = backend.makeOutput(outShape, input.dtype);
    if (util.sizeFromShape(input.shape) !== 0) {
      const outId = backend.dataIdMap.get(out.dataId).id;
      wasmMin(inputId, CppDType[x.dtype], reduceSize, outId);
    }
    if (inputWasTransposed) {
      // dispose of the transposed tensor.
      backend.disposeData(transposed.dataId);
    }
    if (keepDims) {
      // reshape
      const newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);
      out.shape = newShape;
    }
    return out;
  }
  export const minConfig: KernelConfig = {
    kernelName: 'Min',
    backendName: 'wasm',
    setupFunc: setup,
    kernelFunc: min as KernelFunc
  };
}

```

Found in path(s):

```

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
wasm/dist/kernels/Min.js.map

```

No license file was found, but licenses were detected in source scan.

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  the specific language governing permissions and
  limitations under the License.
 */

```

```

=====
*
import {ExpandDims, ExpandDimsAttrs, ExpandDimsInputs, KernelConfig, KernelFunc, util}
from '@tensorflow/tfjs-core';
import {BackendWasm} from '../backend_wasm';
import {reshape} from
'./Reshape';
export function expandDims(args: {
  inputs: ExpandDimsInputs,
  attrs: ExpandDimsAttrs,
  backend: BackendWasm
}) {
  const {inputs, attrs, backend} = args;
  const {input} = inputs;
  const {dim} =
  attrs;
  const inputRank = input.shape.length;
  const newShape = input.shape.slice();
  let $dim = dim;
  if (dim < 0) {
    // Negative value is counted from the tail of rank.
    util.assert(
      -(inputRank + 1) <= dim,
      () => `Axis must be in the interval [${-(inputRank + 1)}, ${inputRank}]`);
    $dim = inputRank + dim
    + 1;
  }
  newShape.splice($dim, 0, 1);
  return reshape({inputs: {x: input}, backend, attrs: {shape:
  newShape}});
}
export const expandDimsConfig: KernelConfig = {
  kernelName: 'ExpandDims',
  backendName: 'wasm',
  kernelFunc: expandDims as KernelFunc
};

```

Found in path(s):

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/ExpandDims.js.map

No license file was found, but licenses were detected in source scan.

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MAAM,CAAC,OAAO,EAAE,CAAC","sourcesContent":["/**\n * @license\n * Copyright 2018 Google LLC. All
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http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*\n\n// Register the wasm backend.\nimport './index';\n\n// tslint:disable-next-line: no-imports-from-dist\nimport
{setTestEnvs} from '@tensorflow/tfjs-core/dist/jasmine_util';\nimport jasmine from
'jasmine';\n\nError.stackTraceLimit = Infinity;\n\nprocess.on('unhandledRejection', e => {\n throw
e;\n});\n\nsetTestEnvs({name: 'wasm-node', backendName: 'wasm', isDataSync: true});\n\nconst runner = new
jasmine({});\n\nrunner.loadConfig({spec_files:
['src/**/*_test.ts'], random: false});\n\nif (process.env.JASMINE_SEED) {\n
runner.seed(process.env.JASMINE_SEED);\n}\n\nrunner.execute();\n\n}]
```

Found in path(s):

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/test_node.js.map

No license file was found, but licenses were detected in source scan.

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C","sourcesContent":["/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under
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License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n
*\n
=====\n
*\n\nimport {Elu, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'./unary_kernel';\n\nexport const eluConfig: KernelConfig = createUnaryKernelConfig(Elu);\n\n}]
```

Found in path(s):

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Elu.js.map

No license file was found, but licenses were detected in source scan.

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License.\n
* =====\n
*\nimport {KernelConfig, Neg} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'/unary_kernel';\nexport const negConfig: KernelConfig = createUnaryKernelConfig(Neg);\n"]}
```

Found in path(s):

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Neg.js.map

No license file was found, but licenses were detected in source scan.

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CAC3C,CAAC","sourcesContent":["/**\n
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n
"]}
```

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```
=====
*\n\nimport { KernelConfig, KernelFunc, NonMaxSuppressionV3, NonMaxSuppressionV3Attrs,
NonMaxSuppressionV3Inputs, TensorInfo } from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from
'./backend_wasm';\n\nimport { parseResultStruct } from './NonMaxSuppression_util';\n\nlet wasmFunc: (\n
boxesId: number, scoresId: number, maxOutputSize: number,\n  iouThreshold: number, scoreThreshold: number)
=> number;\n\nfunction setup(backend: BackendWasm): void {\n  wasmFunc = backend.wasm.cwrap(\n
NonMaxSuppressionV3,\n  'number', // Result*\n  [\n    'number', // boxesId\n    'number', // scoresId\n
    'number', // maxOutputSize\n    'number', // iouThreshold\n    'number', // scoreThreshold\n
  ]);\n\n  function kernelFunc(args: {\n    backend: BackendWasm,\n
  inputs: NonMaxSuppressionV3Inputs,\n  attrs: NonMaxSuppressionV3Attrs\n}): TensorInfo {\n    const { backend,
inputs, attrs } = args;\n    const { iouThreshold, maxOutputSize, scoreThreshold } = attrs;\n    const { boxes, scores } =
inputs;\n    const boxesId = backend.dataIdMap.get(boxes.dataId).id;\n    const scoresId =
backend.dataIdMap.get(scores.dataId).id;\n    const resOffset =\n      wasmFunc(boxesId, scoresId, maxOutputSize,
iouThreshold, scoreThreshold);\n    const { pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs } =\n      parseResultStruct(backend, resOffset);\n    // Since we are not using scores for V3, we have to delete it from the
heap.\n    backend.wasm._free(pSelectedScores);\n    backend.wasm._free(pValidOutputs);\n    const
selectedIndicesTensor =\n      backend.makeOutput([selectedSize], 'int32', pSelectedIndices);\n    return
selectedIndicesTensor;\n  }\n\n  export const nonMaxSuppressionV3Config: KernelConfig = {\n    kernelName:
NonMaxSuppressionV3,\n    backendName: 'wasm',\n
  setupFunc: setup,\n    kernelFunc: kernelFunc as { } as KernelFunc,\n  };\n}
}
```

Found in path(s):

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
wasm/dist/kernels/NonMaxSuppressionV3.js.map

No license file was found, but licenses were detected in source scan.

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```
=====\n*/\n\nimport { CropAndResize, CropAndResizeAttrs, CropAndResizeInputs, KernelConfig, KernelFunc, TensorInfo } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { cast } from './Cast';\n\n// Must match enum in CropAndResize.cc\nenum InterpolationMethod {\n  bilinear = 0,\n  nearest = 1\n}\n\nlet wasmCropAndResize: (\n  imagesId: number, boxesId: number, boxIndId: number, numBoxes: number,\n  imagesShape: Uint8Array, cropHeight: number, cropWidth: number,\n  method: number, extrapolationValue: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n  wasmCropAndResize = backend.wasm.cwrap(CropAndResize, null /*void*/, [\n    'number', // imagesId\n    'number', // boxesId\n    'number', // boxIndId\n    'number', // numBoxes\n    'array', // images shape\n    'number', // cropHeight\n    'number', // cropWidth\n    'number', // method\n    'number', // extrapolation value\n    'number' // out id\n  ]);\n\n  function cropAndResize(args: {\n    backend: BackendWasm,\n    inputs: CropAndResizeInputs,\n    attrs: CropAndResizeAttrs\n  }): TensorInfo {\n    const { backend, inputs, attrs } = args;\n    const { method, extrapolationValue, cropSize } = attrs;\n    const { image, boxes, boxInd } = inputs;\n\n    const numBoxes = boxes.shape[0];\n    const [cropHeight, cropWidth] = cropSize as [number, number];\n    const outShape = [numBoxes, cropHeight, cropWidth, image.shape[3]];\n\n    let imagesData = backend.dataIdMap.get(image.dataId);\n    let castedData;\n    if (image.dtype !== 'float32') {\n      castedData = cast({ backend, inputs: { x: image }, attrs: { dtype: 'float32' } });\n      imagesData = backend.dataIdMap.get(castedData.dataId);\n    }\n\n    const imagesId = imagesData.id;\n    const boxesId = backend.dataIdMap.get(boxes.dataId).id;\n    const boxIndId = backend.dataIdMap.get(boxInd.dataId).id;\n\n    const out = backend.makeOutput(outShape, 'float32');\n    const outId = backend.dataIdMap.get(out.dataId).id;\n\n    const imagesShapeBytes = new Uint8Array(new Int32Array(image.shape).buffer);\n\n    wasmCropAndResize(\n      imagesId, boxesId, boxIndId, numBoxes, imagesShapeBytes, cropHeight,\n      cropWidth,\n      InterpolationMethod[method as {} as keyof typeof InterpolationMethod],\n      extrapolationValue, outId);\n\n    if (castedData !== null) {\n      backend.disposeData(castedData.dataId);\n    }\n\n    return out;\n  }\n\n  export const cropAndResizeConfig: KernelConfig = {\n    kernelName: CropAndResize,\n    backendName: 'wasm',\n    setupFunc: setup,\n    kernelFunc: cropAndResize as {} as KernelFunc\n  };
}
```

Found in path(s):

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```
* =====\n
*\nimport {KernelConfig, Square} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
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Found in path(s):

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```
=====\n*\n\nimport {DepthToSpace, DepthToSpaceAttrs, DepthToSpaceInputs, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmDepthToSpace:\n(xId: number, blockSize: number, channelsLast: number, xStrides: Uint8Array,\n xStridesLength: number, outputShape: Uint8Array, outputStrides: Uint8Array,\n outSize: number, outId: number) => void;\n\nfunction\nsetup(backend: BackendWasm): void {\n  wasmDepthToSpace = backend.wasm.cwrap(DepthToSpace, null\n/*void*/, [\n    'number', // xId\n    'number', // blockSize\n    'number', // channelsLast\n    'array', // xStrides\n    'number', // xStridesLength\n    'array', // outputShape\n    'array', // outputStrides\n    'number', // outSize\n    'number',\n    // outId\n  ]);\n}\n\nexport function depthToSpace(args: {\n  backend: BackendWasm,\n  inputs: DepthToSpaceInputs,\n  attrs: DepthToSpaceAttrs\n}): TensorInfo {\n  const {backend, inputs, attrs} = args;\n  const {x} = inputs;\n  const {blockSize, dataFormat} = attrs;\n\n  const batchSize = x.shape[0];\n  const inputHeight = (dataFormat === 'NHWC') ? x.shape[1] : x.shape[2];\n  const inputWidth = (dataFormat === 'NHWC') ? x.shape[2] : x.shape[3];\n  const inputDepth = (dataFormat === 'NHWC') ? x.shape[3] : x.shape[1];\n  const outputHeight = inputHeight * blockSize;\n  const outputWidth = inputWidth * blockSize;\n  const outputDepth = inputDepth / (blockSize * blockSize);\n\n  const outputShape = (dataFormat === 'NHWC') ?\n    [batchSize, outputHeight, outputWidth, outputDepth] :\n    [batchSize, outputDepth, outputHeight, outputWidth];\n\n  const out = backend.makeOutput(outputShape, 'float32');\n  const xData = backend.dataIdMap.get(x.dataId);\n  const xId = xData.id;\n  const\n  xStridesBytes =\n    new Uint8Array(new Int32Array(util.computeStrides(x.shape)).buffer);\n  const\n  outputShapeBytes = new Uint8Array(new Int32Array(outputShape).buffer);\n  const outStridesBytes =\n    new\n    Uint8Array(new Int32Array(util.computeStrides(outputShape)).buffer);\n  const outId =\n    backend.dataIdMap.get(out.dataId).id;\n  const channelsLast = dataFormat === 'NHWC' ? 1 : 0;\n\n  wasmDepthToSpace(\n    xId, blockSize, channelsLast, xStridesBytes, x.shape.length - 1,\n    outputShapeBytes, outStridesBytes, outputShape.length, outId);\n\n  return out;\n}\n\nexport const depthToSpaceConfig: KernelConfig\n= {\n  kernelName: DepthToSpace,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: depthToSpace as\n  {} as KernelFunc\n};\n\n"]}
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Found in path(s):

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the specific language governing permissions and\n * limitations under the License.\n *

```
=====\n*/\n\nimport {KernelConfig, KernelFunc, slice_util, StridedSlice, StridedSliceAttrs,  
StridedSliceInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from  
 './backend_wasm';\nimport {reshape} from './Reshape';\nimport {slice} from './Slice';\n\nlet wasmStridedSlice: (\n  xId: number, xStridesBytes: Uint8Array, xRank: number,\n  beginBytes: Uint8Array, endBytes: Uint8Array,  
  stridesBytes: Uint8Array,\n  outShapeBytes: Uint8Array, outStridesBytes: Uint8Array,\n  outShapeLength:  
  number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n  wasmStridedSlice =  
  backend.wasm.cwrap(StridedSlice, null /*void*/, [\n    'number', // xId\n    'array', // xStrides\n    'number', //  
  xRank\n    'array', // beginBytes\n    'array', // endBytes\n    'array', // stridesBytes\n    'array', // outShapeBytes\n    'array', // outStridesBytes\n    'number', // outShapeLength\n    'number', // outId\n  ]);\n}\n\nexport function
```



```

stridedSlice(args: {\n backend: BackendWasm,\n inputs: StridedSliceInputs,\n
attrs: StridedSliceAttrs\n}): TensorInfo {\n const {backend, inputs, attrs} = args;\n const {x} = inputs;\n\n const
{\n begin,\n end,\n strides,\n beginMask,\n endMask,\n ellipsisMask,\n newAxisMask,\n
shrinkAxisMask\n } = attrs;\n\n const {\n finalShapeSparse,\n finalShape,\n isIdentity,\n sliceDim0,\n
isSimpleSlice,\n begin: $begin,\n end: $end,\n strides: $strides\n } =\n slice_util.sliceInfo(\n x.shape,
begin, end, strides, beginMask, endMask, ellipsisMask,\n newAxisMask, shrinkAxisMask);\n\n let result;\n\n
if (isIdentity) {\n // Optimization #1, slice is a no-op plus reshape\n result = reshape({inputs: {x}, backend, attrs:
{shape: finalShape}});\n } else if (sliceDim0 || isSimpleSlice) {\n // Optimization #2, slice is memory contiguous
(only occurs in dim 0)\n util.assert(\n x.shape.length >= 1,\n () => `Input must have rank at least 1, got:
${x.shape.length}`);\n\n const
size = slice_util.computeOutShape($begin, $end, $strides);\n // To tolerate begin[0] > end[0] (a 0-output slice),
we min(begin, end).\n const sliced = slice({inputs: {x}, backend, attrs: {begin: $begin, size}});\n result =\n
reshape({inputs: {x: sliced}, backend, attrs: {shape: finalShape}});\n backend.disposeData(sliced.dataId);\n } else
{\n const out = backend.makeOutput(finalShapeSparse, 'float32');\n\n const xId =
backend.dataIdMap.get(x.dataId).id;\n const xStridesBytes =\n new Uint8Array(new
Int32Array(util.computeStrides(x.shape)).buffer);\n const beginBytes = new Uint8Array(new
Int32Array($begin).buffer);\n const endBytes = new Uint8Array(new Int32Array($end).buffer);\n const
stridesBytes = new Uint8Array(new Int32Array($strides).buffer);\n const outputShapeBytes =\n new
Uint8Array(new Int32Array(finalShapeSparse).buffer);\n const outStridesBytes = new Uint8Array(\n new
Int32Array(util.computeStrides(finalShapeSparse)).buffer);\n\n
const outId = backend.dataIdMap.get(out.dataId).id;\n\n wasmStridedSlice(\n xId, xStridesBytes,
x.shape.length, beginBytes, endBytes, stridesBytes,\n outputShapeBytes, outStridesBytes,
finalShapeSparse.length, outId);\n\n result = reshape({inputs: {x: out}, backend, attrs: {shape: finalShape}});\n\n
backend.disposeData(out.dataId);\n }\n\n return result;\n}\n\nexport const stridedSliceConfig: KernelConfig = {\n
kernelName: StridedSlice,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: stridedSlice as {} as
KernelFunc\n};\n"}

```

Found in path(s):

```

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
wasm/dist/kernels/StridedSlice.js.map

```

No license file was found, but licenses were detected in source scan.

```

{"version":3,"file":"tf-backend-
wasm.es2017.min.js","sources":["../src/kernels/types.ts","../src/kernels/_FusedMatMul.ts","../src/kernels/unary_kern
el.ts","../src/kernels/Abs.ts","../src/kernels/binary_kernel.ts","../src/kernels/Add.ts","../src/kernels/AddN.ts","../src/ke
rnels/Identity.ts","../src/kernels/Transpose.ts","../src/kernels/kernel_utils.ts","../src/kernels/All.ts","../src/kernels/Any
.ts","../src/kernels/ArgMax.ts","../src/kernels/AvgPool.ts","../src/kernels/Reshape.ts","../src/kernels/BatchMatMul.ts"
,"../node_modules/@tensorflow/tfjs-backend-
cpu/dist/kernels/Slice.js","../src/kernels/Slice.ts","../src/kernels/BatchToSpaceND.ts","../src/kernels/Cast.ts","../src/k
ernels/Ceil.ts","../src/kernels/ClipByValue.ts","../src/kernels/Concat.ts","../node_modules/@tensorflow/tfjs-
backend-
cpu/dist/kernels/Concat_impl.js","../src/kernels/Conv2D.ts","../src/kernels/Conv2DBackpropInput.ts","../src/kernels/
Cos.ts","../src/kernels/Cosh.ts","../src/kernels/CropAndResize.ts","../src/kernels/Cumsum.ts","../src/kernels/DepthTo
Space.ts","../src/kernels/DepthwiseConv2dNative.ts","../src/kernels/Elu.ts","../src/kernels/Equal.ts","../src/kernels/E
xp.ts","../src/kernels/ExpandDims.ts","../src/kernels/Fill.ts","../src/kernels/FlipLeftRight.ts","../src/kernels/Floor.ts","
../src/kernels/FloorDiv.ts","../src/kernels/FusedBatchNorm.ts","../src/kernels/FusedConv2D.ts","../src/kernels/Fused
DepthwiseConv2D.ts","../src/kernels/GatherNd.ts","../src/kernels/GatherV2.ts","../src/kernels/Greater.ts","../src/kern
els/GreaterEqual.ts","../src/kernels/LeakyRelu.ts","../src/kernels/Less.ts","../src/kernels/LessEqual.ts","../src/kernels/

```

```

Log.ts", "../src/kernels/LogicalAnd.ts", "../src/kernels/Max.ts", "../src/kernels/Maximum.ts", "../src/kernels/MaxPool.ts",
"../src/kernels/Mean.ts", "../src/kernels/Min.ts", "../src/kernels/Minimum.ts", "../src/kernels/MirrorPad.ts", "../src/kern
els/Multiply.ts", "../src/kernels/Neg.ts", "../src/kernels/NonMaxSuppression_util.ts", "../src/kernels/NonMaxSuppression
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"../src/kernels/OneHot.ts", "../src/kernels/OnesLike.ts", "../src/kernels/Pack.ts", "../src/kernels/PadV2.ts", "../src/k
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w/tfjs-backend-
cpu/dist/kernels/Range_impl.js", "../src/kernels/RealDiv.ts", "../src/kernels/Relu.ts", "../src/kernels/Relu6.ts", "../src/kern
els/ResizeBilinear.ts", "../src/kernels/Reverse.ts", "../src/kernels/RotateWithOffset.ts", "../src/kernels/Round.ts", "../sr
c/kernels/Rsqrt.ts", "../src/kernels/ScatterNd.ts", "../src/kernels/Select.ts", "../src/kernels/Sigmoid.ts", "../src/kernels/Sin
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../src/kernels/Sub.ts", "../src/kernels/Sum.ts", "../src/kernels/Tan.ts", "../src/kernels/Tanh.ts", "../src/kernels/Tile.ts", "../sr
c/kernels/TopK.ts", "../src/kernels/Transform.ts", "../src/kernels/Unpack.ts", "../src/kernels/ZerosLike.ts", "../src/registre
r_all_kernels.ts", "../src/flags_wasm.ts", "../wasm-out/tfjs-backend-wasm-threaded-simd.js", "../wasm-out/tfjs-
backend-wasm.js", "../src/backend_wasm.ts", "../wasm-out/tfjs-backend-wasm-threaded-
simd.worker.js", "../src/base.ts", "../src/version.ts"], "sourcesContent": ["/**\n
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WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\n// This enum must align with the enum defined in cc/backend.h.\nexport enum CppDType {\n float32 = 0,\n
int32 = 1,\n bool = 2,\n string = 3,\n complex64 = 4\n}\n\n// Must match enum in cc/fusable_activations.h.\nexport
enum FusableActivation {\n linear = 0,\n relu = 1,\n relu6 = 2,\n prelu = 3,\n leakyrelu = 4,\n sigmoid = 5,\n elu
= 6\n}\n", /**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache
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* distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR
CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing
permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport { _FusedMatMul, _FusedMatMulAttrs, _FusedMatMulInputs, KernelConfig, KernelFunc } from
'@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport { FusableActivation } from
'./types';\n\nlet wasmFusedMatMul: (\n  aId: number, aShape: Uint8Array, aShapeSize: number, bId: number,\n
bShape: Uint8Array, bShapeSize: number, transposeA: boolean,\n  transposeB: boolean, activation: number,\n
biasId: number,\n  preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>\n
void;\n\nfunction setup(backend: BackendWasm) {\n  wasmFusedMatMul = backend.wasm.cwrap(_FusedMatMul,\n
null /* void */, [\n
  'number', // a_id\n  'array', // a_shape\n  'number', // a_shape.length\n  'number', // b_id\n  'array', //
b_shape\n  'number', // b_shape.length\n  'number', // transpose_a\n  'number', // transpose_b\n  'number', //
activation\n  'number', // biasId\n  'number', // preluActivationWeightsId\n  'number', // leakyreluAlpha\n
'number' // out_id\n ];\n}\n\nfunction fusedBatchMatMul(args: {\n inputs: _FusedMatMulInputs,\n backend:
BackendWasm,\n attrs: _FusedMatMulAttrs\n}) {\n  const { inputs, backend, attrs } = args;\n  const { a, b, bias,

```

```

preluActivationWeights} = inputs;\n\n if (a.dtype !== 'float32' || b.dtype !== 'float32') {\n  throw new Error(\n
`_FusedMatMul for non non-float32 tensors not yet supported.`);\n }\n\n const {transposeA, transposeB,
activation, leakyreluAlpha} = attrs;\n const aId = backend.dataIdMap.get(a.dataId).id;\n const bId =
backend.dataIdMap.get(b.dataId).id;\n\n let biasId = 0;\n if (bias !== null)
{\n  const biasData = backend.dataIdMap.get(bias.dataId);\n  if (biasData.shape.length !== 1) {\n  throw new
Error(\n    `_FusedMatMul only supports rank-1 bias but got ` +\n    `rank ${biasData.shape.length}.`);\n
}\n  biasId = biasData.id;\n }\n\n const preluActivationWeightsId = preluActivationWeights === null ?\n  0 :\n  backend.dataIdMap.get(preluActivationWeights.dataId).id;\n\n const fusedActivation =\n  FusableActivation[activation as {} as keyof typeof FusableActivation];\n  if (fusedActivation === null) {\n  throw
new Error(\n    `${activation} activation not yet supported for FusedConv2D ` +\n    `in the wasm backend.`);\n
}\n\n const leftDim = transposeA ? a.shape[2] : a.shape[1];\n const rightDim = transposeB ? b.shape[1] :
b.shape[2];\n const batchDim = a.shape[0];\n\n const out = backend.makeOutput([batchDim, leftDim, rightDim],
a.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const aShapeBytes = new
  Uint8Array(new Int32Array(a.shape).buffer);\n  const bShapeBytes = new Uint8Array(new
  Int32Array(b.shape).buffer);\n\n  wasmFusedMatMul(\n    aId, aShapeBytes, a.shape.length, bId, bShapeBytes,
  b.shape.length,\n    transposeA, transposeB, fusedActivation, biasId, preluActivationWeightsId,\n
  leakyreluAlpha || 0, outId);\n\n  return out;\n}\n\nexport const fusedMatMulConfig: KernelConfig = {\n
kernelName: '_FusedMatMul',\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: fusedBatchMatMul as
{} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT
WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {DataType, KernelConfig, TensorInfo, UnaryInputs, util} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from '../backend_wasm';\n\nimport {CppType} from './types';\n\nexport function
createUnaryKernelConfig(\n  kernelName: string, outType?: DataType): KernelConfig {\n  let wasmFunc: (xId:
number, dtype: number, outId: number) => void;\n\n  function setupFunc(backend: BackendWasm): void {\n
wasmFunc = backend.wasm.cwrap(kernelName, null /* void */, [\n  'number', // x_id\n  'number', // dtype\n
'number', // out_id\n  ]);\n }\n\n  function kernelFunc(args: {backend: BackendWasm, inputs: UnaryInputs});\n
TensorInfo {\n  const {backend, inputs: {x}} = args;\n  const xId = backend.dataIdMap.get(x.dataId).id;\n
  const out = backend.makeOutput(x.shape, outType || x.dtype);\n  const outId =
  backend.dataIdMap.get(out.dataId).id;\n\n  // Short-circuit zero-sized tensors.\n  if (util.sizeFromShape(out.shape)
=== 0) {\n  return out;\n }\n\n  wasmFunc(xId, CppDType[x.dtype], outId);\n  return out;\n }\n\n  return
{kernelName, backendName: 'wasm', setupFunc, kernelFunc};\n}\n\n"/**\n * @license\n * Copyright 2019 Google
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use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions
and\n * limitations under the License.\n *
=====\n
*/\n\nimport {Abs, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'/unary_kernel';\n\nexport const absConfig: KernelConfig = createUnaryKernelConfig(Abs);\n\n"/**\n * @license\n
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```

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```
=====\n*\n\nimport { backend_util, BinaryInputs, DataType, KernelConfig, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport { CppDType } from './types';\nexport function createBinaryKernelConfig(\n  kernelName: string, supportsFullBroadcast: boolean,\n  dtype?: DataType): KernelConfig {\n  let wasmFunc: (\n    aId: number, aShape: Uint8Array, aShapeLen: number, bId: number,\n    bShape: Uint8Array, bShapeLen: number, dtype: number, outId: number) =>\n    void;\n\n  function setupFunc(backend: BackendWasm): void {\n    wasmFunc = backend.wasm.cwrap(kernelName, null /* void *, [\n      'number', // a_id,\n      'array', // a_shape\n      'number', // a_shape.length\n      'number', // b_id\n      'array', // b_shape\n      'number', // b_shape.length\n      'number', // dtype\n      'number' // out_id\n    ]);\n  }\n\n  function kernelFunc(args: { backend: BackendWasm, inputs: BinaryInputs }):\n    TensorInfo {\n    const { backend, inputs } = args;\n    const { a, b } = inputs;\n    const aId = backend.dataIdMap.get(a.dataId).id;\n    const bId = backend.dataIdMap.get(b.dataId).id;\n    const outputType = dtype != null ? dtype : a.dtype;\n    const newShape = backend_util.assertAndGetBroadcastShape(a.shape, b.shape);\n    const out = backend.makeOutput(newShape, outputType);\n    // Short-circuit zero-sized tensors.\n    if (util.sizeFromShape(newShape) === 0) {\n      return out;\n    }\n    const aShapeBytes = new Uint8Array(new Int32Array(a.shape).buffer);\n    const bShapeBytes = new Uint8Array(new Int32Array(b.shape).buffer);\n    const outId = backend.dataIdMap.get(out.dataId).id;\n    const kernelFunc = () => wasmFunc(\n      aId, aShapeBytes, a.shape.length, bId, bShapeBytes, b.shape.length,\n      CppDType[a.dtype], outId);\n    // Currently only some float operations support full broadcast.\n    if (supportsFullBroadcast && a.dtype === 'float32') {\n      kernelFunc();\n      return out;\n    }\n    const aBroadcastDims = backend_util.getBroadcastDims(a.shape, newShape);\n    const bBroadcastDims = backend_util.getBroadcastDims(b.shape, newShape);\n    const loopsOverAllOfA = aBroadcastDims.every((v, i) => v === i);\n    const loopsOverAllOfB = bBroadcastDims.every((v, i) => v === i);\n    if (loopsOverAllOfA && loopsOverAllOfB) {\n      kernelFunc();\n      return out;\n    } else {\n      throw new Error(\n        `Broadcasting along outer dims is not yet ` +\n        `supported for ${a.dtype} ${kernelName}.`);\n    }\n  }\n\n  return {\n    kernelName, backendName: 'wasm', setupFunc, kernelFunc;\n  };\n}\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport { Add, KernelConfig } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from './binary_kernel';\nconst supportsFullBroadcast = true;\nexport const addConfig: KernelConfig =\n  createBinaryKernelConfig(Add, supportsFullBroadcast);\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```

*\n\nimport {AddN, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from './backend_wasm';\n\nimport {CppType} from './types';\n\nlet wasmFunc:\n (inputIds:
Uint8Array, inputIdsLen: number, dtype: number, outId: number) =>\n    void;\n\nfunction setupFunc(backend:
BackendWasm): void {\n    wasmFunc = backend.wasm.cwrap(AddN, null /* void */, [\n    'array', // input_ids\n
'number', // input_ids.length\n    'number', // dtype\n    'number', // out_id\n    ]);\n\nfunction addn(args: {inputs:
TensorInfo[], backend: BackendWasm}) {\n    const
[inputIds, backend] = args;\n    const out = backend.makeOutput(inputIds[0].shape, inputIds[0].dtype);\n\n    // Short-circuit
zero-sized tensors.\n    if (util.sizeFromShape(out.shape) === 0) {\n        return out;\n    }\n\n    const inputIds =
inputIds.map(x => backend.dataIdMap.get(x.dataId).id);\n    const inputIdsBytes = new Uint8Array(new
Int32Array(inputIds).buffer);\n    const outId = backend.dataIdMap.get(out.dataId).id;\n    wasmFunc(inputIdsBytes,
inputIds.length, CppDType[out.dtype], outId);\n\n    return out;\n\n}\n\nexport const addNConfig: KernelConfig = {\n
kernelName: AddN,\n    backendName: 'wasm',\n    setupFunc,\n    kernelFunc: addn as {} as KernelFunc,\n};\n\n"/**\n
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or agreed to in writing, software\n    * distributed under the License is distributed on an "AS IS" BASIS,\n    *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n    * See the License for
the specific language governing permissions and\n    * limitations under the License.\n    *
=====\n
*\n\nimport {Identity, IdentityInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\n\nimport
{TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nexport function
identity(args: {inputs: IdentityInputs, backend: BackendWasm}):\n    TensorInfo {\n    const {inputs: {x}, backend} =
args;\n    const out = backend.makeOutput(x.shape, x.dtype);\n    const inVals = backend.typedArrayFromHeap(x);\n
const outVals = backend.typedArrayFromHeap(out);\n    outVals.set(inVals);\n    return out;\n}\n\nexport const
identityConfig: KernelConfig = {\n    kernelName: Identity,\n    backendName: 'wasm',\n
kernelFunc: identity as {} as KernelFunc,\n};\n\n"/**\n
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Reserved.\n    * Licensed under the Apache License, Version 2.0 (the "License");\n    * you may not use this file
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OR CONDITIONS OF ANY KIND, either express or implied.\n    * See the License for the specific language
governing permissions and\n    * limitations under the License.\n    *
=====\n
*\n\nimport {KernelConfig, KernelFunc, TensorInfo, Transpose, TransposeAttrs, TransposeInputs} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {identity} from
'./Identity';\n\nimport
{CppType} from './types';\n\nlet wasmTranspose: (\n    xId: number, xShape: Uint8Array, xShapeLength:
number, dtype: CppDType,\n    outId: number, perm: Uint8Array, permLength: number) => void;\n\nfunction
setup(backend: BackendWasm) {\n    wasmTranspose = backend.wasm.cwrap(Transpose, null /* void */, [\n
'number', // xId\n    'array', // x.shape\n    'number', // x.shape.length\n    'number', // dtype\n    'number', // outId\n
'array', // perm\n    'number', // perm.length\n    ]);\n\nexport function transpose(\n    args:\n        {inputs:
TransposeInputs, backend: BackendWasm, attrs: TransposeAttrs});\n    TensorInfo {\n    const {inputs, backend,
attrs} = args;\n    // Reduce any dimensions with size one. Lower-rank transpose kernel performs\n    // better due to
simpler memory access pattern.\n    const [reducedShape, perm] = removeOneSizeDims(inputs.x.shape,
attrs.perm);\n\n    let permIsNoOp = true;\n    for (let i = 0; i < perm.length; i++) {\n        if (perm[i] !== i) {\n
permIsNoOp = false;\n        }\n    }\n    const outShape = computeOutShape(inputs.x.shape, attrs.perm);\n    const x = {\n
dataId: inputs.x.dataId,\n    shape: reducedShape,\n    dtype: inputs.x.dtype\n    };\n\n    if (permIsNoOp) {\n    const

```

```

cloned = identity({inputs, backend});\n  cloned.shape = outShape;\n  return cloned;\n }\n\n const out =
backend.makeOutput(outShape, x.dtype);\n const xId = backend.dataIdMap.get(x.dataId).id;\n const outId =
backend.dataIdMap.get(out.dataId).id;\n const permBytes = new Uint8Array(new Int32Array(perm).buffer);\n
const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n\n wasmTranspose(\n  xId,
xShapeBytes, x.shape.length, CppDType[x.dtype], outId, permBytes,\n  perm.length);\n return
out;\n}\n\nfunction computeOutShape(inShape: number[], perm: number[]): number[] {\n  const outShape = new
Array(inShape.length);\n  for (let i = 0; i < outShape.length; i++) {\n    outShape[i] = inShape[perm[i]];\n  }\n
return outShape;\n}\n\nfunction
removeOneSizeDims(\n  shape: number[], perm: number[]): [number[], number[]] {\n  const newShape: number[]
= [];\n  const newPerm: number[] = [];\n  for (let i = 0; i < shape.length; ++i) {\n    if (shape[i] !== 1) {\n
newShape.push(shape[i]);\n    }\n    if (shape[perm[i]] !== 1) {\n      newPerm.push(perm[i]);\n    }\n  }\n  for (let i =
0; i < newPerm.length; ++i) {\n    let minValIdx = -1;\n    for (let j = 0; j < newPerm.length; ++j) {\n      if
(newPerm[j] >= i &&\n      (minValIdx === -1 || newPerm[minValIdx] > newPerm[j])) {\n        minValIdx = j;\n
      }\n    }\n    newPerm[minValIdx] = i;\n  }\n  return [newShape, newPerm];\n}\n\nexport const transposeConfig:
KernelConfig = {\n  kernelName: Transpose,\n  backendName: 'wasm',\n  kernelFunc: transpose as {} as
KernelFunc,\n  setupFunc: setup,\n};\n\n", "/*\n * @license\n * Copyright 2020 Google Inc. All Rights Reserved.\n *
Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use
this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
\n\n
=====\n
*\n\nimport {backend_util, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from
'./backend_wasm';\nimport {transpose} from './Transpose';\n\n/**\n * Compute permutation axes and do a transpose
if necessary.\n * Used by reduction ops.\n * @param x input TensorInfo\n * @param axis reduction axes\n *
@param backend wasm backend instance\n */\nexport function permuteAxesAndTranspose(\n  x: TensorInfo,
axis:
number|number[], backend: BackendWasm): {\n  transposed: TensorInfo|null,\n  axes: number[],\n  originalAxes:
number[],\n  inputWasTransposed: boolean\n} {\n  const xShape = x.shape;\n  const xRank = x.shape.length;\n
const originalAxes = util.parseAxisParam(axis, xShape);\n  let axes = originalAxes;\n  const permutedAxes =
backend_util.getAxesPermutation(axes, xRank);\n  let xTransposed = null;\n  let inputWasTransposed = false;\n  if
(permutedAxes !== null) {\n    const newShape: number[] = new Array(xRank);\n    for (let i = 0; i <
newShape.length; i++) {\n      newShape[i] = xShape[permutedAxes[i]];\n    }\n    axes =
backend_util.getInnerMostAxes(axes.length, xRank);\n    xTransposed =\n      transpose({inputs: {x}, attrs: {perm:
permutedAxes}, backend});\n\n    const xId = backend.dataIdMap.get(x.dataId).id;\n    const transposedId =
backend.dataIdMap.get(xTransposed.dataId).id;\n    if (transposedId !== xId) {\n      inputWasTransposed = true;\n
    }\n  }\n  return {transposed:
xTransposed, originalAxes, axes, inputWasTransposed};\n}\n\n", "/*\n * @license\n * Copyright 2021 Google LLC.
All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
\n\n
=====\n
*\n\nimport {All, AllAttrs, AllInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util} from
'@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport

```

```

{permuteAxesAndTranspose}
from './kernel_utils';\n\nlet wasmAll: (xId: number, reduceSize: number, outId: number) => void;\n\nfunction
setup(backend: BackendWasm): void {\n  wasmAll = backend.wasm.cwrap(All, null /*void*/, ['number, number,
number']);\n}\n\nfunction all(args: {backend: BackendWasm, inputs: AllInputs, attrs: AllAttrs}):\n  TensorInfo {\n  const {backend, inputs, attrs} = args;\n  const {axis, keepDims} = attrs;\n  const {x} = inputs;\n  const xId =
backend.dataIdMap.get(x.dataId).id;\n  let inputId = xId;\n  let input = x;\n\n  const {transposed, axes, originalAxes,
inputWasTransposed} =\n    permuteAxesAndTranspose(x, axis, backend);\n\n  if (inputWasTransposed) {\n
const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n  input = transposed;\n  inputId =
transposedId;\n  }\n\n  const inputRank = input.shape.length;\n  backend_util.assertAxesAreInnerMostDims('all',
axes, inputRank);\n  const [outShape, reduceShape] =\n  backend_util.computeOutAndReduceShapes(input.shape,
axes);\n  const reduceSize = util.sizeFromShape(reduceShape);\n\n  const out = backend.makeOutput(outShape,
x.dtype);\n  if (util.sizeFromShape(input.shape) !== 0) {\n    const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmAll(inputId, reduceSize, outId);\n  }\n\n  if (inputWasTransposed) {\n    // dispose of the transposed tensor.\n
backend.disposeData(transposed.dataId);\n  }\n\n  if (keepDims) {\n    // reshape\n    const newShape =
backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n    out.shape = newShape;\n  }\n\n  return
out;\n}\n\nexport const allConfig: KernelConfig = {\n  kernelName: All,\n  backendName: 'wasm',\n  setupFunc:
setup,\n  kernelFunc: all as {} as KernelFunc\n};\n\n", "/**\n * @license\n * Copyright 2021 Google LLC. All Rights
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http://www.apache.org/licenses/LICENSE-2.0\n
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distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *
=====\n
*/\n\nimport {Any, AnyAttrs, AnyInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport
{permuteAxesAndTranspose} from './kernel_utils';\n\nlet wasmAny: (xId: number, reduceSize: number, outId:
number) => void;\n\nfunction setup(backend: BackendWasm): void {\n  wasmAny = backend.wasm.cwrap(Any,
null /*void*/, ['number, number, number']);\n}\n\nfunction any(args: {backend: BackendWasm, inputs: AnyInputs,
attrs: AnyAttrs}):\n  TensorInfo {\n  const {backend,
inputs, attrs} = args;\n  const {axis, keepDims} = attrs;\n  const {x} = inputs;\n  const xId =
backend.dataIdMap.get(x.dataId).id;\n  let inputId = xId;\n  let input = x;\n\n  const {transposed, axes, originalAxes,
inputWasTransposed} =\n    permuteAxesAndTranspose(x, axis, backend);\n\n  if (inputWasTransposed) {\n
const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n  input = transposed;\n  inputId =
transposedId;\n  }\n\n  const inputRank = input.shape.length;\n  backend_util.assertAxesAreInnerMostDims('any',
axes, inputRank);\n  const [outShape, reduceShape] =\n  backend_util.computeOutAndReduceShapes(input.shape, axes);\n  const reduceSize =
util.sizeFromShape(reduceShape);\n\n  const out = backend.makeOutput(outShape, x.dtype);\n  if
(util.sizeFromShape(input.shape) !== 0) {\n    const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmAny(inputId, reduceSize, outId);\n  }\n\n  if (inputWasTransposed) {\n    // dispose of the transposed tensor.\n
backend.disposeData(transposed.dataId);\n  }\n\n  if (keepDims) {\n    // reshape\n    const newShape =
backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n    out.shape = newShape;\n  }\n\n  return
out;\n}\n\nexport const anyConfig: KernelConfig = {\n  kernelName: Any,\n  backendName: 'wasm',\n  setupFunc:
setup,\n  kernelFunc: any as {} as KernelFunc\n};\n\n", "/**\n * @license\n * Copyright 2019 Google LLC. All Rights
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```

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```
=====  
*  
\nimport { ArgMax, ArgMaxAttrs, ArgMaxInputs, KernelConfig, KernelFunc, util } from '@tensorflow/tfjs-core';  
\nimport { BackendWasm } from '../backend_wasm';  
\nimport { permuteAxesAndTranspose } from './kernel_utils';  
\nimport { CppDType } from './types';  
\nlet wasmFunc: (\n  xId: number, dtype: number, outerSize: number, innerSize: number, outId: number) => void;  
\nfunction setup(backend: BackendWasm) {\n  wasmFunc = backend.wasm.cwrap(ArgMax, null /* void */, [\n    'number', // x_id\n    'number', // dtype\n    'number', // outer_size\n    'number', // inner_size\n    'number' // out_id\n  ]);\n}\nfunction argmax(\n  args: { inputs: ArgMaxInputs, backend: BackendWasm, attrs: ArgMaxAttrs }) {\n  const { backend, inputs, attrs } = args;  
  const { axis } = attrs as {} as ArgMaxAttrs;  
  const { x } = inputs as {} as ArgMaxInputs;  
  const xId = backend.dataIdMap.get(x.dataId).id;  
  let inputId = xId;  
  let input = x;\n  const { transposed, axes, inputWasTransposed } =\n    permuteAxesAndTranspose(x, axis, backend);\n  if (inputWasTransposed) {\n    const transposedId = backend.dataIdMap.get(transposed.dataId).id;  
    if (transposedId !== xId) {\n      // transpose was not a no-op. We will need to dispose of this\n      // once we are done.\n      input = transposed;\n      inputId = transposedId;\n    }\n  }\n  const outShape = input.shape.slice(0, -1);\n  const out = backend.makeOutput(outShape, 'int32');\n  const outId = backend.dataIdMap.get(out.dataId).id;\n  const outerSize = util.sizeFromShape(out.shape);\n  const innerSize = input.shape[axes[0]];\n  wasmFunc(inputId, CppDType[input.dtype], outerSize, innerSize, outId);\n  if (inputWasTransposed) {\n    // dispose of the transposed tensor.\n    backend.disposeData(transposed.dataId);\n  }\n  return out;\n}\nexport const argMaxConfig: KernelConfig = {\n  kernelName: ArgMax,\n  backendName: 'wasm',\n  kernelFunc: argmax as {} as KernelFunc,\n  setupFunc: setup\n};  
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 */
```

```
=====  
*  
\nimport { AvgPool, AvgPoolAttrs, AvgPoolInputs, backend_util, KernelConfig, KernelFunc, Tensor4D } from '@tensorflow/tfjs-core';  
\nimport { BackendWasm } from '../backend_wasm';  
\nlet wasmAvgPool: (\n  xId: number, batchSize: number, inputHeight: number, inputWidth: number, filterHeight: number, filterWidth: number, padTop: number, padRight: number, padBottom: number, padLeft: number, strideHeight: number, strideWidth: number, channels: number, outId: number) => void;  
\nfunction setup(backend: BackendWasm) {\n  wasmAvgPool = backend.wasm.cwrap(AvgPool, null /* void */, [\n    'number', // xId\n    'number', // batchSize\n    'number', // inputHeight\n    'number', // inputWidth\n    'number', // filterHeight\n    'number', // filterWidth\n    'number', // padTop\n    'number', // padRight\n    'number', // padBottom\n    'number', // padLeft\n    'number', // strideHeight\n    'number', // strideWidth\n    'number', // channels\n    'number', // outId\n  ]);\n}\nfunction avgPool(\n  args: { inputs: AvgPoolInputs, backend: BackendWasm, attrs: AvgPoolAttrs }) {\n  const { inputs, attrs, backend } = args;\n  const x = inputs.x as Tensor4D;\n  const xId = backend.dataIdMap.get(x.dataId).id;\n  const { filterSize, strides, pad, dimRoundingMode } = attrs;\n  const convInfo = backend_util.computePool2DInfo(\n    x.shape, filterSize, strides, 1 /* dilations */, pad, dimRoundingMode);\n  const filterHeight = convInfo.filterHeight;\n  const filterWidth = convInfo.filterWidth;\n  const padTop = convInfo.padInfo.top;\n  const padRight = convInfo.padInfo.right;\n  const padBottom =
```



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convInfo.padInfo.bottom;\n const padLeft = convInfo.padInfo.left;\n const strideHeight = convInfo.strideHeight;\n
const strideWidth = convInfo.strideWidth;\n const channels = convInfo.inChannels;\n\n if (convInfo.dataFormat
!== 'channelsLast') {\n   throw new Error(\n     `wasm backend does not support dataFormat:` +\n
`${convInfo.dataFormat}'. Please use 'channelsLast'.`);\n } \n\n if (convInfo.dilationWidth !== 1 ||
convInfo.dilationHeight !== 1) {\n   throw new Error(\n     `wasm backend only supports average pooling with
dilation = [1, 1],\n
` +\n     `got [${convInfo.dilationHeight}, ${convInfo.dilationWidth}].`);\n } \n\n const out =
backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmAvgPool(\n   xId, x.shape[0], x.shape[1], x.shape[2], filterHeight, filterWidth,\n   padTop, padRight,
padBottom, padLeft, strideHeight, strideWidth, channels,\n   outId);\n return out;\n}\n\nexport const
avgPoolConfig: KernelConfig = {\n  kernelName: AvgPool,\n  backendName: 'wasm',\n  setupFunc: setup,\n
kernelFunc: avgPool as {} as KernelFunc\n};\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights
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distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n */
=====\n
*/\n\nimport {KernelConfig, KernelFunc, Reshape, ReshapeAttrs, ReshapeInputs, util} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nexport function reshape(\n  args: {inputs:
ReshapeInputs, attrs: ReshapeAttrs, backend: BackendWasm}) {\n  const {inputs, attrs} = args;\n  const {x} =
inputs;\n  const {shape} = attrs;\n\n  const xSize = util.sizeFromShape(x.shape);\n  const $shape =
util.inferFromImplicitShape(shape, xSize);\n\n  util.assert(\n    xSize === util.sizeFromShape($shape),\n    () =>
`new shape: ${$shape}, old shape: ${x.shape}. New shape and old ` +\n    `shape must have the same number of
elements.`);\n\n  // Backend needs to track
refCount for the dataId for reshape op\n  args.backend.incRef(x.dataId);\n  return {dataId: x.dataId, shape: $shape,
dtype: x.dtype};\n}\n\nexport const reshapeConfig: KernelConfig = {\n  kernelName: Reshape,\n  backendName:
'wasm',\n  kernelFunc: reshape as {} as KernelFunc\n};\n"/**\n * @license\n * Copyright 2019 Google LLC. All
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software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n */
=====\n
*/\n\nimport {BatchMatMul, BatchMatMulAttrs, BatchMatMulInputs, KernelConfig, KernelFunc, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {reshape} from
'/Reshape';\n\nlet wasmBatchMatMul: (\n  aId: number, aShape: Uint8Array, aShapeSize: number, bId: number,\n
bShape: Uint8Array, bShapeSize: number, transposeA: boolean,\n  transposeB: boolean, outId: number) =>
void;\n\nfunction setup(backend: BackendWasm) {\n  wasmBatchMatMul = backend.wasm.cwrap(BatchMatMul,
null /* void */, [\n    'number', // a_id\n    'array', // a_shape\n    'number', // a_shape.length\n    'number', // b_id\n
'array', // b_shape\n    'number', // b_shape.length\n    'number', // transpose_a\n    'number', // transpose_b\n
'number' // out_id\n  ]);\n}\n\nfunction batchMatMul(args: {\n  inputs: BatchMatMulInputs,\n  backend:
BackendWasm,\n  attrs: BatchMatMulAttrs\n}) {\n  const {inputs, backend, attrs} = args;\n  const {a, b} = inputs;\n
const {transposeA, transposeB} = attrs;\n\n  if (a.dtype !== 'float32' || b.dtype !== 'float32') {\n    throw new
Error(\n      `BatchMatMul for non non-float32 tensors not yet supported.`);\n  }\n\n  const aRank =

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a.shape.length;\n const bRank = b.shape.length;\n\n const innerShapeA = transposeA ? a.shape[aRank - 2] :
a.shape[aRank - 1];\n const innerShapeB = transposeB ? b.shape[bRank - 1] : b.shape[bRank - 2];\n\n const
outerShapeA = transposeA ? a.shape[aRank - 1] : a.shape[aRank - 2];\n const outerShapeB = transposeB ?
b.shape[bRank - 2] : b.shape[bRank - 1];\n\n const outerDimsA = a.shape.slice(0, -2);\n const outerDimsB =
b.shape.slice(0, -2);\n\n const batchDimA = util.sizeFromShape(outerDimsA);\n const batchDimB =
util.sizeFromShape(outerDimsB);\n\n const batchDimsCompatible =\n batchDimA === batchDimB ||
batchDimA === 1 || batchDimB === 1;\n\n util.assert(\n aRank >= 2 && bRank >= 2 &&
batchDimsCompatible,\n () => `Error in matMul: the input batch
dimensions must either be the ` +\n `same or at least one input batch dimension must be 1. Got input ` +\n
`batch dimensions of (${outerDimsA}) and (${outerDimsB}).`);\n\n const outShapeOuterDims =\n batchDimA
> batchDimB ? a.shape.slice(0, -2) : b.shape.slice(0, -2);\n\n const outShape =
outShapeOuterDims.concat([outerShapeA, outerShapeB]);\n\n util.assert(\n innerShapeA === innerShapeB,\n
() => `Error in matMul: inner shapes (${innerShapeA}) and ` +\n `(${innerShapeB}) of Tensors with shapes
${a.shape} and ` +\n ` ${b.shape} and transposeA=${transposeA}` +\n ` and transposeB=${transposeB}
must match.`);\n\n const a3dShape = transposeA ? [batchDimA, innerShapeA, outerShapeA] :\n
[batchDimA, outerShapeA, innerShapeA];\n const b3dShape = transposeB ? [batchDimB, outerShapeB,
innerShapeB] :\n [batchDimB, innerShapeB, outerShapeB];\n\n // The rest of the
implementation
is designed to operate on rank-3 tensors\n const a3d = reshape({inputs: {x: a}, backend, attrs: {shape:
a3dShape}});\n const b3d = reshape({inputs: {x: b}, backend, attrs: {shape: b3dShape}});\n\n const a3dId =
backend.dataIdMap.get(a3d.dataId).id;\n const b3dId = backend.dataIdMap.get(b3d.dataId).id;\n\n const leftDim =
transposeA ? a3d.shape[2] : a3d.shape[1];\n const rightDim = transposeB ? b3d.shape[1] : b3d.shape[2];\n const
batchDim = Math.max(batchDimA, batchDimB);\n\n const out = backend.makeOutput([batchDim, leftDim,
rightDim], a3d.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const aShapeBytes = new
Uint8Array(new Int32Array(a3d.shape).buffer);\n const bShapeBytes = new Uint8Array(new
Int32Array(b3d.shape).buffer);\n\n wasmBatchMatMul(\n a3dId, aShapeBytes, a3d.shape.length, b3dId,
bShapeBytes,\n b3d.shape.length, transposeA, transposeB, outId);\n\n backend.disposeData(a3d.dataId);\n\n
backend.disposeData(b3d.dataId);\n\n out.shape
= outShape;\n return out;\n}\n\n\nexport const batchMatMulConfig: KernelConfig = {\n kernelName:
BatchMatMul,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: batchMatMul as { } as
KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
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License.\n */
=====\\n
*\nimport { backend_util, buffer, Slice, slice_util, util } from '@tensorflow/tfjs-core';\nimport
{ assertNotComplex } from './cpu_util';\n\nexport function sliceImpl(vals, begin, size, shape, dtype) {\n const
isContinous = slice_util.isSliceContinous(shape, begin, size);\n const length = util.sizeFromShape(size);\n const
xStrides = util.computeStrides(shape);\n if (isContinous) {\n const flatOffset =
slice_util.computeFlatOffset(begin, xStrides);\n if (dtype === 'string') {\n return vals.slice(flatOffset,
flatOffset + length);\n }\n return vals.subarray(flatOffset, flatOffset + length);\n }\n const decodedData
= dtype === 'string' ?\n backend_util.fromUint8ToStringArray(vals) :\n vals;\n const inBuf =
buffer(shape, dtype, decodedData);\n const outBuf = buffer(size, dtype);\n for (let i = 0; i < outBuf.size; ++i) {\n
const outLoc = outBuf.indexToLoc(i);\n const inLoc = outLoc.map((idx, j) => idx + begin[j]);\n
outBuf.set(inBuf.get(...inLoc), ...outLoc);\n

```


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```
=====\n*\n\nimport { backend_util, KernelConfig, KernelFunc, Slice, slice_util, SliceAttrs, SliceInputs, TypedArray, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { sliceImplCPU } from '../kernel_utils/shared';\nexport function slice(\n  args: { inputs: SliceInputs, attrs: SliceAttrs, backend: BackendWasm }) {\n  const { inputs: { x }, attrs: { begin, size }, backend } = args;\n\n  const [begin_, size_] = slice_util.parseSliceParams(x, begin, size);\n\n  const isContinuous = slice_util.isSliceContinuous(x.shape, begin_, size_);\n  const xVals = backend.readSync(x.dataId);\n  const out = backend.makeOutput(size_, x.dtype);\n  const xStrides = util.computeStrides(x.shape);\n  const outData = backend.dataIdMap.get(out.dataId);\n\n  if (isContinuous) {\n    const flatOffset = slice_util.computeFlatOffset(begin_, xStrides);\n\n    if (x.dtype === 'string') {\n      outData.stringBytes =\n        (xVals as Uint8Array[]).slice(flatOffset, flatOffset + util.sizeFromShape(size_));\n    } else {\n      const outVals = backend.typedArrayFromHeap(out);\n      outVals.set(\n        (xVals as TypedArray).subarray(flatOffset, flatOffset + util.sizeFromShape(size_)));\n    }\n\n    return out;\n  }\n\n  if (x.dtype === 'string') {\n    const res = sliceImplCPU(xVals, begin_, size_, x.shape, x.dtype);\n    outData.stringBytes = res as Uint8Array[];\n    return out;\n  }\n\n  const outVals = backend.typedArrayFromHeap(out);\n  const rank = x.shape.length;\n  if (rank === 2) {\n    slice2d(\n      xVals as TypedArray, xStrides[0], outVals, begin_ as [number, number],\n      size_ as [number, number]);\n  } else if (rank === 3) {\n    slice3d(\n      xVals as TypedArray, xStrides[0], xStrides[1], outVals,\n      begin_ as [number, number, number], size_ as [number, number, number]);\n  } else if (rank === 4) {\n    slice4d(\n      xVals as TypedArray, xStrides[0], xStrides[1], xStrides[2], outVals,\n      begin_ as [number, number, number, number], size_ as [number, number, number, number]);\n  } else {\n    const res =\n      sliceImplCPU(xVals, begin_, size_, x.shape, x.dtype) as TypedArray;\n    outVals.set(res);\n  }\n\n  return out;\n}\n\nfunction slice2d(\n  xVals: backend_util.TypedArray, xStride: number,\n  outVals: backend_util.TypedArray, begin: [number, number],\n  size: [number, number]): void {\n  let outOffset = 0;\n  const beginI = begin[0];\n  const beginJ = begin[1];\n\n  const endI = beginI + size[0];\n  for (let i = beginI; i < endI; i++) {\n    const xOffset = i * xStride + beginJ;\n    outVals.set(xVals.subarray(xOffset, xOffset + size[1]), outOffset);\n    outOffset += size[1];\n  }\n}\n\nfunction slice3d(\n  xVals: backend_util.TypedArray, xStride1: number, xStride2: number,\n  outVals: backend_util.TypedArray, begin: [number, number, number],\n  size: [number, number, number]): void {\n  let outOffset = 0;\n  const beginI = begin[0];\n  const beginJ = begin[1];\n  const beginK = begin[2];\n  const endI = beginI + size[0];\n  const endJ = beginJ + size[1];\n  for (let i = beginI; i < endI; i++) {\n    for (let j = beginJ; j < endJ; j++) {\n      const xOffset = i * xStride1 + j * xStride2 + beginK;\n      outVals.set(xVals.subarray(xOffset, xOffset + size[2]), outOffset);\n      outOffset += size[2];\n    }\n  }\n}\n\nfunction slice4d(\n  xVals: backend_util.TypedArray, xStride1: number, xStride2: number,\n  xStride3: number, outVals: backend_util.TypedArray,\n  begin: [number, number, number, number],\n  size: [number, number, number, number]): void {\n  let outOffset = 0;\n  const beginI = begin[0];\n  const beginJ = begin[1];\n  const beginK = begin[2];\n  const endI = beginI + size[0];\n  const endJ = beginJ + size[1];\n  const endK = beginK + size[2];\n  const beginL = begin[3];\n\n  for (let i = beginI; i < endI; i++) {\n    for (let j = beginJ; j < endJ; j++) {\n      for (let k = beginK; k < endK; k++) {\n        const xOffset = i * xStride1 + j * xStride2 + k * xStride3 + beginL;\n        outVals.set(xVals.subarray(xOffset, xOffset + size[3]), outOffset);\n        outOffset += size[3];\n      }\n    }\n  }\n}\n\nexport const sliceConfig: KernelConfig = {\n  kernelName: Slice,\n  backendName: 'wasm',\n  kernelFunc: slice as {} as KernelFunc,\n};\n\n/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use
```

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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

```
=====\n*\n\nimport { backend_util, BatchToSpaceND, BatchToSpaceNDAttrs, BatchToSpaceNDInputs, KernelConfig,  
KernelFunc } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { reshape } from './Reshape';\nimport { slice } from './Slice';\nimport { transpose } from './Transpose';\n\nfunction  
batchToSpaceND(args: {\n  inputs: BatchToSpaceNDInputs,\n  backend: BackendWasm,\n  attrs:  
BatchToSpaceNDAttrs\n}) {\n  const  
  { inputs, backend, attrs } = args;\n  const { x } = inputs;\n  const { blockShape, crops } = attrs;\n  \n  const prod =  
blockShape.reduce((a, b) => a * b);\n  \n  const reshaped = backend_util.getReshaped(x.shape, blockShape, prod);\n  const permuted = backend_util.getPermuted(reshaped.length, blockShape.length);\n  const reshapedPermuted =\n  backend_util.getReshapedPermuted(x.shape, blockShape, prod);\n  const sliceBeginCoords =\n  backend_util.getSliceBeginCoords(crops, blockShape.length);\n  const sliceSize =\n  backend_util.getSliceSize(reshapedPermuted, crops, blockShape.length);\n  \n  const xReshaped = reshape({ inputs:  
  { x }, backend, attrs: { shape: reshaped } });\n  const xTransposed =\n  transpose({ inputs: { x: xReshaped }, backend,  
  attrs: { perm: permuted } });\n  const xTransposedReshaped = reshape(\n  { inputs: { x: xTransposed }, backend,  
  attrs: { shape: reshapedPermuted } });\n  const result = slice({\n  inputs: { x: xTransposedReshaped },\n  backend,\n  attrs: { begin: sliceBeginCoords,  
    size: sliceSize }\n  });\n  \n  backend.disposeData(xReshaped.dataId);\n  backend.disposeData(xTransposed.dataId);\n  backend.disposeData(xReshaped.dataId);\n  \n  return result;\n}\n\nexport const batchToSpaceNDConfig:  
KernelConfig = {\n  kernelName: BatchToSpaceND,\n  backendName: 'wasm',\n  kernelFunc: batchToSpaceND as  
{ } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed  
under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the  
License.\n * You may obtain a copy of the License at\n *  
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed  
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or  
implied.\n * See the License for the specific language governing permissions and\n * limitations under the  
License.\n *
```

```
=====\n*\n\nimport { Cast, CastAttrs, CastInputs, KernelConfig, KernelFunc } from '@tensorflow/tfjs-core';\nimport { TensorInfo } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\n\nexport function  
cast(\n  args: { inputs: CastInputs, attrs: CastAttrs, backend: BackendWasm }):\n  TensorInfo {\n  const { inputs:  
  { x }, attrs: { dtype }, backend } = args;\n  const out = backend.makeOutput(x.shape, dtype);\n  const inVals =  
backend.typedArrayFromHeap(x);\n  const outVals = backend.typedArrayFromHeap(out);\n  outVals.set(inVals);\n  return out;\n}\n\nexport const castConfig: KernelConfig = {\n  kernelName: Cast,\n  backendName: 'wasm',\n  kernelFunc: cast as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2021 Google LLC. All Rights  
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file  
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by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\"\nBASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the  
License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport { KernelConfig, Ceil } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from  
'/unary_kernel';\n\nexport const ceilConfig: KernelConfig = createUnaryKernelConfig(Ceil);\n\n"/**\n *
```

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```
=====\n*\n\nimport { ClipByValue, ClipByValueAttrs, ClipByValueInputs, KernelConfig, KernelFunc } from\n '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nlet wasmClip: (xId: number, min:\n number, max: number, outId: number) => void;\nfunction setup(backend: BackendWasm) {\n  wasmClip =\n  backend.wasm.cwrap(ClipByValue, null /* void */, [\n    'number', // x_id\n    'number', // min\n    'number', //\n    max\n    'number' // out_id\n  ]);\n  function clip(args: {\n    inputs: ClipByValueInputs,\n    backend:\n    BackendWasm,\n    attrs: ClipByValueAttrs\n  }) {\n    const\n    {inputs, backend, attrs} = args;\n    const {x} = inputs;\n    const {clipValueMin, clipValueMax} = attrs;\n    const xId\n    = backend.dataIdMap.get(x.dataId).id;\n    const out = backend.makeOutput(x.shape, x.dtype);\n    const outId =\n    backend.dataIdMap.get(out.dataId).id;\n    wasmClip(xId, clipValueMin, clipValueMax, outId);\n    return\n    out;\n  }\n  export const clipByValueConfig: KernelConfig = {\n    kernelName: ClipByValue,\n    backendName:\n    'wasm',\n    setupFunc: setup,\n    kernelFunc: clip as {} as KernelFunc\n  };"}\n * @license\n * Copyright 2019\n * Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you\n * may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF
```

ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```
=====\n*\n\nimport { backend_util, Concat, ConcatAttrs, ConcatInputs, KernelConfig, KernelFunc, util } from\n '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { concatImplCPU } from\n '../kernel_utils/shared';\nimport { identity } from './Identity';\nimport { reshape } from './Reshape';\nexport function\n concat(\n  args: {\n    inputs: ConcatInputs,\n    backend: BackendWasm,\n    attrs: ConcatAttrs\n  }) {\n  const {inputs, backend}\n  = args;\n  const axis = util.parseAxisParam(args.attrs.axis, inputs[0].shape)[0];\n  let outShape =\n  backend_util.computeOutShape(inputs.map(t => t.shape), axis);\n  // Keep only non-empty tensors (ignore tensors\n  with 0 in their shape).\n  const $inputs = inputs.filter(t => util.sizeFromShape(t.shape) > 0);\n  if ($inputs.length\n  === 1) {\n    return identity({inputs: {x: $inputs[0]}, backend});\n  }\n  const out =\n  backend.makeOutput(outShape, inputs[0].dtype);\n  if (util.sizeFromShape(outShape) === 0) {\n    return out;\n  }\n  const shapes = $inputs.map(t => t.shape);\n  backend_util.assertParamsConsistent(shapes, axis);\n  if\n  ($inputs[0].dtype === 'string') {\n    // Any concat of n-dimensional tensors across any axis can be reduced to\n    // a\n    concatenation of two-dimensional tensors across the axis 1 by first\n    // partitioning the axes of the original tensors\n    // into those less than the\n    // axis to be concatenated and the rest. Then reshape the tensors\n    // into a two-\n    dimensional tensor by collapsing these two sets of axes and\n    // concatenate the resulting matrices across the axis\n    1, finally reshaping\n    // the result to have the proper shape.\n    const inputs2D = $inputs.map(t => {\n      const\n      innerSize = util.sizeFromShape(t.shape.slice(axis));\n      const shape = [-1, innerSize];\n      return reshape({inputs: {x: t}, backend, attrs: {shape}});\n    });\n    const inputsValShapes = inputs2D.map(t\n    => {\n      return {vals: backend.readSync(t.dataId), shape: t.shape};\n    });\n    // Concat 2d tensors along\n    axis=1.\n    outShape =\n    backend_util.computeOutShape(inputs2D.map(t => t.shape), 1 /* axis */);\n    const\n    simplyConcat = inputs2D[0].shape[0] === 1;\n    const outVals = concatImplCPU(\n    inputsValShapes, outShape, inputs[0].dtype,\n    simplyConcat) as string[];\n    const finalOutShape
```



```

Conv2D, Conv2DAttrs, Conv2DInputs, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from './backend_wasm';\n\nlet wasmConv2d: (\n  xId: number, batchSize:
number, inputHeight: number, inputWidth: number,\n  filterId: number, filterHeight: number, filterWidth: number,
padTop: number,\n  padRight: number, padBottom: number, padLeft: number, isSamePad: number,\n
dilationHeight: number, dilationWidth: number, strideHeight: number,\n  strideWidth: number, inputChannels:
number, outputChannels: number,\n  outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n
wasmConv2d = backend.wasm.cwrap(Conv2D, null /* void */, [\n  'number', // xId\n  'number', // batchSize\n
'number', // inputHeight\n  'number', // inputWidth\n  'number', // filterId\n  'number', // filterHeight\n
'number', // filterWidth\n  'number', // padTop\n  'number', // padRight\n  'number', // padBottom\n  'number',
//
//
padLeft\n  'number', // isSamePad\n  'number', // dilationHeight\n  'number', // dilationWidth\n  'number', //
strideHeight\n  'number', // strideWidth\n  'number', // inputChannels\n  'number', // outputChannels\n
'number', // outId\n  ]);\n\nfunction conv2d(\n  args: {inputs: Conv2DInputs, backend: BackendWasm, attrs:
Conv2DAttrs}) {\n  const {inputs, attrs, backend} = args;\n\n  const {x, filter} = inputs;\n  const xId =
backend.dataIdMap.get(x.dataId).id;\n  const filterId = backend.dataIdMap.get(filter.dataId).id;\n\n  const {strides,
dilations, pad, dimRoundingMode, dataFormat} = attrs;\n  const $dataFormat =
backend_util.convertConv2DDataFormat(dataFormat);\n  const convInfo = backend_util.computeConv2DInfo(\n
(x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations,\n  pad, dimRoundingMode, false,
$dataFormat);\n\n  const filterHeight = convInfo.filterHeight;\n  const filterWidth = convInfo.filterWidth;\n  const
padTop = convInfo.padInfo.top;\n
  const padRight = convInfo.padInfo.right;\n  const padBottom = convInfo.padInfo.bottom;\n  const padLeft =
convInfo.padInfo.left;\n  const dilationHeight = convInfo.dilationHeight;\n  const dilationWidth =
convInfo.dilationWidth;\n  const strideHeight = convInfo.strideHeight;\n  const strideWidth =
convInfo.strideWidth;\n  const inputChannels = convInfo.inChannels;\n  const outputChannels =
convInfo.outChannels;\n  const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;\n\n  if
(convInfo.dataFormat !== 'channelsLast') {\n    throw new Error(\n      `wasm backend Conv2D does not support
dataFormat: ` +\n      `${convInfo.dataFormat}`. Please use 'channelsLast'.`);\n  }\n\n  const out =
backend.makeOutput(convInfo.outShape, 'float32');\n  const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmConv2d(\n  xId, x.shape[0], x.shape[1], x.shape[2], filterId, filterHeight,\n  filterWidth, padTop,
padRight, padBottom, padLeft, isSamePad,\n  dilationHeight,
dilationWidth, strideHeight, strideWidth, inputChannels,\n  outputChannels, outId);\n  return out;\n}\n\nexport
const conv2DConfig: KernelConfig = {\n  kernelName: Conv2D,\n  backendName: 'wasm',\n  setupFunc: setup,\n
kernelFunc: conv2d as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights
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software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport
{backend_util, Conv2DBackpropInput, Conv2DBackpropInputAttrs, Conv2DBackpropInputInputs, KernelConfig,
KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from
'./backend_wasm';\n\nlet wasmConv2DBackpropInput: (\n  dyId: number, filterId: number, batchSize: number,
filterHeight: number,\n  filterWidth: number, inHeight: number, inWidth: number, inChannels: number,\n
outHeight: number, outWidth: number, outChannels: number,\n  strideHeight: number, strideWidth: number,
topPad: number, leftPad: number,\n  fltS0: number, fltS1: number, fltS2: number, xBatchStride: number,\n
xRowStride: number, xColStride: number, xChannelStride: number,\n  yBatchStride: number, yRowStride:

```

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number, yColStride: number,\n  yChannelStride: number, outId: number) => void;\n\nfunction setup(backend:
BackendWasm): void {\n  wasmConv2DBackpropInput = backend.wasm.cwrap(Conv2DBackpropInput, null, [\n
'number', // dyId\n  'number', // filterId\n
'number', // batchSize\n  'number', // filterHeight\n  'number', // filterWidth\n  'number', // inHeight\n
'number', // inWidth\n  'number', // inChannels\n  'number', // outHeight\n  'number', // outWidth\n  'number',
// outChannels\n  'number', // strideHeight\n  'number', // strideWidth\n  'number', // topPad\n  'number', //
leftPad\n  'number', // fltS0\n  'number', // fltS1\n  'number', // fltS2\n  'number', // xBatchStride\n  'number',
// xRowStride\n  'number', // xColStride\n  'number', // xChannelStride\n  'number', // yBatchStride\n
'number', // yRowStride\n  'number', // yColStride\n  'number', // yChannelStride\n  'number', // outId\n
]);\n}\n\nfunction conv2DBackpropInput(args: {\n  backend: BackendWasm,\n  inputs:
Conv2DBackpropInputInputs,\n  attrs: Conv2DBackpropInputAttrs\n}): TensorInfo {\n  const {backend, inputs,
attrs} = args;\n  const {dy, filter} = inputs;\n  const {strides, pad, dataFormat,
dimRoundingMode, inputShape} = attrs;\n  const dilations = 1;\n  const $dataFormat =
backend_util.convertConv2DDataFormat(dataFormat);\n  const convInfo = backend_util.computeConv2DInfo(\n
inputShape, filter.shape as [number, number, number, number], strides,\n  dilations, pad, dimRoundingMode,
false /* depthwise */, $dataFormat);\n  const {\n    batchSize,\n    filterHeight,\n    filterWidth,\n    inChannels,\n
inHeight,\n    inWidth,\n    outChannels,\n    outHeight,\n    outWidth,\n    strideHeight,\n    strideWidth\n  } =
convInfo;\n  const topPad = filterHeight - 1 - convInfo.padInfo.top;\n  const leftPad = filterWidth - 1 -
convInfo.padInfo.left;\n  const isChannelsLast = convInfo.dataFormat === 'channelsLast';\n  const dxStrides =
util.computeStrides(convInfo.inShape);\n  const dyStrides = util.computeStrides(dy.shape);\n  const [fltS0, fltS1,
fltS2] = util.computeStrides(filter.shape);\n  const xBatchStride = dxStrides[0];\n  const xRowStride =
isChannelsLast
? dxStrides[1] : dxStrides[2];\n  const xColStride = isChannelsLast ? dxStrides[2] : 1;\n  const xChannelStride =
isChannelsLast ? 1 : dxStrides[1];\n  const yBatchStride = dyStrides[0];\n  const yRowStride = isChannelsLast ?
dyStrides[1] : dyStrides[2];\n  const yColStride = isChannelsLast ? dyStrides[2] : 1;\n  const yChannelStride =
isChannelsLast ? 1 : dyStrides[1];\n  const out = backend.makeOutput(convInfo.inShape, 'float32');\n  const outId
= backend.dataIdMap.get(out.dataId).id;\n  const dyId = backend.dataIdMap.get(dy.dataId).id;\n  const filterId =
backend.dataIdMap.get(filter.dataId).id;\n  wasmConv2DBackpropInput(\n    dyId, filterId, batchSize,
filterHeight, filterWidth, inHeight, inWidth,\n    inChannels, outHeight, outWidth, outChannels, strideHeight,
strideWidth,\n    topPad, leftPad, fltS0, fltS1, fltS2, xBatchStride, xRowStride,\n    xColStride, xChannelStride,
yBatchStride, yRowStride, yColStride,\n    yChannelStride, outId);\n  return out;\n}\n\nexport
const conv2DBackpropInputConfig: KernelConfig = {\n  kernelName: Conv2DBackpropInput,\n  backendName:
'wasm',\n  setupFunc: setup,\n  kernelFunc: conv2DBackpropInput as {} as KernelFunc\n};\n\n"/**\n * @license\n *
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'License');\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an 'AS IS' BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {Cos, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig}
from './unary_kernel';\n\nexport const cosConfig: KernelConfig = createUnaryKernelConfig(Cos);\n\n"/**\n *
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2.0 (the 'License');\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an 'AS IS' BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *

```

```

=====
*\nimport {Cosh, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'./unary_kernel';\nexport const coshConfig: KernelConfig =
createUnaryKernelConfig(Cosh);\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n *
Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {CropAndResize, CropAndResizeAttrs, CropAndResizeInputs, KernelConfig, KernelFunc,
TensorInfo} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {cast}
from './Cast';\n\n// Must match enum in CropAndResize.cc\nenum
InterpolationMethod {\n  bilinear = 0,\n  nearest = 1\n}\n\nlet wasmCropAndResize: (\n  imagesId: number,
boxesId: number, boxIndId: number, numBoxes: number,\n  imagesShape: Uint8Array, cropHeight: number,
cropWidth: number,\n  method: number, extrapolationValue: number, outId: number) => void;\n\nfunction
setup(backend: BackendWasm): void {\n  wasmCropAndResize = backend.wasm.cwrap(CropAndResize, null
/*void*/, [\n  'number', // imagesId\n  'number', // boxesId\n  'number', // boxIndId\n  'number', // numBoxes\n
'array', // images shape\n  'number', // cropHeight\n  'number', // cropWidth\n  'number', // method\n
'number', // extrapolation value\n  'number' // out id\n  ]);\n\nfunction cropAndResize(args: {\n  backend:
BackendWasm,\n  inputs: CropAndResizeInputs,\n  attrs: CropAndResizeAttrs\n}): TensorInfo {\n  const {backend,
inputs, attrs} = args;\n  const {method, extrapolationValue, cropSize} = attrs;\n  const {image,
boxes, boxInd} = inputs;\n  const numBoxes = boxes.shape[0];\n  const [cropHeight, cropWidth] = cropSize as
[number, number];\n  const outShape = [numBoxes, cropHeight, cropWidth, image.shape[3]];\n  let imagesData =
backend.dataIdMap.get(image.dataId);\n  let castedData;\n  if (image.dtype !== 'float32') {\n  castedData =
cast({backend, inputs: {x: image}, attrs: {dtype: 'float32'}});\n  imagesData =
backend.dataIdMap.get(castedData.dataId);\n  }\n  const imagesId = imagesData.id;\n  const boxesId =
backend.dataIdMap.get(boxes.dataId).id;\n  const boxIndId = backend.dataIdMap.get(boxInd.dataId).id;\n  const
out = backend.makeOutput(outShape, 'float32');\n  const outId = backend.dataIdMap.get(out.dataId).id;\n  const
imagesShapeBytes = new Uint8Array(new Int32Array(image.shape).buffer);\n  wasmCropAndResize(\n
imagesId, boxesId, boxIndId, numBoxes, imagesShapeBytes, cropHeight,\n  cropWidth,\n
InterpolationMethod[method as { } as keyof typeof InterpolationMethod],\n
  extrapolationValue, outId);\n  if (castedData !== null) {\n  backend.disposeData(castedData.dataId);\n  }\n  return out;\n}\n\nexport const cropAndResizeConfig: KernelConfig = {\n  kernelName: CropAndResize,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: cropAndResize as { } as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
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law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {backend_util, KernelConfig, KernelFunc, Cumsum, CumsumAttrs, CumsumInputs, TensorInfo, util}
from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {CppType} from
'./types';\nimport {transpose} from './Transpose';\n\nlet wasmCumsum: (xId: number, exclusive: number, reverse:
number,\n  finalDim: number, outId: number, dtype: CppDType) => void;\n\nfunction setup(backend:
BackendWasm) {\n  wasmCumsum = backend.wasm.cwrap(Cumsum, null /* void */, [\n  'number', // x_id\n

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'number', // exclusive\n 'number', // reverse\n 'number', // final_dim\n 'number', // out_id\n 'number' //
dtype\n ]);\n}\n\nexport function cumsum(\n args: {inputs: CumsumInputs, backend: BackendWasm, attrs:
CumsumAttrs});\nTensorInfo {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {axis,
exclusive, reverse} = attrs;\n const xRank = x.shape.length;\n\n util.assert(x.dtype
=== 'float32' || x.dtype === 'int32',\n () => `cumsum does not support ${x.dtype} tensors in the WASM
backend`);\n // permute required axis to inner most axis\n const permutation =
backend_util.getAxesPermutation([axis], xRank);\n let permutedX = x;\n if (permutation !== null) {\n
permutedX = transpose({inputs: {x}, attrs: {perm: permutation}, backend});\n }\n const permutedAxis =
backend_util.getInnerMostAxes(1, xRank)[0];\n backend_util.assertAxesAreInnerMostDims('cumsum',
[permutedAxis], xRank);\n\n const permutedOut = backend.makeOutput(permutedX.shape, permutedX.dtype);\n
const finalDim = permutedX.shape[permutedAxis];\n const permutedXId =
backend.dataIdMap.get(permutedX.dataId).id;\n const permutedOutId =
backend.dataIdMap.get(permutedOut.dataId).id;\n wasmCumsum(permutedXId, exclusive ? 1 : 0, reverse ? 1 : 0,
finalDim,\n permutedOutId, CppDType[x.dtype]);\n\n // transpose data back if permuted\n let out =
permutedOut;\n if (permutation
!== null) {\n const undoPermutation = backend_util.getUndoAxesPermutation(permutation);\n out =
transpose(\n {inputs: {x: permutedOut}, attrs: {perm: undoPermutation}, backend});\n
backend.disposeData(permutedX.dataId);\n backend.disposeData(permutedOut.dataId);\n }\n return
out;\n}\n\nexport const cumsumConfig: KernelConfig = {\n kernelName: Cumsum,\n backendName: 'wasm',\n
setupFunc: setup,\n kernelFunc: cumsum as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google
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use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
\n\n
=====\n
*/\n\nimport {DepthToSpace, DepthToSpaceAttrs, DepthToSpaceInputs, KernelConfig, KernelFunc, TensorInfo,
util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmDepthToSpace:
(\n xId: number, blockSize: number, channelsLast: number, xStrides: Uint8Array,\n xStridesLength: number,
outputShape: Uint8Array, outputStrides: Uint8Array,\n outSize: number, outId: number) => void;\n\nfunction
setup(backend: BackendWasm): void {\n wasmDepthToSpace = backend.wasm.cwrap(DepthToSpace, null
/*void*/, [\n 'number', // xId\n 'number', // blockSize\n 'number', // channelsLast\n 'array', // xStrides\n
'number', // xStridesLength\n 'array', // outputShape\n 'array', // outputStrides\n 'number', // outSize\n
'number', // outId\n
]);\n}\n\nexport function depthToSpace(args: {\n backend: BackendWasm,\n inputs: DepthToSpaceInputs,\n
attrs: DepthToSpaceAttrs\n}): TensorInfo {\n const {backend, inputs, attrs} = args;\n const {x} = inputs;\n const
{blockSize, dataFormat} = attrs;\n\n const batchSize = x.shape[0];\n const inputHeight = (dataFormat ===
'NHWC') ? x.shape[1] : x.shape[2];\n const inputWidth = (dataFormat === 'NHWC') ? x.shape[2] : x.shape[3];\n
const inputDepth = (dataFormat === 'NHWC') ? x.shape[3] : x.shape[1];\n\n const outputHeight = inputHeight *
blockSize;\n const outputWidth = inputWidth * blockSize;\n const outputDepth = inputDepth / (blockSize *
blockSize);\n\n const outputShape = (dataFormat === 'NHWC') ?\n [batchSize, outputHeight, outputWidth,
outputDepth] :\n [batchSize, outputDepth, outputHeight, outputWidth];\n\n const out =
backend.makeOutput(outputShape, 'float32');\n\n const xData = backend.dataIdMap.get(x.dataId);\n const xId =
xData.id;\n const xStridesBytes
=\n new Uint8Array(new Int32Array(util.computeStrides(x.shape)).buffer);\n\n const outputShapeBytes = new
Uint8Array(new Int32Array(outputShape).buffer);\n const outStridesBytes =\n new Uint8Array(new
Int32Array(util.computeStrides(outputShape)).buffer);\n\n const outId = backend.dataIdMap.get(out.dataId).id;\n

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const channelsLast = dataFormat === 'NHWC' ? 1 : 0;\n  wasmDepthToSpace(\n    xId, blockSize, channelsLast,\n    xStridesBytes, x.shape.length - 1,\n    outputShapeBytes, outStridesBytes, outputShape.length, outId);\n\n  return\n  out;\n}\n\nexport const depthToSpaceConfig: KernelConfig = {\n  kernelName: DepthToSpace,\n  backendName:\n  'wasm',\n  setupFunc: setup,\n  kernelFunc: depthToSpace as { } as KernelFunc\n};\n\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License\n * at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in\n * writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT\n * WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific\n * language governing permissions and\n * limitations under the License.\n *\n *=====\n *\nimport { backend_util, DepthwiseConv2dNative, DepthwiseConv2dNativeAttrs,\n  DepthwiseConv2dNativeInputs, KernelConfig, KernelFunc, Tensor4D } from '@tensorflow/tfjs-core';\nimport\n  { BackendWasm } from './backend_wasm';\n\nlet wasmDepthwiseConv2d: (\n  xId: number, batchSize: number,\n  inputHeight: number, inputWidth: number,\n  filterId: number, filterHeight: number, filterWidth: number, padTop:\n  number,\n  padRight: number, padBottom: number, padLeft: number, isSamePad: number,\n  dilationHeight:\n  number, dilationWidth:\n  number, strideHeight: number,\n  strideWidth: number, inputChannels: number, outputChannels: number,\n  outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n  wasmDepthwiseConv2d =\n  backend.wasm.cwrap(DepthwiseConv2dNative, null /* void */, [\n    'number', // xId\n    'number', //\n    batchSize\n    'number', // inputHeight\n    'number', // inputWidth\n    'number', // filterId\n    'number', //\n    filterHeight\n    'number', // filterWidth\n    'number', // padTop\n    'number', // padRight\n    'number', //\n    padBottom\n    'number', // padLeft\n    'number', // isSamePad\n    'number', // dilationHeight\n    'number', // dilationWidth\n    'number', // strideHeight\n    'number', // strideWidth\n    'number', //\n    inputChannels\n    'number', // outputChannels\n    'number', // outId\n  ]);\n}\n\nfunction\n  depthwiseConv2d(args: {\n  inputs: DepthwiseConv2dNativeInputs,\n  backend: BackendWasm,\n  attrs: DepthwiseConv2dNativeAttrs\n}) {\n  const { inputs, attrs, backend } = args;\n  const { x, filter } = inputs;\n  const xId = backend.dataIdMap.get(x.dataId).id;\n  const filterId =\n  backend.dataIdMap.get(filter.dataId).id;\n  const { strides, dilations, pad, dimRoundingMode } = attrs;\n  const\n  $dilations = dilations === null ? [1, 1] : dilations;\n  const convInfo = backend_util.computeConv2DInfo(\n    (x as\n    Tensor4D).shape, (filter as Tensor4D).shape, strides,\n    ($dilations as number | [number, number]), pad,\n    dimRoundingMode,\n    true /* depthwise */);\n  const filterHeight = convInfo.filterHeight;\n  const filterWidth =\n  convInfo.filterWidth;\n  const padTop = convInfo.padInfo.top;\n  const padRight = convInfo.padInfo.right;\n  const\n  padBottom = convInfo.padInfo.bottom;\n  const padLeft = convInfo.padInfo.left;\n  const dilationHeight =\n  convInfo.dilationHeight;\n  const dilationWidth = convInfo.dilationWidth;\n  const strideHeight =\n  convInfo.strideHeight;\n\n  const strideWidth = convInfo.strideWidth;\n  const inputChannels = convInfo.inChannels;\n  const outputChannels\n  = convInfo.outChannels;\n  const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;\n\n  if\n  (convInfo.dataFormat !== 'channelsLast') {\n    throw new Error(\n      `wasm backend DepthwiseConv2dNative\n      does not support dataFormat: ` +\n      `${convInfo.dataFormat}`. Please use 'channelsLast'.`);\n  }\n\n  const out =\n  backend.makeOutput(convInfo.outShape, 'float32');\n  const outId = backend.dataIdMap.get(out.dataId).id;\n  wasmDepthwiseConv2d(\n    xId, x.shape[0], x.shape[1], x.shape[2], filterId, filterHeight,\n    filterWidth,\n    padTop, padRight, padBottom, padLeft, isSamePad,\n    dilationHeight, dilationWidth, strideHeight, strideWidth,\n    inputChannels,\n    outputChannels, outId);\n  return out;\n}\n\nexport const depthwiseConv2dNativeConfig:\n  KernelConfig = {\n  kernelName: DepthwiseConv2dNative,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: depthwiseConv2d as { } as KernelFunc\n};\n\n", "/*\n * @license\n * Copyright 2021 Google LLC. All\n * Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this

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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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```
=====\n*\nimport {Elu, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from  
 './unary_kernel';\nexport const eluConfig: KernelConfig = createUnaryKernelConfig(Elu);\n"/**\n * @license\n *
```

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 the specific language governing permissions and\n * limitations under the License.\n *

```
=====\n*\nimport {Equal, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from  
 './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const equalConfig: KernelConfig =\n createBinaryKernelConfig(Equal, supportsFullBroadcast, 'bool');\n"/**\n * @license\n * Copyright  
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language  
governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\nimport {Exp, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from  
 './unary_kernel';\nexport const expConfig: KernelConfig = createUnaryKernelConfig(Exp, 'float32');\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache  
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 BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the  
 License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\nimport {ExpandDims, ExpandDimsAttrs, ExpandDimsInputs, KernelConfig, KernelFunc, util} from  
 '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {reshape} from  
 './Reshape';\nexport function expandDims(args: {\n inputs: ExpandDimsInputs,\n attrs: ExpandDimsAttrs,\n backend: BackendWasm\n}) {\n const {inputs, attrs, backend} = args;\n const  
 {input} = inputs;\n const {dim} = attrs;\n const inputRank = input.shape.length;\n const newShape =  
 input.shape.slice();\n let $dim = dim;\n if (dim < 0) {\n // Negative value is counted from the tail of rank.\n util.assert(\n -(inputRank + 1) <= dim,\n () => `Axis must be in the interval [${-(inputRank + 1)}, ${\n inputRank}]`);\n $dim = inputRank + dim + 1;\n } \n newShape.splice($dim, 0, 1);\n return reshape({inputs:  
 {x: input}, backend, attrs: {shape: newShape}});\n}\nexport const expandDimsConfig: KernelConfig = {\n kernelName: ExpandDims,\n backendName: 'wasm',\n kernelFunc: expandDims as {} as KernelFunc,\n};\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version  
 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a  
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\"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```
=====\n*\n\nimport { KernelConfig, KernelFunc } from '@tensorflow/tfjs-core';\nimport { Fill, FillAttrs } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nexport function fill(args: { attrs: FillAttrs, backend: BackendWasm }) {\n  const { attrs: { shape, value, dtype }, backend } = args;\n  const out = backend.makeOutput(shape, dtype);\n  const outVals = backend.typedArrayFromHeap(out);\n  outVals.fill(value as number);\n  return out;\n}\nexport const fillConfig: KernelConfig = {\n  kernelName: Fill,\n  backendName: 'wasm',\n  kernelFunc: fill as { } as KernelFunc,\n};\n"/**\n
```

```
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```

```
=====\n*\n\nimport { FlipLeftRight, FlipLeftRightInputs, KernelConfig, KernelFunc, TensorInfo } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nlet wasmFlipLeftRight: (\n  xId: number, batch: number, imageHeight: number, imageWidth: number,\n  numChannels: number, outId: number) => void;\nfunction setup(backend: BackendWasm) {\n  wasmFlipLeftRight = backend.wasm.cwrap(FlipLeftRight, null /* void */, [\n    'number', // xId\n    'number', // batch\n    'number', // imageHeight\n    'number', // imageWidth\n    'number', // numChannels\n    'number', // outId\n  ]);\n}\nexport function flipLeftRight(\n  args: { inputs: FlipLeftRightInputs, backend: BackendWasm }): TensorInfo {\n  const { inputs, backend } = args;\n  const { image } = inputs;\n  const out = backend.makeOutput(image.shape, image.dtype);\n  const imageId = backend.dataIdMap.get(image.dataId).id;\n  const outId = backend.dataIdMap.get(out.dataId).id;\n  const [batch, imageHeight, imageWidth, numChannels] = image.shape;\n  wasmFlipLeftRight(\n    imageId, batch, imageHeight, imageWidth, numChannels, outId);\n  return out;\n}\nexport const flipLeftRightConfig: KernelConfig = {\n  kernelName: FlipLeftRight,\n  backendName: 'wasm',\n  kernelFunc: flipLeftRight\n
```

```
\n  as { } as KernelFunc,\n  setupFunc: setup\n};\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *\n
```

```
=====\n*\n\nimport { Floor, KernelConfig } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from '../unary_kernel';\nexport const floorConfig: KernelConfig = createUnaryKernelConfig(Floor);\n"/**\n * @license\n * Copyright\n * 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *\n
```

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=====\n
```



```

*\n\nimport {FloorDiv, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from
 './binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const floorDivConfig: KernelConfig =\n createBinaryKernelConfig(FloorDiv, supportsFullBroadcast);\n", "/*\n * @license\n * Copyright
 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n *
 you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
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 OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
 governing permissions and\n * limitations under the License.\n *

```

```

=====\n
*\n\nimport {FusedBatchNorm, FusedBatchNormAttrs, FusedBatchNormInputs, KernelConfig, KernelFunc,
 TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nlet
 wasmBatchNorm: (\n  xId: number, meanId: number, varianceId: number, offsetId: number,\n  scaleId: number,
  varianceEpsilon: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n
  wasmBatchNorm = backend.wasm.cwrap(\n    FusedBatchNorm, null /* void */,\n    ['number', 'number',
 'number', 'number', 'number', 'number', 'number'];\n  )\n\n  function fusedBatchNorm(args: {\n    backend:
 BackendWasm,\n    inputs: FusedBatchNormInputs,\n    attrs: FusedBatchNormAttrs\n  }): TensorInfo {\n    const
 {backend, inputs, attrs} = args;\n    const {varianceEpsilon} = attrs;\n    const {x, mean, variance, offset, scale} =
 inputs;\n    const xId = backend.dataIdMap.get(x.dataId).id;\n    const meanId =
 backend.dataIdMap.get(mean.dataId).id;\n    const varianceId = backend.dataIdMap.get(variance.dataId).id;\n    const
 offsetId = offset != null ? backend.dataIdMap.get(offset.dataId).id : 0;\n    const scaleId = scale != null ?
 backend.dataIdMap.get(scale.dataId).id : 0;\n\n    const out = backend.makeOutput(x.shape, x.dtype);\n    // Short-
circuit zero-sized tensors.\n    if (util.sizeFromShape(x.shape) ===
 0) {\n      return out;\n    }\n\n    const outId = backend.dataIdMap.get(out.dataId).id;\n\n    wasmBatchNorm(\n      xId,
 meanId, varianceId, offsetId, scaleId, varianceEpsilon, outId);\n    return out;\n  }\n\n  export const
 fusedBatchNormConfig: KernelConfig = {\n    kernelName: FusedBatchNorm,\n    backendName: 'wasm',\n
 setupFunc: setup,\n    kernelFunc: fusedBatchNorm as {} as KernelFunc\n  };
\n", "/*\n * @license\n * Copyright 2019
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 you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
 http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
 software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
 OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
 governing permissions and\n * limitations
 under the License.\n *

```

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=====\n
*\n\nimport {backend_util, FusedConv2D, FusedConv2DAttrs, FusedConv2DInputs, KernelConfig, KernelFunc,
 Tensor4D} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport
 {FusableActivation} from './types';\n\nlet wasmFusedConv2d: (\n  xId: number, batchSize: number, inputHeight:
 number, inputWidth: number,\n  filterId: number, filterHeight: number, filterWidth: number,\n  biasId: number,
 padTop: number, padRight: number, padBottom: number,\n  padLeft: number, isSamePad: number,
 dilationHeight: number,\n  dilationWidth: number, strideHeight: number, strideWidth: number,\n
 inputChannels: number, outputChannels: number, activation: number,\n  preluActivationWeightsId: number,
 leakyreluAlpha: number, outId: number) =>\n  void;\n\nfunction setup(backend: BackendWasm) {\n
  wasmFusedConv2d = backend.wasm.cwrap(FusedConv2D, null /*
  void */,\n    [\n      'number', // xId\n      'number', // batchSize\n      'number', // inputHeight\n      'number', // inputWidth\n
      'number', // filterId\n      'number', // filterHeight\n      'number', // filterWidth\n      'number', // biasId\n
      'number', // padTop\n      'number', // padRight\n      'number', // padBottom\n      'number', // padLeft\n
      'number', // isSamePad\n      'number', // dilationHeight\n      'number', // dilationWidth\n      'number', // strideHeight\n
      'number', //

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strideWidth\n 'number', // inputChannels\n 'number', // outputChannels\n 'number', // activation\n 'number',
// preluActivationWeightsId\n 'number', // leakyreluAlpha\n 'number', // outId\n );\n)\n\nfunction
fusedConv2d(args: {\n inputs: FusedConv2DInputs,\n backend: BackendWasm,\n attrs: FusedConv2DAttrs\n})
{\n const {inputs, attrs, backend} = args;\n const {x, filter, bias, preluActivationWeights} = inputs;\n const {\n
strides,\n pad,\n dilations,\n
dataFormat,\n dimRoundingMode,\n activation,\n leakyreluAlpha\n } = attrs;\n\n const convInfo =
backend_util.computeConv2DInfo(\n (x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations,\n
pad, dimRoundingMode);\n\n const fusedActivation =\n FusableActivation[activation as {} as keyof typeof
FusableActivation];\n if (fusedActivation == null) {\n throw new Error(\n ` ${activation} activation not yet
supported for FusedConv2D ` +\n `in the wasm backend.`);\n }\n\n const xId =
backend.dataIdMap.get(x.dataId).id;\n const filterId = backend.dataIdMap.get(filter.dataId).id;\n\n const
outputChannels = convInfo.outChannels;\n\n let biasId = 0;\n if (bias != null) {\n const biasData =
backend.dataIdMap.get(bias.dataId);\n if (biasData.shape.length !== 1) {\n throw new Error(\n
`FusedConv2D only supports rank-1 bias but got ` +\n `rank ${biasData.shape.length}.`);\n }\n if
(biasData.shape[0] !== outputChannels)
{\n throw new Error(\n `FusedConv2D bias shape (${biasData.shape}) does not ` +\n `match the
number of output channels (${outputChannels})`);\n }\n biasId = biasData.id;\n }\n\n const filterHeight =
convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const
padRight = convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n const padLeft =
convInfo.padInfo.left;\n const dilationHeight = convInfo.dilationHeight;\n const dilationWidth =
convInfo.dilationWidth;\n const strideHeight = convInfo.strideHeight;\n const strideWidth =
convInfo.strideWidth;\n const inputChannels = convInfo.inChannels;\n const isSamePad = convInfo.padInfo.type
=== 'SAME' ? 1 : 0;\n const batchSize = convInfo.batchSize;\n const inHeight = convInfo.inHeight;\n const
inWidth = convInfo.inWidth;\n\n if (dataFormat !== 'NHWC') {\n throw new Error(\n `wasm backend
FusedConv2D does not
support dataFormat:` +\n ` ${dataFormat}'. Please use 'NHWC'.`);\n }\n\n const out =
backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n const
preluActivationWeightsId = preluActivationWeights == null ?\n 0 :\n backend.dataIdMap.get(preluActivationWeights.dataId).id;\n\n wasmFusedConv2d(\n xId, batchSize, inHeight,
inWidth, filterId, filterHeight, filterWidth,\n biasId, padTop, padRight, padBottom, padLeft, isSamePad,
dilationHeight,\n dilationWidth, strideHeight, strideWidth, inputChannels, outputChannels,\n fusedActivation,
preluActivationWeightsId, leakyreluAlpha || 0, outId);\n\n return out;\n}\n\nexport const fusedConv2DConfig:
KernelConfig = {\n kernelName: FusedConv2D,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc:
fusedConv2d as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version
2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {backend_util, FusedDepthwiseConv2D, FusedDepthwiseConv2DAttrs,
FusedDepthwiseConv2DInputs, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from './backend_wasm';\n\nimport {FusableActivation} from './types';\n\nlet
wasmFusedDepthwiseConv2d:\n (xId: number, batchSize: number, inputHeight: number, inputWidth: number,\n filterId: number,
filterHeight: number, filterWidth: number,\n biasId: number, padTop: number, padRight: number, padBottom:
number,\n padLeft: number, isSamePad: number, dilationHeight: number,\n dilationWidth: number,

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strideHeight: number, strideWidth: number,\n  inputChannels: number, outputChannels: number, activation:
number,\n  preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>\n
void;\n\nfunction setup(backend: BackendWasm) {\n  wasmFusedDepthwiseConv2d =\n  backend.wasm.cwrap(FusedDepthwiseConv2D, null /* void */, [\n    'number', // xId\n    'number', //
batchSize\n    'number', // inputHeight\n    'number', // inputWidth\n    'number', // filterId\n    'number', //
filterHeight\n    'number', // filterWidth\n    'number', // biasId\n    'number', // padTop\n    'number', //
padRight\n    'number', // padBottom\n    'number', // padLeft\n    'number', // isSamePad\n    'number', //
dilationHeight\n    'number', // dilationWidth\n    'number', // strideHeight\n    'number', //
strideWidth\n    'number', // inputChannels\n    'number', // outputChannels\n    'number', // activation\n    'number', // preluActivationWeightsId\n    'number', // leakyreluAlpha\n    'number', // outId\n
]);\n\nfunction fusedDepthwiseConv2d(args: {\n  inputs: FusedDepthwiseConv2DInputs,\n  backend:
BackendWasm,\n  attrs: FusedDepthwiseConv2DAttrs\n}) {\n  const {inputs, attrs, backend} = args;\n  const {x,
filter, bias, preluActivationWeights} = inputs;\n  const {\n    strides,\n    pad,\n    dilations,\n    dataFormat,\n    dimRoundingMode,\n    activation,\n    leakyreluAlpha\n  } = attrs;\n  const convInfo =
backend_util.computeConv2DInfo(\n    (x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations,\n    pad, dimRoundingMode, true /* depthwise */);\n  const fusedActivation =\n    FusableActivation[activation
as {} as keyof typeof FusableActivation];\n  if (fusedActivation == null) {\n    throw new Error(\n
`${activation} activation not yet supported for FusedDepthwiseConv2D` +\n    `in the wasm backend.`);\n  }\n  const xId = backend.dataIdMap.get(x.dataId).id;\n  const filterId = backend.dataIdMap.get(filter.dataId).id;\n  const outputChannels = convInfo.outChannels;\n  let biasId = 0;\n  if (bias != null) {\n    const biasData =
backend.dataIdMap.get(bias.dataId);\n    if (biasData.shape.length !== 1) {\n      throw new Error(\n
`FusedDepthwiseConv2D only supports rank-1 bias but got ` +\n        `rank ${biasData.shape.length}`);\n    }\n  }\n  if (biasData.shape[0] !== outputChannels) {\n    throw new Error(\n
`FusedDepthwiseConv2D bias shape\n    (${biasData.shape}) does not ` +\n    `match the number of output channels (${outputChannels})`);\n  }\n  biasId = biasData.id;\n  }\n  const filterHeight = convInfo.filterHeight;\n
  const filterWidth = convInfo.filterWidth;\n  const padTop = convInfo.padInfo.top;\n  const padRight =
convInfo.padInfo.right;\n  const padBottom = convInfo.padInfo.bottom;\n  const padLeft = convInfo.padInfo.left;\n  const dilationHeight = convInfo.dilationHeight;\n  const dilationWidth = convInfo.dilationWidth;\n  const
strideHeight = convInfo.strideHeight;\n  const strideWidth = convInfo.strideWidth;\n  const inputChannels =
convInfo.inChannels;\n  const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;\n  const batchSize =
convInfo.batchSize;\n  const inHeight = convInfo.inHeight;\n  const inWidth = convInfo.inWidth;\n  if
(dataFormat !== 'NHWC') {\n    throw new Error(\n      `wasm backend FusedDepthwiseConv2D does not support
dataFormat:` +\n      `${dataFormat}`. Please use 'NHWC'.`);\n  }\n  const out =
backend.makeOutput(convInfo.outShape, 'float32');\n  const outId = backend.dataIdMap.get(out.dataId).id;\n  const
preluActivationWeightsId = preluActivationWeights
== null ?\n    0 : \n    backend.dataIdMap.get(preluActivationWeights.dataId).id;\n  wasmFusedDepthwiseConv2d(\n    xId, batchSize, inHeight, inWidth, filterId, filterHeight, filterWidth,\n    biasId, padTop, padRight, padBottom, padLeft, isSamePad, dilationHeight,\n    dilationWidth, strideHeight,
strideWidth, inputChannels, outputChannels,\n    fusedActivation, preluActivationWeightsId, leakyreluAlpha || 0,
outId);\n  return out;\n}\n\nexport const fusedDepthwiseConv2DConfig: KernelConfig = {\n  kernelName:
FusedDepthwiseConv2D,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: fusedDepthwiseConv2d as
{} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * \n *
Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n */

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=====
*\n\nimport {gather_util, GatherNd, GatherNdInputs, KernelConfig, TensorInfo} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {CppType} from './types';\n\nlet
wasmGatherNd: (\n  xId: number, dtype: CppDType, indicesId: number, numSlices: number,\n  sliceRank:
number, sliceSize: number, strides: Uint8Array, outId: number) =>\n  void;\n\nfunction setup(backend:
BackendWasm): void {\n  wasmGatherNd = backend.wasm.cwrap(GatherNd, null /*void*/, [\n  'number', // xId\n
'number', // dtype\n  'number', // indicesId\n  'number', // numSlices\n  'number', //
sliceRank\n  'number', // sliceSize\n  'array', // strides\n  'number' // outId\n  ]);\n}\n\nfunction gatherNd(args:
{backend: BackendWasm, inputs: GatherNdInputs}):\n  TensorInfo {\n  const {backend, inputs} = args;\n  const
{params, indices} = inputs;\n\n  const [resultShape, numSlices, sliceSize, strides] =\n
gather_util.prepareAndValidate(params, indices);\n\n  const out = backend.makeOutput(resultShape,
params.dtype);\n  if (numSlices === 0) {\n    return out;\n  }\n\n  const indicesShape = indices.shape;\n  const
sliceRank = indicesShape[indicesShape.length - 1];\n\n  const xData = backend.dataIdMap.get(params.dataId);\n
const xId = xData.id;\n  const indicesData = backend.dataIdMap.get(indices.dataId);\n  const indicesId =
indicesData.id;\n\n  const stridesBytes = new Uint8Array(new Int32Array(strides).buffer);\n\n  const outId =
backend.dataIdMap.get(out.dataId).id;\n  wasmGatherNd(\n    xId, CppDType[params.dtype], indicesId,\n
numSlices, sliceRank, sliceSize,\n
    stridesBytes, outId);\n  return out;\n}\n\nexport const gatherNdConfig: KernelConfig = {\n  kernelName:
GatherNd,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: gatherNd\n};\n\n"/**\n * @license\n *
Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
'License');\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an 'AS IS' BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {backend_util, GatherV2, GatherV2Attrs, GatherV2Inputs, KernelConfig,
KernelFunc, Tensor, TensorInfo, TypedArray, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from
'./backend_wasm';\n\nimport {reshape} from './Reshape';\n\nimport {CppType} from './types';\n\nlet wasmGather:
(\n  xId: number, dtype: CppDType, xStrides: Uint8Array, stridesSize: number,\n  indicesId: number, batchSize:
number, outStrides: Uint8Array,\n  outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n
wasmGather = backend.wasm.cwrap('Gather', null /*void*/, [\n  'number', // xId\n  'number', // dtype\n  'array',
// xStrides\n  'number', // stridesSize\n  'number', // indicesId\n  'number', // batchSize\n  'array', //
outStrides\n  'number' // outId\n  ]);\n}\n\nfunction gatherV2(\n  args: {backend: BackendWasm, inputs:
GatherV2Inputs, attrs: GatherV2Attrs}):\n  TensorInfo {\n  const {backend, inputs, attrs} = args;\n  const {x,
indices} = inputs;\n  const {axis, batchDims} = attrs;\n\n  // Throw error when any
index is out of bound.\n  const parsedAxis = util.parseAxisParam(axis, x.shape)[0];\n  const indicesVals =
backend.readSync(indices.dataId) as TypedArray;\n  const axisDim = x.shape[parsedAxis];\n  for (let i = 0; i <
indicesVals.length; ++i) {\n    const index = indicesVals[i];\n    util.assert(\n      index <= axisDim - 1 && index >=
0,\n      () =>\n        `GatherV2: the index value ${index} is not in [0, ${axisDim - 1}]);\n  }\n\n  const
shapeInfo = backend_util.segment_util.collectGatherOpShapeInfo(\n    x as Tensor, indices as Tensor, parsedAxis,
batchDims);\n\n  const flattenX = reshape({\n    inputs: {x},\n    attrs: {\n      shape: [\n        shapeInfo.batchSize,
shapeInfo.outerSize, shapeInfo.dimSize,\n        shapeInfo.sliceSize\n      ]\n    },\n    backend\n  });\n  const
indicesSize = util.sizeFromShape(indices.shape);\n  const flattenIndex = reshape({\n    inputs: {x: indices},\n    attrs:
{shape: [shapeInfo.batchSize, indicesSize / shapeInfo.batchSize]},\n
    backend\n  });\n  const flattenOutputShape = [\n    shapeInfo.batchSize, shapeInfo.outerSize, indicesSize /
shapeInfo.batchSize,\n    shapeInfo.sliceSize\n  ];\n\n  const out = backend.makeOutput(flattenOutputShape,
x.dtype);\n  if (util.sizeFromShape(x.shape) === 0) {\n    return out;\n  }\n  const stridesSize = flattenX.shape.length

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- 1;\n\n const xData = backend.dataIdMap.get(flattenX.dataId);\n const xId = xData.id;\n\n const indicesData =
backend.dataIdMap.get(flattenIndex.dataId);\n const indicesId = indicesData.id;\n\n const outId =
backend.dataIdMap.get(out.dataId).id;\n\n const xStridesBytes = new Uint8Array(\n new
Int32Array(util.computeStrides(flattenX.shape)).buffer);\n const outStridesBytes = new Uint8Array(\n new
Int32Array(util.computeStrides(flattenOutputShape)).buffer);\n\n wasmGather(\n xId, CppDType[x.dtype],
xStridesBytes, stridesSize, indicesId,\n shapeInfo.batchSize, outStridesBytes, outId);\n\n
backend.disposeData(flattenX.dataId);\n
backend.disposeData(flattenIndex.dataId);\n\n // reshape\n out.shape = shapeInfo.outputShape;\n return
out;\n}\n\nexport const gatherV2Config: KernelConfig = {\n kernelName: GatherV2,\n backendName: 'wasm',\n
setupFunc: setup,\n kernelFunc: gatherV2 as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\\n
*/\nimport {Greater, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
'/binary_kernel';\n\nconst supportsFullBroadcast = false;\nexport const greaterConfig: KernelConfig =\ncreateBinaryKernelConfig(Greater, supportsFullBroadcast, 'bool');\n\n"/**\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\\n
*/\nimport {GreaterEqual, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig}
from '/binary_kernel';\n\nconst supportsFullBroadcast = false;\nexport const greaterEqualConfig: KernelConfig =\ncreateBinaryKernelConfig(GreaterEqual, supportsFullBroadcast, 'bool');\n\n"/**\n * @license\n * Copyright 2019
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\\n
*/\nimport {KernelConfig, KernelFunc, LeakyRelu, LeakyReluAttrs, LeakyReluInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {CppType} from
'/types';\n\nlet wasmFunc: (\n xId: number, dtype: number, leakyreluAlpha: number, outId: number) =>
void;\n\nfunction setupFunc(backend: BackendWasm): void {\n wasmFunc = backend.wasm.wrap(LeakyRelu,
null /* void */, [\n 'number', // x_id\n 'number', // dtype\n 'number', // leakyrelu_alpha\n 'number', //
out_id\n ]);\n}\n\nexport function leakyRelu(\n args: {\n inputs: LeakyReluInputs, attrs: LeakyReluAttrs,
backend: BackendWasm});\n TensorInfo {\n const {inputs: {x}, attrs: {alpha}, backend} = args;\n\n const xId =
backend.dataIdMap.get(x.dataId).id;\n // According to TF API, LeakyRelu returns float32 when input is either
float32\n // or int32.\n const out = backend.makeOutput(x.shape, 'float32');\n\n if (util.sizeFromShape(x.shape)
!== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmFunc(xId, CppDType[x.dtype], alpha,
outId);\n }\n\n return out;\n}\n\nexport const leakyReluConfig: KernelConfig = {\n kernelName: LeakyRelu,\n

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backendName: 'wasm',\n setupFunc,\n kernelFunc: leakyRelu as { } as KernelFunc,\n);\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n *

```
=====\n *\nimport {KernelConfig, Less} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from\n './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const lessConfig: KernelConfig =\ncreateBinaryKernelConfig(Less, supportsFullBroadcast, 'bool');\n", "/*\n * @license\n * Copyright 2019 Google\n * LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not\n * use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n *
```

```
=====\n *\nimport {KernelConfig, LessEqual} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from\n './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const lessEqualConfig: KernelConfig =\ncreateBinaryKernelConfig(LessEqual, supportsFullBroadcast, 'bool');\n", "/*\n * @license\n * Copyright 2019\n * Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you\n * may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n *
```

```
=====\n *\nimport {KernelConfig, Log} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from\n './unary_kernel';\nexport const logConfig: KernelConfig = createUnaryKernelConfig(Log);\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n *\nimport {KernelConfig, LogicalAnd}\n from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from './binary_kernel';\nconst\n supportsFullBroadcast = false;\nexport const logicalAndConfig: KernelConfig =\ncreateBinaryKernelConfig(LogicalAnd, supportsFullBroadcast, 'bool');\n", "/*\n * @license\n * Copyright 2019\n * Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you\n * may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n *
```

```
=====\n *
```

```

*\n\nimport {backend_util,
KernelConfig, KernelFunc, Max, MaxAttrs, MaxInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from './backend_wasm';\n\nimport {permuteAxesAndTranspose} from './kernel_utils';\nimport
{CppType} from './types';\n\nlet wasmMax: (xId: number, dtype: number, reduceSize: number, outId: number)
=>\n void;\n\nfunction setup(backend: BackendWasm): void {\n  wasmMax = backend.wasm.cwrap(Max, null
/*void*/, [\n 'number', // x_id\n 'number', // dtype\n 'number', // reduce_size\n 'number', // out_id\n
]);\n}\n\nfunction max(args: {backend: BackendWasm, inputs: MaxInputs, attrs: MaxAttrs}):\n TensorInfo {\n
const {backend, inputs, attrs} = args;\n const {reductionIndices: axis, keepDims} = attrs;\n const {x} = inputs;\n
const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const {transposed, axes,
originalAxes, inputWasTransposed} =\n  permuteAxesAndTranspose(x, axis, backend);\n\n if
(inputWasTransposed)
{\n  const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n  input = transposed;\n  inputId =
transposedId;\n }\n\n const inputRank = input.shape.length;\n backend_util.assertAxesAreInnerMostDims('max',
axes, inputRank);\n const [outShape, reduceShape] =\n
backend_util.computeOutAndReduceShapes(input.shape, axes);\n const reduceSize =
util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, x.dtype);\n if
(util.sizeFromShape(input.shape) !== 0) {\n  const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmMax(inputId, CppDType[x.dtype], reduceSize, outId);\n }\n\n if (inputWasTransposed) {\n  // dispose of the
transposed tensor.\n  backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n  // reshape\n const
newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n  out.shape = newShape;\n }\n\n
return out;\n}\n\nexport const maxConfig: KernelConfig = {\n  kernelName: Max,\n
backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: max as {} as KernelFunc\n};\n\n"/**\n * @license\n *
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\nimport {KernelConfig, Maximum} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
'/binary_kernel';\nconst supportsFullBroadcast = false;\nexport const maximumConfig:
KernelConfig =\n  createBinaryKernelConfig(Maximum, supportsFullBroadcast);\n\n"/**\n * @license\n *
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\nimport {backend_util, KernelConfig, KernelFunc, MaxPool, MaxPoolAttrs, MaxPoolInputs, Tensor4D, util}
from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\n\nlet
wasmMaxPool: (\n  xId: number, batchSize: number, inputHeight: number, inputWidth: number,\n  filterHeight:
number, filterWidth: number, padTop: number, padRight: number,\n  padBottom: number, padLeft: number,
dilationHeight: number,\n  dilationWidth: number, strideHeight: number, strideWidth: number,\n  inputChannels:
number, outputChannels: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n
wasmMaxPool = backend.wasm.cwrap(MaxPool, null /* void */, [\n 'number', // xId\n 'number', // batchSize\n
'number', // inputHeight\n 'number', // inputWidth\n 'number', // filterHeight\n 'number', // filterWidth\n
'number', // padTop\n 'number', // padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', //

```

```

dilationHeight\n 'number', // dilationWidth\n 'number', // strideHeight\n 'number', // strideWidth\n 'number',
// inputChannels\n 'number', // outputChannels\n 'number', // outId\n
  });\n}\n\nfunction maxPool(\n  args: {inputs: MaxPoolInputs, backend: BackendWasm, attrs: MaxPoolAttrs}) {\n
const {inputs, attrs, backend} = args;\n\n const x = inputs.x as Tensor4D;\n const xId =
backend.dataIdMap.get(x.dataId).id;\n\n // TF API supports int32 input. CPU and WebGL backend also support
int32\n // input. WASM backend doesn't support it because it uses xnnpack which only\n // supports float32.\n //\n // Add the following assert only for the WASM backend instead of at core op\n // level.\n //\n // TODO: add
support for int32 input.\n util.assert(\n  x.dtype === 'float32',\n  () =>\n    `Error in MaxPool: only float32
input is supported. Got ${x.dtype}.`);\n\n const {filterSize, strides, pad, dimRoundingMode} = attrs;\n const
convInfo = backend_util.computePool2DInfo(\n  x.shape, filterSize, strides, 1 /* dilations */, pad,
dimRoundingMode);\n\n const filterHeight = convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n
const padTop = convInfo.padInfo.top;\n const padRight = convInfo.padInfo.right;\n const padBottom =
convInfo.padInfo.bottom;\n const padLeft = convInfo.padInfo.left;\n const dilationHeight =
convInfo.dilationHeight;\n const dilationWidth = convInfo.dilationWidth;\n const strideHeight =
convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n const inputChannels =
convInfo.inChannels;\n const outputChannels = convInfo.outChannels;\n\n if (convInfo.dataFormat !==
'channelsLast') {\n  throw new Error(\n    `wasm backend does not support dataFormat:` +\n
`${convInfo.dataFormat}`. Please use 'channelsLast'.`);\n }\n\n const out =
backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n
wasmMaxPool(\n  xId, x.shape[0], x.shape[1], x.shape[2], filterHeight, filterWidth,\n  padTop, padRight,
padBottom, padLeft, dilationHeight, dilationWidth,\n  strideHeight, strideWidth, inputChannels, outputChannels,
outId);\n\n return out;\n}\n\nexport const maxPoolConfig: KernelConfig = {\n  kernelName: MaxPool,\n
backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: maxPool as { } as KernelFunc\n};\n\n"/**\n * @license\n
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {backend_util, KernelConfig, KernelFunc, Mean, MeanAttrs, MeanInputs,
TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {cast}
from './Cast';\n\nimport {permuteAxesAndTranspose} from './kernel_utils';\n\nlet wasmMean: (xId: number,
reduceSize: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n  wasmMean =\n    backend.wasm.cwrap(Mean, null /*void*/, ['number, number, number']);\n}\n\nexport function mean(\n  args:
{backend: BackendWasm, inputs: MeanInputs, attrs: MeanAttrs}):\n  TensorInfo {\n  const {backend, inputs,
attrs} = args;\n  const {axis, keepDims} = attrs;\n  const {x} = inputs;\n  const xId =
backend.dataIdMap.get(x.dataId).id;\n  let inputId = xId;\n  let input = x;\n\n  const {transposed, axes, originalAxes,
inputWasTransposed} =\n    permuteAxesAndTranspose(x, axis, backend);\n\n  let reductionAxes = axes;\n  if
(inputWasTransposed) {\n    const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n    if (transposedId
!== xId) {\n
      // transpose was not a no-op. We will need to dispose of this\n // once we are done.\n      input = transposed;\n
      inputId = transposedId;\n      reductionAxes = backend_util.getInnerMostAxes(\n        reductionAxes.length,
input.shape.length);\n    }\n  }\n\n  backend_util.assertAxesAreInnerMostDims(\n    'mean', reductionAxes,
input.shape.length);\n  const [outShape, reduceShape] =\n    backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n  const reduceSize =
util.sizeFromShape(reduceShape);\n  let castedInput = input;\n  if (input.dtype !== 'float32') {\n    castedInput =\n    cast({backend, inputs: {x: input}, attrs: {dtype: 'float32'}});\n    inputId =

```



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backend.dataIdMap.get(castedInput.dataId).id;\n } \n\n const out = backend.makeOutput(outShape, 'float32');\n if
(util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmMean(inputId, reduceSize, outId);\n } \n\n if (inputWasTransposed) {\n
// dispose of the transposed tensor.\n backend.disposeData(transposed.dataId);\n } \n\n if (keepDims) {\n //
reshape\n const newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape =
newShape;\n } \n\n if (input.dtype !== 'float32') {\n backend.disposeData(castedInput.dataId);\n } \n\n return
out;\n } \n\n\nexport const meanConfig: KernelConfig = {\n kernelName: Mean,\n backendName: 'wasm',\n
setupFunc: setup,\n kernelFunc: mean as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google
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http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
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OR CONDITIONS OF
ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n *
limitations under the License.\n *
=====\n
*/\n\nimport { backend_util, KernelConfig, KernelFunc, Min, MinAttrs, MinInputs, TensorInfo, util } from
'@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport
{ permuteAxesAndTranspose } from './kernel_utils';\n\nimport { CppDType } from './types';\n\nlet wasmMin: (xId:
number, dtype: number, reduceSize: number, outId: number) =>\n void;\n\nfunction setup(backend:
BackendWasm): void {\n wasmMin = backend.wasm.cwrap(Min, null /*void*/, [\n 'number', // x_id\n
'number', // dtype\n 'number', // reduce_size\n 'number', // out_id\n ]);\n }\n\nfunction min(args: { backend:
BackendWasm, inputs: MinInputs, attrs: MinAttrs }):\n TensorInfo {\n const { backend, inputs, attrs } = args;\n
const { axis, keepDims } = attrs;\n const { x }
= inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const
{ transposed, axes, originalAxes, inputWasTransposed } =\n permuteAxesAndTranspose(x, axis, backend);\n\n if
(inputWasTransposed) {\n const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId
!== xId) {\n // transpose was not a no-op. We will need to dispose of this\n // once we are done.\n input =
transposed;\n inputId = transposedId;\n } \n\n } \n\n const inputRank = input.shape.length;\n\n
backend_util.assertAxesAreInnerMostDims('min', axes, inputRank);\n const [outShape, reduceShape] =\n
backend_util.computeOutAndReduceShapes(input.shape, axes);\n const reduceSize =
util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, input.dtype);\n if
(util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmMin(inputId, CppDType[x.dtype], reduceSize,
outId);\n } \n\n if (inputWasTransposed) {\n // dispose of the transposed tensor.\n
backend.disposeData(transposed.dataId);\n } \n\n if (keepDims) {\n // reshape\n const newShape =
backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n } \n\n return
out;\n } \n\n\nexport const minConfig: KernelConfig = {\n kernelName: Min,\n backendName: 'wasm',\n
setupFunc: setup,\n kernelFunc: min as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights
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http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
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OR CONDITIONS OF ANY KIND, either express or implied.\n
* See the License for the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport { KernelConfig, Minimum } from '@tensorflow/tfjs-core';\n\nimport { createBinaryKernelConfig } from
'/binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const minimumConfig: KernelConfig =\n

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createBinaryKernelConfig(Minimum, supportsFullBroadcast);\n", "/*\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```
=====\n*\n\nimport { KernelConfig, KernelFunc, MirrorPad, MirrorPadAttrs, MirrorPadInputs } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { CppDType } from './types';\n// Must match enum in MirrorPad.cc\nenum MirrorPaddingMode {\n  reflect = 0,\n  symmetric = 1\n}\n\nlet wasmMirrorPad: (\n  xId: number, xShapeBytes: Uint8Array, xShapeLength: number, xDtype: number,\n  prePaddingsBytes: Uint8Array, postPaddingsBytes: Uint8Array, mode: number,\n  outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n  wasmMirrorPad = backend.wasm.cwrap(MirrorPad, null /* void */, [\n    'number', // xId\n    'array', // x.shape\n    'number', // x.shape.length\n    'number', // x.dtype\n    'array', // pre-paddings\n    'array', // post-paddings\n    'number',\n    // mode\n    'number', // outId\n  ]);\n\n  function mirrorPad(args: {\n    inputs: MirrorPadInputs,\n    backend: BackendWasm,\n    attrs: MirrorPadAttrs\n  }) {\n    const { inputs: { x }, backend, attrs: { paddings, mode } } = args;\n    const outShape = paddings.map((p, i) => p[0] /* beforePad */ + x.shape[i] + p[1] /* afterPad */);\n    const xId = backend.dataIdMap.get(x.dataId).id;\n    const out = backend.makeOutput(outShape, x.dtype);\n    const outId = backend.dataIdMap.get(out.dataId).id;\n    const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n    const prePaddingsFlat = paddings.map(padTuple => padTuple[0]);\n    const postPaddingsFlat = paddings.map(padTuple => padTuple[1]);\n    const prePaddingsBytes = new Uint8Array(new Int32Array(prePaddingsFlat).buffer);\n    const postPaddingsBytes = new Uint8Array(new Int32Array(postPaddingsFlat).buffer);\n    wasmMirrorPad(xId, xShapeBytes, x.shape.length, CppDType[x.dtype], prePaddingsBytes, postPaddingsBytes, MirrorPaddingMode[mode], outId);\n    return out;\n  }\n\n  export const mirrorPadConfig: KernelConfig = {\n    kernelName: MirrorPad,\n    backendName: 'wasm',\n    kernelFunc: mirrorPad as { } as KernelFunc,\n    setupFunc: setup\n  };\n}\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport { KernelConfig, Multiply } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from './binary_kernel';\nconst supportsFullBroadcast = true;\nexport const multiplyConfig: KernelConfig =\n  createBinaryKernelConfig(Multiply, supportsFullBroadcast);\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport { KernelConfig, Neg } from '@tensorflow/tfjs-core';\nimport
```

```

{createUnaryKernelConfig} from './unary_kernel';\nexport const negConfig: KernelConfig =
createUnaryKernelConfig(Neg);\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n *
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http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {BackendWasm} from './backend_wasm';\n\n// Analogous to `struct Result` in
`non_max_suppression_impl.h`\n\ninterface Result
{\n  pSelectedIndices: number;\n  selectedSize: number;\n  pSelectedScores: number;\n  pValidOutputs:
number;\n}\n\n/*\n * Parse the result of the c++ method, which has the shape equivalent to\n * `Result`\n *\n\nexport
function parseResultStruct(\n  backend: BackendWasm, resOffset: number): Result {\n  const result = new
Int32Array(backend.wasm.HEAPU8.buffer, resOffset, 4);\n  const pSelectedIndices = result[0];\n  const
selectedSize = result[1];\n  const pSelectedScores = result[2];\n  const pValidOutputs = result[3];\n  // Since the
result was allocated on the heap, we have to delete it.\n  backend.wasm._free(resOffset);\n  return
{pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs};\n}\n\n", "/*\n * @license\n * Copyright 2019
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distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *
=====
*\n\nimport {KernelConfig, KernelFunc, NonMaxSuppressionV3, NonMaxSuppressionV3Attrs,
NonMaxSuppressionV3Inputs, TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from
 './backend_wasm';\n\nimport {parseResultStruct} from './NonMaxSuppression_util';\n\nlet wasmFunc: (\n
boxesId: number, scoresId: number, maxOutputSize: number,\n  iouThreshold: number, scoreThreshold: number)
=> number;\n\nfunction setup(backend: BackendWasm): void {\n  wasmFunc = backend.wasm.cwrap(\n
NonMaxSuppressionV3,\n  'number', // Result*\n  [\n
  'number', // boxesId\n  'number', // scoresId\n  'number', // maxOutputSize\n  'number', //
iouThreshold\n  'number', // scoreThreshold\n  ]);\n}\n\nfunction kernelFunc(args: {\n  backend:
BackendWasm,\n  inputs: NonMaxSuppressionV3Inputs,\n  attrs: NonMaxSuppressionV3Attrs\n}): TensorInfo {\n
const {backend, inputs, attrs} = args;\n  const {iouThreshold, maxOutputSize, scoreThreshold} = attrs;\n  const
{boxes, scores} = inputs;\n\n  const boxesId = backend.dataIdMap.get(boxes.dataId).id;\n  const scoresId =
backend.dataIdMap.get(scores.dataId).id;\n\n  const resOffset =\n    wasmFunc(boxesId, scoresId, maxOutputSize,
iouThreshold, scoreThreshold);\n\n  const {pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs} =\n
parseResultStruct(backend, resOffset);\n\n  // Since we are not using scores for V3, we have to delete it from the
heap.\n  backend.wasm._free(pSelectedScores);\n  backend.wasm._free(pValidOutputs);\n\n  const
selectedIndicesTensor
=\n  backend.makeOutput([selectedSize], 'int32', pSelectedIndices);\n\n  return
selectedIndicesTensor;\n}\n\nexport const nonMaxSuppressionV3Config: KernelConfig = {\n  kernelName:
NonMaxSuppressionV3,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: kernelFunc as {} as
KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
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```

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```
=====  
*  
import {KernelConfig, KernelFunc, NonMaxSuppressionV4, NonMaxSuppressionV4Attrs,  
NonMaxSuppressionV4Inputs, TensorInfo} from '@tensorflow/tfjs-core';  
import {BackendWasm} from './backend_wasm';  
import {parseResultStruct} from './NonMaxSuppression_util';  
let wasmFunc: (n boxesId: number, scoresId: number, maxOutputSize: number,  
iouThreshold: number, scoreThreshold: number, padToMaxOutputSize: boolean) => number;  
function setup(backend: BackendWasm): void {  
  wasmFunc = backend.wasm.cwrap(  
    NonMaxSuppressionV4, 'number', // Result*  
    [ 'number', // boxesId  
      'number', // scoresId  
      'number', // maxOutputSize  
      'number', // iouThreshold  
      'number', // scoreThreshold  
      'bool', // padToMaxOutputSize  
    ]);  
  function nonMaxSuppressionV4(args: {  
    backend: BackendWasm,  
    inputs: NonMaxSuppressionV4Inputs,  
    attrs: NonMaxSuppressionV4Attrs  
  }): TensorInfo[] {  
    const {backend, inputs, attrs} = args;  
    const {iouThreshold, maxOutputSize, scoreThreshold, padToMaxOutputSize} =  
      attrs;  
    const {boxes, scores} = inputs;  
    const boxesId = backend.dataIdMap.get(boxes.dataId).id;  
    const scoresId = backend.dataIdMap.get(scores.dataId).id;  
    const resOffset = wasmFunc(  
      boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold,  
      padToMaxOutputSize);  
    const {pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs} =  
      parseResultStruct(backend, resOffset);  
    // Since we are not using scores for V4, we have to delete it from the  
    heap.  
    backend.wasm._free(pSelectedScores);  
    const selectedIndicesTensor =  
      backend.makeOutput([selectedSize], 'int32', pSelectedIndices);  
    const validOutputsTensor =  
      backend.makeOutput([], 'int32', pValidOutputs);  
    return [selectedIndicesTensor,  
      validOutputsTensor];  
  }  
  export const nonMaxSuppressionV4Config: KernelConfig = {  
    kernelName: NonMaxSuppressionV4,  
    backendName: 'wasm',  
    setupFunc: setup,  
    kernelFunc: nonMaxSuppressionV4 as  
  } as KernelFunc,  
  };  
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   * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or  
   * implied. See the License for the specific language governing permissions and  
   * limitations under the License.  
   */  
}
```

```
=====  
*  
import {KernelConfig, KernelFunc, NonMaxSuppressionV5, NonMaxSuppressionV5Attrs,  
NonMaxSuppressionV5Inputs, TensorInfo} from '@tensorflow/tfjs-core';  
import {BackendWasm} from './backend_wasm';  
import {parseResultStruct} from './NonMaxSuppression_util';  
let wasmFunc: (n boxesId: number, scoresId: number, maxOutputSize: number,  
iouThreshold: number, scoreThreshold: number, softNmsSigma: number) => number;  
function setup(backend: BackendWasm): void {  
  wasmFunc = backend.wasm.cwrap(  
    NonMaxSuppressionV5, 'number', // Result*  
    [ 'number', // boxesId  
      'number', // scoresId  
      'number', // maxOutputSize  
      'number', // iouThreshold  
      'number', // scoreThreshold  
      'number', // softNmsSigma  
    ]);  
  function kernelFunc(args: {  
    backend: BackendWasm,  
    inputs: NonMaxSuppressionV5Inputs,  
    attrs: NonMaxSuppressionV5Attrs  
  }): TensorInfo[] {  
    const {backend, inputs, attrs} = args;  
    const {iouThreshold, maxOutputSize, scoreThreshold, softNmsSigma} =  
      attrs;  
    const {boxes, scores} = inputs;  
    const boxesId = backend.dataIdMap.get(boxes.dataId).id;  
    const scoresId = backend.dataIdMap.get(scores.dataId).id;  
    const resOffset = wasmFunc(  
      boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold,  
      softNmsSigma);  
    const {pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs} =  
      parseResultStruct(backend, resOffset);  
    // Since we are
```

```

not using validOutputs for V5, we have to delete it from the
// heap.
backend.wasm._free(pValidOutputs);
const selectedIndicesTensor =
  backend.makeOutput([selectedSize], 'int32', pSelectedIndices);
const selectedScoresTensor =
  backend.makeOutput([selectedSize], 'float32', pSelectedScores);
return
[selectedIndicesTensor, selectedScoresTensor];
}
}
export const nonMaxSuppressionV5Config: KernelConfig =
{
  kernelName: NonMaxSuppressionV5,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: kernelFunc
} as KernelFunc;
"/**
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 * limitations under the License.
 */
=====
*/
import { KernelConfig, NotEqual } from '@tensorflow/tfjs-core';
import { createBinaryKernelConfig } from
'/binary_kernel';
const supportsFullBroadcast = false;
export const notEqualConfig: KernelConfig =
createBinaryKernelConfig(NotEqual, supportsFullBroadcast, 'bool');
"/**
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 * limitations under the License.
 */
=====
*/
import { KernelConfig, KernelFunc, OneHot, OneHotAttrs, OneHotInputs } from '@tensorflow/tfjs-
core';
import { BackendWasm } from './backend_wasm';
let wasmOneHot: (
  indicesId: number, depth:
number, onValue: number, offValue: number,
  outId: number) => void;
function setup(backend:
BackendWasm) {
  wasmOneHot
= backend.wasm.cwrap(OneHot, null /* void */, [
  'number', // indices_id
  'number', // depth,
  'number', //
onValue
  'number', // offValue
  'number' // out_id
]);
function oneHot(
  args: { inputs:
OneHotInputs, attrs: OneHotAttrs, backend: BackendWasm }) {
  const { inputs, backend, attrs } = args;
  const
{ indices } = inputs;
  const { depth, onValue, offValue } = attrs;
  const out =
backend.makeOutput([...indices.shape, depth], 'int32');
  const outId = backend.dataIdMap.get(out.dataId).id;
  const indicesData = backend.dataIdMap.get(indices.dataId);
  const indicesId = indicesData.id;
  wasmOneHot(indicesId, depth, onValue, offValue, outId);
  return out;
}
export const oneHotConfig:
KernelConfig = {
  kernelName: OneHot,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: oneHot
} as KernelFunc;
"/**
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 * limitations under the License.
 */
=====
*/
import { KernelConfig, KernelFunc, OnesLike, OnesLikeInputs } from '@tensorflow/tfjs-core';
import
{ BackendWasm } from './backend_wasm';
function onesLike(args: { inputs: OnesLikeInputs, backend:
BackendWasm }) {
  const { inputs: { x }, backend } = args;
  const out = backend.makeOutput(x.shape, x.dtype);
  const outVals = backend.typedArrayFromHeap(out);
  outVals.fill(1);
  return

```

```

out;\n)\n\nexport const onesLikeConfig: KernelConfig = {\n  kernelName: OnesLike,\n  backendName: 'wasm',\n  kernelFunc: onesLike as {} as KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```

```

=====
*\n\nimport {KernelConfig, KernelFunc, Pack, PackAttrs, PackInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {concat} from './Concat';\nimport {expandDims} from './ExpandDims';\n\nexport function pack(\n  args: {inputs: PackInputs, backend: BackendWasm, attrs: PackAttrs});\n  TensorInfo {\n    const {inputs, backend, attrs} = args;\n    const {axis} = attrs;\n    if (inputs.length === 1) {\n      return expandDims(\n        {inputs: {input: inputs[0]}, backend, attrs: {dim: axis}};\n      );\n    }\n    const shape = inputs[0].shape;\n    const dtype = inputs[0].dtype;\n    inputs.forEach(t => {\n      util.assertShapesMatch(\n        shape, t.shape,\n        'All tensors passed to stack must have matching shapes');\n      util.assert(\n        dtype === t.dtype,\n        () => 'All tensors passed to stack must have matching dtypes');\n    });\n    const intermediateTensorInfos: TensorInfo[] = [];\n    const expandedTensors = inputs.map(t => {\n      const expandedT =\n        expandDims({inputs: {input: t}, backend, attrs: {dim: axis}});\n      intermediateTensorInfos.push(expandedT);\n      return expandedT;\n    });\n    const result = concat({inputs: expandedTensors, backend, attrs: {axis}});\n    intermediateTensorInfos.forEach(t => backend.disposeData(t.dataId));\n    return result;\n  }\n\nexport const packConfig: KernelConfig = {\n  kernelName: Pack,\n  backendName: 'wasm',\n  kernelFunc: pack as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n

```

```

* =====
*\n\nimport {KernelConfig, KernelFunc, PadV2, PadV2Attrs, PadV2Inputs, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {fill} from './Fill';\nimport {CppType} from './types';\n\nlet wasmPadV2: (\n  xId: number, xShapeBytes: Uint8Array, xShapeLength: number, xDtype: number,\n  prePaddingsBytes: Uint8Array, postPaddingsBytes: Uint8Array,\n  constantValue: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n  wasmPadV2 = backend.wasm.cwrap(PadV2, null /* void */, [\n    'number', // xId\n    'array', // x.shape\n    'number', // x.shape.length\n    'number', // x.dtype\n    'array', // pre-paddings\n    'array', // post-paddings\n    'number', // constantValue\n    'number', // outId\n  ]);\n\n  function pad(\n    args: {inputs: PadV2Inputs, backend: BackendWasm, attrs: PadV2Attrs}) {\n    const {inputs: {x}, backend, attrs: {paddings, constantValue}} = args;\n    const outShape = paddings.map((p, i) => p[0] /* beforePad */ + x.shape[i] + p[1] /* afterPad */);\n    if (util.sizeFromShape(x.shape) === 0) {\n      // Short-circuit the computation, since x doesn't have value, only\n      // the shape is used to compute output shape to pad.\n      return fill({\n        backend,\n        attrs: {shape: outShape, value: constantValue, dtype: x.dtype}\n      });\n    }\n    const xId = backend.dataIdMap.get(x.dataId).id;\n    const out = backend.makeOutput(outShape, x.dtype);\n    const outTensorData = backend.dataIdMap.get(out.dataId);\n    const outId = outTensorData.id;\n    const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n    const prePaddingsFlat = paddings.map(padTuple => padTuple[0]);\n    const postPaddingsFlat = paddings.map(padTuple => padTuple[1]);\n    const prePaddingsBytes =\n

```

```

    new Uint8Array(new Int32Array(prePaddingsFlat).buffer);\n  const postPaddingsBytes =\n    new
  Uint8Array(new
  Int32Array(postPaddingsFlat).buffer);\n\n  wasmPadV2(\n    xId, xShapeBytes, x.shape.length,
  CppDType[x.dtype], prePaddingsBytes,\n    postPaddingsBytes, constantValue, outId);\n  return out;\n}\n\nexport
const padV2Config: KernelConfig = {\n  kernelName: PadV2,\n  backendName: 'wasm',\n  kernelFunc: pad as {} as
  KernelFunc,\n  setupFunc: setup\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n
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  OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
  governing permissions and\n * limitations under the License.\n
  *\n * =====\n
  *\nimport { KernelConfig, Pow } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from
  './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const powConfig: KernelConfig =\n  createBinaryKernelConfig(Pow, supportsFullBroadcast);\n", "/*\n * @license\n * Copyright 2019 Google LLC. All
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  *\n * =====\n
  *\nimport { KernelConfig, KernelFunc, Prelu, PreluInputs } from '@tensorflow/tfjs-core';\nimport
  { BackendWasm } from '../backend_wasm';\nimport { cast } from './Cast';\nlet wasmPrelu: (xId: number,
  weightsId: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n  wasmPrelu =
  backend.wasm.cwrap(Prelu, null /* void */, [\n    'number', // x_id\n    'number', // weights_id\n    'number' //
  out_id\n  ]);\n\nfunction prelu(args: { inputs: PreluInputs, backend: BackendWasm }) {\n  const { inputs, backend }
  = args;\n  const { x, alpha } = inputs;\n  const xId = backend.dataIdMap.get(x.dataId).id;\n  const weightsId =
  backend.dataIdMap.get(alpha.dataId).id;\n\n  let inputId = xId;\n  const input = x;\n  let castedInput = input;\n  if
  (input.dtype !== 'float32') {\n    castedInput = cast({ backend, inputs: { x }, attrs: { dtype: 'float32' } });\n    inputId =
  backend.dataIdMap.get(castedInput.dataId).id;\n  }\n\n  const out = backend.makeOutput(x.shape, 'float32');\n  const outId = backend.dataIdMap.get(out.dataId).id;\n
  wasmPrelu(inputId, weightsId, outId);\n\n  if (input.dtype !== 'float32') {\n
  backend.disposeData(castedInput.dataId);\n  }\n  return out;\n}\n\nexport const preluConfig: KernelConfig = {\n
  kernelName: Prelu,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: prelu as {} as
  KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
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  implied.\n * See the License for the specific language governing
  permissions and\n * limitations under the License.\n
  *\n * =====\n
  *\nimport { backend_util, KernelConfig, KernelFunc, Prod, ProdAttrs, ProdInputs, TensorInfo, util } from
  '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport
  { permuteAxesAndTranspose } from './kernel_utils';\nimport { CppDType } from './types';\nlet wasmProd: (\n
  xId: number, reduceSize: number,\n  dtype: number, outId: number) => void;\n\nfunction setup(backend:

```



```

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=====
*\n
*\nimport {KernelConfig, RealDiv} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
'/binary_kernel';\n\nconst supportsFullBroadcast = true;\n\nexport const realDivConfig: KernelConfig =\ncreateBinaryKernelConfig(RealDiv, supportsFullBroadcast);\n",/**\n * @license\n * Copyright 2019 Google LLC.
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=====
*\n
*\nimport {KernelConfig, Relu} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
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=====
*\n
*\nimport {KernelConfig, Relu6} from '@tensorflow/tfjs-core';\nimport
{createUnaryKernelConfig} from './unary_kernel';\n\nexport const relu6Config: KernelConfig =
createUnaryKernelConfig(Relu6);\n",/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n *
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=====
*\n
*\nimport {KernelConfig, KernelFunc, ResizeBilinear, ResizeBilinearAttrs, ResizeBilinearInputs, TensorInfo,
util} from '@tensorflow/tfjs-core';\nimport
{BackendWasm} from '../backend_wasm';\nimport {cast} from './Cast';\n\nlet wasmResizeBilinear: (\n  xId:
number, batch: number, oldHeight: number, oldWidth: number,\n  numChannels: number, newHeight: number,
newWidth: number,\n  alignCorners: number, halfPixelCenters: number, outId: number) => void;\n\nfunction
setup(backend: BackendWasm): void {\n  wasmResizeBilinear = backend.wasm.cwrap(ResizeBilinear, null
/*void*/, [\n    'number', // xId\n    'number', // batch\n    'number', // oldHeight\n    'number', // oldWidth\n
'number', // numChannels\n    'number', // newHeight\n    'number', // newWidth\n    'number', // alignCorners\n
'number', // halfPixelCenters\n    'number' // outId\n  ]);\n\n  function resizeBilinear(args: {\n    backend:
BackendWasm,\n    inputs: ResizeBilinearInputs,\n    attrs: ResizeBilinearAttrs\n  }): TensorInfo {\n    const {backend,
inputs, attrs} = args;\n    const {images} = inputs;\n    const {alignCorners, halfPixelCenters,

```

```

size} = attrs;\n const [newHeight, newWidth] = size;\n\n const [batch, oldHeight, oldWidth, numChannels] =
images.shape;\n const outShape = [batch, newHeight, newWidth, numChannels];\n\n let xData =
backend.dataIdMap.get(images.dataId);\n let castedData;\n if (xData.dtype !== 'float32') {\n  castedData =\n  cast({backend, inputs: {x: images}, attrs: {dtype: 'float32'}});\n  xData =
backend.dataIdMap.get(castedData.dataId);\n }\n const xId = xData.id;\n\n const out =
backend.makeOutput(outShape, 'float32');\n if (util.sizeFromShape(images.shape) === 0) {\n  return out;\n }\n\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n wasmResizeBilinear(\n  xId, batch, oldHeight,
oldWidth, numChannels, newHeight, newWidth,\n  alignCorners ? 1 : 0, halfPixelCenters ? 1 : 0, outId);\n\n if
(castedData !== null) {\n  backend.disposeData(castedData.dataId);\n }\n\n return out;\n}\n\nexport const
resizeBilinearConfig: KernelConfig = {\n  kernelName: ResizeBilinear,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: resizeBilinear as {} as KernelFunc\n};\n\n"/**\n *
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the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {KernelConfig, KernelFunc, Reverse, ReverseAttrs, ReverseInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport
{identity} from './Identity';\n\nimport {reshape} from './Reshape';\n\nlet wasmReverse: (\n  xId: number, axes:
Uint8Array, axesLength: number, outShape: Uint8Array,\n  outShapeLength: number, outId: number) =>
void;\n\nfunction setup(backend: BackendWasm) {\n  wasmReverse = backend.wasm.cwrap(Reverse, null, [\n
'number', // x_id\n 'array', // axes\n 'number', // axes_length\n 'array', // out_shape\n 'number', //
out_shape_length\n 'number' // out_id\n ]);\n}\n\nexport function reverse(\n  args: {inputs: ReverseInputs,
backend: BackendWasm, attrs: ReverseAttrs}):\n  TensorInfo {\n  const {inputs, backend, attrs} = args;\n  const
{x} = inputs;\n  const {dims} = attrs;\n\n  const axes = util.parseAxisParam(dims, x.shape);\n\n  if (x.shape.length
=== 0) {\n  return identity({inputs: {x}, backend});\n }\n\n  const out = backend.makeOutput(x.shape, x.dtype);\n
const xId = backend.dataIdMap.get(x.dataId).id;\n  const outId = backend.dataIdMap.get(out.dataId).id;\n\n
const axesBytes = new Uint8Array(new Int32Array(axes).buffer);\n  const outShapeBytes = new Uint8Array(new
Int32Array(x.shape).buffer);\n\n  wasmReverse(\n  xId, axesBytes, axes.length, outShapeBytes, x.shape.length,
outId);\n\n  const reshaped =\n  reshape({inputs: {x: out}, attrs: {shape: x.shape}, backend});\n\n  backend.disposeData(out.dataId);\n  return reshaped;\n}\n\nexport const reverseConfig: KernelConfig = {\n
kernelName: Reverse,\n  backendName: 'wasm',\n  kernelFunc: reverse as {} as KernelFunc,\n  setupFunc:
setup\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
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License.\n *
=====\n
*/\n\nimport {KernelConfig, KernelFunc, RotateWithOffset, RotateWithOffsetAttrs, RotateWithOffsetInputs,
TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {backend_util} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from '../backend_wasm';\n\nlet wasmRotate: (\n  xId: number, batch: number, imageHeight:
number, imageWidth: number,\n  numChannels: number, radians: number, centerX: number, centerY: number,\n
fillBytes: Uint8Array, fillLength: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n
wasmRotate = backend.wasm.cwrap(RotateWithOffset, null /* void */, [\n 'number', // xId\n 'number', //

```

```

batch\n 'number', // imageHeight\n 'number', //
imageWidth\n 'number', // numChannels\n 'number', // radians\n 'number', // centerX\n 'number', //
centerY\n 'array', // fillBytes\n 'number', // fillLength\n 'number', // outId\n ]);\n}\n\nexport function
rotateWithOffset(args: {\n inputs: RotateWithOffsetInputs,\n backend: BackendWasm,\n attrs:
RotateWithOffsetAttrs\n}): TensorInfo {\n const {inputs, backend, attrs} = args;\n const {image} = inputs;\n const
{radians, fillValue, center} = attrs;\n\n const out = backend.makeOutput(image.shape, image.dtype);\n const
imageId = backend.dataIdMap.get(image.dataId).id;\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n
const [batch, imageHeight, imageWidth, numChannels] = image.shape;\n\n const [centerX, centerY] =\n
backend_util.getImageCenter(center, imageHeight, imageWidth);\n\n const fillIsBlack = fillValue === 0;\n const
fullOpacityValue = 255;\n\n const fillValues = typeof fillValue === 'number' ?\n    [fillValue, fillValue,
fillValue, fillIsBlack ? 0 : fullOpacityValue] :\n    [...fillValue, fullOpacityValue];\n const fillBytes = new
Uint8Array(new Int32Array(fillValues).buffer);\n\n wasmRotate(\n    imageId, batch, imageHeight, imageWidth,
numChannels, radians, centerX,\n    centerY, fillBytes, fillValues.length, outId);\n return out;\n}\n\nexport const
rotateWithOffsetConfig: KernelConfig = {\n kernelName: RotateWithOffset,\n backendName: 'wasm',\n
kernelFunc: rotateWithOffset as {} as KernelFunc,\n setupFunc: setup\n};\n\n"/**\n * @license\n * Copyright 2021
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OR
CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing
permissions and\n * limitations under the License.\n *
=====\n
*/\nimport {KernelConfig, Round} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'./unary_kernel';\n\nexport const roundConfig: KernelConfig = createUnaryKernelConfig(Round);\n\n"/**\n *
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
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specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\nimport {KernelConfig, Rsqrt} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'./unary_kernel';\n\nexport const rsqrtConfig: KernelConfig = createUnaryKernelConfig(Rsqrt);\n\n"/**\n *
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n
*\n *
=====\n
*/\n\nimport {KernelConfig, KernelFunc, scatter_util, ScatterNd, ScatterNdAttrs, ScatterNdInputs, TensorInfo, util}
from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {CppDType} from
'./types';\n\nlet wasmScatterNd: (\n    indicesId: number, updatesId: number, dtype: CppDType, sliceRank:
number,\n    numUpdates: number, sliceSize: number, strides: Uint8Array,\n    outputSize: number, outId: number)
=> void;\n\nfunction setup(backend: BackendWasm): void {\n    wasmScatterNd = backend.wasm.cwrap(ScatterNd,
null /*void*/, [\n        'number', // indicesId\n        'number', // updatesId\n        'number', // dtype\n        'number', //

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sliceRank\n 'number', // numUpdates\n 'number', // sliceSize\n 'array', // strides\n 'number', // outputSize\n 'number' // outId\n ]);\n\nfunction scatterNd(\n  args:\n    {backend: BackendWasm, inputs:
ScatterNdInputs,
  attrs: ScatterNdAttrs});\n  TensorInfo {\n    const {backend, inputs, attrs} = args;\n    const {indices, updates} =
inputs;\n    const {shape} = attrs;\n    const out = backend.makeOutput(shape, updates.dtype);\n    if
(util.sizeFromShape(shape) === 0) {\n      return out;\n    }\n    const {sliceRank, numUpdates, sliceSize, strides,
outputSize} =\n      scatter_util.calculateShapes(updates, indices, shape);\n    const indicesData =
backend.dataIdMap.get(indices.dataId);\n    const indicesId = indicesData.id;\n    const updatesData =
backend.dataIdMap.get(updates.dataId);\n    const updatesId = updatesData.id;\n    const stridesBytes = new
Uint8Array(new Int32Array(strides).buffer);\n    const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmScatterNd(\n      indicesId, updatesId, CppDType[updates.dtype], sliceRank, numUpdates,\n      sliceSize,
stridesBytes, outputSize, outId);\n    return out;\n  }\n\nexport const scatterNdConfig: KernelConfig = {\n
kernelName: ScatterNd,\n  backendName: 'wasm',\n
  setupFunc: setup,\n  kernelFunc: scatterNd as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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=====
*\n\nimport {KernelConfig, KernelFunc, Select, SelectInputs, util} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from '../backend_wasm';\n\nlet wasmSelect: (\n  conditionId: number, tId: number,
eId: number, offset: number,\n  outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n
wasmSelect = backend.wasm.cwrap('SelectV2', null, [\n  'number', // conditionId\n  'number', // tId\n  'number',
// eId\n  'number', // offset\n  'number', // outId\n]);\n\nfunction select(args: {inputs: SelectInputs, backend:
BackendWasm}) {\n  const {inputs, backend} = args;\n  const {condition, t, e} = inputs;\n  const conditionId =
backend.dataIdMap.get(condition.dataId).id;\n  const tId = backend.dataIdMap.get(t.dataId).id;\n  const eId =
backend.dataIdMap.get(e.dataId).id;\n  const out = backend.makeOutput(t.shape, t.dtype);\n  const outId =
backend.dataIdMap.get(out.dataId).id;\n  const cRank = condition.shape.length;\n  const tRank =
t.shape.length;\n  const offset = cRank === 0 || cRank > 1 || tRank === 1 ?\n    1 :\n    util.sizeFromShape(t.shape.slice(1));\n  wasmSelect(conditionId, tId, eId, offset, outId);\n  return out;\n}\n\nexport
const
selectConfig: KernelConfig = {\n  kernelName: Select,\n  backendName: 'wasm',\n  kernelFunc: select as { } as
KernelFunc,\n  setupFunc: setup\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n *
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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=====
*\n\nimport {KernelConfig, KernelFunc, Sigmoid, SigmoidInputs, TensorInfo, util} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm}
from '../backend_wasm';\n\nlet wasmFunc: (xId: number, outId: number) => void;\n\nfunction setup(backend:
BackendWasm): void {\n  wasmFunc = backend.wasm.cwrap(Sigmoid, null /* void */, ['number',
'number']);\n\nfunction sigmoid(args: {backend: BackendWasm, inputs: SigmoidInputs});\n  TensorInfo {\n
const {backend, inputs: {x}} = args;\n  const xId = backend.dataIdMap.get(x.dataId).id;\n  const out =

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backend.makeOutput(x.shape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n // Short-circuit
zero-sized tensors.\n if (util.sizeFromShape(out.shape) === 0) {\n return out;\n }\n\n wasmFunc(xId, outId);\n
return out;\n}\n\nexport const sigmoidConfig: KernelConfig = {\n kernelName: 'Sigmoid',\n backendName:
'wasm',\n setupFunc: setup,\n kernelFunc: sigmoid as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {KernelConfig, Sin} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'./unary_kernel';\n\nexport const sinConfig: KernelConfig = createUnaryKernelConfig(Sin);\n", "/*\n * @license\n *
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WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {KernelConfig, KernelFunc, Softmax, SoftmaxAttrs, SoftmaxInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmFunc: (xId: number, outId:
number, channels: number, batch: number) =>\n void;\n\nfunction setup(backend: BackendWasm): void {\n
wasmFunc = backend.wasm.cwrap(Softmax, null /* void */, [\n 'number', // xId\n 'number', // outId\n
'number', // channels\n 'number' // batch\n ]);\n}\n\nfunction softmax(\n args: {\n backend: BackendWasm,\n
inputs: SoftmaxInputs, attrs: SoftmaxAttrs\n }):\n TensorInfo {\n const {backend, inputs: {logits}, attrs: {dim}} =
args;\n const xId = backend.dataIdMap.get(logits.dataId).id;\n const out = backend.makeOutput(logits.shape,
logits.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n const channels = logits.shape[dim];\n
const batch = util.sizeFromShape(logits.shape) / channels;\n\n // Short-circuit zero-sized tensors.\n if
(util.sizeFromShape(out.shape) === 0) {\n return out;\n }\n\n wasmFunc(xId, outId, channels, batch);\n return
out;\n}\n\nexport const softmaxConfig: KernelConfig = {\n kernelName: Softmax,\n backendName: 'wasm',\n
setupFunc: setup,\n kernelFunc: softmax as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2021 Google
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WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {backend_util, KernelConfig, KernelFunc, ReshapeAttrs, ReshapeInputs, SpaceToBatchND,
SpaceToBatchNDAttrs, SpaceToBatchNDInputs, TensorInfo, TransposeAttrs, TransposeInputs, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {padV2Config} from
'./PadV2';\n\nimport {reshape} from './Reshape';\n\nimport {transpose} from './Transpose';\n\nfunction
spaceToBatchND(args: {\n inputs: SpaceToBatchNDInputs,\n backend: BackendWasm,\n attrs:
SpaceToBatchNDAttrs\n }) {\n const {inputs,

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backend, attrs} = args;\n const {x} = inputs;\n const {blockShape, paddings} = attrs;\n\n const prod =
util.sizeFromShape(blockShape);\n\n const completePaddings: Array<[number, number]> = [[0, 0]];\n
completePaddings.push(...(paddings as Array<[number, number]>));\n\n for (let i = 1 + blockShape.length; i <
x.shape.length; ++i) {\n  completePaddings.push([0, 0]);\n }\n\n const paddedX = padV2Config.kernelFunc({\n
inputs: {x},\n backend,\n attrs: {paddings: completePaddings, constantValue: 0}\n }) as TensorInfo;\n\n const
reshapedPaddedShape =\n  backend_util.getReshaped(paddedX.shape, blockShape, prod, false);\n\n const
permutedReshapedPaddedPermutation = backend_util.getPermuted(\n  reshapedPaddedShape.length,
blockShape.length, false);\n\n const flattenShape =\n  backend_util.getReshapedPermuted(paddedX.shape,
blockShape, prod, false);\n\n const reshapeInputs: ReshapeInputs = {x: paddedX};\n const reshapeAttrs:
ReshapeAttrs = {shape: reshapedPaddedShape};\n
const paddedXReshaped =\n  reshape({inputs: reshapeInputs, backend, attrs: reshapeAttrs});\n\n const
transposeInputs: TransposeInputs = {x: paddedXReshaped};\n const transposeAttrs:\n  TransposeAttrs = {perm:
permutedReshapedPaddedPermutation};\n\n const paddedXT =\n  transpose({inputs: transposeInputs, backend,
attrs: transposeAttrs});\n\n const resultReshapeInputs: ReshapeInputs = {x: paddedXT};\n const
resultReshapeAttrs: ReshapeAttrs = {shape: flattenShape};\n\n const result = reshape(\n  {inputs:
resultReshapeInputs, backend, attrs: resultReshapeAttrs});\n\n backend.disposeData(paddedX.dataId);\n
backend.disposeData(paddedXReshaped.dataId);\n backend.disposeData(paddedXT.dataId);\n\n return
result;\n}\n\nexport const spaceToBatchNDConfig: KernelConfig = {\n kernelName: SpaceToBatchND,\n backendName: 'wasm',\n kernelFunc: spaceToBatchND as { } as KernelFunc\n};\n"/**\n * @license\n *
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express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *
=====\n
*/\n\nimport {KernelConfig, KernelFunc, SplitV, SplitVAttrs, SplitVInputs, util} from '@tensorflow/tfjs-
core';\nimport {backend_util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from
'./backend_wasm';\n\nimport {slice} from './Slice';\n\nexport function splitV(\n  args: {inputs: SplitVInputs, attrs:
SplitVAttrs, backend: BackendWasm}) {\n  const
{inputs, attrs, backend} = args;\n  const {x} = inputs;\n  const {numOrSizeSplits, axis} = attrs;\n\n  const $axis =
util.parseAxisParam(axis, x.shape)[0];\n\n  const splitSizes = backend_util.prepareSplitSize(x, numOrSizeSplits,
$axis);\n  const begin = new Array(x.shape.length).fill(0);\n  const size = x.shape.slice();\n  return splitSizes.map(s
=> {\n    const xSliceSize = [...size];\n    xSliceSize[$axis] = s;\n    const xSlice =\n      slice({inputs: {x}, attrs:
{begin, size: xSliceSize}, backend});\n    begin[$axis] += s;\n    return xSlice;\n  });\n}\n\nexport const
splitVConfig: KernelConfig = {\n kernelName: SplitV,\n backendName: 'wasm',\n kernelFunc: splitV as { } as
KernelFunc\n};\n"/**\n * @license\n *
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the License.\n *
=====\n
*/\n\nimport {KernelConfig, Sqrt} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'./unary_kernel';\n\nexport const sqrtConfig: KernelConfig = createUnaryKernelConfig(Sqrt);\n"/**\n * @license\n *
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```
=====\n*\nimport {KernelConfig, Square} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from './unary_kernel';\nexport const squareConfig: KernelConfig = createUnaryKernelConfig(Square);\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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=====\n*\nimport {KernelConfig, SquaredDifference} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from './binary_kernel';\nconst supportsFullBroadcast = true;\nexport const squaredDifferenceConfig: KernelConfig =\n  createBinaryKernelConfig(SquaredDifference, supportsFullBroadcast);\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on\n  an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\nimport {KernelConfig, KernelFunc, Step, StepAttrs, StepInputs, TensorInfo} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {CppType} from './types';\nlet wasmStep: (xId: number, alpha: number, dtype: number, outId: number) => void;\nfunction setup(backend: BackendWasm): void {\n  wasmStep = backend.wasm.cwrap(Step, null /*void*/, [\n    'number', // x_id\n    'number', // alpha\n    'number', // dtype\n    'number', // out_id\n  ]);\n  function step(\n    args: {\n      backend: BackendWasm,\n      inputs: StepInputs,\n      attrs: StepAttrs\n    }): TensorInfo {\n    const {backend, inputs, attrs} = args;\n    const {alpha} = attrs;\n    const {x} = inputs;\n    const xId = backend.dataIdMap.get(x.dataId).id;\n    const out = backend.makeOutput(x.shape, x.dtype);\n    const outId = backend.dataIdMap.get(out.dataId).id;\n    wasmStep(xId, alpha, CCppType[x.dtype], outId);\n    return out;\n  }\n  export const stepConfig: KernelConfig = {\n    kernelName: Step,\n    backendName: 'wasm',\n    setupFunc: setup,\n    kernelFunc: step as {} as KernelFunc\n  }; \n", "/*\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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```
=====\n*\nimport {KernelConfig, KernelFunc, slice_util, StridedSlice, StridedSliceAttrs, StridedSliceInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {reshape} from
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=====\n
*\n\nimport {backend_util, KernelConfig, KernelFunc, Sum, SumAttrs, SumInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport
{permuteAxesAndTranspose} from './kernel_utils';\n\nimport {CppType} from './types';\n\nlet wasmSum: (xId:
number, reduceSize: number, dtype: number, outId: number) =>\n void;\n\nfunction setup(backend:
BackendWasm): void {\n  wasmSum = backend.wasm.cwrap(Sum, null /*void*/, [\n    'number', // input_id\n
'number', // reduce_size\n    'number', //
dtype\n    'number', // out_id\n  ]);\n}\n\nfunction sum(args: {backend: BackendWasm, inputs: SumInputs, attrs:
SumAttrs}): \n TensorInfo {\n  const {backend, inputs, attrs} = args;\n  const {axis, keepDims} = attrs;\n  const
{x} = inputs;\n  const xId = backend.dataIdMap.get(x.dataId).id;\n  let inputId = xId;\n  let input = x;\n  const
{transposed, axes, originalAxes, inputWasTransposed} =\n    permuteAxesAndTranspose(x, axis, backend);\n  let
reductionAxes = axes;\n  if (inputWasTransposed) {\n    const transposedId =
backend.dataIdMap.get(transposed.dataId).id;\n    if (transposedId !== xId) {\n      // transpose was not a no-op. We
will need to dispose of this\n      // once we are done.\n      input = transposed;\n      inputId = transposedId;\n
reductionAxes = backend_util.getInnerMostAxes(\n      reductionAxes.length, input.shape.length);\n    }\n  }\n  backend_util.assertAxesAreInnerMostDims(\n    'sum', reductionAxes, input.shape.length);\n  const [outShape,
reduceShape] =\n    backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n  const reduceSize
= util.sizeFromShape(reduceShape);\n  const out = backend.makeOutput(outShape, input.dtype);\n  if
(util.sizeFromShape(input.shape) !== 0) {\n    const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmSum(inputId, reduceSize, CppDType[out.dtype], outId);\n  }\n  if (inputWasTransposed) {\n    // dispose of
the transposed tensor.\n    backend.disposeData(transposed.dataId);\n  }\n  if (keepDims) {\n    // reshape\n    const
newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n    out.shape = newShape;\n  }\n  return out;\n}\n\nexport const sumConfig: KernelConfig = {\n  kernelName: Sum,\n  backendName: 'wasm',\n
setupFunc: setup,\n  kernelFunc: sum as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2021 Google
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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=====\n
*\n\nimport {KernelConfig, Tan} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'./unary_kernel';\n\nexport const tanConfig: KernelConfig = createUnaryKernelConfig(Tan);\n\n"/**\n * @license\n *
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WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
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=====\n
*\n\nimport {KernelConfig, Tanh} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'./unary_kernel';\n\nexport const tanhConfig: KernelConfig = createUnaryKernelConfig(Tanh);\n\n"/**\n * @license\n *
Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
"License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
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```

law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```
=====\n*\n\nimport { KernelConfig, KernelFunc, Tile, TileAttrs, TileInputs } from '@tensorflow/tfjs-core';\nimport\n{ BackendWasm } from '../backend_wasm';\nimport { CppDType } from './types';\nlet wasmTile: (\n  xId:\n  number, xShape: Uint8Array, xShapeSize: number, newShape: Uint8Array,\n  newShapeSize: number, dtype:\n  number, outId: number) => void;\nfunction setup(backend: BackendWasm) {\n  wasmTile =\n  backend.wasm.cwrap(Tile, null /* void */, [\n    'number', // x_id\n    'array', // x_shape\n    'number', //\n    x_shape.length\n    'array', // new_shape\n    'number', // new_shape.length\n    'number' // out_id\n  ]);\n\n  function tile(\n    args: {inputs: TileInputs, backend: BackendWasm, attrs: TileAttrs}) {\n    const {inputs,\n    backend, attrs} = args;\n    const {x} = inputs;\n    const xId = backend.dataIdMap.get(x.dataId).id;\n    const {reps} =\n    attrs;\n\n    const newShape: number[] = new Array(x.shape.length);\n    for (let i = 0; i < newShape.length; i++) {\n      newShape[i] = x.shape[i] * reps[i];\n    }\n    const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n    const newShapeBytes = new Uint8Array(new Int32Array(newShape).buffer);\n\n    const out =\n    backend.makeOutput(newShape, x.dtype);\n    const outId = backend.dataIdMap.get(out.dataId).id;\n    wasmTile(\n    xId, xShapeBytes, x.shape.length, newShapeBytes, newShape.length,\n    CppDType[out.dtype], outId);\n    return\n    out;\n  }\n\n  export const tileConfig: KernelConfig = {\n    kernelName: Tile,\n    backendName: 'wasm',\n    setupFunc:\n    setup,\n    kernelFunc: tile as {} as KernelFunc\n  };}\n\n/**\n * @license\n * Copyright 2020 Google\n  LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not\n  use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *  
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n  software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n  OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n  governing permissions and\n * limitations under the License.\n *\n  */\n\n
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=====\n*\n\nimport { KernelConfig, KernelFunc, TensorInfo, TopK, TopKAttrs, TopKInputs } from '@tensorflow/tfjs-\n  core';\nimport { BackendWasm } from '../backend_wasm';\nimport { CppDType } from './types';\nlet wasmTopK:\n  (\n    xId: number, xShapeBytes: Uint8Array, xShapeLength: number,\n    xDtype: CppDType, k: number, sorted:\n    boolean,\n    outValuesId: number,\n    outIndicesId: number) => void;\nfunction setup(backend: BackendWasm) {\n  wasmTopK = backend.wasm.cwrap(TopK, null /* void */, [\n    'number', // xId\n    'array', // x.shape\n    'number',\n    // x.shape.length\n    'number', // x.dtype\n    'number', // k\n    'bool', // sorted\n    'number', // outValuesId\n    'number', // outIndicesId\n  ]);\n\n  export const topk:\n  (\n    args: {inputs: TopKInputs, backend: BackendWasm,\n    attrs: TopKAttrs}) =>\n  TensorInfo[] | TensorInfo = ({inputs, backend, attrs}) => {\n    const {x} = inputs;\n    const {k, sorted} = attrs;\n    const xId = backend.dataIdMap.get(x.dataId).id;\n    const xShapeBytes\n    = new Uint8Array(new Int32Array(x.shape).buffer);\n    const outputShape = x.shape.slice();\n    outputShape[outputShape.length - 1] = k;\n    const outValues = backend.makeOutput(outputShape, x.dtype);\n    const outValuesId = backend.dataIdMap.get(outValues.dataId).id;\n\n    const outIndices = backend.makeOutput(outputShape, 'int32');\n    const outIndicesId =\n    backend.dataIdMap.get(outIndices.dataId).id;\n\n    wasmTopK(\n    xId, xShapeBytes, x.shape.length,\n    CppDType[x.dtype], k, sorted,\n    outValuesId, outIndicesId);\n    return [outValues, outIndices];\n  };\n\n  export const topKConfig: KernelConfig = {\n    kernelName: TopK,\n    backendName: 'wasm',\n    setupFunc:\n    setup,\n    kernelFunc: topk as {} as KernelFunc\n  };}\n\n/**\n * @license\n * Copyright 2021 Google LLC. All\n  Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not\n  use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *  
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n  software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

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=====\n*\n\nimport { KernelConfig, KernelFunc, TensorInfo, Transform, TransformAttrs, TransformInputs, util } from\n '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\n\nlet wasmTransform: (\n  imageId:\n  number, transformsId: number, isBatchTransform: boolean,\n  batch: number, outHeight: number, outWidth:\n  number, numChannels: number,\n  imageWidth: number, imageHeight: number, strides: Uint8Array,\n  stridesLength: number, interpolationModeId: number, fillModeId: number,\n  fillValue: number, outId: number)\n=> void;\n\nfunction setup(backend: BackendWasm): void {\n  wasmTransform = backend.wasm.cwrap(Transform,\n  null /*void*/, [\n    'number', // imageId\n    'number', // transformsId\n    'bool', // isBatchTransform\n    'number', // batch\n    'number', // outHeight\n    'number', // outWidth\n    'number', // numChannels\n    'number', // imageWidth\n    'number', // imageHeight\n    'array', // strides\n    'number', // stridesLength\n    'number', // interpolationModeId\n    'number', // fillModeId\n    'number', // fillValue\n    'number' // outId\n  ]);\n}\n\nfunction transform(\n  args: {\n    backend: BackendWasm, inputs: TransformInputs, attrs:\n    TransformAttrs\n  }):\n  TensorInfo {\n  const { backend, inputs, attrs } = args;\n  const { image, transforms } = inputs;\n  const { interpolation, fillMode, fillValue, outputShape } = attrs;\n  const [batch, imageHeight, imageWidth,\n  numChannels] = image.shape;\n  const [outHeight, outWidth] =\n  outputShape != null ? outputShape :\n  [imageHeight, imageWidth];\n  const outShape =\n  [batch, outHeight, outWidth,\n  numChannels] as\n  [number, number, number, number];\n  const strides =\n  new Uint8Array(new\n  Int32Array(util.computeStrides(image.shape)).buffer);\n\n  const out = backend.makeOutput(outShape, image.dtype);\n  const outId =\n  backend.dataIdMap.get(out.dataId).id;\n\n  const imageData = backend.dataIdMap.get(image.dataId);\n  const\n  imageId = imageData.id;\n\n  const transformsData = backend.dataIdMap.get(transforms.dataId);\n  const\n  transformsId = transformsData.id;\n\n  const interpolationModeId = interpolation === 'nearest' ? 1 : 2;\n  let\n  fillModeId;\n  switch (fillMode) {\n    case 'constant':\n      fillModeId = 1;\n      break;\n    case 'reflect':\n      fillModeId = 2;\n      break;\n    case 'wrap':\n      fillModeId = 3;\n      break;\n    case 'nearest':\n      fillModeId =\n      4;\n      break;\n    default:\n      fillModeId = 1;\n      break;\n  }\n\n  wasmTransform(\n  imageId, transformsId,\n  (transforms.shape[0] > 1), batch, outHeight,\n  outWidth, numChannels, imageWidth, imageHeight, strides,\n  image.shape.length - 1, interpolationModeId, fillModeId, fillValue,\n  outId);\n\n  return out;\n}\n\nexport const transformConfig: KernelConfig = {\n  kernelName: Transform,\n  backendName:\n  'wasm',\n  setupFunc: setup,\n  kernelFunc: transform as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright\n 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n governing permissions and\n * limitations under the License.\n */\n\n=====\n
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=====\n*\n\nimport { KernelConfig, KernelFunc, TensorInfo, Unpack, UnpackAttrs, UnpackInputs }\n from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { slice } from\n './Slice';\n\nfunction unpack(\n  args: { inputs: UnpackInputs, backend: BackendWasm, attrs: UnpackAttrs }):\n  TensorInfo[] {\n  const { inputs, backend, attrs } = args;\n  const { value } = inputs;\n  let { axis } = attrs;\n  if (axis <\n  0) {\n    axis += value.shape.length;\n  }\n\n  const numOutputs = value.shape[axis];\n  const rank =\n  value.shape.length;\n  const outShape: number[] = new Array(rank - 1);\n  let outIndex = 0;\n  for (let i = 0; i < rank;\n  i++) {\n    if (i !== axis) {\n      outShape[outIndex++] = value.shape[i];\n    }\n  }\n  const outs: TensorInfo[] = new\n  Array(numOutputs);\n  const begin = new Array(rank).fill(0);\n  const size = value.shape.slice();\n  size[axis] = 1;\n  for (let i = 0; i < outs.length; i++) {\n    begin[axis] = i;\n    outs[i] = slice({ inputs: { x: value }, attrs: { begin, size },\n  backend});\n  }\n  return outs.map(({ dataId, dtype }) => ({ dataId,
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dtype, shape: outShape}));\n\n\nexport const unpackConfig: KernelConfig = {\n  kernelName: Unpack,\n  backendName: 'wasm',\n  kernelFunc: unpack as {} as KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2020\n * Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you\n * may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n *
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=====\n\n*\n\nimport {KernelConfig, KernelFunc, ZerosLike, ZerosLikeInputs} from '@tensorflow/tfjs-core';\nimport\n  {BackendWasm} from '../backend_wasm';\n\nfunction zerosLike(args: {inputs: ZerosLikeInputs, backend:\n  BackendWasm}) {\n  const {inputs: {x}, backend} = args;\n  const out = backend.makeOutput(x.shape, x.dtype);\n  const outVals = backend.typedArrayFromHeap(out);\n  outVals.fill(0);\n  return out;\n}\n\nexport const\n  zerosLikeConfig: KernelConfig = {\n    kernelName: ZerosLike,\n    backendName: 'wasm',\n    kernelFunc: zerosLike\n  } as KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed\n * under the Apache License, Version 2.0 (the \"License\");\n * you\n * may not use this file except in compliance with the\n * License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed\n * on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n * implied.\n * See the License\n * for the specific language governing permissions and\n * limitations under the License.\n *
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We explicitly import the modular kernels so they get registered in the\n// global registry when we compile the\n// library. A modular build would replace\n// the contents of this file and import only the kernels that are\n// needed.\nimport {KernelConfig, registerKernel} from '@tensorflow/tfjs-core';\nimport {fusedMatMulConfig}\n  from './kernels/_FusedMatMul';\nimport {absConfig} from './kernels/Abs';\nimport {addConfig} from\n  './kernels/Add';\nimport {addNConfig} from './kernels/AddN';\nimport {allConfig} from './kernels/All';\nimport\n  {anyConfig} from './kernels/Any';\nimport {argMaxConfig} from './kernels/ArgMax';\nimport {avgPoolConfig}\n  from './kernels/AvgPool';\nimport {batchMatMulConfig} from './kernels/BatchMatMul';\nimport\n  {batchToSpaceNDConfig} from './kernels/BatchToSpaceND';\nimport {castConfig} from './kernels/Cast';\nimport\n  {ceilConfig} from './kernels/Ceil';\nimport {clipByValueConfig} from './kernels/ClipByValue';\nimport\n  {concatConfig} from './kernels/Concat';\nimport {conv2DConfig} from './kernels/Conv2D';\nimport\n  {conv2DBackpropInputConfig} from './kernels/Conv2DBackpropInput';\nimport {cosConfig} from\n  './kernels/Cos';\nimport {coshConfig} from './kernels/Cosh';\nimport {cropAndResizeConfig} from\n  './kernels/CropAndResize';\nimport {cumsumConfig} from './kernels/Cumsum';\nimport {depthToSpaceConfig}\n  from './kernels/DepthToSpace';\nimport {depthwiseConv2dNativeConfig} from\n  './kernels/DepthwiseConv2dNative';\nimport {eluConfig} from './kernels/Elu';\nimport {equalConfig} from\n  './kernels/Equal';\nimport {expConfig} from './kernels/Exp';\nimport {expandDimsConfig} from\n  './kernels/ExpandDims';\nimport {fillConfig} from './kernels/Fill';\nimport {flipLeftRightConfig} from\n  './kernels/FlipLeftRight';\nimport {floorConfig} from './kernels/Floor';\nimport {floorDivConfig} from\n  './kernels/FloorDiv';\nimport\n  {fusedBatchNormConfig} from './kernels/FusedBatchNorm';\nimport {fusedConv2DConfig} from\n  './kernels/FusedConv2D';\nimport {fusedDepthwiseConv2DConfig} from\n  './kernels/FusedDepthwiseConv2D';\nimport {gatherNdConfig} from './kernels/GatherNd';\nimport\n  {gatherV2Config} from './kernels/GatherV2';\nimport {greaterConfig} from './kernels/Greater';\nimport\n  {greaterEqualConfig} from './kernels/GreaterEqual';\nimport {identityConfig} from './kernels/Identity';\nimport\n  {leakyReluConfig} from './kernels/LeakyRelu';\nimport {lessConfig} from './kernels/Less';\nimport\n  {lessEqualConfig} from './kernels/LessEqual';\nimport {logConfig} from './kernels/Log';\nimport
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{logicalAndConfig} from './kernels/LogicalAnd';\nimport {maxConfig} from './kernels/Max';\nimport
{maximumConfig} from './kernels/Maximum';\nimport {maxPoolConfig} from './kernels/MaxPool';\nimport
{meanConfig} from './kernels/Mean';\nimport {minConfig} from './kernels/Min';\nimport {minimumConfig} from
 './kernels/Minimum';\nimport
{mirrorPadConfig} from './kernels/MirrorPad';\nimport {multiplyConfig} from './kernels/Multiply';\nimport
{negConfig} from './kernels/Neg';\nimport {nonMaxSuppressionV3Config} from
 './kernels/NonMaxSuppressionV3';\nimport {nonMaxSuppressionV4Config} from
 './kernels/NonMaxSuppressionV4';\nimport {nonMaxSuppressionV5Config} from
 './kernels/NonMaxSuppressionV5';\nimport {notEqualConfig} from './kernels/NotEqual';\nimport {oneHotConfig}
from './kernels/OneHot';\nimport {onesLikeConfig} from './kernels/OnesLike';\nimport {packConfig} from
 './kernels/Pack';\nimport {padV2Config} from './kernels/PadV2';\nimport {powConfig} from
 './kernels/Pow';\nimport {preluConfig} from './kernels/Prelu';\nimport {prodConfig} from './kernels/Prod';\nimport
{rangeConfig} from './kernels/Range';\nimport {realDivConfig} from './kernels/RealDiv';\nimport {reluConfig}
from './kernels/Relu';\nimport {relu6Config} from './kernels/Relu6';\nimport {reshapeConfig} from
 './kernels/Reshape';\nimport {resizeBilinearConfig}
from './kernels/ResizeBilinear';\nimport {reverseConfig} from './kernels/Reverse';\nimport
{rotateWithOffsetConfig} from './kernels/RotateWithOffset';\nimport {roundConfig} from
 './kernels/Round';\nimport {rsqrtConfig} from './kernels/Rsqrt';\nimport {scatterNdConfig} from
 './kernels/ScatterNd';\nimport {selectConfig} from './kernels/Select';\nimport {sigmoidConfig} from
 './kernels/Sigmoid';\nimport {sinConfig} from './kernels/Sin';\nimport {sliceConfig} from './kernels/Slice';\nimport
{softmaxConfig} from './kernels/Softmax';\nimport {spaceToBatchNDConfig} from
 './kernels/SpaceToBatchND';\nimport {splitVConfig} from './kernels/SplitV';\nimport {sqrtConfig} from
 './kernels/Sqrt';\nimport {squareConfig} from './kernels/Square';\nimport {squaredDifferenceConfig} from
 './kernels/SquaredDifference';\nimport {stepConfig} from './kernels/Step';\nimport {stridedSliceConfig} from
 './kernels/StridedSlice';\nimport {subConfig} from './kernels/Sub';\nimport {sumConfig} from
 './kernels/Sum';\nimport
{tanConfig} from './kernels/Tan';\nimport {tanhConfig} from './kernels/Tanh';\nimport {tileConfig} from
 './kernels/Tile';\nimport {topKConfig} from './kernels/TopK';\nimport {transformConfig} from
 './kernels/Transform';\nimport {transposeConfig} from './kernels/Transpose';\nimport {unpackConfig} from
 './kernels/Unpack';\nimport {zerosLikeConfig} from './kernels/ZerosLike';\n\n// List all kernel configs here\nconst
kernelConfigs: KernelConfig[] = [\n  absConfig,\n  addConfig,\n  addNConfig,\n  allConfig,\n  anyConfig,\n  argMaxConfig,\n  avgPoolConfig,\n  batchMatMulConfig,\n  batchToSpaceNDConfig,\n  castConfig,\n  ceilConfig,\n  clipByValueConfig,\n  concatConfig,\n  conv2DConfig,\n  conv2DBackpropInputConfig,\n  cosConfig,\n  coshConfig,\n  cropAndResizeConfig,\n  cumsumConfig,\n  depthToSpaceConfig,\n  depthwiseConv2dNativeConfig,\n  eluConfig,\n  equalConfig,\n  expConfig,\n  expandDimsConfig,\n  fillConfig,\n  flipLeftRightConfig,\n  floorConfig,\n  floorDivConfig,\n  fusedMatMulConfig,\n  fusedBatchNormConfig,\n  fusedConv2DConfig,\n  fusedDepthwiseConv2DConfig,\n  gatherNdConfig,\n  gatherV2Config,\n  greaterConfig,\n  greaterEqualConfig,\n  identityConfig,\n  leakyReluConfig,\n  lessConfig,\n  lessEqualConfig,\n  logConfig,\n  logicalAndConfig,\n  maxConfig,\n  maximumConfig,\n  maxPoolConfig,\n  meanConfig,\n  minConfig,\n  minimumConfig,\n  mirrorPadConfig,\n  multiplyConfig,\n  negConfig,\n  nonMaxSuppressionV3Config,\n  nonMaxSuppressionV4Config,\n  nonMaxSuppressionV5Config,\n  notEqualConfig,\n  oneHotConfig,\n  onesLikeConfig,\n  packConfig,\n  padV2Config,\n  powConfig,\n  preluConfig,\n  prodConfig,\n  rangeConfig,\n  realDivConfig,\n  reluConfig,\n  relu6Config,\n  reshapeConfig,\n  resizeBilinearConfig,\n  reverseConfig,\n  rotateWithOffsetConfig,\n  rsqrtConfig,\n  roundConfig,\n  scatterNdConfig,\n  selectConfig,\n  sigmoidConfig,\n  sinConfig,\n  sliceConfig,\n  softmaxConfig,\n  spaceToBatchNDConfig,\n  splitVConfig,\n  sqrtConfig,\n  squareConfig,\n  squaredDifferenceConfig,\n  stepConfig,\n  stridedSliceConfig,\n  subConfig,\n  sumConfig,\n  tanConfig,\n  tanhConfig,\n  tileConfig,\n  topKConfig,\n  transformConfig,\n  transposeConfig,\n  unpackConfig,\n

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zerosLikeConfig\n];\n\nfor (const kernelConfig of kernelConfigs) {\n registerKernel(kernelConfig);\n}\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

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=====\n *\nimport {env} from '@tensorflow/tfjs-core';\nconst ENV = env();\n/**\n * True if SIMD is supported.\n */\n// From: https://github.com/GoogleChromeLabs/wasm-feature-detect\nENV.registerFlag(\n // This typed array passed in to WebAssembly.validate is WebAssembly binary\n // code. In this case it is a small program that contains SIMD\n // instructions.\n 'WASM_HAS_SIMD_SUPPORT', async () => WebAssembly.validate(new Uint8Array([\n 0, 97, 115, 109, 1, 0, 0, 0, 1, 4, 1, 96, 0, 0, 3,\n 2, 1, 0, 10, 9, 1, 7, 0, 65, 0, 253, 15, 26, 11\n ])));\n/**\n * True if threads are supported.\n */\n// From: https://github.com/GoogleChromeLabs/wasm-feature-detect\nENV.registerFlag('WASM_HAS_MULTITHREAD_SUPPORT', async () => {\n //\n // TODO(annxingyuan): Enable node support once this is resolved.\n //\n // https://github.com/tensorflow/tfjs/issues/3830\n if (ENV.get('IS_NODE')) {\n return false;\n }\n\n try {\n // Test for transferability of SABs (needed for Firefox)\n //\n // https://groups.google.com/forum/#!msg/mozilla.dev.platform/IHkBZIHETpA/dwsMNchWEQAJ\n new MessageChannel().port1.postMessage(new SharedArrayBuffer(1));\n // This typed array is a WebAssembly program containing threaded\n // instructions.\n return WebAssembly.validate(new Uint8Array([\n 0, 97, 115, 109, 1, 0, 0, 0, 1, 4, 1, 96, 0, 0, 3, 2, 1, 0, 5,\n 4, 1, 3, 1, 1, 10, 11, 1, 9, 0, 65, 0, 254, 16, 2, 0, 26, 11\n ]));\n } catch (e) {\n return false;\n }\n});\n",\n nvar WasmBackendModuleThreadedSimd = (function() {\n var _scriptDir = typeof document !== 'undefined' && document.currentScript ? document.currentScript.src : undefined;\n if (typeof __filename !== 'undefined') _scriptDir = _scriptDir || __filename;\n return (function(WasmBackendModuleThreadedSimd) {\n WasmBackendModuleThreadedSimd = WasmBackendModuleThreadedSimd || {};\n\nfunction\nGROWABLE_HEAP_I8(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}\nreturn\nHEAP8}function\nGROWABLE_HEAP_U8(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}\nreturn HEAPU8}function\nGROWABLE_HEAP_I32(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}\nreturn HEAP32}function\nGROWABLE_HEAP_U32(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}\nreturn HEAPU32}function\nGROWABLE_HEAP_F64(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}\nreturn HEAPF64}var Module=typeof\nWasmBackendModuleThreadedSimd!="undefined"?WasmBackendModuleThreadedSimd:{};var\nreadyPromiseResolve,readyPromiseReject;Module["ready"]=new\nPromise(function(resolve,reject){readyPromiseResolve=resolve;readyPromiseReject=reject});var\nmoduleOverrides={};var key;for(key in\nModule){if(Module.hasOwnProperty(key)){moduleOverrides[key]=Module[key]}}var arguments_=[];var\nthisProgram=\.this.program\";var quit_=function(status,toThrow){throw\ntoThrow};var ENVIRONMENT_IS_WEB=false;var ENVIRONMENT_IS_WORKER=false;var\nENVIRONMENT_IS_NODE=false;var ENVIRONMENT_IS_SHELL=false;ENVIRONMENT_IS_WEB=typeof\nwindow==="object\";ENVIRONMENT_IS_WORKER=typeof\nimportScripts==="function\";ENVIRONMENT_IS_NODE=typeof process==="object\"&&typeof
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process.versions===\"object\"&&typeof
process.versions.node===\"string\";ENVIRONMENT_IS_SHELL=!ENVIRONMENT_IS_WEB&&!ENVIRONM
ENT_IS_NODE&&!ENVIRONMENT_IS_WORKER;var
ENVIRONMENT_IS_PTHREAD=Module[\"ENVIRONMENT_IS_PTHREAD\"]||false;if(ENVIRONMENT_IS_P
THREAD){buffer=Module[\"buffer\"]}var scriptDirectory=\\\";function
locateFile(path){if(Module[\"locateFile\"]){return Module[\"locateFile\"](path,scriptDirectory)}return
scriptDirectory+path}var read_,readAsync,readBinary,setWindowTitle;var nodeFS;var
nodePath;if(ENVIRONMENT_IS_NODE){if(ENVIRONMENT_IS_WORKER){scriptDirectory=require(\\\"path\\\").
dirname(scriptDirectory)+\\\"^\"}else{scriptDirectory=__dirname+\\\"^\"}read_=function
shell_read(filename,binary){if(!nodeFS)nodeFS=require(\\\"fs\\\");if(!nodePath)nodePath=require(\\\"path\\\");filename=n
odePath[\\\"normalize\\\"](filename);return
nodeFS[\\\"readFileSync\\\"](filename,binary?null:\\\"utf8\\\");readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret};if(process[\\\"argv\\\"].length>1){thisProgram=process[\\\"argv\\\"][[1]].replace(/\\\\\\\\\\\\g,\\\"^\\\")arguments_=process[\\\"arg
v\\\"].slice(2);process[\\\"on\\\"](\\\"uncaughtException\\\",function(ex){if(!(ex instanceof ExitStatus)){throw
ex}});process[\\\"on\\\"](\\\"unhandledRejection\\\",abort);quit_=function(status){process[\\\"exit\\\"](status)};Module[\\\"insp
ect\\\"]=function(){return\\\"[Emscripten Module object]\\\"};var
nodeWorkerThreads;try{nodeWorkerThreads=require(\\\"worker_threads\\\")}catch(e){console.error(\\\"The
\\\"worker_threads\\\" module is not supported in this node.js build - perhaps a newer version is needed?\\\");throw
e}global.Worker=nodeWorkerThreads.Worker}else if(ENVIRONMENT_IS_SHELL){if(typeof
read!=\\\"undefined\\\"){read_=function shell_read(f){return read(f)}readBinary=function readBinary(f){var
data;if(typeof readbuffer===\\\"function\\\"){return new
Uint8Array(readbuffer(f))}data=read(f,\\\"binary\\\");assert(typeof data===\\\"object\\\");return data};if(typeof
scriptArgs!=\\\"undefined\\\"){arguments_=scriptArgs}else if(typeof
arguments!=\\\"undefined\\\"){arguments_=arguments}if(typeof
quit===\\\"function\\\"){quit_=function(status){quit(status)}}if(typeof print===\\\"undefined\\\"){if(typeof
console===\\\"undefined\\\")console={};console.log=print;console.warn=console.error=typeof
printErr===\\\"undefined\\\"?printErr:print}}else
if(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER){if(ENVIRONMENT_IS_WORKER){scriptDire
ctory=self.location.href}else if(typeof
document!=\\\"undefined\\\"&&document.currentScript){scriptDirectory=document.currentScript.src}if(typeof
_scriptDir != \\\"undefined\\\" &&
_scriptDir){scriptDirectory=_scriptDir}if(scriptDirectory.indexOf(\\\"blob:\\\")!=0){scriptDirectory=scriptDirectory.s
ubstr(0,scriptDirectory.lastIndexOf(\\\"^\\")+1)}else{scriptDirectory=\\\"}\\\"}if(ENVIRONMENT_IS_NODE){read_=fun
ction
shell_read(filename,binary){if(!nodeFS)nodeFS=require(\\\"fs\\\");if(!nodePath)nodePath=require(\\\"path\\\");filename=n
odePath[\\\"normalize\\\"](filename);return
nodeFS[\\\"readFileSync\\\"](filename,binary?null:\\\"utf8\\\");readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret}}else{read_=function(url){var xhr=new XMLHttpRequest;xhr.open(\\\"GET\\\",url,false);xhr.send(null);return
xhr.responseText};if(ENVIRONMENT_IS_WORKER){readBinary=function(url){var xhr=new
XMLHttpRequest;xhr.open(\\\"GET\\\",url,false);xhr.responseType=\\\"arraybuffer\\\";xhr.send(null);return new
Uint8Array(xhr.response)}}readAsync=function(url,onload,onerror){var xhr=new
XMLHttpRequest;xhr.open(\\\"GET\\\",url,true);xhr.responseType=\\\"arraybuffer\\\";xhr.onload=function(){if(xhr.status
==200||xhr.status==0&&xhr.response){onload(xhr.response);return}onerror();}xhr.onerror=onerror;xhr.send(null)}
}setWindowTitle=function(title){document.title=title}}else{if(ENVIRONMENT_IS_NODE){if(typeof
performance===\\\"undefined\\\"){global.performance=require(\\\"perf_hooks\\\").performance}}var
out=Module[\\\"print\\\"]||console.log.bind(console);var err=Module[\\\"printErr\\\"]||console.warn.bind(console);for(key

```


in

```
moduleOverrides){if(moduleOverrides.hasOwnProperty(key)){Module[key]=moduleOverrides[key]}}moduleOverr
ides=null;if(Module["arguments\"])arguments_=Module["arguments\"];if(Module["thisProgram\"])thisProgram=
Module["thisProgram\"];if(Module["quit\"])quit_=Module["quit\"];function
warnOnce(text){if(!warnOnce.shown)warnOnce.shown={};if(!warnOnce.shown[text]){warnOnce.shown[text]=1;er
r(text)}}var Atomics_load=Atomics.load;var Atomics_store=Atomics.store;var
Atomics_compareExchange=Atomics.compareExchange;var
wasmBinary;if(Module["wasmBinary\"])wasmBinary=Module["wasmBinary\"];var
noExitRuntime=Module["noExitRuntime\"]||true;if(typeof WebAssembly!=="object"){abort("no
native wasm support detected")}var wasmMemory;var wasmModule;var ABORT=false;var
EXITSTATUS;function assert(condition,text){if(!condition){abort("Assertion failed: "+text)}}function
getCFunc(ident){var func=Module["__"+ident];assert(func,"Cannot call unknown function "+ident+", make sure
it is exported");return func}function ccall(ident,returnType,argTypes,args,opts){var
toC={"string":function(str){var ret=0;if(str!==null&&str!==undefined&&str!==0){var
len=(str.length<<2)+1;ret=stackAlloc(len);stringToUTF8(str,ret,len)}return ret},"array":function(arr){var
ret=stackAlloc(arr.length);writeArrayToMemory(arr,ret);return ret}};function
convertReturnValue(ret){if(returnType==="string")return UTF8ToString(ret);if(returnType==="boolean")return
Boolean(ret);return ret}var func=getCFunc(ident);var cArgs=[];var stack=0;if(args){for(var
i=0;i<args.length;i++){var
converter=toC[argTypes[i]];if(converter){if(stack===0)stack=stackSave();cArgs[i]=converter(args[i])}else{cArgs[i
]=args[i]}}var
ret=func.apply(null,cArgs);ret=convertReturnValue(ret);if(stack!==0)stackRestore(stack);return ret}function
cwrap(ident,returnType,argTypes,opts){argTypes=argTypes||[];var
numericArgs=argTypes.every(function(type){return type==="number"});var
numericRet=returnType!=="string";if(numericRet&&numericArgs&&!opts){return getCFunc(ident)}return
function(){return ccall(ident,returnType,argTypes,arguments,opts)}}function
UTF8ArrayToString(heap,idx,maxBytesToRead){var endIdx=idx+maxBytesToRead;var
str="";while(!(idx>=endIdx)){var u0=heap[idx++];if(!u0)return
str;if(!(u0&128)){str+=String.fromCharCode(u0);continue}var
u1=heap[idx++]&63;if((u0&224)==192){str+=String.fromCharCode((u0&31)<<6|u1);continue}var
u2=heap[idx++]&63;if((u0&240)==224){u0=(u0&15)<<12|u1<<6|u2}else{u0=(u0&7)<<18|u1<<12|u2<<6|heap[id
x++]&63;if(u0<65536){str+=String.fromCharCode(u0)}else{var ch=u0-
65536;str+=String.fromCharCode(55296|ch>>10,56320|ch&1023)}}return str}function
UTF8ToString(ptr,maxBytesToRead){return
ptr?UTF8ArrayToString(GROWABLE_HEAP_U8(),ptr,maxBytesToRead):""}function
stringToUTF8Array(str,heap,outIdx,maxBytesToWrite){if(!(maxBytesToWrite>0))return 0;var startIdx=outIdx;var
endIdx=outIdx+maxBytesToWrite-1;for(var i=0;i<str.length;++i){var
u=str.charCodeAtAt(i);if(u>=55296&&u<=57343){var
u1=str.charCodeAtAt(++i);u=65536+((u&1023)<<10|u1&1023)}if(u<=127){if(outIdx>=endIdx)break;heap[outIdx++]
=u}else if(u<=2047){if(outIdx+1>=endIdx)break;heap[outIdx++]=192|u>>6;heap[outIdx++]=128|u&63}else
if(u<=65535){if(outIdx+2>=endIdx)break;heap[outIdx++]=224|u>>12;heap[outIdx++]=128|u>>6&63;heap[outIdx
++]=128|u&63}else{if(outIdx+3>=endIdx)break;heap[outIdx++]=240|u>>18;heap[outIdx++]=128|u>>12&63;heap[
outIdx++]=128|u>>6&63;heap[outIdx++]=128|u&63}}heap[outIdx]=0;return outIdx-startIdx}function
stringToUTF8(str,outPtr,maxBytesToWrite){return
stringToUTF8Array(str,GROWABLE_HEAP_U8(),outPtr,maxBytesToWrite)}function lengthBytesUTF8(str){var
len=0;for(var i=0;i<str.length;++i){var
u=str.charCodeAtAt(i);if(u>=55296&&u<=57343)u=65536+((u&1023)<<10|str.charCodeAtAt(++i)&1023);if(u<=127)+
+len;else if(u<=2047)len+=2;else if(u<=65535)len+=3;else len+=4}return len}function
```

```

writeArrayToMemory(array,buffer){GROWABLE_HEAP_I8().set(array,buffer)}function
alignUp(x,multiple){if(x%multiple>0){x+=multiple-x%multiple}return x}var
buffer,HEAP8,HEAPU8,HEAP16,HEAPU16,HEAP32,HEAPU32,HEAPF32,HEAPF64;function
updateGlobalBufferAndViews(buf){buffer=buf;Module["HEAP8"]=HEAP8=new
Int8Array(buf);Module["HEAP16"]=HEAP16=new Int16Array(buf);Module["HEAP32"]=HEAP32=new
Int32Array(buf);Module["HEAPU8"]=HEAPU8=new Uint8Array(buf);Module["HEAPU16"]=HEAPU16=new
Uint16Array(buf);Module["HEAPU32"]=HEAPU32=new
Uint32Array(buf);Module["HEAPF32"]=HEAPF32=new
Float32Array(buf);Module["HEAPF64"]=HEAPF64=new Float64Array(buf)}var
INITIAL_MEMORY=Module["INITIAL_MEMORY"]||16777216;if(ENVIRONMENT_IS_PTHREAD){wasmmem
ory=Module["wasmMemory"];buffer=Module["buffer"]}else{if(Module["wasmMemory"]){wasmMemory=
Module["wasmMemory"]}else{wasmMemory=new
WebAssembly.Memory({"initial":INITIAL_MEMORY/65536,"maximum":2147483648/65536,"shared":true});
if(!(wasmMemory.buffer instanceof SharedArrayBuffer)){err("requested a shared WebAssembly.Memory but the
returned buffer is not a SharedArrayBuffer, indicating that while the browser has SharedArrayBuffer it does not
have WebAssembly threads support - you may need to set a
flag");if(ENVIRONMENT_IS_NODE){console.log("(on node you may need: --experimental-wasm-threads --
experimental-wasm-bulk-memory and also use a recent version)")}throw Error("bad
memory")}}if(wasmMemory){buffer=wasmMemory.buffer}INITIAL_MEMORY=buffer.byteLength;updateGlob
alBufferAndViews(buffer);var wasmTable;var __ATPRERUN__=[];var __ATINIT__=[];var __ATMAIN__=[];var
__ATEXIT__=[];var __ATPOSTRUN__=[];var runtimeInitialized=false;var
runtimeExited=false;if(!ENVIRONMENT_IS_PTHREAD)__ATINIT__.push({func:function(){__wasm_call_ctors()}});function
preRun(){if(ENVIRONMENT_IS_PTHREAD)return;if(Module["preRun"]){if(typeof
Module["preRun"]="function")Module["preRun"]=[Module["preRun"]];while(Module["preRun"].length){a
ddOnPreRun(Module["preRun"].shift())}callRuntimeCallbacks(__ATPRERUN__)}function
initRuntime(){runtimeInitialized=true;if(ENVIRONMENT_IS_PTHREAD)return;callRuntimeCallbacks(__ATINIT
__)function
preMain(){if(ENVIRONMENT_IS_PTHREAD)return;callRuntimeCallbacks(__ATMAIN__)}function
exitRuntime(){if(ENVIRONMENT_IS_PTHREAD)return;runtimeExited=true}function
postRun(){if(ENVIRONMENT_IS_PTHREAD)return;if(Module["postRun"]){if(typeof
Module["postRun"]="function")Module["postRun"]=[Module["postRun"]];while(Module["postRun"].lengt
h){addOnPostRun(Module["postRun"].shift())}callRuntimeCallbacks(__ATPOSTRUN__)}function
addOnPreRun(cb){__ATPRERUN__.unshift(cb)}function addOnPostRun(cb){__ATPOSTRUN__.unshift(cb)}var
runDependencies=0;var runDependencyWatcher=null;var dependenciesFulfilled=null;function
addRunDependency(id){assert(!ENVIRONMENT_IS_PTHREAD,"addRunDependency cannot be used in a
pthread
worker");runDependencies++;if(Module["monitorRunDependencies"]){Module["monitorRunDependencies"](ru
nDependencies)}}function removeRunDependency(id){runDependencies--
;if(Module["monitorRunDependencies"]){Module["monitorRunDependencies"](runDependencies)}if(runDepen
dencies==0){if(runDependencyWatcher!==null){clearInterval(runDependencyWatcher);runDependencyWatcher=null}
if(dependenciesFulfilled){var
callback=dependenciesFulfilled;dependenciesFulfilled=null;callback()}}Module["preloadedImages"]={};Module
["preloadedAudios"]={};function
abort(what){if(Module["onAbort"]){Module["onAbort"](what)}if(ENVIRONMENT_IS_PTHREAD)console.err
or("Pthread aborting at "+(new
Error).stack);what+="\n";err(what);ABORT=true;EXITSTATUS=1;what+="abort("+what+"). Build with -s
ASSERTIONS=1 for more info.";var e=new WebAssembly.RuntimeError(what);readyPromiseReject(e);throw

```

```

e}function
hasPrefix(str,prefix){return String.prototype.startsWith?str.startsWith(prefix):str.indexOf(prefix)===0}var
dataURIPrefix="data:application/octet-stream;base64,";function isDataURI(filename){return
hasPrefix(filename,dataURIPrefix)}var fileURIPrefix="file://";function isFileURI(filename){return
hasPrefix(filename,fileURIPrefix)}var wasmBinaryFile="tfjs-backend-wasm-threaded-
simd.wasm";if(!isDataURI(wasmBinaryFile)){wasmBinaryFile=locateFile(wasmBinaryFile)}function
getBinary(file){try{if(file===wasmBinaryFile&&wasmBinary){return new
Uint8Array(wasmBinary)}if(readBinary){return readBinary(file)}else{throw"both async and sync fetching of the
wasm failed"}}catch(err){abort(err)}}function
getBinaryPromise(){if(!wasmBinary&&(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER)){if(typeof
fetch==="function"&&!isFileURI(wasmBinaryFile)){return fetch(wasmBinaryFile,{credentials:"same-
origin"}).then(function(response){if(!response["ok"]){throw"failed to load wasm binary file at
"+wasmBinaryFile+""}return
response["arrayBuffer"]()).catch(function(){return getBinary(wasmBinaryFile)})}else{if(readAsync){return new
Promise(function(resolve,reject){readAsync(wasmBinaryFile,function(response){resolve(new
Uint8Array(response)),reject}))})}return Promise.resolve().then(function(){return
getBinary(wasmBinaryFile)})}function createWasm(){var info={"a":asmLibraryArg};function
receiveInstance(instance,module){var
exports=instance.exports;Module["asm"]=exports;wasmTable=Module["asm"]["I"];wasmModule=module;if(!E
NVIRONMENT_IS_PTHREAD){var
numWorkersToLoad=PThread.unusedWorkers.length;PThread.unusedWorkers.forEach(function(w){PThread.load
WasmModuleToWorker(w,function(){if(--numWorkersToLoad)removeRunDependency("wasm-
instantiate")})))}if(!ENVIRONMENT_IS_PTHREAD){addRunDependency("wasm-instantiate")}function
receiveInstantiatedSource(output){receiveInstance(output["instance"],output["module"])}function
instantiateArrayBuffer(receiver){return getBinaryPromise().then(function(binary){return
WebAssembly.instantiate(binary,info)}.then(receiver,function(reason){err("failed to asynchronously prepare
wasm: "+reason);abort(reason)}))}function instantiateAsync(){if(!wasmBinary&&typeof
WebAssembly.instantiateStreaming==="function"&&!isDataURI(wasmBinaryFile)&&!isFileURI(wasmBinaryFil
e)&&typeof fetch==="function"){return fetch(wasmBinaryFile,{credentials:"same-
origin"}).then(function(response){var result=WebAssembly.instantiateStreaming(response,info);return
result.then(receiveInstantiatedSource,function(reason){err("wasm streaming compile failed: "+reason);err("falling
back to ArrayBuffer instantiation");return instantiateArrayBuffer(receiveInstantiatedSource)}))}else{return
instantiateArrayBuffer(receiveInstantiatedSource)}if(Module["instantiateWasm"]){try{var
exports=Module["instantiateWasm"](info,receiveInstance);return exports}catch(e){err("Module.instantiateWasm
callback failed with error: "+e);return false}}instantiateAsync().catch(Promise.reject);return{}}var
ASM_CONSTS={10520:function(){throw"Canceled!"},10538:function($0,$1){setTimeout(function(){__emscript
en_do_dispatch_to_thread($0,$1),0})}};function initPthreadsJS(){PThread.initRuntime();function
callRuntimeCallbacks(callbacks){while(callbacks.length>0){var callback=callbacks.shift();if(typeof
callback==="function"){callback(Module);continue}var func=callback.func;if(typeof
func==="number"){if(callback.arg===undefined){wasmTable.get(func)}else{wasmTable.get(func)(callback.arg)
}}else{func(callback.arg===undefined?null:callback.arg)}}}var
ERRNO_CODES={EPERM:63,ENOENT:44,ESRCH:71,EINTR:27,EIO:29,ENXIO:60,E2BIG:1,ENOEXEC:45,E
BADF:8,ECHILD:12,EAGAIN:6,EWOULDBLOCK:6,ENOMEM:48,EACCES:2,EFAULT:21,ENOTBLK:105,EB
USY:10,EEXIST:20,EXDEV:75,ENODEV:43,ENOTDIR:54,EISDIR:31,EINVAL:28,ENFILE:41,EMFILE:33,EN
OTTY:59,ETXTBSY:74,EFBIG:22,ENOSPC:51,ESPIPE:70,EROFS:69,EMLINK:34,EPIPE:64,EDOM:18,ERAN
GE:68,ENOMSG:49,EIDRM:24,ECHRNG:106,EL2NSYNC:156,EL3HLT:107,EL3RST:108,ELNRNG:109,EUNA
TCH:110,ENOSYS:111,EL2HLT:112,EDEADLK:16,ENOLCK:46,EBADDE:113,EBADR:114,EXFULL:115,ENOA
NO:104,EBADRQC:103,EBADSLT:102,EDEADLOCK:16,EBFONT:101,ENOSTR:100,ENODATA:116,ETIME:

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117,ENOSR:118,ENONET:119,ENOPKG:120,EREMOTE:121,ENOLINK:47,EADV:122,ESRMNT:123,ECOMM
:124,EPROTO:65,EMULTIHOP:36,EDOTDOT:125,EBADMSG:9,ENOTUNIQ:126,EBADFD:127,EREMCHG:1
28,ELIBACC:129,ELIBBAD:130,ELIBSCN:131,ELIBMAX:132,ELIBEXEC:133,ENOSYS:52,ENOTEMPTY:55,
ENAMETOOLONG:37,ELOOP:32,EOPNOTSUPP:138,EPFNOSUPPORT:139,ECONNRESET:15,ENOBUFS:42,
EAFNOSUPPORT:5,EPROTOTYPE:67,ENOTSOCK:57,ENOPROTOOPT:50,ESHUTDOWN:140,ECONNREFU
SED:14,EADDRINUSE:3,ECONNABORTED:13,ENETUNREACH:40,ENETDOWN:38,ETIMEDOUT:73,EHOS
TDOWN:142,EHOSTUNREACH:23,EINPROGRESS:26,EALREADY:7,EDESTADDRREQ:17,EMSGSIZE:35,E
PROTONOSUPPORT:66,ESOCKTNOSUPPORT:137,EADDRNOTAVAIL:4,ENETRESET:39,EISCONN:30,EN
OTCONN:53,ETOOMANYREFS:141,EUSERS:136,EDQUOT:19,ESTALE:72,ENOTSUP:138,ENOMEDIUM:14
8,EILSEQ:25,E_OVERFLOW:61,ECANCELED:11,ENOTRECOVERABLE:56,EOWNERDEAD:62,ESTRPIPE:13
5};function
_emsripten_futex_wake(addr,count){if(addr<=0||addr>GROWABLE_HEAP_I8().length||addr&3!=0||count<0)retu
rn-28;if(count==0)return 0;if(count>=2147483647)count=Infinity;var
mainThreadWaitAddress=Atomics.load(GROWABLE_HEAP_I32(),__emsripten_main_thread_futex>>2);var
mainThreadWoken=0;if(mainThreadWaitAddress==addr){var
loadedAddr=Atomics.compareExchange(GROWABLE_HEAP_I32(),__emsripten_main_thread_futex>>2,mainTh
readWaitAddress,0);if(loadedAddr==mainThreadWaitAddress){--count;mainThreadWoken=1;if(count<=0)return
1}}var ret=Atomics.notify(GROWABLE_HEAP_I32(),addr>>2,count);if(ret>=0)return
ret+mainThreadWoken;throw\"Atomics.notify returned an unexpected value
\"+ret}Module[\"_emsripten_futex_wake\"]=_emsripten_futex_wake;function
killThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw\"Internal Error! killThread() can only ever be
called from main application thread!\";if(!pthread_ptr)throw\"Internal Error! Null pthread_ptr in
killThread!\";GROWABLE_HEAP_I32()[pthread_ptr+12>>2]=0;var
pthread=PThread.threads[pthread_ptr];pthread.worker.terminate();PThread.freeThreadData(pthread);PThread.runni
ngWorkers.splice(PThread.runningWorkers.indexOf(pthread.worker),1);pthread.worker.pthread=undefined}functio
n cancelThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw\"Internal Error! cancelThread() can only
ever be called from main application thread!\";if(!pthread_ptr)throw\"Internal Error! Null pthread_ptr in
cancelThread!\";var
pthread=PThread.threads[pthread_ptr];pthread.worker.postMessage({\"cmd\": \"cancel\"})}function
cleanupThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw\"Internal Error! cleanupThread() can only
ever be called from main application thread!\";if(!pthread_ptr)throw\"Internal Error! Null pthread_ptr in
cleanupThread!\";var
pthread=PThread.threads[pthread_ptr];if(pthread){GROWABLE_HEAP_I32()[pthread_ptr+12>>2]=0;var
worker=pthread.worker;PThread.returnWorkerToPool(worker)}}var
PThread={unusedWorkers:[],runningWorkers:[],initMainThreadBlock:function(){var
pthreadPoolSize=8;for(var
i=0;i<pthreadPoolSize;++i){PThread.allocateUnusedWorker()}},initRuntime:function(){var
tb=_malloc(228);for(var
i=0;i<228/4;++i)GROWABLE_HEAP_U32()[tb/4+i]=0;GROWABLE_HEAP_I32()[tb+12>>2]=tb;var
headPtr=tb+152;GROWABLE_HEAP_I32()[headPtr>>2]=headPtr;var tlsMemory=_malloc(512);for(var
i=0;i<128;++i)GROWABLE_HEAP_U32()[tlsMemory/4+i]=0;Atomics.store(GROWABLE_HEAP_U32(),tb+100
>>2,tlsMemory);Atomics.store(GROWABLE_HEAP_U32(),tb+40>>2,tb);__emsripten_thread_init(tb,1,ENVIRON
MENT_IS_WORKER,1);__emsripten_register_main_browser_thread_id(tb);initWorker:function(){},threads:{},t
hreadExitHandlers:[],setThreadStatus:function(){},runExitHandlers:function(){while(PThread.threadExitHandlers.l
ength>0){PThread.threadExitHandlers.pop()}if(ENVIRONMENT_IS_PTHREAD&&__pthread_self())__pthread
_tsd_run_dtors()},runExitHandlersAndDeinitThread:function(tb,exitCode){Atomics.store(GROWABLE_HEAP_U
32(),tb+56>>2,1);Atomics.store(GROWABLE_HEAP_U32(),tb+60>>2,0);PThread.runExitHandlers();Atomics.stor
e(GROWABLE_HEAP_U32(),tb+4>>2,exitCode);Atomics.store(GROWABLE_HEAP_U32(),tb+0>>2,1);_emscri

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pten_futex_wake(tb+0,2147483647);__emscripten_thread_init(0,0,0)},threadExit:function(exitCode){var
tb=_pthread_self();if(tb){PThread.runExitHandlersAndDeinitThread(tb,exitCode);if(ENVIRONMENT_IS_PTHRE
AD){postMessage({"cmd":"exit"})}},threadCancel:function(){PThread.runExitHandlersAndDeinitThread(_pthr
ead_self(),-1);postMessage({"cmd":"cancelDone"})},terminateAllThreads:function(){for(var t in
PThread.pthreads){var
pthread=PThread.pthreads[t];if(pthread&&pthread.worker){PThread.returnWorkerToPool(pthread.worker)}PThre
ad.pthreads={};for(var i=0;i<PThread.unusedWorkers.length;++i){var
worker=PThread.unusedWorkers[i];worker.terminate()}PThread.unusedWorkers=[];for(var
i=0;i<PThread.runningWorkers.length;++i){var worker=PThread.runningWorkers[i];var
pthread=worker.pthread;PThread.freeThreadData(pthread);worker.terminate()}PThread.runningWorkers=[],freeTh
readData:function(pthread){if(!pthread)return;if(pthread.threadInfoStruct){var
tlsMemory=GROWABLE_HEAP_I32()[pthread.threadInfoStruct+100>>2];GROWABLE_HEAP_I32()[pthread.thr
eadInfoStruct+100>>2]=0;_free(tlsMemory);_free(pthread.threadInfoStruct)}pthread.threadInfoStruct=0;if(pthread.
allocatedOwnStack&&pthread.stackBase)_free(pthread.stackBase);pthread.stackBase=0;if(pthread.worker)pthread.
worker.pthread=null},returnWorkerToPool:function(worker){PThread.runWithoutMainThreadQueuedCalls(funcio
n){delete
PThread.pthreads[worker.pthread.threadInfoStruct];PThread.unusedWorkers.push(worker);PThread.runningWorker
s.splice(PThread.runningWorkers.indexOf(worker),1);PThread.freeThreadData(worker.pthread);worker.pthread=un
defined}},runWithoutMainThreadQueuedCalls:function(func){GROWABLE_HEAP_I32()[__emscripten_allow_ma
in_runtime_queued_calls>>2]=0;try{func()}finally{GROWABLE_HEAP_I32()[__emscripten_allow_ma
in_runtime_queued_calls>>2]=1}},receiveObjectTransfer:function(data){},loadWasmModuleToWorker:function(worker,o
nFinishedLoading){worker.onmessage=function(e){var
d=e["data"];var
cmd=d["cmd"];if(worker.pthread)PThread.currentProxiedOperationCallerThread=worker.pthread.threadInfoStruct;
if(d["targetThread"]&&d["targetThread"]!="_pthread_self"){var
thread=PThread.pthreads[d.targetThread];if(thread){thread.worker.postMessage(e.data,d["transferList"]);}else{con
sole.error('Internal error! Worker sent a message \''+cmd+'\' to target pthread '+d["targetThread"]+', but that
thread no longer
exists!')}PThread.currentProxiedOperationCallerThread=undefined;return}if(cmd==="processQueuedMainThread
Work"){__emscripten_main_thread_process_queued_calls()}else
if(cmd==="spawnThread"){spawnThread(e.data)}else
if(cmd==="cleanupThread"){cleanupThread(d["thread"]);}else
if(cmd==="killThread"){killThread(d["thread"]);}else
if(cmd==="cancelThread"){cancelThread(d["thread"]);}else
if(cmd==="loaded"){worker.loaded=true;if(onFinishedLoading)onFinishedLoading(worker);if(worker.runPthread)
{worker.runPthread();delete
worker.runPthread}}else if(cmd==="print"){out("Thread "+d["threadId"]+": "+d["text"]);}else
if(cmd==="printErr"){err("Thread "+d["threadId"]+": "+d["text"]);}else if(cmd==="alert"){alert("Thread
"+d["threadId"]+": "+d["text"]);}else if(cmd==="exit"){var
detached=worker.pthread&&Atomics.load(GROWABLE_HEAP_U32(),worker.pthread.threadInfoStruct+64>>2);if
(detached){PThread.returnWorkerToPool(worker)}else
if(cmd==="exitProcess"){try{exit(d["returnCode"]);}catch(e){if(e instanceof ExitStatus)return;throw e}}else
if(cmd==="cancelDone"){PThread.returnWorkerToPool(worker)}else
if(cmd==="objectTransfer"){PThread.receiveObjectTransfer(e.data)}else
if(e.data.target==="setimmediate"){worker.postMessage(e.data)}else{err("worker sent an unknown command
'+cmd')}PThread.currentProxiedOperationCallerThread=undefined};worker.onerror=function(e){err("pthread sent
an error! "+e.filename+": "+e.lineno+":
'+e.message)};if(ENVIRONMENT_IS_NODE){worker.on("message",function(data){worker.onmessage({data:d

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ata}));worker.on("error",function(data){worker.onerror(data)});worker.on("exit",function(data){})}worker.postMessage({"cmd":"load","urlOrBlob":"Module["mainScriptUrlOrBlob"]|_scriptDir,"wasmMemory":"wasmMemory","wasmModule":"wasmModule"}),allocateUnusedWorker:function(){var pthreadMainJs=locateFile("tfjs-backend-wasm-threaded-simd.worker.js");PThread.unusedWorkers.push(new Worker(pthreadMainJs)),getNewWorker:function(){if(PThread.unusedWorkers.length==0){PThread.allocateUnusedWorker();PThread.loadWasmModuleToWorker(PThread.unusedWorkers[0])}if(PThread.unusedWorkers.length>0)return PThread.unusedWorkers.pop();else return null},busySpinWait:function(msecs){var t=performance.now()+msecs;while(performance.now()<t){}};function establishStackSpace(stackTop,stackMax){_emscripten_stack_set_limits(stackTop,stackMax);stackRestore(stackTop)}Module["establishStackSpace"]=establishStackSpace;function getNoExitRuntime(){return noExitRuntime}Module["getNoExitRuntime"]=getNoExitRuntime;function invokeEntryPoint(ptr,arg){return wasmTable.get(ptr)(arg)}Module["invokeEntryPoint"]=invokeEntryPoint;function __assert_fail(condition,filename,line,func){abort("Assertion failed: "+UTF8ToString(condition)+" , at: "+[filename?UTF8ToString(filename):"unknown filename",line,func?UTF8ToString(func):"unknown function"])}function __call_main(argc,argv){var returnCode=_main(argc,argv)}var _emscripten_get_now;if(ENVIRONMENT_IS_NODE){_emscripten_get_now=function(){var t=process["hrtime"]();return t[0]*1e3+t[1]/1e6}}else if(ENVIRONMENT_IS_PTHREAD){_emscripten_get_now=function(){return performance.now()-Module["__performance_now_clock_drift"]}}else if(typeof dateNow!="undefined"){_emscripten_get_now=dateNow}else _emscripten_get_now=function(){return performance.now()};function setErrNo(value){GROWABLE_HEAP_I32()[__errno_location()>>2]=value;return value}function _atexit(func,arg){if(ENVIRONMENT_IS_PTHREAD)return _emscripten_proxy_to_main_thread_js(1,1,func,arg)}function __emscripten_notify_thread_queue(targetThreadId,mainThreadId){if(targetThreadId==mainThreadId){postMessage({"cmd":"processQueuedMainThreadWork"})}else if(ENVIRONMENT_IS_PTHREAD){postMessage({"targetThread":targetThreadId,"cmd":"processThreadQueue"})}else{var pthread=PThread.threads[targetThreadId];var worker=pthread&&pthread.worker;if(!worker){return}worker.postMessage({"cmd":"processThreadQueue"})}return 1}function _abort(){abort()}function _emscripten_asm_const_int(code,sigPtr,argbuf){var args=readAsmConstArgs(sigPtr,argbuf);return ASM_CONSTS[code].apply(null,args)}function _emscripten_conditional_set_current_thread_status(expectedStatus,newStatus){}function _emscripten_futex_wait(addr,val,timeout){if(addr<=0||addr>GROWABLE_HEAP_I8().length||addr&3!=0)return-28;if(!ENVIRONMENT_IS_WEB){var ret=Atomics.wait(GROWABLE_HEAP_I32(),addr>>2,val,timeout);if(ret==="timed-out")return-73;if(ret==="not-equal")return-6;if(ret==="ok")return 0;throw"Atomics.wait returned an unexpected value "+ret}else{if(Atomics.load(GROWABLE_HEAP_I32(),addr>>2)!=val){return-6}var tNow=performance.now();var tEnd=tNow+timeout;var lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2,addr);while(1){tNow=performance.now();if(tNow>tEnd){lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2,0);return-73}lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2,0);if(lastAddr==0){break}}_emscripten_main_thread_process_queued_calls();if(Atomics.load(GROWABLE_HEAP_I32(),addr>>2)!=val){return-6}lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2,addr)}return 0}}function _emscripten_memcpy_big(dest,src,num){GROWABLE_HEAP_U8().copyWithin(dest,src,src+num)}function

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_emsripten_num_logical_cores(){if(ENVIRONMENT_IS_NODE)return require("\os").cpus().length;return
navigator["hardwareConcurrency"]}function
_emsripten_proxy_to_main_thread_js(index, sync){ var numCallArgs=arguments.length-2; var
stack=stackSave(); var serializedNumCallArgs=numCallArgs; var args=stackAlloc(serializedNumCallArgs*8); var
b=args>>3; for(var i=0; i<numCallArgs; i++){ var arg=arguments[2+i]; GROWABLE_HEAP_F64()[b+i]=arg } var
ret=_emsripten_run_in_main_runtime_thread_js(index, serializedNumCallArgs, args, sync); stackRestore(stack); return
ret } var _emsripten_receive_on_main_thread_js_callArgs=[]; var readAsmConstArgsArray=[]; function
readAsmConstArgs(sigPtr, buf){ readAsmConstArgsArray.length=0; var
ch; buf>>=2; while(ch=GROWABLE_HEAP_U8()[sigPtr++){ var
double=ch<105; if(double&&buf&1)buf++; readAsmConstArgsArray.push(double?GROWABLE_HEAP_F64()[buf
++>>1]:GROWABLE_HEAP_I32()[buf]); ++buf } return readAsmConstArgsArray } function
_emsripten_receive_on_main_thread_js(index, numCallArgs, args){ _emsripten_receive_on_main_thread_js_callA
rgs.length=numCallArgs; var b=args>>3; for(var
i=0; i<numCallArgs; i++){ _emsripten_receive_on_main_thread_js_callArgs[i]=GROWABLE_HEAP_F64()[b+i] } v
ar
isEmAsmConst=index<0; var func=isEmAsmConst?proxiedFunctionTable[index]:ASM_CONSTS[-index-
1]; return func.apply(null, _emsripten_receive_on_main_thread_js_callArgs) } function
_emsripten_get_heap_size(){ return GROWABLE_HEAP_U8().length } function
emsripten_realloc_buffer(size){ try { wasmMemory.grow(size-
buffer.byteLength+65535>>>16); updateGlobalBufferAndViews(wasmMemory.buffer); return
1 } catch(e) { } } function _emsripten_resize_heap(requestedSize){ var
oldSize=_emsripten_get_heap_size(); if(requestedSize<=oldSize){ return false } var
maxHeapSize=2147483648; if(requestedSize>maxHeapSize){ return false } for(var
cutDown=1; cutDown<=4; cutDown*=2){ var
overGrownHeapSize=oldSize*(1+.2/cutDown); overGrownHeapSize=Math.min(overGrownHeapSize, requestedSize
+100663296); var
newSize=Math.min(maxHeapSize, alignUp(Math.max(requestedSize, overGrownHeapSize), 65536)); var
replacement=emsripten_realloc_buffer(newSize); if(replacement){ return true } } return false } var
JSEvents={ inEventHandler:0, removeAllEventListeners:function(){ for(var
i=JSEvents.eventHandlers.length-1; i>=0; --
i){ JSEvents._removeHandler(i) } JSEvents.eventHandlers=[]; JSEvents.deferredCalls=[] }, registerRemoveEventListen
ers:function(){ if(!JSEvents.removeAllEventListenersRegistered){ __ATEXIT__.push(JSEvents.removeAllEventListene
rs); JSEvents.removeAllEventListenersRegistered=true } }, deferredCalls:[], deferCall:function(targetFunction, precedence
, argsList){ function arraysHaveEqualContent(arrA, arrB){ if(arrA.length!=arrB.length) return false; for(var i in
arrA){ if(arrA[i]!=arrB[i]) return false } return true } for(var i in JSEvents.deferredCalls){ var
call=JSEvents.deferredCalls[i]; if(call.targetFunction==targetFunction&&arraysHaveEqualContent(call.argsList, args
List)){ return } } JSEvents.deferredCalls.push({ targetFunction:targetFunction, precedence:precedence, argsList:argsList
}); JSEvents.deferredCalls.sort(function(x, y){ return
x.precedence<y.precedence } ), removeDeferredCalls:function(targetFunction){ for(var
i=0; i<JSEvents.deferredCalls.length; ++i){ if(JSEvents.deferredCalls[i].targetFunction==targetFunction){ JSEvents.d
eferredCalls.splice(i, 1); --i } }, canPerformEventHandlerRequests:function(){ return
JSEvents.inEventHandler&&JSEvents.currentEventHandler.allowsDeferredCalls }, runDeferredCalls:function(){ if(!J
SEvents.canPerformEventHandlerRequests()){ return } for(var i=0; i<JSEvents.deferredCalls.length; ++i){ var
call=JSEvents.deferredCalls[i]; JSEvents.deferredCalls.splice(i, 1); --
i; call.targetFunction.apply(null, call.argsList) }, eventHandlers:[], removeAllHandlersOnTarget:function(target, event
TypeString){ for(var
i=0; i<JSEvents.eventHandlers.length; ++i){ if(JSEvents.eventHandlers[i].target==target&&(!eventTypeString||event
TypeString==JSEvents.eventHandlers[i].eventTypeString)){ JSEvents._removeHandler(i--

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}}} ,_removeHandler:function(i){ var
h=JSEvents.eventHandlers[i];h.target.removeEventListener(h.eventTypeString,h.eventListenerFunc,h.useCapture);J
SEvents.eventHandlers.splice(i,1)},registerOrRemoveHandler:function(eventHandler){ var
jsEventHandler=function
jsEventHandler(event){++JSEvents.inEventHandler;JSEvents.currentEventHandler=eventHandler;JSEvents.runDef
erredCalls();eventHandler.handlerFunc(event);JSEvents.runDeferredCalls();--
JSEvents.inEventHandler};if(eventHandler.callbackfunc){ eventHandler.eventListenerFunc=jsEventHandler;eventH
andler.target.addEventListener(eventHandler.eventTypeString,jsEventHandler,eventHandler.useCapture);JSEvents.e
ventHandlers.push(eventHandler);JSEvents.registerRemoveEventListeners()}else{ for(var
i=0;i<JSEvents.eventHandlers.length;+i){ if(JSEvents.eventHandlers[i].target==eventHandler.target&&JSEvents.e
ventHandlers[i].eventTypeString==eventHandler.eventTypeString){JSEvents._removeHandler(i--
)}}}},queueEventHandlerOnThread_iiii:function(targetThread,eventHandlerFunc,eventTypeId,eventData,userData)
{ var stackTop=stackSave();var
varargs=stackAlloc(12);GROWABLE_HEAP_I32()[varargs>>2]=eventTypeId;GROWABLE_HEAP_I32()[varargs
+4>>2]=eventData;GROWABLE_HEAP_I32()[varargs+8>>2]=userData;__emscripten_call_on_thread(0,targetThr
ead,637534208,eventHandlerFunc,eventData,varargs);stackRestore(stackTop)},getTargetThreadForEventCallback:f
unction(targetThread){ switch(targetThread){ case
1:return 0;case 2:return PThread.currentProxiedOperationCallerThread;default:return
targetThread}},getNodeNameForTarget:function(target){ if(!target)return\"";if(target==window)return\"#window\";
if(target==screen)return\"#screen\";return
target&&target.nodeName?target.nodeName:\"\"},fullscreenEnabled:function(){ return
document.fullscreenEnabled||document.webkitFullscreenEnabled}};function stringToNewUTF8(jsString){ var
length=lengthBytesUTF8(jsString)+1;var cString=_malloc(length);stringToUTF8(jsString,cString,length);return
cString}function
_emscripten_set_offscreencanvas_size_on_target_thread_js(targetThread,targetCanvas,width,height){ var
stackTop=stackSave();var varargs=stackAlloc(12);var
targetCanvasPtr=0;if(targetCanvas){ targetCanvasPtr=stringToNewUTF8(targetCanvas);GROWABLE_HEAP_I32(
)[varargs>>2]=targetCanvasPtr;GROWABLE_HEAP_I32()[varargs+4>>2]=width;GROWABLE_HEAP_I32()[var
args+8>>2]=height;__emscripten_call_on_thread(0,targetThread,657457152,0,targetCanvasPtr,varargs);stackRestor
e(stackTop)}function
_emscripten_set_offscreencanvas_size_on_target_thread(targetThread,targetCanvas,width,height){ targetCanvas=tar
getCanvas?UTF8ToString(targetCanvas):\"\";_emscripten_set_offscreencanvas_size_on_target_thread_js(targetThr
ead,targetCanvas,width,height)}function maybeCStringToJsString(cString){ return
cString>2?UTF8ToString(cString):cString}var specialHTMLTargets=[0,typeof
document!=="undefined"?document:0,typeof window!=="undefined"?window:0];function
findEventTarget(target){ target=maybeCStringToJsString(target);var
domElement=specialHTMLTargets[target]||(typeof
document!=="undefined"?document.querySelector(target):undefined);return domElement}function
findCanvasEventTarget(target){ return findEventTarget(target)}function
_emscripten_set_canvas_element_size_calling_thread(target,width,height){ var
canvas=findCanvasEventTarget(target);if(!canvas)return-
4;if(canvas.canvasSharedPtr){ GROWABLE_HEAP_I32()[canvas.canvasSharedPtr>>2]=width;GROWABLE_HEA
P_I32()[canvas.canvasSharedPtr+4>>2]=height}if(canvas.offscreenCanvas||!canvas.controlTransferredOffscreen){ if
(canvas.offscreenCanvas)canvas=canvas.offscreenCanvas;var
autoResizeViewport=false;if(canvas.GLctxObject&&canvas.GLctxObject.GLctx){ var
prevViewport=canvas.GLctxObject.GLctx.getParameter(2978);autoResizeViewport=prevViewport[0]==0&&prev
Viewport[1]==0&&prevViewport[2]==0&&prevViewport[3]==0&&prevViewport[3]==0&&prevViewport[3]==0&&prev
Viewport[3]==0&&prevViewport[2]==0&&prevViewport[2]==0&&prevViewport[3]==0&&prevViewport[3]==0}
canvas.width=width;
canvas.height=height;if(autoResizeViewport){ canvas.GLctxObject.GLctx.viewport(0,0,width,height)}}else

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if(canvas.canvasSharedPtr){ var
targetThread=GROWABLE_HEAP_I32()[canvas.canvasSharedPtr+8>>2];_emscripten_set_offscreencanvas_size_o
n_target_thread(targetThread,target,width,height);return 1 }else{return-4}return 0}function
_emscripten_set_canvas_element_size_main_thread(target,width,height){if(ENVIRONMENT_IS_PTHREAD)retur
n
_emscripten_proxy_to_main_thread_js(2,1,target,width,height);return
_emscripten_set_canvas_element_size_calling_thread(target,width,height)}function
_emscripten_set_canvas_element_size(target,width,height){ var
canvas=findCanvasEventTarget(target);if(canvas){ return
_emscripten_set_canvas_element_size_calling_thread(target,width,height)}else{return
_emscripten_set_canvas_element_size_main_thread(target,width,height)} }function
_emscripten_set_current_thread_status(newStatus){ }function
_emscripten_set_thread_name(threadId,name){ }function __webgl_enable_ANGLE_instanced_arrays(ctx){ var
ext=ctx.getExtension("\ ANGLE_instanced_arrays");if(ext){ ctx["vertexAttribDivisor"]=function(index,divisor){ ex
t["vertexAttribDivisorANGLE"](index,divisor)};ctx["drawArraysInstanced"]=function(mode,first,count,primcou
nt){ ext["drawArraysInstancedANGLE"](mode,first,count,primcount)};ctx["drawElementsInstanced"]=function(
mode,count,type,indices,primcount){ ext["drawElementsInstancedANGLE"](mode,count,type,indices,primcount)};
return
1 } }function __webgl_enable_OES_vertex_array_object(ctx){ var
ext=ctx.getExtension("\ OES_vertex_array_object");if(ext){ ctx["createVertexArray"]=function(){ return
ext["createVertexArrayOES"]();};ctx["deleteVertexArray"]=function(vao){ ext["deleteVertexArrayOES"](vao)};
ctx["bindVertexArray"]=function(vao){ ext["bindVertexArrayOES"](vao)};ctx["isVertexArray"]=function(vao)
{ return ext["isVertexArrayOES"](vao)};return 1 } }function __webgl_enable_WEBGL_draw_buffers(ctx){ var
ext=ctx.getExtension("\ WEBGL_draw_buffers");if(ext){ ctx["drawBuffers"]=function(n,bufs){ ext["drawBuffers
WEBGL"](n,bufs)};return 1 } }function
__webgl_enable_WEBGL_multi_draw(ctx){ return!(ctx.multiDrawWebgl=ctx.getExtension("\ WEBGL_multi_dra
w"))}var
GL={ counter:1,buffers:[],programs:[],framebuffers:[],renderbuffers:[],textures:[],uniforms:[],shaders:[],vaos:[],cont
exts:{ },offscreenCanvases:{ },timerQueriesEXT:[],programInfos:{ },stringCache:{ },unpackAlignment:4,recordError:
function
recordError(errorCode){ if(!GL.lastError){ GL.lastError=errorCode } },getNewId:function(table){ var
ret=GL.counter++;for(var i=table.length;i<ret;i++){ table[i]=null}return
ret},getSource:function(shader,count,string,length){ var source="";for(var i=0;i<count;++i){ var
len=length?GROWABLE_HEAP_I32()[length+i*4>>2]:-
1;source+=UTF8ToString(GROWABLE_HEAP_I32()[string+i*4>>2],len<0?undefined:len)}return
source},createContext:function(canvas,webGLContextAttributes){ var
ctx=canvas.getContext("\ webgl",webGLContextAttributes);if(!ctx)return 0;var
handle=GL.registerContext(ctx,webGLContextAttributes);return
handle},registerContext:function(ctx,webGLContextAttributes){ var
handle=_malloc(8);GROWABLE_HEAP_I32()[handle+4>>2]=_pthread_self();var
context={ handle:handle,attributes:webGLContextAttributes,version:webGLContextAttributes.majorVersion,GLctx:
ctx };if(ctx.canvas)ctx.canvas.GLctxObject=context;GL.contexts[handle]=context;if(typeof
webGLContextAttributes.enableExtensionsByDefault===\ undefined\ ||webGLContextAttributes.enableExtensions
ByDefault){ GL.initExtensions(context)}return
handle},makeContextCurrent:function(contextHandle){ GL.currentContext=GL.contexts[contextHandle];Module.ctx
=GLctx=GL.currentContext&&GL.currentContext.GLctx;return!(contextHandle&&!GLctx)},getContext:function(c
ontextHandle){ return
GL.contexts[contextHandle]},deleteContext:function(contextHandle){ if(GL.currentContext===GL.contexts[context

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Handle))GL.currentContext=null;if(typeof
JSEvents===\"object\")JSEvents.removeAllHandlersOnTarget(GL.contexts[contextHandle].GLctx.canvas);if(GL.co
ntexts[contextHandle]&&GL.contexts[contextHandle].GLctx.canvas)GL.contexts[contextHandle].GLctx.canvas.GL
ctxObject=undefined;_free(GL.contexts[contextHandle].handle);GL.contexts[contextHandle]=null},initExtensions:f
unction(context){if(!context)context=GL.currentContext;if(context.initExtensionsDone)return;context.initExtension
sDone=true;var
GLctx=context.GLctx;__webgl_enable_ANGLE_instanced_arrays(GLctx);__webgl_enable_OES_vertex_array_obj
ect(GLctx);__webgl_enable_WEBGL_draw_buffers(GLctx);GLctx.disjointTimerQueryExt=GLctx.getExtension(\"
EXT_disjoint_timer_query\");__webgl_enable_WEBGL_multi_draw(GLctx);var
exts=GLctx.getSupportedExtensions()||[];exts.forEach(function(ext){if(ext.indexOf(\"lose_context\")<0&&ext.inde
xOf(\"debug\")<0){GLctx.getExtension(ext)}}),populateUniformTable:function(program){var
p=GL.programs[program];var
ptable=GL.programInfos[program]={uniforms:{},maxUniformLength:0,maxAttributeLength:-
1,maxUniformBlockNameLength:-1};var utable=ptable.uniforms;var
numUniforms=GLctx.getProgramParameter(p,35718);for(var i=0;i<numUniforms;++i){var
u=GLctx.getActiveUniform(p,i);var
name=u.name;ptable.maxUniformLength=Math.max(ptable.maxUniformLength,name.length+1);if(name.slice(-
1)===\"|\"){name=name.slice(0,name.lastIndexOf(\"|\"))}var loc=GLctx.getUniformLocation(p,name);if(loc){var
id=GL.getNewId(GL.uniforms);utable[name]=[u.size,id];GL.uniforms[id]=loc;for(var
j=1;j<u.size;++j){var
n=name+\"|+j+|\";loc=GLctx.getUniformLocation(p,n);id=GL.getNewId(GL.uniforms);GL.uniforms[id]=loc}}
};var __emscripten_webgl_power_preferences=[\"default\", \"low-power\", \"high-performance\"];function
__emscripten_webgl_do_create_context(target,attributes){var a=attributes>>2;var
powerPreference=GROWABLE_HEAP_I32()[a+(24>>2)];var
contextAttributes={\"alpha\":!!GROWABLE_HEAP_I32()[a+(0>>2)],\"depth\":!!GROWABLE_HEAP_I32()[a+(4
>>2)],\"stencil\":!!GROWABLE_HEAP_I32()[a+(8>>2)],\"antialias\":!!GROWABLE_HEAP_I32()[a+(12>>2)],\"p
remultipliedAlpha\":!!GROWABLE_HEAP_I32()[a+(16>>2)],\"preserveDrawingBuffer\":!!GROWABLE_HEAP_
I32()[a+(20>>2)],\"powerPreference\":__emscripten_webgl_power_preferences[powerPreference],\"failIfMajorPerf
ormanceCaveat\":!!GROWABLE_HEAP_I32()[a+(28>>2)],majorVersion:GROWABLE_HEAP_I32()[a+(32>>2)],
minorVersion:GROWABLE_HEAP_I32()[a+(36>>2)],enableExtensionsByDefault:GROWABLE_HEAP_I32()[a+(
40>>2)],explicitSwapControl:GROWABLE_HEAP_I32()[a+(44>>2)],proxyContextToMainThread:GROWABLE_
HEAP_I32()[a+(48>>2)],renderViaOffscreenBackBuffer:GROWABLE_HEAP_I32()[a+(52>>2)]};var
canvas=findCanvasEventTarget(target);if(!canvas){return 0}if(contextAttributes.explicitSwapControl){return
0}var contextHandle=GL.createContext(canvas,contextAttributes);return contextHandle}function
__emscripten_webgl_create_context(a0,a1){return __emscripten_webgl_do_create_context(a0,a1)}var
SYSCALLS={mappings:{},buffers:[null,[],[]],printChar:function(stream,curr){var
buffer=SYSCALLS.buffers[stream];if(curr===0||curr===10){(stream===1?out:err)(UTF8ArrayToString(buffer,0));
buffer.length=0}else{buffer.push(curr)}},varargs:undefined,get:function(){SYSCALLS.varargs+=4;var
ret=GROWABLE_HEAP_I32()[SYSCALLS.varargs-4>>2];return ret},getStr:function(ptr){var
ret=UTF8ToString(ptr);return ret},get64:function(low,high){return low}};function
__fd_close(fd){if(ENVIRONMENT_IS_PTHREAD)return __emscripten_proxy_to_main_thread_js(3,1,fd);return
0}function __fd_seek(fd,offset_low,offset_high,whence,newOffset){if(ENVIRONMENT_IS_PTHREAD)return
__emscripten_proxy_to_main_thread_js(4,1,fd,offset_low,offset_high,whence,newOffset)}function
__fd_write(fd,iiov,iiovcnt,pnum){if(ENVIRONMENT_IS_PTHREAD)return
__emscripten_proxy_to_main_thread_js(5,1,fd,iiov,iiovcnt,pnum);var num=0;for(var i=0;i<iiovcnt;i++){var
ptr=GROWABLE_HEAP_I32()[iiov+i*8>>2];var len=GROWABLE_HEAP_I32()[iiov+(i*8+4)>>2];for(var
j=0;j<len;j++){SYSCALLS.printChar(fd,GROWABLE_HEAP_U8)[ptr+j]}num+=len}GROWABLE_HEAP_I32
()[pnum>>2]=num;return 0}function __pthread_cleanup_pop(execute){var

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routine=PThread.threadExitHandlers.pop();if(execute)routine()}function
_thread_cleanup_push(routine,arg){PThread.threadExitHandlers.push(function(){ wasmTable.get(routine)(arg)}})f
unction spawnThread(threadParams){if(ENVIRONMENT_IS_PTHREAD)throw\`"Internal Error! spawnThread()
can only ever be called from main application thread!\`;var
worker=PThread.getNewWorker();if(worker.pthread!==undefined)throw\`"Internal
error!\`;if(!threadParams.pthread_ptr)throw\`"Internal
error, no pthread ptr!\`;PThread.runningWorkers.push(worker);var tlsMemory=_malloc(128*4);for(var
i=0;i<128;++i){GROWABLE_HEAP_I32()[tlsMemory+i*4>>2]=0}var
stackHigh=threadParams.stackBase+threadParams.stackSize;var
pthread=PThread.pthreads[threadParams.pthread_ptr]={ worker:worker,stackBase:threadParams.stackBase,stackSize
:threadParams.stackSize,allocatedOwnStack:threadParams.allocatedOwnStack,threadInfoStruct:threadParams.pthrea
d_ptr};var
tis=pthread.threadInfoStruct>>2;Atomics.store(GROWABLE_HEAP_U32(),tis+(64>>2),threadParams.detached);A
tomics.store(GROWABLE_HEAP_U32(),tis+(100>>2),tlsMemory);Atomics.store(GROWABLE_HEAP_U32(),tis
+(40>>2),pthread.threadInfoStruct);Atomics.store(GROWABLE_HEAP_U32(),tis+(80>>2),threadParams.stackSiz
e);Atomics.store(GROWABLE_HEAP_U32(),tis+(76>>2),stackHigh);Atomics.store(GROWABLE_HEAP_U32(),t
is+(104>>2),threadParams.stackSize);Atomics.store(GROWABLE_HEAP_U32(),tis+(104+8>>2),stackHigh);Atom
ics.store(GROWABLE_HEAP_U32(),tis+(104+12>>2),threadParams.detached);var
global_libc=_emscripten_get_global_libc();var
global_locale=global_libc+40;Atomics.store(GROWABLE_HEAP_U32(),tis+(172>>2),global_locale);worker.pthr
ead=pthread;var
msg={"cmd\`:"run\`,`"start_routine\`:threadParams.startRoutine,\`"arg\`:threadParams.arg,\`"threadInfoStruct\`:thre
adParams.pthread_ptr,\`"stackBase\`:threadParams.stackBase,\`"stackSize\`:threadParams.stackSize};worker.runPthr
ead=function(){ msg.time=performance.now();worker.postMessage(msg,threadParams.transferList)};if(worker.loaded
){ worker.runPthread();delete worker.runPthread} }function
_thread_create(pthread_ptr,attr,start_routine,arg){if(typeof SharedArrayBuffer===\`"undefined\`){err(\`"Current
environment does not support SharedArrayBuffer, pthreads are not available!\`");return
6}if(!pthread_ptr){err(\`"pthread_create called with a null thread pointer!\`");return 28}var transferList=[];var
error=0;if(ENVIRONMENT_IS_PTHREAD&&(transferList.length===0||error)){return
_emscripten_sync_run_in_main_thread_4(687865856,pthread_ptr,attr,start_routine,arg)}if(error)return
error;var stackSize=0;var stackBase=0;var detached=0;if(attr&&attr!=-
1){stackSize=GROWABLE_HEAP_I32()[attr>>2];stackSize+=81920;stackBase=GROWABLE_HEAP_I32()[attr+
8>>2];detached=GROWABLE_HEAP_I32()[attr+12>>2]!==0}else{stackSize=2097152}var
allocatedOwnStack=stackBase===0;if(allocatedOwnStack){stackBase=_memalign(16,stackSize)}else{stackBase=
stackSize;assert(stackBase>0)}var threadInfoStruct=_malloc(228);for(var
i=0;i<228>>2;++i)GROWABLE_HEAP_U32()[threadInfoStruct>>2+i]=0;GROWABLE_HEAP_I32()[pthread_ptr
>>2]=threadInfoStruct;GROWABLE_HEAP_I32()[threadInfoStruct+12>>2]=threadInfoStruct;var
headPtr=threadInfoStruct+152;GROWABLE_HEAP_I32()[headPtr>>2]=headPtr;var
threadParams={ stackBase:stackBase,stackSize:stackSize,allocatedOwnStack:allocatedOwnStack,detached:detached
,startRoutine:start_routine,pthread_ptr:threadInfoStruct,arg:arg,transferList:transferList};if(ENVIRONMENT_IS_P
THREAD){threadParams.cmd=\`"spawnThread\`;postMessage(threadParams,transferList)}else{spawnThread(thread
Params)}return
0}function __pthread_testcancel_js(){if(!ENVIRONMENT_IS_PTHREAD)return;var
tb=_pthread_self();if(!tb)return;var
cancelDisabled=Atomics.load(GROWABLE_HEAP_U32(),tb+56>>2);if(cancelDisabled)return;var
canceled=Atomics.load(GROWABLE_HEAP_U32(),tb+0>>2);if(canceled===2)throw\`"Canceled!\`"}function
_emscripten_check_blocking_allowed(){if(ENVIRONMENT_IS_NODE)return;if(ENVIRONMENT_IS_WORKE
R)return;warnOnce(\`"Blocking on the main thread is very dangerous, see

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https://emscripten.org/docs/porting/threads.html#blocking-on-the-main-browser-thread"}}function
__emscripten_do_pthread_join(thread,status,block){if(!thread){err("\pthread_join attempted on a null thread
pointer!");return
ERRNO_CODES.ESRCH}if(ENVIRONMENT_IS_PTHREAD&&_pthread_self()==thread){err("\PThread
\"+thread+\" is attempting to join to itself!");return ERRNO_CODES.EDEADLK}else
if(!ENVIRONMENT_IS_PTHREAD&&_emscripten_main_browser_thread_id()==thread){err("\Main
thread \"+thread+\" is attempting to join to itself!");return ERRNO_CODES.EDEADLK}var
self=GROWABLE_HEAP_I32()[thread+12>>2];if(self!==thread){err("\pthread_join attempted on thread
\"+thread+\", which does not point to a valid thread, or does not exist anymore!");return
ERRNO_CODES.ESRCH}var
detached=Atomics.load(GROWABLE_HEAP_U32(),thread+64>>2);if(detached){err("\Attempted to join thread
\"+thread+\", which was already detached!");return
ERRNO_CODES.EINVAL}if(block){_emscripten_check_blocking_allowed()}for(;;){var
threadStatus=Atomics.load(GROWABLE_HEAP_U32(),thread+0>>2);if(threadStatus==1){var
threadExitCode=Atomics.load(GROWABLE_HEAP_U32(),thread+4>>2);if(status)GROWABLE_HEAP_I32()[sta
tus>>2]=threadExitCode;Atomics.store(GROWABLE_HEAP_U32(),thread+64>>2,1);if(!ENVIRONMENT_IS_PT
HREAD)cleanupThread(thread);else postMessage({"cmd":\"cleanupThread\", \"thread\":thread});return
0}if(!block){return
ERRNO_CODES.EBUSY}}_pthread_testcancel_js();if(!ENVIRONMENT_IS_PTHREAD)_emscripten_main_thre
ad_process_queued_calls();_emscripten_futex_wait(thread+0,threadStatus,ENVIRONMENT_IS_PTHREAD?100:1
)}}function
_pthread_join(thread,status){return __emscripten_do_pthread_join(thread,status,true)}function
_sysconf(name){if(ENVIRONMENT_IS_PTHREAD)return
_emscripten_proxy_to_main_thread_js(6,1,name);switch(name){case 30:return 16384;case 85:var
maxHeapSize=2147483648;return maxHeapSize/16384;case 132:case 133:case 12:case 137:case 138:case 15:case
235:case 16:case 17:case 18:case 19:case 20:case 149:case 13:case 10:case 236:case 153:case 9:case 21:case 22:case
159:case 154:case 14:case 77:case 78:case 139:case 82:case 68:case 67:case 164:case 11:case 29:case 47:case
48:case 95:case 52:case 51:case 46:return 200809;case 27:case 246:case 127:case 128:case 23:case 24:case 160:case
161:case 181:case 182:case 242:case 183:case 184:case 243:case 244:case 245:case 165:case 178:case 179:case
49:case 50:case 168:case 169:case 175:case 170:case 171:case 172:case
97:case 76:case 32:case 173:case 35:case 80:case 81:case 79:return-1;case 176:case 177:case 7:case 155:case 8:case
157:case 125:case 126:case 92:case 93:case 129:case 130:case 131:case 94:case 91:return 1;case 74:case 60:case
69:case 70:case 4:return 1024;case 31:case 42:case 72:return 32;case 87:case 26:case 33:return 2147483647;case
34:case 1:return 47839;case 38:case 36:return 99;case 43:case 37:return 2048;case 0:return 2097152;case 3:return
65536;case 28:return 32768;case 44:return 32767;case 75:return 16384;case 39:return 1e3;case 89:return 700;case
71:return 256;case 40:return 255;case 2:return 100;case 180:return 64;case 25:return 20;case 5:return 16;case
6:return 6;case 73:return 4;case 84:{if(typeof navigator===\"object\")return
navigator[\"hardwareConcurrency\"]||1;return 1}}setErrNo(28);return-
1}if(!ENVIRONMENT_IS_PTHREAD)PThread.initMainThreadBlock();var GLctx;var
proxiedFunctionTable=[null,_atexit,_emscripten_set_canvas_element_size_main_thread,_fd_close,_fd_seek,_fd_wr
ite,_sysconf];var
asmLibraryArg={\"e\":__assert_fail,\"r\":__call_main,\"x\":__emscripten_notify_thread_queue,\"b\":_abort,\"y\":
_emscripten_asm_const_int,\"j\":_emscripten_conditional_set_current_thread_status,\"d\":_emscripten_futex_wait,\"
c\":_emscripten_futex_wake,\"f\":_emscripten_get_now,\"p\":_emscripten_memcpy_big,\"A\":_emscripten_num_l
ogical_cores,\"u\":_emscripten_receive_on_main_thread_js,\"q\":_emscripten_resize_heap,\"v\":_emscripten_set_ca
nvas_element_size,\"i\":_emscripten_set_current_thread_status,\"s\":_emscripten_set_thread_name,\"w\":_emscript
en_webgl_create_context,\"l\":_fd_close,\"n\":_fd_seek,\"g\":_fd_write,\"o\":initPthreadsJS,\"a\":wasmMemory|Mo
dule[\"wasmMemory\"],\"z\":_pthread_cleanup_pop,\"k\":_pthread_cleanup_push,\"h\":_pthread_create,\"m\":_pthr

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ead_join,\"t\":_sysconf});var asm=createWasm();var
__wasm_call_ctors=Module[\"__wasm_call_ctors\"]=function(){return(__wasm_call_ctors=Module[\"__wasm
_call_ctors\"]=Module[\"asm\"][\"B\"]).apply(null,arguments)};var
_init=Module[\"_init\"]=function(){return(_init=Module[\"asm\"][\"C\"]).apply(null,arguments)};
var
_init_with_threads_count=Module[\"_init_with_threads_count\"]=function(){return(_init_with_threads_count=Mod
ule[\"_init_with_threads_count\"]=Module[\"asm\"][\"D\"]).apply(null,arguments)};var
_get_threads_count=Module[\"_get_threads_count\"]=function(){return(_get_threads_count=Module[\"_get_threads
_count\"]=Module[\"asm\"][\"E\"]).apply(null,arguments)};var
_register_tensor=Module[\"_register_tensor\"]=function(){return(_register_tensor=Module[\"_register_tensor\"]=M
odule[\"asm\"][\"F\"]).apply(null,arguments)};var
_dispose_data=Module[\"_dispose_data\"]=function(){return(_dispose_data=Module[\"_dispose_data\"]=Module[\"
asm\"][\"G\"]).apply(null,arguments)};var
_dispose=Module[\"_dispose\"]=function(){return(_dispose=Module[\"_dispose\"]=Module[\"asm\"][\"H\"]).apply(
null,arguments)};var
_Abs=Module[\"_Abs\"]=function(){return(_Abs=Module[\"_Abs\"]=Module[\"asm\"][\"J\"]).apply(null,arguments
)};var
_Add=Module[\"_Add\"]=function(){return(_Add=Module[\"_Add\"]=Module[\"asm\"][\"K\"]).apply(null,argumen
ts)};var
_AddN=Module[\"_AddN\"]=function(){return(_AddN=Module[\"_AddN\"]=Module[\"asm\"][\"L\"]).apply(null,ar
guments)};var
_All=Module[\"_All\"]=function(){return(_All=Module[\"_All\"]=Module[\"asm\"][\"M\"]).apply(null,arguments)};
var
_Any=Module[\"_Any\"]=function(){return(_Any=Module[\"_Any\"]=Module[\"asm\"][\"N\"]).apply(null,argumen
ts)};var
_ArgMax=Module[\"_ArgMax\"]=function(){return(_ArgMax=Module[\"_ArgMax\"]=Module[\"asm\"][\"O\"]).ap
ply(null,arguments)};var
_AvgPool=Module[\"_AvgPool\"]=function(){return(_AvgPool=Module[\"_AvgPool\"]=Module[\"asm\"][\"P\"]).a
pply(null,arguments)};var
_BatchMatMul=Module[\"_BatchMatMul\"]=function(){return(_BatchMatMul=Module[\"_BatchMatMul\"]=Modu
le[\"asm\"][\"Q\"]).apply(null,arguments)};var
_Ceil=Module[\"_Ceil\"]=function(){return(_Ceil=Module[\"_Ceil\"]=Module[\"asm\"][\"R\"]).apply(null,argument
s)};var
_ClipByValue=Module[\"_ClipByValue\"]=function(){return(_ClipByValue=Module[\"_ClipByValue\"]=Module[\"
asm\"][\"S\"]).apply(null,arguments)};var
_Conv2D=Module[\"_Conv2D\"]=function(){return(_Conv2D=Module[\"_Conv2D\"]=Module[\"asm\"][\"T\"]).app
ly(null,arguments)};var
_Conv2DBackpropInput=Module[\"_Conv2DBackpropInput\"]=function(){return(_Conv2DBackpropInput=Modul
e[\"_Conv2DBackpropInput\"]=Module[\"asm\"][\"U\"]).apply(null,arguments)};var
_Cos=Module[\"_Cos\"]=function(){return(_Cos=Module[\"_Cos\"]=Module[\"asm\"][\"V\"]).apply(null,arguments
)};var
_Cosh=Module[\"_Cosh\"]=function(){return(_Cosh=Module[\"_Cosh\"]=Module[\"asm\"][\"W\"]).apply(null,argu
ments)};var
_CropAndResize=Module[\"_CropAndResize\"]=function(){return(_CropAndResize=Module[\"_CropAndResize\"]
=Module[\"asm\"][\"X\"]).apply(null,arguments)};var
_Cumsum=Module[\"_Cumsum\"]=function(){return(_Cumsum=Module[\"_Cumsum\"]=Module[\"asm\"][\"Y\"]).a
pply(null,arguments)};var
_DepthToSpace=Module[\"_DepthToSpace\"]=function(){return(_DepthToSpace=Module[\"_DepthToSpace\"]=M

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odule["asm\"][\"Z\").apply(null,arguments)};var
_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=function(){return(_DepthwiseConv2dNative=Module["asm\"][\"_\"].apply(null,arguments)};var
odule["_DepthwiseConv2dNative"]=Module["asm\"][\"_\"].apply(null,arguments)};var
_Elu=Module["_Elu"]=function(){return(_Elu=Module["_Elu"]=Module["asm\"][\"$\"].apply(null,arguments)}
;var
_Equal=Module["_Equal"]=function(){return(_Equal=Module["_Equal"]=Module["asm\"][\"aa\").apply(null,arguments)};var
_Exp=Module["_Exp"]=function(){return(_Exp=Module["_Exp"]=Module["asm\"][\"ba\").apply(null,arguments)};var
_FlipLeftRight=Module["_FlipLeftRight"]=function(){return(_FlipLeftRight=Module["_FlipLeftRight"]=Module["asm\"][\"ca\").apply(null,arguments)};var
_Floor=Module["_Floor"]=function(){return(_Floor=Module["_Floor"]=Module["asm\"][\"da\").apply(null,arguments)};var
_FloorDiv=Module["_FloorDiv"]=function(){return(_FloorDiv=Module["_FloorDiv"]=Module["asm\"][\"ea\").apply(null,arguments)};var
_FusedBatchNorm=Module["_FusedBatchNorm"]=function(){return(_FusedBatchNorm=Module["_FusedBatchNorm"]=Module["asm\"][\"fa\").apply(null,arguments)};var
_FusedConv2D=Module["_FusedConv2D"]=function(){return(_FusedConv2D=Module["_FusedConv2D"]=Module["asm\"][\"ga\").apply(null,arguments)};var
_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=function(){return(_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=Module["asm\"][\"ha\").apply(null,arguments)};var
_Gather=Module["_Gather"]=function(){return(_Gather=Module["_Gather"]=Module["asm\"][\"ia\").apply(null,arguments)};var
_GatherNd=Module["_GatherNd"]=function(){return(_GatherNd=Module["_GatherNd"]=Module["asm\"][\"ja\").apply(null,arguments)};var
_Greater=Module["_Greater"]=function(){return(_Greater=Module["_Greater"]=Module["asm\"][\"ka\").apply(null,arguments)};var
_GreaterEqual=Module["_GreaterEqual"]=function(){return(_GreaterEqual=Module["_GreaterEqual"]=Module["asm\"][\"la\").apply(null,arguments)};var
_LeakyRelu=Module["_LeakyRelu"]=function(){return(_LeakyRelu=Module["_LeakyRelu"]=Module["asm\"][\"ma\").apply(null,arguments)};var
_Less=Module["_Less"]=function(){return(_Less=Module["_Less"]=Module["asm\"][\"na\").apply(null,arguments)};var
_LessEqual=Module["_LessEqual"]=function(){return(_LessEqual=Module["_LessEqual"]=Module["asm\"][\"oa\").apply(null,arguments)};var
_Log=Module["_Log"]=function(){return(_Log=Module["_Log"]=Module["asm\"][\"pa\").apply(null,arguments)};var
_LogicalAnd=Module["_LogicalAnd"]=function(){return(_LogicalAnd=Module["_LogicalAnd"]=Module["asm\"][\"qa\").apply(null,arguments)};var
_Max=Module["_Max"]=function(){return(_Max=Module["_Max"]=Module["asm\"][\"ra\").apply(null,arguments)};var
_MaxPool=Module["_MaxPool"]=function(){return(_MaxPool=Module["_MaxPool"]=Module["asm\"][\"sa\").apply(null,arguments)};var
_Maximum=Module["_Maximum"]=function(){return(_Maximum=Module["_Maximum"]=Module["asm\"][\"ta\").apply(null,arguments)};var
_Mean=Module["_Mean"]=function(){return(_Mean=Module["_Mean"]=Module["asm\"][\"ua\").apply(null,arguments)};var
_Min=Module["_Min"]=function(){return(_Min=Module["_Min"]=Module["asm\"][\"va\").apply(null,arguments)}

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ts));var
_Minimum=Module["_Minimum"]=function(){return(_Minimum=Module["_Minimum"]=Module["asm"]["wa
"]).apply(null,arguments)};var
_MirrorPad=Module["_MirrorPad"]=function(){return(_MirrorPad=Module["_MirrorPad"]=Module["asm"]["xa
a"]).apply(null,arguments)};var
_Multiply=Module["_Multiply"]=function(){return(_Multiply=Module["_Multiply"]=Module["asm"]["ya"]).a
pply(null,arguments)};var
_Neg=Module["_Neg"]=function(){return(_Neg=Module["_Neg"]=Module["asm"]["za"]).apply(null,argumen
ts)};var
_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=function(){return(_NonMaxSuppressionV3=Mod
ule["_NonMaxSuppressionV3"]=Module["asm"]["Aa"]).apply(null,arguments)};var
_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=function(){return(_NonMaxSuppressionV4=Mod
ule["_NonMaxSuppressionV4"]=Module["asm"]["Ba"]).apply(null,arguments)};var
_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=function(){return(_NonMaxSuppressionV5=Mod
ule["_NonMaxSuppressionV5"]=Module["asm"]["Ca"]).apply(null,arguments)};var
_NotEqual=Module["_NotEqual"]=function(){return(_NotEqual=Module["_NotEqual"]=Module["asm"]["Da"
]).apply(null,arguments)};var
_OneHot=Module["_OneHot"]=function(){return(_OneHot=Module["_OneHot"]=Module["asm"]["Ea"]).appl
y(null,arguments)};var
_PadV2=Module["_PadV2"]=function(){return(_PadV2=Module["_PadV2"]=Module["asm"]["Fa"]).apply(nu
ll,arguments)};var
_Pow=Module["_Pow"]=function(){return(_Pow=Module["_Pow"]=Module["asm"]["Ga"]).apply(null,argume
nts)};var
_Prelu=Module["_Prelu"]=function(){return(_Prelu=Module["_Prelu"]=Module["asm"]["Ha"]).apply(null,arg
uments)};var
_Prod=Module["_Prod"]=function(){return(_Prod=Module["_Prod"]=Module["asm"]["Ia"]).apply(null,argum
ents)};var
_RealDiv=Module["_RealDiv"]=function(){return(_RealDiv=Module["_RealDiv"]=Module["asm"]["Ja"]).app
ly(null,arguments)};var
_RelU=Module["_Relu"]=function(){return(_Relu=Module["_Relu"]=Module["asm"]["Ka"]).apply(null,argum
ents)};var
_RelU6=Module["_Relu6"]=function(){return(_Relu6=Module["_Relu6"]=Module["asm"]["La"]).apply(null,a
rguments)};var
_ResizeBilinear=Module["_ResizeBilinear"]=function(){return(_ResizeBilinear=Module["_ResizeBilinear"]=Mo
dule["asm"]["Ma"]).apply(null,arguments)};var
_Reverse=Module["_Reverse"]=function(){return(_Reverse=Module["_Reverse"]=Module["asm"]["Na"]).app
ly(null,arguments)};var
_RotateWithOffset=Module["_RotateWithOffset"]=function(){return(_RotateWithOffset=Module["_RotateWith
Offset"]=Module["asm"]["Oa"]).apply(null,arguments)};var
_Round=Module["_Round"]=function(){return(_Round=Module["_Round"]=Module["asm"]["Pa"]).apply(nul
l,arguments)};var
_Rsqrt=Module["_Rsqrt"]=function(){return(_Rsqrt=Module["_Rsqrt"]=Module["asm"]["Qa"]).apply(null,arg
uments)};var
_ScatterNd=Module["_ScatterNd"]=function(){return(_ScatterNd=Module["_ScatterNd"]=Module["asm"]["Ra
"]).apply(null,arguments)};var
_SelectV2=Module["_SelectV2"]=function(){return(_SelectV2=Module["_SelectV2"]=Module["asm"]["Sa"
]).apply(null,arguments)};var
_Sigmoid=Module["_Sigmoid"]=function(){return(_Sigmoid=Module["_Sigmoid"]=Module["asm"]["Ta"]).app

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ply(null,arguments)};var
_Sin=Module["_Sin"]=function(){return(_Sin=Module["_Sin"]=Module["asm"]["Ua"]).apply(null,arguments)
};var
_Softmax=Module["_Softmax"]=function(){return(_Softmax=Module["_Softmax"]=Module["asm"]["Va"]).a
pply(null,arguments)};var
_Sqrt=Module["_Sqrt"]=function(){return(_Sqrt=Module["_Sqrt"]=Module["asm"]["Wa"]).apply(null,argume
nts)};var
_Square=Module["_Square"]=function(){return(_Square=Module["_Square"]=Module["asm"]["Xa"]).apply(n
ull,arguments)};var
_SquaredDifference=Module["_SquaredDifference"]=function(){return(_SquaredDifference=Module["_Squared
Difference"]=Module["asm"]["Ya"]).apply(null,arguments)};var
_Step=Module["_Step"]=function(){return(_Step=Module["_Step"]=Module["asm"]["Za"]).apply(null,argume
nts)};var
_StridedSlice=Module["_StridedSlice"]=function(){return(_StridedSlice=Module["_StridedSlice"]=Module["as
m"]["_a"]).apply(null,arguments)};var
_Sub=Module["_Sub"]=function(){return(_Sub=Module["_Sub"]=Module["asm"]["$a"]).apply(null,argument
s)};var
_Sum=Module["_Sum"]=function(){return(_Sum=Module["_Sum"]=Module["asm"]["ab"]).apply(null,argume
nts)};var
_Tan=Module["_Tan"]=function(){return(_Tan=Module["_Tan"]=Module["asm"]["bb"]).apply(null,argument
s)};var
_Tanh=Module["_Tanh"]=function(){return(_Tanh=Module["_Tanh"]=Module["asm"]["cb"]).apply(null,argu
ments)};var
_Tile=Module["_Tile"]=function(){return(_Tile=Module["_Tile"]=Module["asm"]["db"]).apply(null,argument
s)};var
_TopK=Module["_TopK"]=function(){return(_TopK=Module["_TopK"]=Module["asm"]["eb"]).apply(null,ar
guments)};var
_Transform=Module["_Transform"]=function(){return(_Transform=Module["_Transform"]=Module["asm"]["fb
b"]).apply(null,arguments)};var
_Transpose=Module["_Transpose"]=function(){return(_Transpose=Module["_Transpose"]=Module["asm"]["gb
b"]).apply(null,arguments)};var
__FusedMatMul=Module["__FusedMatMul"]=function(){return(__FusedMatMul=Module["__FusedMatMul"]=
Module["asm"]["hb"]).apply(null,arguments)};var
_malloc=Module["_malloc"]=function(){return(_malloc=Module["_malloc"]=Module["asm"]["ib"]).apply(nul
l,arguments)};var
_free=Module["_free"]=function(){return(_free=Module["_free"]=Module["asm"]["jb"]).apply(null,arguments
)};var
__errno_location=Module["__errno_location"]=function(){return(__errno_location=Module["__errno_locati
on"]=Module["asm"]["kb"]).apply(null,arguments)};var
_emscripten_get_global_libc=Module["_emscripten_get_global_libc"]=function(){return(_emscripten_get_global
_libc=Module["_emscripten_get_global_libc"]=Module["asm"]["lb"]).apply(null,arguments)};var
_thread_self=Module["_thread_self"]=function(){return(_thread_self=Module["_thread_self"]=Module["as
m"]["mb"]).apply(null,arguments)};var
__pthread_tsd_run_dtors=Module["__pthread_tsd_run_dtors"]=function(){return(__pthread_tsd_run_dtors=M
odule["__pthread_tsd_run_dtors"]=Module["asm"]["nb"]).apply(null,arguments)};var
_emscripten_main_thread_process_queued_calls=Module["_emscripten_main_thread_process_queued_calls"]=fu
nction(){return(_emscripten_main_thread_process_queued_calls=Module["_emscripten_main_thread_process_que
ued_calls"]=Module["asm"]["ob"]).apply(null,arguments)};var

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_emsripten_current_thread_process_queued_calls=Module["_emsripten_current_thread_process_queued_calls"]=function(){return(_emsripten_current_thread_process_queued_calls=Module["_emsripten_current_thread_process_queued_calls"]=Module["asm"][["pb"]]).apply(null,arguments)};var
_emsripten_register_main_browser_thread_id=Module["_emsripten_register_main_browser_thread_id"]=function(){return(_emsripten_register_main_browser_thread_id=Module["_emsripten_register_main_browser_thread_id"]=Module["asm"][["qb"]]).apply(null,arguments)};var
_emsripten_main_browser_thread_id=Module["_emsripten_main_browser_thread_id"]=function(){return(_emsripten_main_browser_thread_id=Module["_emsripten_main_browser_thread_id"]=Module["asm"][["rb"]]).apply(null,arguments)};var
__emsripten_do_dispatch_to_thread=Module["__emsripten_do_dispatch_to_thread"]=function(){return(__emsripten_do_dispatch_to_thread=Module["__emsripten_do_dispatch_to_thread"]=Module["asm"][["sb"]]).apply(null,arguments)};var
_emsripten_sync_run_in_main_thread_4=Module["_emsripten_sync_run_in_main_thread_4"]=function(){return(_emsripten_sync_run_in_main_thread_4=Module["_emsripten_sync_run_in_main_thread_4"]=Module["asm"][["tb"]]).apply(null,arguments)};var
_emsripten_run_in_main_runtime_thread_js=Module["_emsripten_run_in_main_runtime_thread_js"]=function(){return(_emsripten_run_in_main_runtime_thread_js=Module["_emsripten_run_in_main_runtime_thread_js"]=Module["asm"][["ub"]]).apply(null,arguments)};var
__emsripten_call_on_thread=Module["__emsripten_call_on_thread"]=function(){return(__emsripten_call_on_thread=Module["__emsripten_call_on_thread"]=Module["asm"][["vb"]]).apply(null,arguments)};var
_emsripten_tls_init=Module["_emsripten_tls_init"]=function(){return(_emsripten_tls_init=Module["_emsripten_tls_init"]=Module["asm"][["wb"]]).apply(null,arguments)};var
__emsripten_thread_init=Module["__emsripten_thread_init"]=function(){return(__emsripten_thread_init=Module["__emsripten_thread_init"]=Module["asm"][["xb"]]).apply(null,arguments)};var
stackSave=Module["stackSave"]=function(){return(stackSave=Module["stackSave"]=Module["asm"][["yb"]]).apply(null,arguments)};var
stackRestore=Module["stackRestore"]=function(){return(stackRestore=Module["stackRestore"]=Module["asm"][["zb"]]).apply(null,arguments)};var
stackAlloc=Module["stackAlloc"]=function(){return(stackAlloc=Module["stackAlloc"]=Module["asm"][["Ab"]]).apply(null,arguments)};var
_emsripten_stack_set_limits=Module["_emsripten_stack_set_limits"]=function(){return(_emsripten_stack_set_limits=Module["_emsripten_stack_set_limits"]=Module["asm"][["Bb"]]).apply(null,arguments)};var
_memalign=Module["_memalign"]=function(){return(_memalign=Module["_memalign"]=Module["asm"][["Cb"]]).apply(null,arguments)};var
__emsripten_allow_main_runtime_queued_calls=Module["__emsripten_allow_main_runtime_queued_calls"]=10512;var
__emsripten_main_thread_futex=Module["__emsripten_main_thread_futex"]=12148;Module["cwrap"]=cwrap;Module["PThread"]=PThread;Module["PThread"]=PThread;Module["wasmMemory"]=wasmMemory;Module["ExitStatus"]=ExitStatus;var
calledRun;function ExitStatus(status){this.name="ExitStatus";this.message="Program terminated with exit("+status+")";this.status=status}dependenciesFulfilled=function
runCaller(){if(!calledRun)run();if(!calledRun)dependenciesFulfilled=runCaller};function
run(args){args=args||arguments;if(runDependencies>0){return}if(ENVIRONMENT_IS_PTHREAD){readyPromiseResolve(Module);initRuntime();postMessage({"cmd":"loaded"});return}preRun();if(runDependencies>0){return}function
doRun(){if(calledRun)return;calledRun=true;Module["calledRun"]=true;if(ABORT)return;initRuntime();preMain();readyPromiseResolve(Module);if(Module["onRuntimeInitialized"])Module["onRuntimeInitialized"]();postRun()}if(Module["setStatus"]){Module["setStatus"]("Running...");setTimeout(function(){setTimeout(function(){Mo

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dule["setStatus"]("\\"),1);doRun(),1)}else{doRun()}}Module["run"]=run;function
exit(status,implicit){if(implicit&&&noExitRuntime&&status===0){return}if(!implicit){if(ENVIRONMENT_IS_PT
HREAD){postMessage({"cmd":"exitProcess"},"returnCode":status});throw
new
ExitStatus(status)}else{}}if(noExitRuntime){}else{PThread.terminateAllThreads();EXITSTATUS=status;exitRunti
me();if(Module["onExit"])Module["onExit"](status);ABORT=true}quit_(status,new
ExitStatus(status));if(Module["preInit"]){if(typeof
Module["preInit"]=="function")Module["preInit"]=Module["preInit"];while(Module["preInit"].length>0){
Module["preInit"].pop()}if(ENVIRONMENT_IS_PTHREAD){noExitRuntime=false;PThread.initWorker()}run
();\n\n return WasmBackendModuleThreadedSimd.ready\n\n\n\n);nif (typeof exports === 'object' && typeof
module === 'object')\n module.exports = WasmBackendModuleThreadedSimd;\nelse if (typeof define ===
'function' && define['amd'])\n define([], function() { return WasmBackendModuleThreadedSimd; });\nelse if
(typeof exports === 'object')\n exports["WasmBackendModuleThreadedSimd"]
= WasmBackendModuleThreadedSimd;\n", "\nvar WasmBackendModule = (function() {\n var _scriptDir = typeof
document !== 'undefined' && document.currentScript ? document.currentScript.src : undefined;\n if (typeof
__filename !== 'undefined') _scriptDir = _scriptDir || __filename;\n return (\nfunction(WasmBackendModule) {\n
WasmBackendModule = WasmBackendModule || {};\n\nvar Module=typeof
WasmBackendModule!="undefined"?WasmBackendModule: {} ;var
readyPromiseResolve,readyPromiseReject;Module["ready"]=new
Promise(function(resolve,reject){readyPromiseResolve=resolve;readyPromiseReject=reject});var
moduleOverrides={};var key;for(key in
Module){if(Module.hasOwnProperty(key)){moduleOverrides[key]=Module[key]}}var arguments_=[];var
thisProgram=\.this.program";var quit_=function(status,toThrow){throw toThrow};var
ENVIRONMENT_IS_WEB=false;var ENVIRONMENT_IS_WORKER=false;var
ENVIRONMENT_IS_NODE=false;var ENVIRONMENT_IS_SHELL=false;ENVIRONMENT_IS_WEB=typeof
window==="object";ENVIRONMENT_IS_WORKER=typeof
importScripts==="function";ENVIRONMENT_IS_NODE=typeof process==="object"&&typeof
process.versions==="object"&&typeof
process.versions.node==="string";ENVIRONMENT_IS_SHELL=!ENVIRONMENT_IS_WEB&&!ENVIRONM
ENT_IS_NODE&&!ENVIRONMENT_IS_WORKER;var scriptDirectory="";function
locateFile(path){if(Module["locateFile"]){return Module["locateFile"](path,scriptDirectory)}return
scriptDirectory+path}var read_,readAsync,readBinary,setWindowTitle;var nodeFS;var
nodePath;if(ENVIRONMENT_IS_NODE){if(ENVIRONMENT_IS_WORKER){scriptDirectory=require("path").
dirname(scriptDirectory)+"^"}else{scriptDirectory=__dirname+"^"}read_=function
shell_read(filename,binary){if(!nodeFS)nodeFS=require("fs");if(!nodePath)nodePath=require("path");filename=n
odePath["normalize"](filename);return
nodeFS["readFileSync"](filename,binary?null:"utf8");};readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret};if(process["argv"].length>1){thisProgram=process["argv"][1].replace(/\\/g,"^")}arguments_=process["arg
v"].slice(2);process["on"]("uncaughtException",function(ex){if(!(ex instanceof ExitStatus)){throw
ex}});process["on"]("unhandledRejection",abort);quit_=function(status){process["exit"](status)};Module["inps
ect"]=function(){return"[Emscripten Module object]"};else if(ENVIRONMENT_IS_SHELL){if(typeof
read!="undefined"){read_=function shell_read(f){return read(f)};readBinary=function readBinary(f){var
data;if(typeof readbuffer==="function"){return new
Uint8Array(readbuffer(f))}data=read(f,"binary");assert(typeof data==="object");return data};if(typeof
scriptArgs!="undefined"){arguments_=scriptArgs}else if(typeof
arguments!="undefined"){arguments_=arguments}if(typeof
quit==="function"){quit_=function(status){quit(status)}}if(typeof print!="undefined"){if(typeof

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console===\"undefined\")console={ };console.log=print;console.warn=console.error=typeof
printErr!==\"undefined\"?printErr:print }else
if(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER){if(ENVIRONMENT_IS_WORKER){scriptDire
ctory=self.location.href}else if(typeof
document!==\"undefined\"&&document.currentScript){ scriptDirectory=document.currentScript.src }if(_scriptDir){ s
criptDirectory=_scriptDir }if(scriptDirectory.indexOf(\"blob:\")!=0){ scriptDirectory=scriptDirectory.substr(0,script
Directory.lastIndexOf(\"^\")+1)}else {scriptDirectory=\"\"} }read_=function(url){ var xhr=new
XMLHttpRequest;xhr.open(\"GET\",url,false);xhr.send(null);return
xhr.responseText };if(ENVIRONMENT_IS_WORKER){readBinary=function(url){ var xhr=new
XMLHttpRequest;xhr.open(\"GET\",url,false);xhr.responseType=\"arraybuffer\";xhr.send(null);return new
Uint8Array(xhr.response) } }readAsync=function(url,onload,onerror){ var xhr=new
XMLHttpRequest;xhr.open(\"GET\",url,true);xhr.responseType=\"arraybuffer\";xhr.onload=function(){ if(xhr.status
==200||xhr.status==0&&xhr.response){ onload(xhr.response);return }onerror() };xhr.onerror=onerror;xhr.send(null)
} }setWindowTitle=function(title){ document.title=title } }else { var
out=Module[\"print\"]||console.log.bind(console);var err=Module[\"printErr\"]||console.warn.bind(console);for(key
in
moduleOverrides){ if(moduleOverrides.hasOwnProperty(key)){ Module[key]=moduleOverrides[key] } }moduleOverr
ides=null;if(Module[\"arguments\"]arguments_=Module[\"arguments\"];if(Module[\"thisProgram\"]thisProgram=
Module[\"thisProgram\"];if(Module[\"quit\"]quit_=Module[\"quit\"];var
wasmBinary;if(Module[\"wasmBinary\"]wasmBinary=Module[\"wasmBinary\"];var
noExitRuntime=Module[\"noExitRuntime\"]||true;if(typeof WebAssembly!=\"object\"){ abort(\"no native wasm
support detected\") }var wasmMemory;var ABORT=false;var EXITSTATUS;function
assert(condition,text){ if(!condition){ abort(\"Assertion failed: \"+text) } }function getCFunc(ident){ var
func=Module[\"_\"+ident];assert(func,\"Cannot call unknown function \"+ident+\", make sure it is exported\");return
func }function
ccall(ident,returnType,argTypes,args,opts){ var toC={ \"string\":function(str){ var
ret=0;if(str!==null&&str!==undefined&&str!==0){ var
len=(str.length<<2)+1;ret=stackAlloc(len);stringToUTF8(str,ret,len)}return ret },\"array\":function(arr){ var
ret=stackAlloc(arr.length);writeArrayToMemory(arr,ret);return ret } };function
convertReturnValue(ret){ if(returnType===\"string\")return UTF8ToString(ret);if(returnType===\"boolean\")return
Boolean(ret);return ret }var func=getCFunc(ident);var cArgs=[];var stack=0;if(args){ for(var
i=0;i<args.length;i++){ var
converter=toC[argTypes[i]];if(converter){ if(stack===0)stack=stackSave();cArgs[i]=converter(args[i]) }else { cArgs[i
]=args[i] } } }var ret=func.apply(null,cArgs);ret=convertReturnValue(ret);if(stack!==0)stackRestore(stack);return
ret }function cwrap(ident,returnType,argTypes,opts){ argTypes=argTypes||[];var
numericArgs=argTypes.every(function(type){ return type===\"number\" });var
numericRet=returnType!=\"string\";if(numericRet&&numericArgs&&!opts){ return
getCFunc(ident) }return function() { return ccall(ident,returnType,argTypes,arguments,opts) } }var
UTF8Decoder=typeof TextDecoder!=\"undefined\"?new TextDecoder(\"utf8\"):undefined;function
UTF8ArrayToString(heap,idx,maxBytesToRead){ var endIdx=idx+maxBytesToRead;var
endPtr=idx;while(heap[endPtr]&&!(endPtr>=endIdx))++endPtr;if(endPtr-
idx>16&&heap.subarray&&UTF8Decoder){ return UTF8Decoder.decode(heap.subarray(idx,endPtr)) }else { var
str=\"\";while(idx<endPtr){ var u0=heap[idx++];if(!(u0&128)){ str+=String.fromCharCode(u0);continue } var
u1=heap[idx++]&63;if((u0&224)==192){ str+=String.fromCharCode((u0&31)<<6|u1);continue } var
u2=heap[idx++]&63;if((u0&240)==224){ u0=(u0&15)<<12|u1<<6|u2 }else { u0=(u0&7)<<18|u1<<12|u2<<6|heap[id
x++]&63 }if(u0<65536){ str+=String.fromCharCode(u0) }else { var ch=u0-
65536;str+=String.fromCharCode(55296|ch>>10,56320|ch&1023) } } }return str }function
UTF8ToString(ptr,maxBytesToRead){ return

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ptr?UTF8ArrayToString(HEAPU8,ptr,maxBytesToRead):\""}function
stringToUTF8Array(str,heap,outIdx,maxBytesToWrite){if(!(maxBytesToWrite>0))return
0;var startIdx=outIdx;var endIdx=outIdx+maxBytesToWrite-1;for(var i=0;i<str.length;+i){var
u=str.charCodeAtAt(i);if(u>=55296&&u<=57343){var
u1=str.charCodeAtAt(++i);u=65536+((u&1023)<<10)|u1&1023}if(u<=127){if(outIdx>=endIdx)break;heap[outIdx++]
=u}else if(u<=2047){if(outIdx+1>=endIdx)break;heap[outIdx++]=192|u>>6;heap[outIdx++]=128|u&63}else
if(u<=65535){if(outIdx+2>=endIdx)break;heap[outIdx++]=224|u>>12;heap[outIdx++]=128|u>>6&63;heap[outIdx
++]=128|u&63}else{if(outIdx+3>=endIdx)break;heap[outIdx++]=240|u>>18;heap[outIdx++]=128|u>>12&63;heap[
outIdx++]=128|u>>6&63;heap[outIdx++]=128|u&63}}heap[outIdx]=0;return outIdx-startIdx}function
stringToUTF8(str,outPtr,maxBytesToWrite){return
stringToUTF8Array(str,HEAPU8,outPtr,maxBytesToWrite)}function
writeArrayToMemory(array,buffer){HEAP8.set(array,buffer)}function
alignUp(x,multiple){if(x%multiple>0){x+=multiple-x%multiple}return x}var
buffer,HEAP8,HEAPU8,HEAP16,HEAPU16,HEAP32,HEAPU32,HEAPF32,HEAPF64;function
updateGlobalBufferAndViews(buf){buffer=buf;Module[\"HEAP8\"]=HEAP8=new
Int8Array(buf);Module[\"HEAP16\"]=HEAP16=new Int16Array(buf);Module[\"HEAP32\"]=HEAP32=new
Int32Array(buf);Module[\"HEAPU8\"]=HEAPU8=new Uint8Array(buf);Module[\"HEAPU16\"]=HEAPU16=new
Uint16Array(buf);Module[\"HEAPU32\"]=HEAPU32=new
Uint32Array(buf);Module[\"HEAPF32\"]=HEAPF32=new
Float32Array(buf);Module[\"HEAPF64\"]=HEAPF64=new Float64Array(buf)}var
INITIAL_MEMORY=Module[\"INITIAL_MEMORY\"]||16777216;var wasmTable;var __ATPRERUN__=[];var
__ATINIT__=[];var __ATMAIN__=[];var __ATPOSTRUN__=[];var
runtimeInitialized=false;__ATINIT__.push({func:function(){__wasm_call_ctors()}});function
preRun(){if(Module[\"preRun\"]){if(typeof
Module[\"preRun\"]!=\"function\")Module[\"preRun\"]=[Module[\"preRun\"]];while(Module[\"preRun\"].length){a
ddOnPreRun(Module[\"preRun\"].shift())}callRuntimeCallbacks(__ATPRERUN__)}function
initRuntime(){runtimeInitialized=true;callRuntimeCallbacks(__ATINIT__)}function
preMain(){callRuntimeCallbacks(__ATMAIN__)}function
postRun(){if(Module[\"postRun\"]){if(typeof
Module[\"postRun\"]!=\"function\")Module[\"postRun\"]=[Module[\"postRun\"]];while(Module[\"postRun\"].lengt
h){addOnPostRun(Module[\"postRun\"].shift())}callRuntimeCallbacks(__ATPOSTRUN__)}function
addOnPreRun(cb){__ATPRERUN__.unshift(cb)}function addOnPostRun(cb){__ATPOSTRUN__.unshift(cb)}var
runDependencies=0;var runDependencyWatcher=null;var dependenciesFulfilled=null;function
addRunDependency(id){runDependencies++;if(Module[\"monitorRunDependencies\"]){Module[\"monitorRunDep
endencies\"](runDependencies)}function removeRunDependency(id){runDependencies--
;if(Module[\"monitorRunDependencies\"]){Module[\"monitorRunDependencies\"](runDependencies)}if(runDepend
encies==0){if(runDependencyWatcher!==null){clearInterval(runDependencyWatcher);runDependencyWatcher=null
}if(dependenciesFulfilled){var
callback=dependenciesFulfilled;dependenciesFulfilled=null;callback()}}Module[\"preloadedImages\"]={};Module
[\"preloadedAudios\"]={};function
abort(what){if(Module[\"onAbort\"]){Module[\"onAbort\"](what)}what+=\"\\n\";err(what);ABORT=true;EXITSTAT
US=1;what=\"abort(\\n+what+\\n). Build with -s ASSERTIONS=1 for more info.\";var e=new
WebAssembly.RuntimeError(what);readyPromiseReject(e);throw e}function hasPrefix(str,prefix){return
String.prototype.startsWith?str.startsWith(prefix):str.indexOf(prefix)===0}var
dataURIPrefix=\"data:application/octet-stream;base64,\";function isDataURI(filename){return
hasPrefix(filename,dataURIPrefix)}var fileURIPrefix=\"file://\";function isFileURI(filename){return
hasPrefix(filename,fileURIPrefix)}var wasmBinaryFile=\"tfjs-backend-
wasm.wasm\";if(!isDataURI(wasmBinaryFile)){wasmBinaryFile=locateFile(wasmBinaryFile)}function

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getBinary(file){try{if(file===wasmBinaryFile&&wasmBinary){return new
Uint8Array(wasmBinary)}if(readBinary){return readBinary(file)}else{throw"both async and sync fetching of the
wasm failed"} }catch(err){abort(err)} }function
getBinaryPromise(){if(!wasmBinary&&(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER)){if(typeof
fetch==="function"&&!isFileURI(wasmBinaryFile)){return fetch(wasmBinaryFile,{credentials:"same-
origin"}).then(function(response){if(!response["ok"]){throw"failed to load wasm binary file at
"+"wasmBinaryFile+"})return response["arrayBuffer"]().catch(function(){return
getBinary(wasmBinaryFile)})})}else{if(readAsync){return new
Promise(function(resolve,reject){readAsync(wasmBinaryFile,function(response){resolve(new
Uint8Array(response)),reject}))})}return Promise.resolve().then(function(){return
getBinary(wasmBinaryFile)})}function createWasm(){var info={"a":asmLibraryArg};function
receiveInstance(instance,module){var
exports=instance.exports;Module["asm"]=exports;wasmMemory=Module["asm"]["j"];updateGlobalBufferAnd
Views(wasmMemory.buffer);wasmTable=Module["asm"]["r"];removeRunDependency("wasm-
instantiate")}addRunDependency("wasm-instantiate");function
receiveInstantiatedSource(output){receiveInstance(output["instance"]) }function
instantiateArrayBuffer(receiver){return getBinaryPromise().then(function(binary){return
WebAssembly.instantiate(binary,info)}).then(receiver,function(reason){err("failed to asynchronously prepare
wasm: "+reason);abort(reason)})}function instantiateAsync(){if(!wasmBinary&&typeof
WebAssembly.instantiateStreaming==="function"&&!isDataURI(wasmBinaryFile)&&!isFileURI(wasmBinaryFil
e)&&typeof fetch==="function"){return fetch(wasmBinaryFile,{credentials:"same-
origin"}).then(function(response){var result=WebAssembly.instantiateStreaming(response,info);return
result.then(receiveInstantiatedSource,function(reason){err("wasm streaming compile failed: "+reason);err("falling
back to ArrayBuffer instantiation");return instantiateArrayBuffer(receiveInstantiatedSource)}))} }else{return
instantiateArrayBuffer(receiveInstantiatedSource)}if(Module["instantiateWasm"]){try{var
exports=Module["instantiateWasm"](info,receiveInstance);return exports }catch(e){err("Module.instantiateWasm
callback failed with error: "+e);return false }}instantiateAsync().catch(Promise.reject);return {} }function
callRuntimeCallbacks(callbacks){while(callbacks.length>0){var callback=callbacks.shift();if(typeof
callback==="function"){callback(Module);continue }var func=callback.func;if(typeof
func==="number"){if(callback.arg===undefined){wasmTable.get(func)}else{wasmTable.get(func)(callback.arg)
}}else{func(callback.arg===undefined?null:callback.arg)}} }function _abort(){abort()}function
_emscripten_memcpy_big(dest,src,num){HEAPU8.copyWithin(dest,src,src+num)}function
_emscripten_get_heap_size(){return HEAPU8.length}function
emscripten_realloc_buffer(size){try{wasmMemory.grow(size-
buffer.byteLength+65535>>>16);updateGlobalBufferAndViews(wasmMemory.buffer);return
1}catch(e){}}function _emscripten_resize_heap(requestedSize){var oldSize=_emscripten_get_heap_size();var
maxHeapSize=2147483648;if(requestedSize>maxHeapSize){return false }for(var
cutDown=1;cutDown<=4;cutDown*=2){var
overGrownHeapSize=oldSize*(1+.2/cutDown);overGrownHeapSize=Math.min(overGrownHeapSize,requestedSize
+100663296);var
newSize=Math.min(maxHeapSize,alignUp(Math.max(requestedSize,overGrownHeapSize),65536));var
replacement=emscripten_realloc_buffer(newSize);if(replacement){return true }}return false }var
SYSCALLS={mappings:{},buffers:[null,[],[]],printChar:function(stream,curr){var
buffer=SYSCALLS.buffers[stream];if(curr===0||curr===10){(stream===1?out:err)(UTF8ArrayToString(buffer,0));
buffer.length=0}else{buffer.push(curr)}},varargs:undefined,get:function(){SYSCALLS.varargs+=4;var
ret=HEAP32[SYSCALLS.varargs-4>>2];return ret},getStr:function(ptr){var ret=UTF8ToString(ptr);return
ret},get64:function(low,high){return low}};function _fd_close(fd){return 0}function
_fd_seek(fd,offset_low,offset_high,whence,newOffset){var num=0;for(var

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i=0;i<iocvnt;i++){var ptr=HEAP32[iov+i*8>>2];var len=HEAP32[iov+(i*8+4)>>2];for(var
j=0;j<len;j++){SYSCALLS.printChar(fd,HEAPU8[ptr+j])}num+=len}HEAP32[pnum>>2]=num;return
0}function _pthread_create(){return 6}function _pthread_join(){return 28}function
setErrNo(value){HEAP32[___errno_location()>>2]=value;return value}function
_sysconf(name){switch(name){case 30:return 16384;case 85:var maxHeapSize=2147483648;return
maxHeapSize/16384;case 132:case 133:case 12:case 137:case 138:case 15:case 235:case 16:case 17:case 18:case
19:case 20:case 149:case 13:case 10:case 236:case 153:case 9:case 21:case 22:case 159:case 154:case 14:case
77:case 78:case 139:case 82:case 68:case 67:case 164:case 11:case 29:case 47:case 48:case 95:case 52:case 51:case
46:return 200809;case 27:case 246:case 127:case 128:case 23:case 24:case 160:case 161:case 181:case 182:case
242:case 183:case 184:case 243:case 244:case 245:case 165:case 178:case 179:case 49:case 50:case 168:case
169:case 175:case 170:case 171:case 172:case 97:case 76:case 32:case 173:case 35:case 80:case 81:case 79:return-
1;case 176:case 177:case
7:case 155:case 8:case 157:case 125:case 126:case 92:case 93:case 129:case 130:case 131:case 94:case 91:return
1;case 74:case 60:case 69:case 70:case 4:return 1024;case 31:case 42:case 72:return 32;case 87:case 26:case
33:return 2147483647;case 34:case 1:return 47839;case 38:case 36:return 99;case 43:case 37:return 2048;case
0:return 2097152;case 3:return 65536;case 28:return 32768;case 44:return 32767;case 75:return 16384;case
39:return 1e3;case 89:return 700;case 71:return 256;case 40:return 255;case 2:return 100;case 180:return 64;case
25:return 20;case 5:return 16;case 6:return 6;case 73:return 4;case 84:{if(typeof navigator===\"object\")return
navigator[\"hardwareConcurrency\"]||1;return 1}}setErrNo(28);return-1}var
asmLibraryArg={\"a\":_abort,\"d\":_emscripten_memcpy_big,\"e\":_emscripten_resize_heap,\"f\":_fd_close,\"c\":_f
d_seek,\"b\":_fd_write,\"h\":_pthread_create,\"g\":_pthread_join,\"i\":_sysconf};var asm=createWasm();var
___wasm_call_ctors=Module[\"___wasm_call_ctors\"]=function(){return(___wasm_call_ctors=Module[\"___wasm
_call_ctors\"]=Module[\"asm\"][\"k\"]).apply(null,arguments)};var
_init=Module[\"_init\"]=function(){return(_init=Module[\"_init\"]=Module[\"asm\"][\"l\"]).apply(null,arguments)};
var
_init_with_threads_count=Module[\"_init_with_threads_count\"]=function(){return(_init_with_threads_count=Mod
ule[\"_init_with_threads_count\"]=Module[\"asm\"][\"m\"]).apply(null,arguments)};var
_get_threads_count=Module[\"_get_threads_count\"]=function(){return(_get_threads_count=Module[\"_get_threads
_count\"]=Module[\"asm\"][\"n\"]).apply(null,arguments)};var
_register_tensor=Module[\"_register_tensor\"]=function(){return(_register_tensor=Module[\"_register_tensor\"]=M
odule[\"asm\"][\"o\"]).apply(null,arguments)};var
_dispose_data=Module[\"_dispose_data\"]=function(){return(_dispose_data=Module[\"_dispose_data\"]=Module[\"
asm\"][\"p\"]).apply(null,arguments)};var
_dispose=Module[\"_dispose\"]=function(){return(_dispose=Module[\"_dispose\"]=Module[\"asm\"][\"q\"]).apply(n
ull,arguments)};var
_Abs=Module[\"_Abs\"]=function(){return(_Abs=Module[\"_Abs\"]=Module[\"asm\"][\"s\"]).apply(null,arguments
)};var
_Add=Module[\"_Add\"]=function(){return(_Add=Module[\"_Add\"]=Module[\"asm\"][\"t\"]).apply(null,argument
s)};var
_AddN=Module[\"_AddN\"]=function(){return(_AddN=Module[\"_AddN\"]=Module[\"asm\"][\"u\"]).apply(null,ar
guments)};var
_All=Module[\"_All\"]=function(){return(_All=Module[\"_All\"]=Module[\"asm\"][\"v\"]).apply(null,arguments)};
var
_Any=Module[\"_Any\"]=function(){return(_Any=Module[\"_Any\"]=Module[\"asm\"][\"w\"]).apply(null,argumen
ts)};var
_ArgMax=Module[\"_ArgMax\"]=function(){return(_ArgMax=Module[\"_ArgMax\"]=Module[\"asm\"][\"x\"]).app
ly(null,arguments)};var
_AvgPool=Module[\"_AvgPool\"]=function(){return(_AvgPool=Module[\"_AvgPool\"]=Module[\"asm\"][\"y\"]).a

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pply(null,arguments));var
_BatchMatMul=Module["_BatchMatMul"]=function(){return(_BatchMatMul=Module["_BatchMatMul"]=Module["asm"]["z"]).apply(null,arguments));var
_Ceil=Module["_Ceil"]=function(){return(_Ceil=Module["_Ceil"]=Module["asm"]["A"]).apply(null,arguments));var
_ClipByValue=Module["_ClipByValue"]=function(){return(_ClipByValue=Module["_ClipByValue"]=Module["asm"]["B"]).apply(null,arguments));var
_Conv2D=Module["_Conv2D"]=function(){return(_Conv2D=Module["_Conv2D"]=Module["asm"]["C"]).apply(null,arguments));var
_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=function(){return(_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=Module["asm"]["D"]).apply(null,arguments));var
_Cos=Module["_Cos"]=function(){return(_Cos=Module["_Cos"]=Module["asm"]["E"]).apply(null,arguments));var
_Cosh=Module["_Cosh"]=function(){return(_Cosh=Module["_Cosh"]=Module["asm"]["F"]).apply(null,arguments));var
_CropAndResize=Module["_CropAndResize"]=function(){return(_CropAndResize=Module["_CropAndResize"]=Module["asm"]["G"]).apply(null,arguments));var
_Cumsum=Module["_Cumsum"]=function(){return(_Cumsum=Module["_Cumsum"]=Module["asm"]["H"]).apply(null,arguments));var
_DepthToSpace=Module["_DepthToSpace"]=function(){return(_DepthToSpace=Module["_DepthToSpace"]=Module["asm"]["I"]).apply(null,arguments));var
_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=function(){return(_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=Module["asm"]["J"]).apply(null,arguments));var
_Elu=Module["_Elu"]=function(){return(_Elu=Module["_Elu"]=Module["asm"]["K"]).apply(null,arguments));var
_Equal=Module["_Equal"]=function(){return(_Equal=Module["_Equal"]=Module["asm"]["L"]).apply(null,arguments));var
_Exp=Module["_Exp"]=function(){return(_Exp=Module["_Exp"]=Module["asm"]["M"]).apply(null,arguments));var
_FlipLeftRight=Module["_FlipLeftRight"]=function(){return(_FlipLeftRight=Module["_FlipLeftRight"]=Module["asm"]["N"]).apply(null,arguments));var
_Floor=Module["_Floor"]=function(){return(_Floor=Module["_Floor"]=Module["asm"]["O"]).apply(null,arguments));var
_FloorDiv=Module["_FloorDiv"]=function(){return(_FloorDiv=Module["_FloorDiv"]=Module["asm"]["P"]).apply(null,arguments));var
_FusedBatchNorm=Module["_FusedBatchNorm"]=function(){return(_FusedBatchNorm=Module["_FusedBatchNorm"]=Module["asm"]["Q"]).apply(null,arguments));var
_FusedConv2D=Module["_FusedConv2D"]=function(){return(_FusedConv2D=Module["_FusedConv2D"]=Module["asm"]["R"]).apply(null,arguments));var
_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=function(){return(_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=Module["asm"]["S"]).apply(null,arguments));var
_Gather=Module["_Gather"]=function(){return(_Gather=Module["_Gather"]=Module["asm"]["T"]).apply(null,arguments));var
_GatherNd=Module["_GatherNd"]=function(){return(_GatherNd=Module["_GatherNd"]=Module["asm"]["U"]).apply(null,arguments));var
_Greater=Module["_Greater"]=function(){return(_Greater=Module["_Greater"]=Module["asm"]["V"]).apply(null,arguments));var

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_GreaterEqual=Module["_GreaterEqual"]=function(){return(_GreaterEqual=Module["_GreaterEqual"]=Module["asm"][_"W"]).apply(null,arguments)};var
_LeakyRelu=Module["_LeakyRelu"]=function(){return(_LeakyRelu=Module["_LeakyRelu"]=Module["asm"][_"X"]).apply(null,arguments)};var
_Less=Module["_Less"]=function(){return(_Less=Module["_Less"]=Module["asm"][_"Y"]).apply(null,arguments)};var
_LessEqual=Module["_LessEqual"]=function(){return(_LessEqual=Module["_LessEqual"]=Module["asm"][_"Z"]).apply(null,arguments)};var
_Log=Module["_Log"]=function(){return(_Log=Module["_Log"]=Module["asm"][_" _"]).apply(null,arguments)};var
_LogicalAnd=Module["_LogicalAnd"]=function(){return(_LogicalAnd=Module["_LogicalAnd"]=Module["asm"][_"$"]).apply(null,arguments)};var
_Max=Module["_Max"]=function(){return(_Max=Module["_Max"]=Module["asm"][_"aa"]).apply(null,arguments)};var
_MaxPool=Module["_MaxPool"]=function(){return(_MaxPool=Module["_MaxPool"]=Module["asm"][_"ba"]).apply(null,arguments)};var
_Maximum=Module["_Maximum"]=function(){return(_Maximum=Module["_Maximum"]=Module["asm"][_"ca"]).apply(null,arguments)};var
_Mean=Module["_Mean"]=function(){return(_Mean=Module["_Mean"]=Module["asm"][_"da"]).apply(null,arguments)};var
_Min=Module["_Min"]=function(){return(_Min=Module["_Min"]=Module["asm"][_"ea"]).apply(null,arguments)};var
_Minimum=Module["_Minimum"]=function(){return(_Minimum=Module["_Minimum"]=Module["asm"][_"fa"]).apply(null,arguments)};var
_MirrorPad=Module["_MirrorPad"]=function(){return(_MirrorPad=Module["_MirrorPad"]=Module["asm"][_"ga"]).apply(null,arguments)};var
_Multiply=Module["_Multiply"]=function(){return(_Multiply=Module["_Multiply"]=Module["asm"][_"ha"]).apply(null,arguments)};var
_Neg=Module["_Neg"]=function(){return(_Neg=Module["_Neg"]=Module["asm"][_"ia"]).apply(null,arguments)};var
_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=function(){return(_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=Module["asm"][_"ja"]).apply(null,arguments)};var
_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=function(){return(_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=Module["asm"][_"ka"]).apply(null,arguments)};var
_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=function(){return(_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=Module["asm"][_"la"]).apply(null,arguments)};var
_NotEqual=Module["_NotEqual"]=function(){return(_NotEqual=Module["_NotEqual"]=Module["asm"][_"ma"]).apply(null,arguments)};var
_OneHot=Module["_OneHot"]=function(){return(_OneHot=Module["_OneHot"]=Module["asm"][_"na"]).apply(null,arguments)};var
_PadV2=Module["_PadV2"]=function(){return(_PadV2=Module["_PadV2"]=Module["asm"][_"oa"]).apply(null,arguments)};var
_Pow=Module["_Pow"]=function(){return(_Pow=Module["_Pow"]=Module["asm"][_"pa"]).apply(null,arguments)};var
_Prelu=Module["_Prelu"]=function(){return(_Prelu=Module["_Prelu"]=Module["asm"][_"qa"]).apply(null,arguments)};var
_Prod=Module["_Prod"]=function(){return(_Prod=Module["_Prod"]=Module["asm"][_"ra"]).apply(null,arguments)};var

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_RealDiv=Module["_RealDiv"]=function(){return(_RealDiv=Module["_RealDiv"]=Module["asm"][_"sa"]).apply(
null,arguments);var
_RelU=Module["_Relu"]=function(){return(_Relu=Module["_Relu"]=Module["asm"][_"ta"]).apply(null,arguments);var
_RelU6=Module["_Relu6"]=function(){return(_Relu6=Module["_Relu6"]=Module["asm"][_"ua"]).apply(null,arguments);var
_ResizeBilinear=Module["_ResizeBilinear"]=function(){return(_ResizeBilinear=Module["_ResizeBilinear"]=Module["asm"][_"va"]).apply(
null,arguments);var
_Reverse=Module["_Reverse"]=function(){return(_Reverse=Module["_Reverse"]=Module["asm"][_"wa"]).apply(
null,arguments);var
_RotateWithOffset=Module["_RotateWithOffset"]=function(){return(_RotateWithOffset=Module["_RotateWithOffset"]=Module["asm"][_"xa"]).apply(
null,arguments);var
_Round=Module["_Round"]=function(){return(_Round=Module["_Round"]=Module["asm"][_"ya"]).apply(
null,arguments);var
_Rsqrt=Module["_Rsqrt"]=function(){return(_Rsqrt=Module["_Rsqrt"]=Module["asm"][_"za"]).apply(
null,arguments);var
_ScatterNd=Module["_ScatterNd"]=function(){return(_ScatterNd=Module["_ScatterNd"]=Module["asm"][_"Aa"]).apply(
null,arguments);var
_SelectV2=Module["_SelectV2"]=function(){return(_SelectV2=Module["_SelectV2"]=Module["asm"][_"Ba"]).apply(
null,arguments);var
_Sigmoid=Module["_Sigmoid"]=function(){return(_Sigmoid=Module["_Sigmoid"]=Module["asm"][_"Ca"]).apply(
null,arguments);var
_Sin=Module["_Sin"]=function(){return(_Sin=Module["_Sin"]=Module["asm"][_"Da"]).apply(
null,arguments);var
_Softmax=Module["_Softmax"]=function(){return(_Softmax=Module["_Softmax"]=Module["asm"][_"Ea"]).apply(
null,arguments);var
_Sqrt=Module["_Sqrt"]=function(){return(_Sqrt=Module["_Sqrt"]=Module["asm"][_"Fa"]).apply(
null,arguments);var
_Square=Module["_Square"]=function(){return(_Square=Module["_Square"]=Module["asm"][_"Ga"]).apply(
null,arguments);var
_SquaredDifference=Module["_SquaredDifference"]=function(){return(_SquaredDifference=Module["_SquaredDifference"]=Module["asm"][_"Ha"]).apply(
null,arguments);var
_Step=Module["_Step"]=function(){return(_Step=Module["_Step"]=Module["asm"][_"Ia"]).apply(
null,arguments);var
_StridedSlice=Module["_StridedSlice"]=function(){return(_StridedSlice=Module["_StridedSlice"]=Module["asm"][_"Ja"]).apply(
null,arguments);var
_Sub=Module["_Sub"]=function(){return(_Sub=Module["_Sub"]=Module["asm"][_"Ka"]).apply(
null,arguments);var
_Sum=Module["_Sum"]=function(){return(_Sum=Module["_Sum"]=Module["asm"][_"La"]).apply(
null,arguments);var
_Tan=Module["_Tan"]=function(){return(_Tan=Module["_Tan"]=Module["asm"][_"Ma"]).apply(
null,arguments);var
_Tanh=Module["_Tanh"]=function(){return(_Tanh=Module["_Tanh"]=Module["asm"][_"Na"]).apply(
null,arguments);var
_Tile=Module["_Tile"]=function(){return(_Tile=Module["_Tile"]=Module["asm"][_"Oa"]).apply(
null,arguments);var
_TopK=Module["_TopK"]=function(){return(_TopK=Module["_TopK"]=Module["asm"][_"Pa"]).apply(
null,arguments);var

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_Transform=Module["_Transform"]=function(){return(_Transform=Module["_Transform"]=Module["asm"])[\
Qa\").apply(null,arguments)};var
_Transpose=Module["_Transpose"]=function(){return(_Transpose=Module["_Transpose"]=Module["asm"])[\
Ra\").apply(null,arguments)};var
__FusedMatMul=Module["__FusedMatMul"]=function(){return(__FusedMatMul=Module["__FusedMatMul"]=
Module["asm"])[\Sa\").apply(null,arguments)};var
_malloc=Module["_malloc"]=function(){return(_malloc=Module["_malloc"]=Module["asm"])[\Ta\").apply(nu
ll,arguments)};var
_free=Module["_free"]=function(){return(_free=Module["_free"]=Module["asm"])[\Ua\").apply(null,argument
s)};var
___errno_location=Module["___errno_location"]=function(){return(___errno_location=Module["___errno_locati
on"]=Module["asm"])[\Va\").apply(null,arguments)};var
stackSave=Module["stackSave"]=function(){return(stackSave=Module["stackSave"]=Module["asm"])[\Wa\").
apply(null,arguments)};var
stackRestore=Module["stackRestore"]=function(){return(stackRestore=Module["stackRestore"]=Module["asm"
][\Xa\").apply(null,arguments)};var
stackAlloc=Module["stackAlloc"]=function(){return(stackAlloc=Module["stackAlloc"]=Module["asm"])[\Ya\
\").apply(null,arguments)};Module["cwrap"]=cwrap;var calledRun;function
ExitStatus(status){this.name="\ExitStatus\";this.message="\Program terminated with
exit(\"+status+\")\";this.status=status}dependenciesFulfilled=function
runCaller(){if(!calledRun)run();if(!calledRun)dependenciesFulfilled=runCaller};function
run(args){args=args||arguments_;if(runDependencies>0){return}preRun();if(runDependencies>0){return}function
doRun(){if(calledRun)return;calledRun=true;Module["calledRun"]=true;if(ABORT)return;initRuntime();preMain(
);readyPromiseResolve(Module);if(Module["onRuntimeInitialized"])Module["onRuntimeInitialized"]();postRun(
)}if(Module["setStatus"]){Module["setStatus"]("\Running..");setTimeout(function(){setTimeout(function(){Mo
dule["setStatus"]("\"),1});doRun(),1)}else{doRun()}}Module["run"]=run;if(Module["preInit"]){if(typeof
Module["preInit"]=="function")Module["preInit"]=Module["preInit"];while(Module["preInit"].length>0){
Module["preInit"].pop()}run();\n\n\n return WasmBackendModule.ready\n\n);}\n\nif (typeof exports ===
'object' && typeof module === 'object')\n module.exports = WasmBackendModule;\nelse if (typeof define ===
'function' && define['amd'])\n define([], function() { return WasmBackendModule; });\nelse if (typeof exports ===
'object')\n exports["WasmBackendModule"] = WasmBackendModule;\n"/**\n * @license\n * Copyright 2019
Google LLC. All Rights Reserved.\n * Licensed under
the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====
*\nimport './flags_wasm';\n\nimport {backend_util, BackendTimingInfo, DataStorage, DataType, deprecationWarn,
engine, env, KernelBackend, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasmModule,
WasmFactoryConfig} from './wasm-out/tfjs-backend-wasm';\n\nimport {BackendWasmThreadedSimdModule} from
'./wasm-out/tfjs-backend-wasm-threaded-simd';\n\nimport
wasmFactoryThreadedSimd from './wasm-out/tfjs-backend-wasm-threaded-simd.js';\n\n// @ts-ignore\nimport
{wasmWorkerContents} from './wasm-out/tfjs-backend-wasm-threaded-simd.worker.js';\n\nimport wasmFactory
from './wasm-out/tfjs-backend-wasm.js';\n\ninterface TensorData {\n id: number;\n memoryOffset: number;\n
shape: number[];\n dtype: DataType;\n refCount: number;\n /** Only used for string tensors, storing encoded
bytes. */\n stringBytes?: Uint8Array[];\n}\n\nexport type DataId = object; // object instead of {} to force non-

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primitive.\n\nexport class BackendWasm extends KernelBackend {\n // 0 is reserved for null data ids.\n private
dataIdNextNumber = 1;\n dataIdMap: DataStorage<TensorData>;\n\n constructor(public wasm:
BackendWasmModule|BackendWasmThreadedSimdModule) {\n super();\n
this.wasm.tfjs.initWithThreadsCount(threadsCount);\n actualThreadsCount = this.wasm.tfjs.getThreadsCount();\n
this.dataIdMap = new DataStorage(this, engine());\n }\n\n write(values:
backend_util.BackendValues, shape: number[], dtype: DataType):\n DataId {\n const dataId = {id:
this.dataIdNextNumber++};\n this.move(dataId, values, shape, dtype, 1);\n return dataId;\n }\n\n
numDataIds(): number {\n return this.dataIdMap.numDataIds();\n }\n\n async time(f: () => void):
Promise<BackendTimingInfo> {\n const start = util.now();\n f();\n const kernelMs = util.now() - start;\n
return {kernelMs};\n }\n\n move(\n dataId: DataId, values: backend_util.BackendValues, shape: number[],\n
dtype: DataType, refCount: number): void {\n const id = this.dataIdNextNumber++;\n if (dtype === 'string') {\n
const stringBytes = values as Uint8Array[];\n this.dataIdMap.set(\n dataId,\n {id, stringBytes,
shape, dtype, memoryOffset: null, refCount});\n return;\n }\n\n const size = util.sizeFromShape(shape);\n
const numBytes = size * util.bytesPerElement(dtype);\n const memoryOffset = this.wasm._malloc(numBytes);\n
this.dataIdMap.set(dataId, {id, memoryOffset, shape, dtype, refCount});\n this.wasm.tfjs.registerTensor(id,
size, memoryOffset);\n if (values != null) {\n this.wasm.HEAPU8.set(\n new Uint8Array(\n
(values as backend_util.TypedArray).buffer,\n (values as backend_util.TypedArray).byteOffset,
numBytes),\n memoryOffset);\n }\n }\n\n async read(dataId: DataId):
Promise<backend_util.BackendValues> {\n return this.readSync(dataId);\n }\n\n readSync(dataId: DataId):
backend_util.BackendValues {\n const {memoryOffset, dtype, shape, stringBytes} =\n
this.dataIdMap.get(dataId);\n if (dtype === 'string') {\n return stringBytes;\n }\n const bytes =
this.wasm.HEAPU8.slice(\n memoryOffset,\n memoryOffset + util.sizeFromShape(shape) *
util.bytesPerElement(dtype));\n return typedArrayFromBuffer(bytes.buffer, dtype);\n }\n\n /**\n * Dispose the
memory if the dataId
has 0 refCount. Return true if the memory\n * is released, false otherwise.\n * @param dataId\n * @oaram force
Optional, remove the data regardless of refCount\n */\n disposeData(dataId: DataId, force = false): boolean {\n if
(this.dataIdMap.has(dataId)) {\n const data = this.dataIdMap.get(dataId);\n data.refCount--;\n if (!force
&& data.refCount > 0) {\n return false;\n }\n\n this.wasm._free(data.memoryOffset);\n
this.wasm.tfjs.disposeData(data.id);\n this.dataIdMap.delete(dataId);\n }\n return true;\n }\n\n /** Return
refCount of a `TensorData`.\n */\n refCount(dataId: DataId): number {\n if (this.dataIdMap.has(dataId)) {\n
const tensorData = this.dataIdMap.get(dataId);\n return tensorData.refCount;\n }\n return 0;\n }\n\n
incRef(dataId: DataId) {\n const data = this.dataIdMap.get(dataId);\n if (data != null) {\n data.refCount++;\n
}\n }\n\n floatPrecision(): 32 {\n return 32;\n
}\n\n // Returns the memory offset of a tensor. Useful for debugging and unit\n // testing.\n
getMemoryOffset(dataId: DataId): number {\n return this.dataIdMap.get(dataId).memoryOffset;\n }\n\n
dispose() {\n this.wasm.tfjs.dispose();\n if ('PThread' in this.wasm) {\n
this.wasm.PThread.terminateAllThreads();\n }\n this.wasm = null;\n }\n\n memory() {\n return {unreliable:
false};\n }\n\n /**\n * Make a tensor info for the output of an op. If `memoryOffset` is not\n * present, this
method allocates memory on the WASM heap. If `memoryOffset`\n * is present, the memory was allocated
elsewhere (in c++) and we just record\n * the pointer where that memory lives.\n */\n makeOutput(shape:
number[], dtype: DataType, memoryOffset?: number):\n TensorInfo {\n let dataId: {};\n if (memoryOffset
=== null) {\n dataId = this.write(null /* values */, shape, dtype);\n } else {\n const id =
this.dataIdNextNumber++;\n dataId = {id};\n
this.dataIdMap.set(dataId, {id, memoryOffset, shape, dtype, refCount: 1});\n const size =
util.sizeFromShape(shape);\n this.wasm.tfjs.registerTensor(id, size, memoryOffset);\n }\n return {dataId,
shape, dtype};\n }\n\n typedArrayFromHeap({shape, dtype, dataId}: TensorInfo):\n backend_util.TypedArray
{\n const buffer = this.wasm.HEAPU8.buffer;\n const {memoryOffset} = this.dataIdMap.get(dataId);\n const
size = util.sizeFromShape(shape);\n switch (dtype) {\n case 'float32':\n return new Float32Array(buffer,

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memoryOffset, size);\n    case 'int32':\n        return new Int32Array(buffer, memoryOffset, size);\n    case 'bool':\n        return new Uint8Array(buffer, memoryOffset, size);\n    default:\n        throw new Error(`Unknown dtype\n    ${dtype}`);\n    }\n    }\n}\n\nfunction createInstantiateWasmFunc(path: string) {\n    // this will be replace by rollout\n    plugin patchWechatWebAssembly in\n    // miniprogram's output.\n    // tslint:disable-next-line:no-any\n    return (imports: any, callback: any) => {\n        util.fetch(path, {credentials: 'same-origin'}).then((response) => {\n            if (!response['ok']) {\n                imports.env.a(`failed to load wasm binary file at '${path}'`);\n            }\n            response.arrayBuffer().then(binary => {\n                WebAssembly.instantiate(binary, imports).then(output => {\n                    callback(output.instance, output.module);\n                });\n            });\n        });\n        return {};\n    };}\n}\n\n/**\n * Returns the\n    path of the WASM binary.\n    * @param simdSupported whether SIMD is supported\n    * @param threadsSupported\n        whether multithreading is supported\n    * @param wasmModuleFolder the directory containing the WASM\n        binaries.\n    */\nfunction getPathToWasmBinary(\n    simdSupported: boolean, threadsSupported: boolean,\n    wasmModuleFolder: string) {\n    if (wasmPath != null) {\n        // If wasmPath is defined, the user has supplied a full\n        path to\n        // the vanilla .wasm binary.\n        return wasmPath;\n    }\n\n    let path:\n        WasmBinaryName = 'tfjs-backend-wasm.wasm';\n    if (simdSupported && threadsSupported) {\n        path = 'tfjs-\n        backend-wasm-threaded-simd.wasm';\n    } else if (simdSupported) {\n        path = 'tfjs-backend-wasm-simd.wasm';\n    }\n\n    if (wasmFileMap != null) {\n        if (wasmFileMap[path] != null) {\n            return wasmFileMap[path];\n        }\n    }\n\n    return wasmModuleFolder + path;\n}\n\n/**\n * Initializes the wasm module and creates the js <--> wasm\n    bridge.\n    * NOTE: We wrap the wasm module in a object with property 'wasm' instead of\n    * returning\n        Promise<BackendWasmModule> to avoid freezing Chrome (last tested\n    * in Chrome 76).\n    */\nexport async\n    function init(): Promise<{wasm: BackendWasmModule}> {\n        const [simdSupported, threadsSupported] = await\n            Promise.all([\n                env().getAsync('WASM_HAS_SIMD_SUPPORT'),\n                env().getAsync('WASM_HAS_MULTITHREAD_SUPPORT')\n            ]);\n        return new Promise((resolve, reject) => {\n            const factoryConfig: WasmFactoryConfig = {};\n\n            /**\n             * This function\n                overrides the Emscripten module locateFile utility.\n            * @param path The relative path to the file that needs to be\n                loaded.\n            * @param prefix The path to the main JavaScript file's directory.\n            */\n            factoryConfig.locateFile =\n                (path, prefix) => {\n                    if (path.endsWith('.worker.js')) {\n                        const response = wasmWorkerContents;\n                        const\n                            blob = new Blob([response], {type: 'application/javascript'});\n                        return URL.createObjectURL(blob);\n                    }\n                    if (path.endsWith('.wasm')) {\n                        return getPathToWasmBinary(\n                            simdSupported as boolean,\n                            threadsSupported as boolean,\n                            wasmPathPrefix != null ? wasmPathPrefix : prefix);\n                    }\n                    return prefix\n                        + path;\n                };\n\n            // Use the instantiateWasm override when system fetch is not available.\n            // Reference:\n            // https://github.com/emscripten-\n            core/emscripten/blob/2bca083cbbd5a4133db61fd74d04f7feecfa907/tests/manual_wasm_instantiate.html#L170\n            if (customFetch) {\n                factoryConfig.instantiateWasm =\n                    createInstantiateWasmFunc(getPathToWasmBinary(\n                        simdSupported as boolean, threadsSupported as boolean,\n                        wasmPathPrefix != null ? wasmPathPrefix :\n                    ));\n            }\n\n            let initialized = false;\n            factoryConfig.onAbort = () => {\n                if (initialized) {\n                    // Emscripten\n                    already called console.warn so no need to double log.\n                    return;\n                }\n                if (initAborted) {\n                    //\n                    Emscripten calls `onAbort` twice, resulting in double error\n                    // messages.\n                    return;\n                }\n                initAborted\n                    = true;\n                const rejectMsg =\n                    `Make sure the server can serve the `.wasm` file relative to the ` +\n                    '\n                    'bundled js file. For more details see https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-\n                    wasm/README.md#using-bundlers';\n                reject({message: rejectMsg});\n            };\n\n            let wasm:\n                Promise<BackendWasmModule>;\n            // If `wasmPath` has been defined we must initialize\n            the vanilla module.\n            if (threadsSupported && simdSupported && wasmPath == null) {\n                factoryConfig.mainScriptUrlOrBlob = new Blob([\n                    `var WasmBackendModuleThreadedSimd = ` +\n                    wasmFactoryThreadedSimd.toString(),\n                    {type: 'text/javascript'}\n                ]);\n                wasm =\n                    wasmFactoryThreadedSimd(factoryConfig);\n            } else {\n                // The wasmFactory works for both vanilla and SIMD\n                binaries.\n                wasm = wasmFactory(factoryConfig);\n            }\n\n            // The WASM module has been successfully\n            created by the factory.\n            // Any error will be caught by the onAbort callback defined above.\n
```

```

wasm.then((module) => {
  initialized = true;
  initAborted = false;

  const voidReturnType: string = null;
  // Using the tfjs namespace to avoid conflict with emscripten's API.
  module.tfjs = {
    init: module.cwrap('init', null, []),
    initWithThreadCount: module.cwrap('init_with_threads_count', null, ['number']),
    getThreadCount: module.cwrap('get_threads_count', 'number', []),
    registerTensor: module.cwrap('register_tensor', null, [
      'number', // id
      'number', // size
      'number', // memoryOffset
    ]),
    disposeData: module.cwrap('dispose_data', voidReturnType, ['number']),
    dispose: module.cwrap('dispose', voidReturnType, []),
  };

  resolve({wasm: module});
});

function typedArrayFromBuffer(buffer: ArrayBuffer, dtype: DataType): backend_util.TypedArray {
  switch (dtype) {
    case 'float32': return new Float32Array(buffer);
    case 'int32': return new Int32Array(buffer);
    case 'bool': return new Uint8Array(buffer);
    default: throw new Error(`Unknown dtype ${dtype}`);
  }
}

const wasmBinaryNames = [
  'tfjs-backend-wasm.wasm',
  'tfjs-backend-wasm-simd.wasm',
  'tfjs-backend-wasm-threaded-simd.wasm'
] as const;

type WasmbinaryName = typeof wasmBinaryNames[number];
let wasmPath: string = null;
let wasmPathPrefix: string = null;
let wasmFileMap: {[key in WasmbinaryName]?: string} = {};
let initAborted = false;
let customFetch = false;

/**
 * @deprecated Use `setWasmpaths` instead.
 * Sets the path to the .wasm file which will be fetched when the wasm backend is initialized. See
 * https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-wasm/README.md#using-bundlers
 * for more details.
 * @param path wasm file path or url
 * @param usePlatformFetch optional boolean to use platform fetch to download
 * the wasm file, default to false.
 * @doc {heading: 'Environment', namespace: 'wasm'}
 */
export function setWasmPath(path: string, usePlatformFetch = false): void {
  deprecationWarn('setWasmPath has been deprecated in favor of setWasmpaths and ' +
    ' will be removed in a future release.');
```

if (initAborted) {
 throw new Error(
 'The WASM backend was already initialized. Make sure you call ' +
 'setWasmPath()' before you call 'tf.setBackend()' or 'tf.ready()');

wasmpath = path;
customFetch = usePlatformFetch;
}

/**
 * Configures the locations of the WASM binaries.
 * js setWasmpaths({
 * 'tfjs-backend-wasm.wasm': 'renamed.wasm',
 * 'tfjs-backend-wasm-simd.wasm': 'renamed-simd.wasm',
 * 'tfjs-backend-wasm-threaded-simd.wasm': 'renamed-threaded-simd.wasm'
 * });
 * tf.setBackend('wasm');

/**
 * @param prefixOrFileMap This can be either a string or object:
 * - (string) The path to the directory where the WASM binaries are located.
 * Note that this prefix will be used to load each binary (vanilla, SIMD-enabled, threading-enabled, etc.).
 * - (object) Mapping from names of WASM binaries to custom full paths specifying the locations of those binaries. This is useful if your WASM binaries are not all located in the same directory,
 * or if your WASM binaries have been renamed.
 * @param usePlatformFetch optional boolean to use platform fetch to download
 * the wasm file, default to false.
 * @doc {heading: 'Environment', namespace: 'wasm'}
 */
export function setWasmpaths(prefixOrFileMap: string | {[key in WasmbinaryName]?: string}, usePlatformFetch = false): void {
 if (initAborted) {
 throw new Error('The WASM backend was already initialized. Make sure you call ' +
 'setWasmpaths()' before you call 'tf.setBackend()' or 'tf.ready()');

if (typeof prefixOrFileMap === 'string') {
 wasmpathPrefix = prefixOrFileMap;
} else {
 wasmFileMap = prefixOrFileMap;
 const missingPaths = wasmBinaryNames.filter(name => wasmFileMap[name] == null);
 if (missingPaths.length > 0) {
 throw new Error(`There were no entries found for the following binaries: ` +
 `\${missingPaths.join(',')}`. Please either call setWasmpaths with a `map providing a path for each binary, or with a string indicating `the directory where all the binaries can be found.`);
 }
}
customFetch = usePlatformFetch;
}

/**
 * Used in unit tests.
 */
export function resetWasmPath(): void {
 wasmpath = null;
 wasmpathPrefix = null;
 wasmFileMap = {};
 customFetch = false;
 initAborted = false;
}

let threadCount = -1;
let actualThreadCount = -1;

/**
 * Sets the number of threads that will be used by XNNPACK to create threadpool (default to the number of logical CPU cores).
 * This must be called before calling

```

`tf.setBackend('wasm')`.n */nexport function setThreadsCount(numThreads: number) {n threadsCount =
numThreads;n}n/n/**n * Gets the actual threads count that is used by XNNPACK.n */n * It is set after the
backend is intialized.n */nexport function getThreadsCount(): number {n if (actualThreadsCount === -1) {n
throw new Error(`WASM
backend not initialized.`);n }n return actualThreadsCount;n}n",export const wasmWorkerContents = 'var
Module={};function threadPrintErr(){var text=Array.prototype.slice.call(arguments).join(
`");console.error(text)}function threadAlert(){var text=Array.prototype.slice.call(arguments).join(
`");postMessage({ cmd:"alert",text:text,threadId:Module["_pthread_self"]()})}var
err=threadPrintErr;this.alert=threadAlert;Module["instantiateWasm"]=function(info,receiveInstance){ var
instance=new
WebAssembly.Instance(Module["wasmModule"],info);Module["wasmModule"]=null;receiveInstance(instance);r
eturn instance.exports};function
moduleLoaded(){ }this.onmessage=function(e){ try {if(e.data.cmd===`load`){Module["wasmModule"]=e.data.wa
smModule;Module["wasmMemory"]=e.data.wasmMemory;Module["buffer"]=Module["wasmMemory"].buffer;
Module["ENVIRONMENT_IS_PTHREAD"]=true;if(typeof
e.data.urlOrBlob===`string`){importScripts(e.data.urlOrBlob)}else{ var
objectUrl=URL.createObjectURL(e.data.urlOrBlob);importScripts(objectUrl);URL.revokeObjectURL(objectUrl)
WasmBackendModuleThreadedSimd(Module).then(function(instance){ Module=instance;moduleLoaded()})}else
if(e.data.cmd===`objectTransfer`){Module["PThread"].receiveObjectTransfer(e.data)}else
if(e.data.cmd===`run`){Module["__performance_now_clock_drift"]=performance.now()-
e.data.time;Module["__emscripten_thread_init"](e.data.threadInfoStruct,0,0);var max=e.data.stackBase;var
top=e.data.stackBase+e.data.stackSize;Module["establishStackSpace"](top,max);Module["__emscripten_tls_init"](
);Module["PThread"].receiveObjectTransfer(e.data);Module["PThread"].setThreadStatus(Module["_pthread_self
"],1);try{ var
result=Module["invokeEntryPoint"](e.data.start_routine,e.data.arg);if(!Module["getNoExitRuntime"]())Module[
"PThread"].threadExit(result)} catch(ex){ if(ex===`Canceled!`){Module["PThread"].threadCancel()}else
if(ex!==`unwind`){if(ex instanceof
Module["ExitStatus"]){if(Module["getNoExitRuntime"]()){ } else {Module["PThread"].threadExit(ex.status) } }el
se{ Module["PThread"].threadExit(-2);throw
ex } } } } else
if(e.data.cmd===`cancel`){if(Module["_pthread_self"]()){Module["PThread"].threadCancel()} }else
if(e.data.target===`setimmediate`){ } else
if(e.data.cmd===`processThreadQueue`){if(Module["_pthread_self"]()){Module["__emscripten_current_thread_
process_queued_calls"]()} } else {err(`worker.js received unknown command
`+e.data.cmd);err(e.data)} } catch(ex){err(`worker.js onmessage() captured an uncaught exception:
`+ex);if(ex&&ex.stack)err(ex.stack);throw ex } } ;if(typeof process===`object`&&typeof
process.versions===`object`&&typeof process.versions.node===`string`){self={location:{href:__filename}};var
onmessage=this.onmessage;var
nodeWorkerThreads=require(`worker_threads`);global.Worker=nodeWorkerThreads.Worker;var
parentPort=nodeWorkerThreads.parentPort;parentPort.on(`message`,function(data){ onmessage({ data:data})});var
nodeFS=require(`fs`);var nodeRead=function(filename){ return
nodeFS.readFileSync(filename,`utf8`)};function
globalEval(x){ global.require=require;global.Module=Module;eval.call(null,x)}importScripts=function(f){globalEva
l(nodeRead(f));postMessage=function(msg){ parentPort.postMessage(msg)};if(typeof
performance===`undefined`){performance={now:function(){return Date.now()}}};"/**n * @licensen *
Copyright 2020 Google LLC. All Rights Reserved.n * Licensed under the Apache License, Version 2.0 (the
`License`);n * you may not use this file except in compliance with the License.n * You may obtain a copy of the
License atn */n * http://www.apache.org/licenses/LICENSE-2.0n */n * Unless required by applicable law or

```

agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```
=====\n*\n\nimport './flags_wasm';\n\nimport {registerBackend} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm, init} from './backend_wasm';\n\nexport {BackendWasm, getThreadsCount, setThreadsCount, setWasmPath, setWasmPaths} from './backend_wasm';\n\nexport {version as version_wasm} from './version';\n\nconst WASM_PRIORITY = 2;\n\nregisterBackend('wasm', async () => {\n  const {wasm} = await init();\n  return new BackendWasm(wasm);\n}, WASM_PRIORITY);\n\n/** @license See the LICENSE file. *\n\n// This code is auto-generated, do not modify this file!\n\nconst version = '3.11.0';\n\nexport {version};\n\n], "names": ["CppType", "FusableActivation", "wasmFusedMatMul", "fusedMatMulConfig", "kernelName", "_FusedMatMul", "backendName", "setupFunc", "backend", "wasm", "cwrap", "kernelFunc", "args", "inputs", "attrs", "a", "b", "bias", "preluActivationWeights", "dtype", "Error", "transposeA", "transposeB", "activation", "leakyreluAlpha", "aId", "dataIdMap", "get", "dataId", "id", "bId", "biasId", "biasData", "shape", "length", "preluActivationWeightsId", "fuseActivation", "leftDim", "rightDim", "batchDim", "out", "makeOutput", "outId", "aShapeBytes", "Uint8Array", "Int32Array", "buffer", "bShapeBytes", "createUnaryKernelConfig", "outType", "wasmFunc", "x", "xId", "util", "sizeFromShape", "absConfig", "Abs", "createBinaryKernelConfig", "supportsFullBroadcast", "outputType", "newShape", "backend_util", "assertAndGetBroadcastShape", "aBroadcastDims", "getBroadcastDims", "bBroadcastDims", "loopsOverAllOfA", "every", "v", "i", "loopsOverAllOfB", "addConfig", "Add", "addNConfig", "AddN", "inputIds", "map", "inputIdsBytes", "identity", "inVals", "typedArrayFromHeap", "set", "identityConfig", "Identity", "wasmTranspose", "transpose", "reducedShape", "perm", "newPerm", "push", "minValIdx", "j", "removeOneSizeDims", "permIsNoOp", "outShape", "inShape", "Array", "computeOutShape", "cloned", "permBytes", "xShapeBytes", "transposeConfig", "Transpose", "permuteAxesAndTranspose", 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"dyStrides", "fltS0", "fltS1", "fltS2", "xBatch
```

Stride", "xRowStride", "xColStride", "xChannelStride", "yBatchStride", "yRowStride", "yColStride", "yChannelStride", "dyId", "cosConfig", "Cos", "coshConfig", "Cosh", "InterpolationMethod", "wasmCropAndResize", "cropAndResizeConfig", "CropAndResize", "method", "extrapolationValue", "cropSize", "image", "boxes", "boxInd", "numBoxes", "cropHeight", "cropWidth", "castedData", "imagesData", "imagesId", "boxesId", "boxIndId", "imagesShapeBytes", "wasmCumsum", "cumsumConfig", "Cumsum", "exclusive", "reverse", "permutation", "permutedX", "permutedAxis", "permutedOut", "finalDim", "permutedXId", "permutedOutId", "getUndoAxesPermutation", "wasmDepthToSpace", "depthToSpaceConfig", "DepthToSpace", "blockSize", "outputHeight", "outputWidth", "outputDepth", "outputShape", "xStridesBytes", "outputShapeBytes", "outStridesBytes", "wasmDepthwiseConv2d", "depthwiseConv2dNativeConfig", "DepthwiseConv2dNative", "\$dilations", "eluConfig", "Elu", "equalConfig", "Equal", "expConfig", "Exp", "expandDims", 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"NonMaxSuppressionV4", "padToMaxOutputSize", "nonMaxSuppressionV5Config", "NonMaxSuppressionV5", "softNmsSigma", "notEqualConfig", "NotEqual", "wasmOneHot", "oneHotConfig", "OneHot", "depth", "onValue", "offValue", "onesLikeConfig", "OnesLike", "packConfig", "Pack", "assertShapesMatch", "intermediateTensorInfos", "expandedT", "wasmPadV2", "padV2Config", "PadV2", "constantValue", "powConfig", "Pow", "wasmPrelu", "preluConfig", "Prelu", "weightsId", "wasmProd", "prodConfig", "Prod", "rangeConfig", "Range", "start", "stop", "step", "makeZerosTypedArray", "numElements", "abs", "ceil", "rangeImplCPU", "realDivConfig", "RealDiv", "reluConfig", "Relu", "relu6Config", "Relu6", "wasmResizeBilinear", "resizeBilinearConfig", "ResizeBilinear", "images", "alignCorners", "halfPixelCenters", "newHeight", "newWidth", "oldHeight", "oldWidth", "xData", "wasmReverse", "reverseConfig", "Reverse", "dims", "axesBytes", "outShapeBytes", "wasmRotate", "rotateWithOffsetConfig", "RotateWithOffset", "radians", 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_U8", "GROWABLE_HEAP_I32", "HEAP32", "GROWABLE_HEAP_U32", "HEAPU32", "GROWABLE_HEAP_F
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, "arg", "ERRNO_CODES", "EPERM", "ENOENT", "ESRCH", "EINTR", "EIO", "ENXIO", "E2BIG", "ENOEXEC", "E
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, "EEXIST", "EXDEV", "ENODEV", "ENOTDIR", "EISDIR", "EINVAL", "ENFILE", "EMFILE", "ENOTTY", "ETXT
BSY", "EFBIG", "ENOSPC", "ESPIPE", "EROFS", "EMLINK", "EPIPE", "EDOM", "ERANGE", "ENOMSG", "EIDRM
, "ECHRNG", "EL2NSYNC", "EL3HLT", "EL3RST", "ELNRNG", "EUNATCH", "ENOCSI", "EL2HLT", "EDEADL
K", "ENOLCK", "EBADE", "EBADR", "EXFULL", "ENOANO", "EBADRQC", "EBADSLT", "EDEADLOCK", "EBF
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AUC,GAAoB,EAAUC,GAAqB,EAAMH,EAAmC,iBAATI,OAAkBH,EAA6C,mBAAhBI,cAA2BH,EAAqC,iBAA VI,SAA8C,iBAAnBA,QAAQC,UAAoD,iBAAXBD,QAAQC,SAASC,KAAgBL,GAAsBH,IAAqBE,IAAsBD,EAA sB,IAAIQ,EAAuBnB,EAA+B,yBAAG,EAASmB,IAAwB1tB,EAAOusB,EAAe,QAAE,IAA4JoB,EAAMC,EAAU C,EAA8BC,EAAWC,EAAjNC,EAAgB,GAAG,SAASC,EAAWC,GAAM,OAAAG3B,EAAmB,WAAUA,EAAmB, WAAE2B,EAAKF,GAAwBA,EAAgBE,EAA2E,GAAGf,EAAoB,CAAU0B,IAAIgB,EAHzBH,EAAvBd,EAAuC kB,EAAgBC,QAAQL,GAAiB,IAAyBM,UAAU,IAAIX,EAAM,SAAoBY,EAASC,GAAuH,OAA3GV,IAAOA,EA AOW,GAAkBv,IAASA,EAASK,GAAgBG,EAASR,EAAoB,UAAEQ,GAAiBT,EAAqB,aAAES,EAASC,EAAO, KAAK,SAASX,EAAW,SAAoBU,GAAU,IAAIG,EAAIf,EAAMY,GAAS,GAAiE,OAAvDG,EAAI1uB,SAAQ0uB, EAAI,IAAI5uB,WAAW4uB,IAAK/mB,EAAO+mB,EAAI1uB,QAAe0uB,GAAQnB,QAAc,KAAEnuB,OAAO,GA AemB,QAAc,KAAE,GAAGoB,QAAQ,MAAM,KAAgBpB,QAAc,KAAE9nB,MAAM,GAAG8nB,QAAy,GAAE ,qBAAoB,SAASqB,GAAI,KAAKA,aAAcC,IAAa,MAAMD,KAAmRb,QAAy,GAAE,qBAAqBuB,IAAOhC,EAA M,SAASC,GAAQQ,QAAc,KAAER,IAASR,EAAgB,QAAE,WAAW,MAAM,8BAAoD,IAAI4B,EAakBY,EAA0 B,MAAM5K,GAA4H,MAAzH6K,QAAQC,MAAM,2GAAiH9K,EAAE+K,GAAOC,OAAOhB,EAakBgB,YAAe/ B,GAAsC,oBAANgC,OAAmBzB,EAAM,SAAoB0B,GAAG,OAAOD,KAAKC,KAAIxB,EAAW,SAAoBwB,GA AG,IAAIC,EAAK,MAAuB,mBAAbC,WAAgC,IAAIzvB,WAAWyvB,WAAWF,KAA0B1nB,EAAqB,iBAA3C2n B,EAAKF,KAAKC,EAAE,YAAgDC,IAA4B,oBAAZE,YAAoCA,WAAwF,mBAAPC,OAAmB3C,EAAM,SAAS C,GAAQ0C,KAAK1C,KAA2B,oBAAR2C,QAAyC,oBAAVV,UAAsBA,QAAQ,IAAGA,QAAQW,IAAID,MAA MV,QAAQY,KAAKZ,QAAQC,MAAwB,oBAAXY,SAAuBA,SAASH,SAAezC,GAAoBC,KAA0BA,EAAuBc,E AAgB8B,KAAKC,SAASC,KAA+B,oBAAX3E,UAAwBA,SAASC,gBAAe0C,EAAgB3C,SAASC,cAAcC,KAA6 B,oBAAfJ,GAA8BA,IAAY6C,EAAgB7C,GAAoD6C,EAH,IAAnCA,EAAgBiC,QAAQ,SAA8BjC,EAAgBkC,O AAO,EAAEIC,EAAgBmC,YAAy,KAAK,GAAwB,GAAMhD,GAAqBQ,EAAM,SAAoBY,EAASC,GAAuH,OAA 3GV,IAAOA,EAAOW,GAAkBv,IAASA,EAASK,GAAgBG,EAASR,EAAoB,UAAEQ,GAAiBT,EAAqB,aAAES, EAASC,EAAO,KAAK,SAASX,EAAW,SAAoBU,GAAU,IAAIG,EAAIf,EAAMY,GAAS,GAAiE,OAAvDG,EAAI 1uB,SAAQ0uB,EAAI,IAAI5uB,WAAW4uB,IAAK/mB,EAAO+mB,EAAI1uB,QAAe0uB,KAAUf,EAAM,SAASy C,GAAK,IAAIC,EAAI,IAAIC,eAAwD,OAAzCD,EAAIE,KAAK,MAAMH,GAAL,GAAOC,EAAIG,KAAK,MAA aH,EAAII,cAAiBvD,IAAuBW,EAAW,SAASuC,GAAK,IAAIC,EAAI,IAAIC,eAAuF,OAAxED,EAAIE,KAAK,M AAMH,GAAL,GAAOC,EAAIK,aAAa,cAAcL,EAAIG,KAAK,MAAa,IAAI1wB,WAAWuwB,EAAIM,YAAW/C,E AAU,SAASwC,EAAIQ,EAAOC,GAAS,IAAIR,EAAI,IAAIC,eAAeD,EAAIE,KAAK,MAAMH,GAAL,GAAMC,E AAIK,aAAa,cAAcL,EAAIO,OAAO,WAA0B,KAAZP,EAAItD,QAAyB,GAAZsD,EAAItD,QAAWsD,EAAIM,SA AUC,EAAOP,EAAIM,UAAiBE,KAAWR,EAAIQ,QAAQA,EAAQR,EAAIG,KAAK,SAAqErD,GAA6C,oBAAd2 D,cAA2B5B,GAAO4B,YAAyC,EAAsBD,aAAa,IAA4mBE,EAAxmBtxB,EAAI6sB,EAAc,OAAgYc,QAAQW,I AAI5B,KAAKjC,SAAakC,EAAI3E,EAAiB,UAAgYc,QAAQY,KAAKqB,KAAKjC,SAAS,IAAIrC,KAAOC,EAA oBA,EAAgBC,eAAeF,KAAmJ,EAAOI,GAAKC,EAAgBD,IAAmL,SAASwE,EAASC,GAAUD,EAASE,QAAMF, EAASE,MAAM,IAAOF,EAASE,MAAMD,KAAOD,EAASE,MAAMD,GAAM,EAAEF,EAAIE,IAA/RxE,EAAgB ,KAAQL,EAAkB,WAAaA,EAAkB,UAAKA,EAAoB,aAAcA,EAAoB,YAAKA,EAAa,OAAEO,EAAMP,EAAa,M AA+PA,EAAmB,aAAEyE,EAAWzE,EAAmB,YAAE,IAA+HZ,EAAe2F,EAA1IC,EAAchF,EAAsB,gBAAG,EAA 6B,iBAAd1B,aAAwBiE,GAAM,mCAAiE,IAAsqG9uB,EAAO6rB,EAAMtO,EAAsByO,EAAOE,EAAgBE,EAA5t GoF,GAAM,EAAqB,SAAS7pB,EAAOuc,EAAUkN,GAAUIN,GAAW4K,GAAM,qBAAqBsC,GAAO,SAASK,EA ASC,GAAO,IAAIC,EAAKpF,EAAO,IAAI mF,GAAuF,OAAhF/pB,EAAOgqB,EAAK,gCAAgCD,EAAM,8BAAq CC,EAAK,SAASC,EAAMF,EAAMG,EAAWC,EAASH0B,EAAKi0B,GAAM,IAAIC,EAAI,CAACC,OAAAS,SAA SC,GAAK,IAAIxD,EAAI,EAAE,GAAGwD,MAAAA,GAAmC,IAANA,EAAQ,CAAC,IAAIC,EAAoB,GAAfD,E AAI9yB,QAAQ,GAAyBgZB,EAAaF,EAAjCxD,EAAI2D,GAAWF,GAA0BA,GAAK,OAAOzD,GAAK4D,MAAQ ,SAASC,GAAK,IAAI7D,EAAI2D,GAawe,EAAInzB,QAAoC,OAA5BozB,GAAMBD,EAAI7D,GAAYA,IAAsJi D,EAAKF,EAASC,GAAWe,EAAM,GAAOC,EAAM,EAAE,GAAG50B,EAAM,IAAI,IAAIyD,EAAE,EAAEA,E AAEzD,EAAKsB,OAAOmC,IAAI,CAAC,IAAIoxB,EAAUX,EAAIF,EAASvW,IAAOoxB,GAAsB,IAARD,IAA UA,EAAME,MAAYH,EAAMIxB,GAAGoxB,EAAU70B,EAAKyD,KAASkxB,EAAMIxB,GAAGzD,EAAKyD,G AAK,IAAI mTb,EAAIiD,EAAKkB,MAAM,KAAKJ,GAAoE,OAA7D/D,EAArY,SAA4BA,GAAK,MAAgB,WAAb mD,EAA6BiB,EAAapE,GAAqB,YAAbmD,EAA8BkB,QAAQrE,GAAYA,EAAiQsE,CAAmBtE,GAAgB,IAARgE

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* =====\n
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http://www.apache.org/licenses/LICENSE-2.0\n
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distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
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the License.\n
* =====\n
*\nimport {KernelConfig, KernelFunc, OnesLike, OnesLikeInputs} from '@tensorflow/tfjs-core';\nimport
{BackendWasm} from './backend_wasm';\nfunction onesLike(args: {inputs: OnesLikeInputs, backend:
BackendWasm}) {\n  const {inputs: {x}, backend} = args;\n  const out = backend.makeOutput(x.shape, x.dtype);\n
const outVals = backend.typedArrayFromHeap(out);\n  outVals.fill(1);\n  return out;\n}\nexport const
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 *
 *=====\n
 */\n
\n
import {KernelConfig, KernelFunc, Step, StepAttrs, StepInputs, TensorInfo} from '@tensorflow/tfjs-
core';\n
\n
import {BackendWasm} from '../backend_wasm';\n
\n
import {CppType} from './types';\n
\n
let wasmStep: (xId: number, alpha: number, dtype: number, outId: number) => void;\n
\n
function setup(backend: BackendWasm): void {\n
  wasmStep = backend.wasm.cwrap(Step, null /*void*/, [\n
    'number', // x_id\n
    'number', // alpha\n
    'number', // out_id\n
  ]);\n
\n
  function step(\n
    args: {backend: BackendWasm, inputs: StepInputs, attrs: StepAttrs});\n
  TensorInfo {\n
    const {backend, inputs, attrs} = args;\n
    const {alpha} = attrs;\n
    const {x} = inputs;\n
    const xId = backend.dataIdMap.get(x.dataId).id;\n
    const out = backend.makeOutput(x.shape, x.dtype);\n
    const outId = backend.dataIdMap.get(out.dataId).id;\n
    wasmStep(xId, alpha, CppDType[x.dtype], outId);\n
    return out;\n
  }\n
\n
  export const stepConfig: KernelConfig = {\n
    kernelName: Step,\n
    backendName: 'wasm',\n
    setupFunc: setup,\n
    kernelFunc: step as {} as KernelFunc\n
  };
}
```

Found in path(s):

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```
=====\n*/\n\nimport {KernelConfig, KernelFunc, Softmax, SoftmaxAttrs, SoftmaxInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\n\nlet wasmFunc: (xId: number, outId: number, channels: number, batch: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n  wasmFunc = backend.wasm.cwrap(Softmax, null /* void */, [\n    'number', // xId\n    'number', // outId\n    'number', // channels\n    'number' // batch\n  ]);\n\n  function softmax(\n    args: {backend: BackendWasm, inputs: SoftmaxInputs, attrs: SoftmaxAttrs}): TensorInfo {\n    const {backend, inputs: {logits}, attrs: {dim}} = args;\n    const xId = backend.dataIdMap.get(logits.dataId).id;\n    const out = backend.makeOutput(logits.shape, logits.dtype);\n    const outId = backend.dataIdMap.get(out.dataId).id;\n    const channels = logits.shape[dim];\n    const batch = util.sizeFromShape(logits.shape) / channels;\n\n    // Short-circuit zero-sized tensors.\n    if (util.sizeFromShape(out.shape) === 0) {\n      return out;\n    }\n\n    wasmFunc(xId, outId, channels, batch);\n    return out;\n  }\n\n  export const softmaxConfig: KernelConfig = {\n    kernelName: Softmax,\n    backendName: 'wasm',\n    setupFunc: setup,\n    kernelFunc: softmax as {} as KernelFunc\n  };\n}
```

Found in path(s):

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No license file was found, but licenses were detected in source scan.

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```

```
=====\n*/\n\nimport {KernelConfig, Pow} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from './binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const powConfig: KernelConfig =\n  createBinaryKernelConfig(Pow, supportsFullBroadcast);\n}
```


Found in path(s):

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Pow.js.map

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for the specific language governing permissions and\n * limitations under the License.\n *

=====\n*\n// Import core for side effects (e.g. flag registration)\nimport '@tensorflow/tfjs-core';\n// tslint:disable-next-
line:no-imports-from-dist\nimport '@tensorflow/tfjs-core/dist/public/chained_ops/register_all_chained_ops';\n//

```

tslint:disable-next-line: no-imports-from-dist\nimport '@tensorflow/tfjs-core/dist/register_all_gradients';\n\n//
tslint:disable-next-line: no-imports-from-dist\nimport { setTestEnvs, setupTestFilters, TestFilter } from
'@tensorflow/tfjs-core/dist/jasmine_util';\n\nsetTestEnvs({ name: 'test-wasm', backendName: 'wasm', isDataSync:
true});\n\n/**\n * Tests that have these substrings in their name will be included unless one\n * of the strings in
excludes appears in the name.\n *\nconst TEST_FILTERS: TestFilter[] = [\n {\n   startsWith: 'tensor',\n   excludes: [\n     'complex', // Complex
numbers not supported yet\n     'derivative', // Gradients not yet supported.\n     // Downcasting broken, see:
https://github.com/tensorflow/tfjs/issues/2590\n     'Tensor2D float32 -> bool', 'Tensor2D int32 -> bool'\n   ]\n },\n {\n   include: 'softmax',\n   \n {\n   include: 'pow',\n   excludes: [\n     'gradient', // zerosLike not defined yet.\n     'broadcasting same rank Tensors different shape', // Broadcasting along\n     // inner
dims not\n     // supported yet.\n   ]\n },\n {\n   include: 'add',\n   excludes: [\n     'gradient',
// Gradient is missing.\n     'upcasts when dtypes dont match', // Uses the 'complex'
dtype.\n     'complex', // Complex numbers not supported yet\n   ]\n },\n {\n   include:
'depthToSpace',\n   \n {\n   include: 'avgPool',\n   excludes: [\n     'gradient', // Not yet implemented.\n     'avgPool3d', // Not yet implemented.\n   ]\n },\n {\n   include: 'relu',\n   excludes: [\n     'derivative',
// Not yet implemented.\n     'gradient', // Not yet implemented.\n     'valueAndGradients', // Not yet
implemented.\n     'broadcasted bias', // Not yet implemented.\n     'fused A x B with 2d bias' // Fused matMul
with 2D bias not yet\n     // supported.\n   ]\n },\n {\n   include: 'maxPool',\n   excludes: [\n     'maxPoolBackprop', // Not yet implemented.\n     'maxPool3d', // Not yet implemented.\n     'maxPool3dBackprop', // Not yet implemented.\n     'ignores NaNs', // Actual != expected.\n     'maxPoolWithArgmax' // Not yet implemented.\n   ]\n },\n {\n   include: 'cropAndResize',\n   \n {\n   include:
'resizeBilinear',\n   excludes: [\n     'gradients', // Not yet implemented.\n   ]\n },\n {\n   include: 'matmul',\n   excludes: [\n     'valueAndGradients',
// Gradients not defined yet\n     'gradient', // Gradients not defined yet\n     'zero in its shape',
// Zero in shapes aren't supported yet\n     'matmul followed by mul', // mul not supported yet\n     'upcasts',
// Upcasting not supported yet.\n     'fused A x B with 2d bias', // Fused matMul with 2D bias not yet\n     //
supported.\n   ]\n },\n {\n   include: 'depthwiseConv2D',\n   excludes: [\n     'broadcasted bias', //
Broadcasted bias not yet supported.\n     'gradient', // Gradients not defined yet.\n     'NCHW', // xnn
pack does not support channels first.\n   ]\n },\n {\n   include: 'conv2d',\n   excludes: [\n     'broadcasted bias', //
Broadcasted bias not yet supported.\n     'gradient', // Gradients not defined yet.\n     'backProp input
x=[2,3,3,1] f=[2,2,1,1] s=1 p=0', // Gradients not\n     // defined.\n     'NCHW', // xnn pack does not support channels first.\n     // Issue:
https://github.com/tensorflow/tfjs/issues/3104.\n     // Actual != expected.\n     'relu bias stride 2 x=[1,8,8,16]
f=[3,3,16,1] s=[2,2] d=8 p=same',\n     'prelu bias stride 2 x=[1,8,8,16] f=[3,3,16,1] s=[2,2] d=8 p=same',\n   ]\n },\n {\n   include: 'conv2dTranspose',\n   excludes: ['gradient']},\n {\n   include: 'prelu',\n   excludes: [\n     'gradient', //
Gradient is missing.\n     'derivative' // Missing gradient.\n   ]\n },\n {\n   include: 'cast',\n   excludes: [\n     'complex', // Complex numbers not yet implemented.\n     'shallow slice an input that was cast' // Slice is not
implemented.\n   ]\n },\n {\n   include: 'gather',\n   excludes: [\n     'gradient' // Not yet implemented.\n   ]\n },\n {\n   include: 'sigmoid',\n   excludes: [\n     'sigmoidCrossEntropy', // Not yet implemented.\n     'gradient'
// Not
yet implemented.\n   ]\n },\n {\n   include: 'scatterND',\n   \n {\n   include: 'abs',\n   excludes: [\n     'gradient', // Not
yet implemented.\n     'complex' // Complex numbers not supported yet.\n   ]\n },\n {\n   include: 'sub',\n   excludes: [\n     'complex', // Complex numbers not yet implemented.\n     'gradient', // Not yet implemented.\n     'upcasts', // Upcasting not supported yet.\n   ]\n },\n {\n   include: 'mul',\n   excludes: [\n     'complex', //
Complex numbers not yet supported.\n     'gradient', // Gradient not defined yet.\n   ]\n },\n {\n   include: 'div',\n   excludes: [\n     'gradient', // Gradient not defined yet.\n     'upcasts', // Cast not supported yet.\n     'divNoNan' //
divNoNan not yet implemented.\n   ]\n },\n {\n   include: 'batchNorm',\n   excludes: [\n     'gradient' // Gradient
is missing.\n   ]\n },\n {\n   include: 'slice',\n   \n {\n   include: 'stridedSlice',\n   \n {\n   include: 'rotate',\n   \n {\n   include:

```

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'rotateWithOffset'},\n
  {include: 'flipLeftRight'},\n {include: 'square'},\n {include: 'squaredDifference'},\n {\n  startsWith: 'min',\n  excludes: [\n    '2D, axis=0', // Permuted axes requires transpose, which is not yet\n                      // implemented.\n    'index corresponds to start of a non-initial window', // argMin not yet\n                                                              //\n    implemented,\n    'gradient' // Gradients not yet implemented\n  ]\n },\n {\n  startsWith: 'max',\n  excludes: [\n    'gradient' // Gradients not yet implemented\n  ]\n },\n {\n  include: 'concat',\n  excludes: [\n    'complex',\n    // Complex numbers not supported yet\n    'gradient' // Split is not yet implemented\n  ]\n },\n {\n  include: 'transpose',\n  {include: 'oneHot'},\n  {include: 'split'},\n  {include: 'pad', excludes: ['complex', 'zerosLike']},\n  {\n  include: 'clip',\n  excludes: [\n    'gradient',\n    'propagates NaNs' // clip\n    delegates to XNNPACK which does not make\n                      // guarantees about behavior of nans.\n  ]\n },\n {\n  include: 'addN'},\n  {include: 'nonMaxSuppression'},\n  {include: 'argmax', excludes: ['gradient']},\n  {include: 'exp'},\n  {\n  include: 'elu',\n  excludes: [\n    'derivative', // Not yet implemented.\n    'gradient', // Not yet\n    implemented.\n    'selu' // Not yet implemented.\n  ]\n },\n {\n  include: 'unstack'},\n  {\n  include: 'minimum',\n  excludes: [\n    'gradient',\n    // Not yet implemented.\n    'broadcasts 2x1\n    Tensor2D and 2x2 Tensor2D' // Broadcasting along inner\n                      // dims not supported\n    yet.\n  ]\n },\n {\n  include: 'maximum',\n  excludes: [\n    'gradient',\n    // Not yet\n    implemented.\n    'broadcasts 2x1 Tensor2D and 2x2 Tensor2D' // Broadcasting along inner\n                      //\n                      // dims not supported yet.\n  ]\n },\n {\n  include: 'log',\n  },\n {\n  startsWith: 'equal',\n  excludes: [\n    'broadcasting Tensor2D shapes', // Broadcasting along outer dims not\n                      // supported\n    yet.\n    'broadcasting Tensor3D shapes', // Same as above.\n    'broadcasting Tensor4D shapes', // Same as\n    above.\n    'string'\n  ]\n },\n {\n  include: 'greater',\n  excludes: [\n    'broadcasting Tensor2D shapes', //\n    Broadcasting along outer dims not\n                      // supported yet.\n    'broadcasting Tensor3D shapes',\n    // Same as above.\n    'broadcasting Tensor4D shapes', // Same as above.\n    'string'\n  ]\n },\n {\n  include: 'greaterEqual',\n  excludes: [\n    'gradient',\n    // Not yet implemented.\n    'broadcasting Tensor2D\n    shapes', // Broadcasting along outer dims not\n                      // supported yet.\n    'broadcasting Tensor3D shapes', // Same as above.\n    'broadcasting Tensor4D shapes', // Same as above.\n    'string'\n  ]\n },\n {\n  include: 'less',\n  excludes: [\n    'broadcasting Tensor2D shapes', // Broadcasting along\n    outer dims not\n                      // supported yet.\n    'broadcasting Tensor3D shapes', // Same as above.\n    'broadcasting Tensor3D float32', // Same as above.\n    'broadcasting Tensor4D shapes', // Same as above.\n    'string'\n  ]\n },\n {\n  include: 'lessEqual',\n  excludes: [\n    'gradient',\n    // Not yet implemented.\n    'broadcasting Tensor2D shapes', // Broadcasting along outer dims not\n                      // supported\n    yet.\n    'broadcasting Tensor3D shapes', // Same as above.\n    'broadcasting Tensor3D float32', // Same as\n    above.\n    'broadcasting Tensor4D shapes', // Same as above.\n    'string'\n  ]\n },\n {\n  include: 'notEqual',\n  excludes: [\n    'broadcasting Tensor2D shapes', // Broadcasting along outer dims not\n                      // supported yet.\n    'broadcasting Tensor3D shapes', // Same as above.\n    'broadcasting Tensor4D\n    shapes', // Same as above.\n    'string'\n  ]\n },\n {\n  include: 'mean',\n  excludes: [\n    'axis=0', // Reduction\n    not supported along inner dimensions.\n  ]\n },\n {\n  startsWith: 'reverse',\n  },\n {\n  startsWith: 'sum',\n  },\n {\n  startsWith: 'cumsum',\n  },\n {\n  startsWith: 'logicalAnd',\n  excludes: [\n    'broadcasting Tensor2D shapes', // Broadcasting\n    along outer dimensions\n                      // not yet supported.\n    'broadcasting Tensor3D shapes', // Same\n    as above.\n    'broadcasting Tensor4D shapes', // Same as above.\n  ]\n },\n {\n  startsWith: 'tile',\n  excludes: [\n    'gradient', // Gradient not yet implemented.\n    'string tensor' // String tensors not yet implemented.\n  ]\n },\n {\n  startsWith: 'sin',\n  },\n {\n  startsWith: 'cos',\n  excludes: [\n    'gradient', // Gradient not yet\n    implemented.\n  ]\n },\n {\n  startsWith: 'cosh',\n  excludes: [\n    'gradient' // Gradient not yet implemented.\n  ]\n },\n {\n  startsWith: 'tan',\n  excludes: ['gradient'] // Gradient not yet implemented.\n },\n {\n  startsWith: 'tanh',\n  excludes: ['gradient'] // Gradient not yet implemented.\n },\n {\n  startsWith: 'rsqrt',\n  excludes: ['gradient'] // Gradient not yet implemented.\n },\n {\n  startsWith: 'sqrt',\n  excludes: ['gradient'] //\n    Gradient not yet implemented.\n },\n {\n  startsWith: 'where',\n  excludes: [\n    '1D condition with higher rank\n
```

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a and b', // Fill not yet implemented.\n  'gradient' // Gradient not yet implemented.\n ]\n },\n
{\n  startsWith: 'zerosLike',\n // Complex numbers not supported yet.\n  excludes: ['complex'],\n
},\n {\n  startsWith: 'onesLike',\n // Complex numbers not supported yet.\n  excludes: ['complex'],\n },\n
{include: 'prod'},\n {include: 'floor'},\n {include: 'topk'},\n {include: 'expandDims'},\n {include: 'stack'},\n {\n
include: 'round',\n // Pool is not supported yet.\n  excludes: ['pool'],\n },\n {include: 'step kernel'},\n {include:
'ceil'},\n {include: 'mirrorPad'},\n {\n  startsWith: 'all',\n  excludes: [\n  'ignores NaNs' // Doesn't yet ignore
NaN\n ]\n },\n {\n  startsWith: 'any',\n  excludes: [\n  'ignores NaNs' // Doesn't yet ignore NaN\n ]\n },\n
{include: 'image.transform'},\n {include: 'batchToSpaceND'},\n {include: 'spaceToBatchND'},\n];\n\nconst
customInclude = (testName: string) => {\n // Include all regular describe() tests.\n  if (testName.indexOf('test-
wasm') < 0) {\n    return true;\n  }\n\n // Include all of the wasm specific tests.\n  if (testName.startsWith('wasm'))
{\n    return true;\n  }\n\n  return
false;\n};\n\nsetupTestFilters(TEST_FILTERS, customInclude);\n\n// Import and run all the tests from core.\n\n//
tslint:disable-next-line:no-imports-from-dist\n// tslint:disable-next-line:no-require-
imports\nrequire('@tensorflow/tfjs-core/dist/tests');\n"}

```

Found in path(s):

```

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/setup_test.js.map
No license file was found, but licenses were detected in source scan.

```

```

{"version":3,"file":"SplitV.js","sourceRoot":"","sources":["../../src/kernels/SplitV.ts"],"names":[],"mappings":"AAA
A;;;;;;;;;;;;;GAeG;AAEH,OAAO,EAA2B,MAAM,EAA6B,IAAI,EAAC,MAAM,uBAAuB,CAAC;AACxG,OAAO
,EAAC,YAAY,EAAC,MAAM,uBAAuB,CAAC;AAInD,OAAO,EAAC,KAAK,EAAC,MAAM,SAAS,CAAC;AAE
9B,MAAM,UAAU,MAAM,CACIB,IAAsE;IACxE,MAAM,EAAC,MAAM,EAAE,KAAK,EAAE,OAAO,EAAC,G
AAG,IAAI,CAAC;IACtC,MAAM,EAAC,CAAC,EAAC,GAAG,MAAM,CAAC;IACnB,MAAM,EAAC,eAAe,EA
AE,IAAI,EAAC,GAAG,KAAK,CAAC;IAEtC,MAAM,KAAK,GAAG,IAAI,CAAC,cAAc,CAAC,IAAI,EAAE,CA
AC,CAAC,KAAK,CAAC,CAAC,CAAC,CAAC;IAEpD,MAAM,UAAU,GAAG,YAAY,CAAC,gBAAGb,C
AAC,CAAC,EAAE,eAAe,EAAE,KAAK,CAAC,CAAC;IAC5E,MAAM,KAAK,GAAG,IAAI,KAAK,CAAC,CAA
C,CAAC,KAAK,CAAC,MAAM,CAAC,CAAC,IAAI,CAAC,CAAC,CAAC;IAC7B,MAAM,IAAI,GAAG,
CAAC,CAAC,KAAK,CAAC,KAAK,EAAE,CAAC;IAC7B,OAAO,UAAU,CAAC,GAAG,CAAC,CAAC,CAAC,E
AAE;QACxB,MAAM,UAAU,GAAG,CAAC,GAAG,IAAI,CAAC,CAAC;QAC7B,UAAU,CAAC,KAAK,CAAC,
GAAG,CAAC,CAAC;QACtB,MAAM,MAAM,GACR,KAAK,CAAC,EAAC,MAAM,EAAE,EAAC,CAAC,EAAC
,EAAE,KAAK,EAAE,EAAC,KAAK,EAAE,IAAI,EAAE,UAAU,EAAC,EAAE,OAAO,EAAC,CAAC,CAAC;QA
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EAAE,MAAM;IACnB,UAAU,EAAE,MAA0B;CACvC,CAAC","sourcesContent":["/**\n

```

```

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the specific language governing permissions and\n * limitations under the License.\n *

```

```

=====\n
*\n\nimport {KernelConfig, KernelFunc, SplitV, SplitVAttrs, SplitVInputs, util} from '@tensorflow/tfjs-
core';\nimport {backend_util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from
'./backend_wasm';\nimport {slice} from './Slice';\nexport function splitV(\n  args: {inputs: SplitVInputs, attrs:
SplitVAttrs, backend: BackendWasm}) {\n  const {inputs, attrs, backend} = args;\n  const {x} = inputs;\n  const
{numOrSizeSplits, axis} = attrs;\n\n  const $axis = util.parseAxisParam(axis, x.shape)[0];\n\n  const splitSizes =
backend_util.prepareSplitSize(x, numOrSizeSplits, $axis);\n  const begin = new Array(x.shape.length).fill(0);\n

```

```
const size = x.shape.slice();\n return splitSizes.map(s => {\n   const xSliceSize = [...size];\n   xSliceSize[$axis] =\n   s;\n   const xSlice =\n     slice({inputs: {x}, attrs: {begin, size: xSliceSize}, backend});\n   begin[$axis] += s;\n   return xSlice;\n });\n}\n\nexport const\n  splitVConfig: KernelConfig = {\n    kernelName: SplitV,\n    backendName: 'wasm',\n    kernelFunc: splitV as {} as\n    KernelFunc\n  };}
```

Found in path(s):

```
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/SplitV.js.map
```

No license file was found, but licenses were detected in source scan.

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```

AM,iBAAiB,CAAC;AAC5C,OAAO,EAAC,UAAU,EAAC,MAAM,gBAAGB,CAAC;AAC1C,OAAO,EAAC,WA
AW,EAAC,MAAM,iBAAiB,CAAC;AAC5C,OAAO,EAAC,aAAa,EAAC,MAAM,mBAAmB,CAAC;AACChD,OA
AO,EAAC,UAAU,EAAC,MAAM,gBAAGB,CAAC;AAC1C,OAAO,EAAC,WAAW,EAAC,MAAM,iBAAiB,CAA
C;AAC5C,OAAO,EAAC,aAAa,EAAC,MAAM,mBAAmB,CAAC;AACChD,OAAO,EAAC,oBAAoB,EAAC,MAA
M,0BAA0B,CAAC;AAC9D,OAAO,EAAC,aAAa,EAAC,MAAM,mBAAmB,CAAC;AACChD,OAAO,EAAC,sBAA
sB,EAAC,MAAM,4BAA4B,CAAC;AACIE,OAAO,EAAC,WAAW,EAAC,MAAM,iBAAiB,CAAC;AAC5C,OAA
O,EAAC,WAAW,EAAC,MAAM,iBAAiB,CAAC;AAC5C,OAAO,EAAC,eAAe,EAAC,MAAM,qBAAqB,CAAC;
AACpD,OAAO,EAAC,YAAY,EAAC,MAAM,kBAaKB,CAAC;AAC9C,OAAO,EAAC,aAAa,EAAC,MAAM,mB
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AAS;IACT,SAAS;IACT,UAAU;IACV,UAAU;IACV,UAAU;IACV,eAAe;IACf,eAAe;IACf,YAAY;IACZ,eAAe;C
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9B", "sourcesContent":["/**\n

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=====\n */\n//
We explicitly import the modular kernels so they get registered in the\n// global registry when we compile the
library. A modular build would replace\n// the contents of this file and import only the kernels that are
needed.\nimport {KernelConfig, registerKernel} from '@tensorflow/tfjs-core';\nimport {fusedMatMulConfig}
from './kernels/_FusedMatMul';\nimport {absConfig} from './kernels/Abs';\nimport {addConfig} from
'./kernels/Add';\nimport {addNConfig} from './kernels/AddN';\nimport {allConfig} from './kernels/All';\nimport
{anyConfig} from './kernels/Any';\nimport {argMaxConfig} from './kernels/ArgMax';\nimport {avgPoolConfig}

```

from './kernels/AvgPool';\nimport
{batchMatMulConfig} from './kernels/BatchMatMul';\nimport {batchToSpaceNDConfig} from
 './kernels/BatchToSpaceND';\nimport {castConfig} from './kernels/Cast';\nimport {ceilConfig} from
 './kernels/Ceil';\nimport {clipByValueConfig} from './kernels/ClipByValue';\nimport {concatConfig} from
 './kernels/Concat';\nimport {conv2DConfig} from './kernels/Conv2D';\nimport {conv2DBackpropInputConfig} from
 './kernels/Conv2DBackpropInput';\nimport {cosConfig} from './kernels/Cos';\nimport {coshConfig} from
 './kernels/Cosh';\nimport {cropAndResizeConfig} from './kernels/CropAndResize';\nimport {cumsumConfig} from
 './kernels/Cumsum';\nimport {depthToSpaceConfig} from './kernels/DepthToSpace';\nimport
{depthwiseConv2dNativeConfig} from './kernels/DepthwiseConv2dNative';\nimport {eluConfig} from
 './kernels/Elu';\nimport {equalConfig} from './kernels/Equal';\nimport {expConfig} from './kernels/Exp';\nimport
{expandDimsConfig} from './kernels/ExpandDims';\nimport {fillConfig} from './kernels/Fill';\nimport
{flipLeftRightConfig} from './kernels/FlipLeftRight';\nimport {floorConfig} from './kernels/Floor';\nimport
{floorDivConfig} from './kernels/FloorDiv';\nimport {fusedBatchNormConfig} from
 './kernels/FusedBatchNorm';\nimport {fusedConv2DConfig} from './kernels/FusedConv2D';\nimport
{fusedDepthwiseConv2DConfig} from './kernels/FusedDepthwiseConv2D';\nimport {gatherNdConfig} from
 './kernels/GatherNd';\nimport {gatherV2Config} from './kernels/GatherV2';\nimport {greaterConfig} from
 './kernels/Greater';\nimport {greaterEqualConfig} from './kernels/GreaterEqual';\nimport {identityConfig} from
 './kernels/Identity';\nimport {leakyReluConfig} from './kernels/LeakyRelu';\nimport {lessConfig} from
 './kernels/Less';\nimport {lessEqualConfig} from './kernels/LessEqual';\nimport {logConfig} from
 './kernels/Log';\nimport {logicalAndConfig} from './kernels/LogicalAnd';\nimport {maxConfig} from
 './kernels/Max';\nimport {maximumConfig} from './kernels/Maximum';\nimport {maxPoolConfig} from
 './kernels/MaxPool';\nimport {meanConfig} from './kernels/Mean';\nimport {minConfig} from
 './kernels/Min';\nimport {minimumConfig} from './kernels/Minimum';\nimport {mirrorPadConfig} from
 './kernels/MirrorPad';\nimport {multiplyConfig} from './kernels/Multiply';\nimport {negConfig} from
 './kernels/Neg';\nimport {nonMaxSuppressionV3Config} from './kernels/NonMaxSuppressionV3';\nimport
{nonMaxSuppressionV4Config} from './kernels/NonMaxSuppressionV4';\nimport {nonMaxSuppressionV5Config}
from './kernels/NonMaxSuppressionV5';\nimport {notEqualConfig} from './kernels/NotEqual';\nimport
{oneHotConfig} from './kernels/OneHot';\nimport {onesLikeConfig} from './kernels/OnesLike';\nimport
{packConfig} from './kernels/Pack';\nimport {padV2Config} from './kernels/PadV2';\nimport {powConfig} from
 './kernels/Pow';\nimport {preluConfig} from './kernels/Prelu';\nimport {prodConfig} from './kernels/Prod';\nimport
{rangeConfig} from './kernels/Range';\nimport {realDivConfig} from './kernels/RealDiv';\nimport
{reluConfig} from './kernels/Relu';\nimport {relu6Config} from './kernels/Relu6';\nimport {reshapeConfig} from
 './kernels/Reshape';\nimport {resizeBilinearConfig} from './kernels/ResizeBilinear';\nimport {reverseConfig} from
 './kernels/Reverse';\nimport {rotateWithOffsetConfig} from './kernels/RotateWithOffset';\nimport {roundConfig}
from './kernels/Round';\nimport {rsqrtConfig} from './kernels/Rsqrt';\nimport {scatterNdConfig} from
 './kernels/ScatterNd';\nimport {selectConfig} from './kernels/Select';\nimport {sigmoidConfig} from
 './kernels/Sigmoid';\nimport {sinConfig} from './kernels/Sin';\nimport {sliceConfig} from './kernels/Slice';\nimport
{softmaxConfig} from './kernels/Softmax';\nimport {spaceToBatchNDConfig} from
 './kernels/SpaceToBatchND';\nimport {splitVConfig} from './kernels/SplitV';\nimport {sqrtConfig} from
 './kernels/Sqrt';\nimport {squareConfig} from './kernels/Square';\nimport {squaredDifferenceConfig} from
 './kernels/SquaredDifference';\nimport {stepConfig} from
 './kernels/Step';\nimport {stridedSliceConfig} from './kernels/StridedSlice';\nimport {subConfig} from
 './kernels/Sub';\nimport {sumConfig} from './kernels/Sum';\nimport {tanConfig} from './kernels/Tan';\nimport
{tanhConfig} from './kernels/Tanh';\nimport {tileConfig} from './kernels/Tile';\nimport {topKConfig} from
 './kernels/TopK';\nimport {transformConfig} from './kernels/Transform';\nimport {transposeConfig} from
 './kernels/Transpose';\nimport {unpackConfig} from './kernels/Unpack';\nimport {zerosLikeConfig} from
 './kernels/ZerosLike';\n\n// List all kernel configs here\nconst kernelConfigs: KernelConfig[] = [\n  absConfig,\n  addConfig,\n  addNConfig,\n  allConfig,\n  anyConfig,\n  argMaxConfig,\n  avgPoolConfig,\n

```



```

batchMatMulConfig,\n batchToSpaceNDConfig,\n castConfig,\n ceilConfig,\n clipByValueConfig,\n
concatConfig,\n conv2DConfig,\n conv2DBackpropInputConfig,\n cosConfig,\n coshConfig,\n
cropAndResizeConfig,\n cumsumConfig,\n depthToSpaceConfig,\n depthwiseConv2dNativeConfig,\n
  eluConfig,\n equalConfig,\n expConfig,\n expandDimsConfig,\n fillConfig,\n flipLeftRightConfig,\n
floorConfig,\n floorDivConfig,\n fusedMatMulConfig,\n fusedBatchNormConfig,\n fusedConv2DConfig,\n
fusedDepthwiseConv2DConfig,\n gatherNdConfig,\n gatherV2Config,\n greaterConfig,\n greaterEqualConfig,\n
identityConfig,\n leakyReluConfig,\n lessConfig,\n lessEqualConfig,\n logConfig,\n logicalAndConfig,\n
maxConfig,\n maximumConfig,\n maxPoolConfig,\n meanConfig,\n minConfig,\n minimumConfig,\n
mirrorPadConfig,\n multiplyConfig,\n negConfig,\n nonMaxSuppressionV3Config,\n
nonMaxSuppressionV4Config,\n nonMaxSuppressionV5Config,\n notEqualConfig,\n oneHotConfig,\n
onesLikeConfig,\n packConfig,\n padV2Config,\n powConfig,\n preluConfig,\n prodConfig,\n rangeConfig,\n
realDivConfig,\n reluConfig,\n relu6Config,\n reshapeConfig,\n resizeBilinearConfig,\n reverseConfig,\n
rotateWithOffsetConfig,\n rsqrtConfig,\n roundConfig,\n
  scatterNdConfig,\n selectConfig,\n sigmoidConfig,\n sinConfig,\n sliceConfig,\n softmaxConfig,\n
spaceToBatchNDConfig,\n splitVConfig,\n sqrtConfig,\n squareConfig,\n squaredDifferenceConfig,\n
stepConfig,\n stridedSliceConfig,\n subConfig,\n sumConfig,\n tanConfig,\n tanhConfig,\n tileConfig,\n
topKConfig,\n transformConfig,\n transposeConfig,\n unpackConfig,\n zerosLikeConfig\n];\n\nfor (const
kernelConfig of kernelConfigs) {\n  registerKernel(kernelConfig);\n}\n"}

```

Found in path(s):

```

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
wasm/dist/register_all_kernels.js.map

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No license file was found, but licenses were detected in source scan.

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```
=====\n*\n\nimport {AvgPool, AvgPoolAttrs,  
  AvgPoolInputs, backend_util, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';\nimport  
{BackendWasm} from '../backend_wasm';\nlet wasmAvgPool: (\n  xId: number, batchSize: number,  
  inputHeight: number, inputWidth: number,\n  filterHeight: number, filterWidth: number, padTop: number,  
  padRight: number,\n  padBottom: number, padLeft: number, strideHeight: number,\n  strideWidth: number,  
  channels: number, outId: number) => void;\nfunction setup(backend: BackendWasm) {\n  wasmAvgPool =  
  backend.wasm.cwrap(AvgPool, null /* void */, [\n    'number', // xId\n    'number', // batchSize\n    'number', //  
inputHeight\n    'number', // inputWidth\n    'number', // filterHeight\n    'number', // filterWidth\n    'number', //  
padTop\n    'number', // padRight\n    'number', // padBottom\n    'number', // padLeft\n    'number', //  
strideHeight\n    'number', // strideWidth\n    'number', // channels\n    'number', // outId\n  ]);\n}\nfunction  
avgPool(\n  args: {inputs: AvgPoolInputs, backend: BackendWasm, attrs: AvgPoolAttrs}) {\n  const {inputs, attrs, backend} =  
args;\n  const x = inputs.x as Tensor4D;\n  const xId = backend.dataIdMap.get(x.dataId).id;\n  const {filterSize,  
  strides, pad, dimRoundingMode} = attrs;\n  const convInfo = backend_util.computePool2DInfo(\n    x.shape,  
    filterSize, strides, 1 /* dilations */, pad, dimRoundingMode);\n  const filterHeight = convInfo.filterHeight;\n  const  
filterWidth = convInfo.filterWidth;\n  const padTop = convInfo.padInfo.top;\n  const padRight =  
convInfo.padInfo.right;\n  const padBottom = convInfo.padInfo.bottom;\n  const padLeft = convInfo.padInfo.left;\n  const strideHeight = convInfo.strideHeight;\n  const strideWidth = convInfo.strideWidth;\n  const channels =  
convInfo.inChannels;\n  if (convInfo.dataFormat !== 'channelsLast') {\n    throw new Error(\n      `wasm backend  
does not support dataFormat: ` +\n      `${convInfo.dataFormat}`. Please use 'channelsLast'.`);\n  }\n  if (convInfo.dilationWidth !== 1 || convInfo.dilationHeight !== 1) {\n    throw new Error(\n      `was backend only  
supports average pooling with dilation = [1, 1], ` +\n      `got [${convInfo.dilationHeight},  
${convInfo.dilationWidth}].`);\n  }\n  const out = backend.makeOutput(convInfo.outShape, 'float32');\n  const  
outId = backend.dataIdMap.get(out.dataId).id;\n  wasmAvgPool(\n    xId, x.shape[0], x.shape[1], x.shape[2],  
    filterHeight, filterWidth,\n    padTop, padRight, padBottom, padLeft, strideHeight, strideWidth, channels,\n    outId);\n  return out;\n}\nexport const avgPoolConfig: KernelConfig = {\n  kernelName: AvgPool,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: avgPool as { } as KernelFunc\n};\n}]]
```

Found in path(s):

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
wasm/dist/kernels/AvgPool.js.map

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* distributed under the License is distributed on an "AS IS" BASIS,
* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
* See the License for the specific language governing permissions and
* limitations under the License.
* =====
*/
/**
 * @deprecated Use `setWasmPaths`
instead.
 * Sets the path to the `.wasm` file which will be fetched when the wasm
 * backend is initialized. See
 * https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-wasm/README.md#using-bundlers
 * for more details.
 * @param path wasm file path or url
 * @param usePlatformFetch optional boolean to use platform fetch to download
 * the wasm file, default to false.
 *
 * @doc {heading: 'Environment', namespace: 'wasm'}
 */

```

Found in path(s):

```

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/tf-backend-wasm.es2017.js

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```

{"version":3,"file":"tf-backend-wasm.node.js","sources":["../src/kernels/types.ts","../src/kernels/_FusedMatMul.ts","../src/kernels/unary_kernel.ts","../src/kernels/Abs.ts","../src/kernels/binary_kernel.ts","../src/kernels/Add.ts","../src/kernels/AddN.ts","../src/kernels/Identity.ts","../src/kernels/Transpose.ts","../src/kernels/kernel_utils.ts","../src/kernels/All.ts","../src/kernels/Any.ts","../src/kernels/ArgMax.ts","../src/kernels/AvgPool.ts","../src/kernels/Reshape.ts","../src/kernels/BatchMatMul.ts","../node_modules/@tensorflow/tfjs-backend-cpu/dist/kernels/Concat_impl.js","../node_modules/@tensorflow/tfjs-backend-cpu/dist/kernels/Range_impl.js","../node_modules/@tensorflow/tfjs-backend-cpu/dist/kernels/Slice.js","../src/kernels/Slice.ts","../src/kernels/BatchToSpaceND.ts","../src/kernels/Cast.ts","../src/kernels/Ceil.ts","../src/kernels/ClipByValue.ts","../src/kernels/Concat.ts","../src/kernels/Conv2D.ts","../src/kernels/Conv2DBackpropInput.ts","../src/kernels/Cos.ts","../src/kernels/Cosh.ts","../src/kernels/CropAndResize.ts","../src/kernels/Cumsum.ts","../src/kernels/DepthToSpace.ts","../src/kernels/DepthwiseConv2dNative.ts","../src/kernels/Elu.ts","../src/kernels/Equal.ts","../src/kernels/Exp.ts","../src/kernels/ExpandDims.ts","../src/kernels/Fill.ts","../src/kernels/FlipLeftRight.ts","../src/kernels/Floor.ts","../src/kernels/FloorDiv.ts","../src/kernels/FusedBatchNorm.ts","../src/kernels/FusedConv2D.ts","../src/kernels/FusedDepthwiseConv2D.ts","../src/kernels/GatherNd.ts","../src/kernels/GatherV2.ts","../src/kernels/Greater.ts","../src/kernels/GreaterEqual.ts","../src/kernels/LeakyRelu.ts","../src/kernels/Less.ts","../sr

```

c/kernels/LessEqual.ts", "../src/kernels/Log.ts", "../src/kernels/LogicalAnd.ts", "../src/kernels/Max.ts", "../src/kernels/Maximum.ts", "../src/kernels/MaxPool.ts", "../src/kernels/Mean.ts", "../src/kernels/Min.ts", "../src/kernels/Minimum.ts", "../src/kernels/MirrorPad.ts", "../src/kernels/Multiply.ts", "../src/kernels/Neg.ts", "../src/kernels/NonMaxSuppression_util.ts", "../src/kernels/NonMaxSuppressionV3.ts", "../src/kernels/NonMaxSuppressionV4.ts", "../src/kernels/NonMaxSuppressionV5.ts", "../src/kernels/NotEqual.ts", "../src/kernels/OneHot.ts", "../src/kernels/OnesLike.ts", "../src/kernels/Pack.ts", "../src/kernels/PadV2.ts", "../src/kernels/Pow.ts", "../src/kernels/Prelu.ts", "../src/kernels/Prod.ts", "../src/kernels/Range.ts", "../src/kernels/RealDiv.ts", "../src/kernels/Relu.ts", "../src/kernels/Relu6.ts", "../src/kernels/ResizeBilinear.ts", "../src/kernels/Reverse.ts", "../src/kernels/RotateWithOffset.ts", "../src/kernels/Round.ts", "../src/kernels/Rsqrt.ts", "../src/kernels/ScatterNd.ts", "../src/kernels/Select.ts", "../src/kernels/Sigmoid.ts", "../src/kernels/Sin.ts", "../src/kernels/Softmax.ts", "../src/kernels/SpaceToBatchND.ts", "../src/kernels/SplitV.ts", "../src/kernels/Sqrt.ts", "../src/kernels/Square.ts", "../src/kernels/SquaredDifference.ts", "../src/kernels/Step.ts", "../src/kernels/StridedSlice.ts", "../src/kernels/Sub.ts", "../src/kernels/Sum.ts", "../src/kernels/Tan.ts", "../src/kernels/Tanh.ts", "../src/kernels/Tile.ts", "../src/kernels/TopK.ts", "../src/kernels/Transform.ts", "../src/kernels/Unpack.ts", "../src/kernels/ZerosLike.ts", "../src/register_all_kernels.ts", "../src/c/flags_wasm.ts", "../wasm-out/tfjs-backend-wasm-threaded-simd.js", "../wasm-out/tfjs-backend-wasm-threaded-simd.worker.js", "../wasm-out/tfjs-backend-

```
wasm.js", "../src/backend_wasm.ts", "../src/version.ts", "../src/base.ts"], "sourcesContent": ["/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT
```

```
WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n *\n\n// This enum must align with the enum defined in cc/backend.h.\nexport enum CppDType {\n  float32 = 0,\n  int32 = 1,\n  bool = 2,\n  string = 3,\n  complex64 = 4\n}\n\n// Must match enum in cc/fusable_activations.h.\nexport enum FusableActivation {\n  linear = 0,\n  relu = 1,\n  relu6 = 2,\n  prelu = 3,\n  leakyrelu = 4,\n  sigmoid = 5,\n  elu = 6\n}\n\n/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n *\n\nimport { _FusedMatMul, _FusedMatMulAttrs, _FusedMatMulInputs, KernelConfig, KernelFunc } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { FusableActivation } from './types';\n\nlet wasmFusedMatMul: (\n  aId: number, aShape: Uint8Array, aShapeSize: number, bId: number, bShape: Uint8Array, bShapeSize: number, transposeA: boolean, transposeB: boolean, activation: number, biasId: number, preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>\n  void;\n\nfunction setup(backend: BackendWasm) {\n  wasmFusedMatMul = backend.wasm.cwrap(_FusedMatMul, null /* void */, [\n    'number',\n    // a_id\n    'array', // a_shape\n    'number', // a_shape.length\n    'number', // b_id\n    'array', // b_shape\n    'number', // b_shape.length\n    'number', // transpose_a\n    'number', // transpose_b\n    'number', // activation\n    'number', // biasId\n    'number', // preluActivationWeightsId\n    'number', // leakyreluAlpha\n    'number' // out_id\n  ]);\n\n  function fusedBatchMatMul(args: {\n    inputs: _FusedMatMulInputs,\n    backend: BackendWasm,\n    attrs: _FusedMatMulAttrs\n  }) {\n    const { inputs, backend, attrs } = args;\n    const { a, b, bias, preluActivationWeights } = inputs;\n\n    if (a.dtype !== 'float32' || b.dtype !== 'float32') {\n      throw new Error(\n
```

```

`_FusedMatMul for non non-float32 tensors not yet supported.`);
}

const {transposeA, transposeB,
activation, leakyreluAlpha} = attrs;
const aId = backend.dataIdMap.get(a.dataId).id;
const bId =
backend.dataIdMap.get(b.dataId).id;
let biasId = 0;
if (bias != null) {
  const biasData = backend.dataIdMap.get(bias.dataId);
  if (biasData.shape.length !== 1) {
    throw new
Error(`_FusedMatMul only supports rank-1 bias but got ` +
`rank ${biasData.shape.length}`);
  }
  biasId = biasData.id;
}
const preluActivationWeightsId = preluActivationWeights == null ? 0 :
backend.dataIdMap.get(preluActivationWeights.dataId).id;
const fusedActivation =
FusableActivation[activation as { } as keyof typeof FusableActivation];
if (fusedActivation == null) {
  throw
new Error(`_${activation} activation not yet supported for FusedConv2D ` +
`in the wasm backend.`);
}
const leftDim = transposeA ? a.shape[2] : a.shape[1];
const rightDim = transposeB ? b.shape[1] :
b.shape[2];
const batchDim = a.shape[0];
const out = backend.makeOutput([batchDim, leftDim, rightDim],
a.dtype);
const outId = backend.dataIdMap.get(out.dataId).id;
const aShapeBytes = new Uint8Array(new
Int32Array(a.shape).buffer);
const bShapeBytes = new Uint8Array(new Int32Array(b.shape).buffer);
wasmFusedMatMul(aId, aShapeBytes, a.shape.length, bId, bShapeBytes, b.shape.length,
transposeA,
transposeB, fusedActivation, biasId, preluActivationWeightsId,
leakyreluAlpha || 0, outId);
return
out;
}

export const fusedMatMulConfig: KernelConfig = {
  kernelName: '_FusedMatMul',
  backendName:
'wasm',
  setupFunc: setup,
  kernelFunc: fusedBatchMatMul as { } as KernelFunc;
}, /**
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 * you may not use this file except in compliance with the License.
 * You may obtain a copy of the
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 * distributed under the License is distributed on an "AS IS" BASIS,
 * WITHOUT WARRANTIES
 * OR CONDITIONS OF ANY KIND, either express or implied.
 * See the License for the specific language
 * governing permissions and
 * limitations under the License.
 */
};

=====
import {DataType, KernelConfig, TensorInfo, UnaryInputs, util} from '@tensorflow/tfjs-core';
import
{BackendWasm} from '../backend_wasm';
import {CppType} from './types';
export function
createUnaryKernelConfig(kernelName: string, outType?: DataType): KernelConfig {
  let wasmFunc: (xId:
number, dtype: number, outId: number) => void;
  function setupFunc(backend: BackendWasm): void {
    wasmFunc = backend.wasm.cwrap(kernelName, null /* void */, [
      'number', // x_id
      'number', // dtype
      'number', // out_id
    ]);
  }
  function kernelFunc(args: {backend: BackendWasm, inputs: UnaryInputs}):
TensorInfo {
    const {backend, inputs: {x}} = args;
    const xId = backend.dataIdMap.get(x.dataId).id;
    const out = backend.makeOutput(x.shape, outType || x.dtype);
    const outId =
backend.dataIdMap.get(out.dataId).id;
    // Short-circuit zero-sized tensors.
    if (util.sizeFromShape(out.shape)
=== 0) {
      return out;
    }
    wasmFunc(xId, CppDType[x.dtype], outId);
    return out;
  }
  return
{kernelName, backendName: 'wasm', setupFunc, kernelFunc};
}, /**
 * @license
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 * LLC. All Rights Reserved.
 * Licensed under the Apache License, Version 2.0 (the "License");
 * you may not
 * use this file except in compliance with the License.
 * You may obtain a copy of the License at
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 * distributed under the License is distributed on an "AS IS" BASIS,
 * WITHOUT WARRANTIES
 * OR CONDITIONS OF ANY KIND, either express or implied.
 * See the License for the specific language
 * governing permissions
 * and
 * limitations under the License.
 */
};

=====
import {Abs, KernelConfig} from '@tensorflow/tfjs-core';
import {createUnaryKernelConfig} from
'./unary_kernel';
export const absConfig: KernelConfig = createUnaryKernelConfig(Abs);
/**
 * @license
 * Copyright 2019 Google
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 * Licensed under the Apache License, Version 2.0 (the
 * "License");
 * you may not use this file except in compliance with the License.
 * You may obtain a copy of the

```

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```
=====
*/\n\nimport {backend_util, BinaryInputs, DataType, KernelConfig, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {CppType} from './types';\n\nexport function createBinaryKernelConfig(\n  kernelName: string, supportsFullBroadcast: boolean,\n  dtype?:\n  DataType): KernelConfig {\n  let wasmFunc:\n    (aId: number, aShape: Uint8Array, aShapeLen: number, bId:\n    number,\n    bShape: Uint8Array, bShapeLen: number, dtype: number, outId: number) =>\n    void;\n\n  function setupFunc(backend: BackendWasm): void {\n    wasmFunc = backend.wasm.cwrap(kernelName, null /*\n    void*/, [\n      'number', // a_id,\n      'array', // a_shape\n      'number', // a_shape.length\n      'number', // b_id\n      'array', // b_shape\n      'number', // b_shape.length\n      'number', // dtype\n      'number' // out_id\n    ]);\n  }\n\n  function kernelFunc(args: {backend: BackendWasm, inputs: BinaryInputs}):\n    TensorInfo {\n    const {backend, inputs} = args;\n    const {a, b} = inputs;\n    const aId =\n    backend.dataIdMap.get(a.dataId).id;\n    const bId = backend.dataIdMap.get(b.dataId).id;\n\n    const outputType =\n    dtype != null ? dtype : a.dtype;\n\n    const newShape = backend_util.assertAndGetBroadcastShape(a.shape,\n    b.shape);\n\n    const out = backend.makeOutput(newShape, outputType);\n\n    // Short-circuit zero-sized tensors.\n    if (util.sizeFromShape(newShape) === 0) {\n      return out;\n    }\n\n    const aShapeBytes = new Uint8Array(new\n    Int32Array(a.shape).buffer);\n    const bShapeBytes = new Uint8Array(new\n    Int32Array(b.shape).buffer);\n\n    const\n    outId = backend.dataIdMap.get(out.dataId).id;\n\n    const kernelFunc = () => wasmFunc(\n      aId, aShapeBytes,\n      a.shape.length, bId, bShapeBytes, b.shape.length,\n      CCppType[a.dtype], outId);\n\n    // Currently only some\n    float operations support full broadcast.\n    if (supportsFullBroadcast && a.dtype === 'float32')\n      {\n        kernelFunc();\n        return out;\n      }\n\n    const aBroadcastDims = backend_util.getBroadcastDims(a.shape,\n    newShape);\n    const bBroadcastDims = backend_util.getBroadcastDims(b.shape, newShape);\n\n    const\n    loopsOverAllOfA = aBroadcastDims.every((v, i) => v === i);\n    const loopsOverAllOfB =\n    bBroadcastDims.every((v, i) => v === i);\n\n    if (loopsOverAllOfA && loopsOverAllOfB) {\n      kernelFunc();\n      return out;\n    } else {\n      throw new Error(\n        `Broadcasting along outer dims is not yet`\n        +`\n        `supported for ${a.dtype} ${kernelName}.`);\n    }\n\n    return {kernelName, backendName: 'wasm', setupFunc,\n    kernelFunc};\n  }\n\n  "/**\n  * @license\n  * Copyright 2019 Google LLC. All Rights Reserved.\n  * Licensed under the\n  * Apache License, Version 2.0 (the "License");\n  * you may not use this file except in compliance with the\n  * License.\n  * You may obtain a copy of the License at\n  * http://www.apache.org/licenses/LICENSE-2.0\n  * Unless required
```

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```
=====
*/\n\nimport {Add, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from\n './binary_kernel';\n\nconst supportsFullBroadcast = true;\n\nexport const addConfig: KernelConfig =\n  createBinaryKernelConfig(Add, supportsFullBroadcast);\n\n"/**\n  * @license\n  * Copyright 2019 Google LLC. All\n  * Rights Reserved.\n  * Licensed under the Apache License, Version 2.0 (the "License");\n  * you may not use this\n  * file except in compliance with the License.\n  * You may obtain a copy of the License at\n  * http://www.apache.org/licenses/LICENSE-2.0\n  * Unless required by applicable\n  * law or agreed to in writing, software\n  * distributed under the License is distributed on an "AS IS" BASIS,\n  * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n  * See the License for\n  * the specific language governing permissions and\n  * limitations under the License.\n  */
```

```
=====
*/\n\nimport {AddN, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport
```

```

{BackendWasm} from './backend_wasm';\n\nimport {CppType} from './types';\n\nlet wasmFunc:\n  (inputIds:
  Uint8Array, inputIdsLen: number, dtype: number, outId: number) =>\n    void;\n\nfunction setupFunc(backend:
  BackendWasm): void {\n  wasmFunc = backend.wasm.cwrap(AddN, null /* void */, [\n  'array', // input_ids\n  'number', // input_ids.length\n  'number', // dtype\n  'number', // out_id\n  ]);\n}\n\nfunction addn(args: {inputs:
  TensorInfo[], backend: BackendWasm}) {\n  const {inputs,
  backend} = args;\n  const out = backend.makeOutput(inputs[0].shape, inputs[0].dtype);\n\n  // Short-circuit zero-
  sized tensors.\n  if (util.sizeFromShape(out.shape) === 0) {\n    return out;\n  }\n\n  const inputIds = inputs.map(x
  => backend.dataIdMap.get(x.dataId).id);\n  const inputIdsBytes = new Uint8Array(new
  Int32Array(inputIds).buffer);\n  const outId = backend.dataIdMap.get(out.dataId).id;\n  wasmFunc(inputIdsBytes,
  inputIds.length, CppDType[out.dtype], outId);\n\n  return out;\n}\n\nexport const addNConfig: KernelConfig = {\n
  kernelName: AddN,\n  backendName: 'wasm',\n  setupFunc,\n  kernelFunc: addn as {} as KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
  2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
  copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
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  to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT
  WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
  language governing permissions and\n * limitations under the License.\n *
  =====\n
  *\n\nimport {Identity, IdentityInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\nimport
  {TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nexport function
  identity(args: {inputs: IdentityInputs, backend: BackendWasm}):\n  TensorInfo {\n  const {inputs: {x}, backend} =
  args;\n  const out = backend.makeOutput(x.shape, x.dtype);\n  const inVals = backend.typedArrayFromHeap(x);\n
  const outVals = backend.typedArrayFromHeap(out);\n  outVals.set(inVals);\n  return out;\n}\n\nexport const
  identityConfig: KernelConfig = {\n  kernelName: Identity,\n  backendName: 'wasm',\n
  kernelFunc: identity as {} as KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights
  Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
  except in compliance with the License.\n * You may obtain a copy of the License at\n *
  http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
  software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
  OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
  governing permissions and\n * limitations under the License.\n *
  =====\n
  *\n\nimport {KernelConfig, KernelFunc, TensorInfo, Transpose, TransposeAttrs, TransposeInputs} from
  '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {identity} from
  './Identity';\nimport {CppType}
  from './types';\n\nlet wasmTranspose: (\n  xId: number, xShape: Uint8Array, xShapeLength: number, dtype:
  CppDType,\n  outId: number, perm: Uint8Array, permLength: number) => void;\n\nfunction setup(backend:
  BackendWasm) {\n  wasmTranspose = backend.wasm.cwrap(Transpose, null /* void */, [\n  'number', // xId\n
  'array', // x.shape\n  'number', // x.shape.length\n  'number', // dtype\n  'number', // outId\n  'array', // perm\n
  'number', // perm.length\n  ]);\n}\n\nexport function transpose(\n  args:\n  {inputs: TransposeInputs, backend:
  BackendWasm, attrs: TransposeAttrs}):\n  TensorInfo {\n  const {inputs, backend, attrs} = args;\n  // Reduce any
  dimensions with size one. Lower-rank transpose kernel performs\n  // better due to simpler memory access pattern.\n
  const [reducedShape, perm] = removeOneSizeDims(inputs.x.shape, attrs.perm);\n\n  let permIsNoOp = true;\n  for
  (let i = 0; i < perm.length; i++) {\n    if (perm[i] !== i) {\n      permIsNoOp
  = false;\n    }\n  }\n  const outShape = computeOutShape(inputs.x.shape, attrs.perm);\n  const x = {\n  dataId:
  inputs.x.dataId,\n  shape: reducedShape,\n  dtype: inputs.x.dtype\n};\n\n  if (permIsNoOp) {\n    const cloned =
  identity({inputs, backend});\n    cloned.shape = outShape;\n    return cloned;\n  }\n\n  const out =
  
```



```

backend.makeOutput(outShape, x.dtype);\n const xId = backend.dataIdMap.get(x.dataId).id;\n const outId =
backend.dataIdMap.get(out.dataId).id;\n const permBytes = new Uint8Array(new Int32Array(perm).buffer);\n
const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n\n wasmTranspose(\n  xId,
xShapeBytes, x.shape.length, CppDType[x.dtype], outId, permBytes,\n  perm.length);\n return
out;\n}\n\nfunction computeOutShape(inShape: number[], perm: number[]): number[] {\n const outShape = new
Array(inShape.length);\n for (let i = 0; i < outShape.length; i++) {\n  outShape[i] = inShape[perm[i]];}\n }\n
return outShape;\n}\n\nfunction
removeOneSizeDims(\n  shape: number[], perm: number[]): [number[], number[]] {\n const newShape: number[]
= [];\n const newPerm: number[] = [];\n for (let i = 0; i < shape.length; ++i) {\n  if (shape[i] !== 1) {\n
newShape.push(shape[i]);\n  }\n  if (shape[perm[i]] !== 1) {\n  newPerm.push(perm[i]);\n  }\n }\n for (let i =
0; i < newPerm.length; ++i) {\n  let minValIdx = -1;\n  for (let j = 0; j < newPerm.length; ++j) {\n  if
(newPerm[j] >= i &&\n    (minValIdx === -1 || newPerm[minValIdx] > newPerm[j])) {\n    minValIdx = j;\n  }
}\n  newPerm[minValIdx] = i;\n }\n return [newShape, newPerm];}\n}\n\nexport const transposeConfig:
KernelConfig = {\n kernelName: Transpose,\n backendName: 'wasm',\n kernelFunc: transpose as {} as
KernelFunc,\n setupFunc: setup,\n};\n\n", "/**\n * @license\n * Copyright 2020 Google Inc. All Rights Reserved.\n *
Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *\n
=====*\n\nimport { backend_util, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from
'./backend_wasm';\nimport { transpose } from './Transpose';\n\n/**\n * Compute permutation axes and do a transpose
if necessary.\n *\n * Used by reduction ops.\n *\n * @param x input TensorInfo\n * @param axis reduction axes\n *
@param backend wasm backend instance\n */\nexport function permuteAxesAndTranspose(\n  x: TensorInfo,
axis: number|number[],
  backend: BackendWasm): {\n  transposed: TensorInfo|null,\n  axes: number[],\n  originalAxes: number[],\n
inputWasTransposed: boolean\n} {\n  const xShape = x.shape;\n  const xRank = x.shape.length;\n  const
originalAxes = util.parseAxisParam(axis, xShape);\n  let axes = originalAxes;\n  const permutedAxes =
backend_util.getAxesPermutation(axes, xRank);\n  let xTransposed = null;\n  let inputWasTransposed = false;\n
if (permutedAxes != null) {\n  const newShape: number[] = new Array(xRank);\n  for (let i = 0; i <
newShape.length; i++) {\n  newShape[i] = xShape[permutedAxes[i]];}\n }\n  axes =
backend_util.getInnerMostAxes(axes.length, xRank);\n  xTransposed =\n    transpose({inputs: {x}, attrs: {perm:
permutedAxes}, backend});\n  const xId = backend.dataIdMap.get(x.dataId).id;\n  const transposedId =
backend.dataIdMap.get(xTransposed.dataId).id;\n  if (transposedId !== xId) {\n  inputWasTransposed = true;\n
}\n }\n }\n  return {transposed:
xTransposed, originalAxes, axes, inputWasTransposed};}\n\n", "/**\n * @license\n * Copyright 2021 Google LLC.
All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *\n
=====*\n\nimport { All, AllAttrs, AllInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util } from
'@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport
{ permuteAxesAndTranspose } from './kernel_utils';\n\nlet

```

```

wasmAll: (xId: number, reduceSize: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm):
void {\n  wasmAll = backend.wasm.cwrap(All, null /*void*/, ['number, number, number']);\n}\n\nfunction all(args:
{backend: BackendWasm, inputs: AllInputs, attrs: AllAttrs});\n  TensorInfo {\n    const {backend, inputs, attrs} =
args;\n    const {axis, keepDims} = attrs;\n    const {x} = inputs;\n    const xId = backend.dataIdMap.get(x.dataId).id;\n
let inputId = xId;\n    let input = x;\n\n    const {transposed, axes, originalAxes, inputWasTransposed} =\npermuteAxesAndTranspose(x, axis, backend);\n\n    if (inputWasTransposed) {\n      const transposedId =
backend.dataIdMap.get(transposed.dataId).id;\n      input = transposed;\n      inputId = transposedId;\n    }\n\n    const
inputRank = input.shape.length;\n    backend_util.assertAxesAreInnerMostDims('all', axes, inputRank);\n    const
[outShape, reduceShape] =\n      backend_util.computeOutAndReduceShapes(input.shape, axes);\n    const reduceSize = util.sizeFromShape(reduceShape);\n\n    const out = backend.makeOutput(outShape, x.dtype);\n
if (util.sizeFromShape(input.shape) !== 0) {\n      const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmAll(inputId, reduceSize, outId);\n    }\n\n    if (inputWasTransposed) {\n      // dispose of the transposed tensor.\n
backend.disposeData(transposed.dataId);\n    }\n\n    if (keepDims) {\n      // reshape\n      const newShape =
backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n      out.shape = newShape;\n    }\n\n    return
out;\n}\n\nexport const allConfig: KernelConfig = {\n  kernelName: All,\n  backendName: 'wasm',\n  setupFunc:
setup,\n  kernelFunc: all as {} as KernelFunc\n};\n\n", "/*\n * @license\n * Copyright 2021 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n
*\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is
distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *
=====\n
*\n\nimport {Any, AnyAttrs, AnyInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport
{permuteAxesAndTranspose} from './kernel_utils';\n\nlet wasmAny: (xId: number, reduceSize: number, outId:
number) => void;\n\nfunction setup(backend: BackendWasm): void {\n  wasmAny = backend.wasm.cwrap(Any,
null /*void*/, ['number, number, number']);\n}\n\nfunction any(args: {backend: BackendWasm, inputs: AnyInputs,
attrs: AnyAttrs});\n  TensorInfo {\n    const {backend, inputs,
attrs} = args;\n    const {axis, keepDims} = attrs;\n    const {x} = inputs;\n    const xId =
backend.dataIdMap.get(x.dataId).id;\n    let inputId = xId;\n    let input = x;\n\n    const {transposed, axes, originalAxes,
inputWasTransposed} =\n      permuteAxesAndTranspose(x, axis, backend);\n\n    if (inputWasTransposed) {\n      const
transposedId = backend.dataIdMap.get(transposed.dataId).id;\n      input = transposed;\n      inputId =
transposedId;\n    }\n\n    const inputRank = input.shape.length;\n    backend_util.assertAxesAreInnerMostDims('any',
axes, inputRank);\n    const [outShape, reduceShape] =\n      backend_util.computeOutAndReduceShapes(input.shape, axes);\n    const reduceSize =
util.sizeFromShape(reduceShape);\n\n    const out = backend.makeOutput(outShape, x.dtype);\n    if
(util.sizeFromShape(input.shape) !== 0) {\n      const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmAny(inputId, reduceSize, outId);\n    }\n\n    if (inputWasTransposed) {\n      // dispose of the transposed tensor.\n
backend.disposeData(transposed.dataId);\n    }\n\n    if (keepDims) {\n      // reshape\n      const newShape = backend_util.expandShapeToKeepDim(out.shape,
originalAxes);\n      out.shape = newShape;\n    }\n\n    return out;\n}\n\nexport const anyConfig: KernelConfig = {\n
kernelName: Any,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: any as {} as
KernelFunc\n};\n\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n *
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on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n

```
* =====\n*\n\nimport { ArgMax, ArgMaxAttrs, ArgMaxInputs, KernelConfig, KernelFunc, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport { permuteAxesAndTranspose } from './kernel_utils';\nimport { CppDType } from './types';\n\nlet wasmFunc: (\n  xId: number, dtype: number, outerSize: number, innerSize: number,\n  outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n  wasmFunc = backend.wasm.cwrap(ArgMax, null /* void */, [\n    'number', // x_id\n    'number', // dtype\n    'number', // outer_size\n    'number', // inner_size\n    'number' // out_id\n  ]);\n\n  function argmax(\n    args: { inputs: ArgMaxInputs, backend: BackendWasm, attrs: ArgMaxAttrs }) {\n    const { backend, inputs, attrs } = args;\n    const { axis } = attrs as {} as ArgMaxAttrs;\n    const { x } = inputs as {} as ArgMaxInputs;\n    const xId = backend.dataIdMap.get(x.dataId).id;\n    let inputId = xId;\n    let input = x;\n\n    const { transposed, axes, inputWasTransposed } =\n      permuteAxesAndTranspose(x, axis, backend);\n\n    if (inputWasTransposed) {\n      const transposedId =\n        backend.dataIdMap.get(transposed.dataId).id;\n      if (transposedId !== xId) {\n        // transpose was not a no-op. We will need to dispose of this\n        // once we are done.\n        input = transposed;\n        inputId = transposedId;\n      }\n\n      const outShape = input.shape.slice(0, -1);\n      const out = backend.makeOutput(outShape, 'int32');\n      const outId = backend.dataIdMap.get(out.dataId).id;\n      const outerSize = util.sizeFromShape(out.shape);\n      const innerSize = input.shape[axes[0]];\n      wasmFunc(inputId, CppDType[input.dtype], outerSize, innerSize, outId);\n\n      if (inputWasTransposed) {\n        // dispose of the transposed tensor.\n        backend.disposeData(transposed.dataId);\n      }\n\n      return out;\n    }\n\n    export const argMaxConfig: KernelConfig = {\n      kernelName: ArgMax,\n      backendName: 'wasm',\n
```

```
  kernelFunc: argmax as {} as KernelFunc,\n  setupFunc: setup\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n * \n
```

```
=====*\n\nimport { AvgPool, AvgPoolAttrs, AvgPoolInputs, backend_util, KernelConfig, KernelFunc, Tensor4D } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\n\nlet wasmAvgPool: (\n  xId: number, batchSize: number, inputHeight: number, inputWidth: number,\n  filterHeight: number, filterWidth: number, padTop: number, padRight: number,\n  padBottom: number, padLeft: number, strideHeight: number, strideWidth: number, channels: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n  wasmAvgPool = backend.wasm.cwrap(AvgPool, null /* void */, [\n    'number', // xId\n    'number', // batchSize\n    'number', // inputHeight\n    'number', // inputWidth\n    'number', // filterHeight\n    'number', // filterWidth\n    'number', // padTop\n    'number', // padRight\n    'number', // padBottom\n    'number', // padLeft\n    'number', // strideHeight\n    'number', // strideWidth\n    'number', // channels\n    'number', // outId\n  ]);\n\n  function avgPool(\n    args: { inputs: AvgPoolInputs, backend: BackendWasm, attrs: AvgPoolAttrs }) {\n    const { inputs, attrs, backend } = args;\n    const x = inputs.x as Tensor4D;\n    const xId = backend.dataIdMap.get(x.dataId).id;\n    const { filterSize, strides, pad, dimRoundingMode } = attrs;\n    const convInfo =\n      backend_util.computePool2DInfo(\n        x.shape, filterSize, strides, 1 /* dilations */, pad, dimRoundingMode);\n    const filterHeight = convInfo.filterHeight;\n    const filterWidth = convInfo.filterWidth;\n    const padTop = convInfo.padInfo.top;\n    const padRight = convInfo.padInfo.right;\n    const padBottom = convInfo.padInfo.bottom;\n    const padLeft = convInfo.padInfo.left;\n    const strideHeight = convInfo.strideHeight;\n    const strideWidth = convInfo.strideWidth;\n    const channels = convInfo.inChannels;\n\n    if (convInfo.dataFormat !== 'channelsLast') {\n
```

```

throw new Error(\n    `wasm backend does not support dataFormat:` + \n        `${convInfo.dataFormat}'. Please
use 'channelsLast'.`);\n } \n\n if (convInfo.dilationWidth !== 1 || convInfo.dilationHeight !== 1) {\n    throw new
Error(\n    `was backend only supports average pooling with dilation = [1, 1],` + \n
        `got [${convInfo.dilationHeight}, ${convInfo.dilationWidth}].`);\n } \n\n const out =
backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n
wasmAvgPool(\n    xId, x.shape[0], x.shape[1], x.shape[2], filterHeight, filterWidth,\n    padTop, padRight, padBottom, padLeft, strideHeight, strideWidth, channels,\n    outId);\n return out;\n}\n\n\nexport const
avgPoolConfig: KernelConfig = {\n    kernelName: AvgPool,\n    backendName: 'wasm',\n    setupFunc: setup,\n    kernelFunc: avgPool as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
===== \n
*/\n\nimport {KernelConfig, KernelFunc, Reshape, ReshapeAttrs, ReshapeInputs, util} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from './backend_wasm';\n\nexport function reshape(\n    args: {inputs:
ReshapeInputs, attrs: ReshapeAttrs, backend: BackendWasm}) {\n    const {inputs, attrs} = args;\n    const {x} =
inputs;\n    const {shape} = attrs;\n\n    const xSize = util.sizeFromShape(x.shape);\n    const $shape =
util.inferFromImplicitShape(shape, xSize);\n\n    util.assert(\n        xSize === util.sizeFromShape($shape),\n        () =>
`new shape: ${$shape}, old shape: ${x.shape}. New shape and old ` + \n            `shape must have the same number of
elements.`);\n\n    // Backend needs to track refCount
for the dataId for reshape op\n    args.backend.incRef(x.dataId);\n    return {dataId: x.dataId, shape: $shape, dtype:
x.dtype};\n}\n\n\nexport const reshapeConfig: KernelConfig = {\n    kernelName: Reshape,\n    backendName: 'wasm',\n    kernelFunc: reshape as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
===== \n
*/\n\nimport
{BatchMatMul, BatchMatMulAttrs, BatchMatMulInputs, KernelConfig, KernelFunc, util} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {reshape} from './Reshape';\n\nlet
wasmBatchMatMul: (\n    aId: number, aShape: Uint8Array, aShapeSize: number, bId: number,\n    bShape:
Uint8Array, bShapeSize: number, transposeA: boolean,\n    transposeB: boolean, outId: number) =>
void;\n\nfunction setup(backend: BackendWasm) {\n    wasmBatchMatMul = backend.wasm.cwrap(BatchMatMul,
null /* void */, [\n        'number', // a_id\n        'array', // a_shape\n        'number', // a_shape.length\n        'number', // b_id\n        'array', // b_shape\n        'number', // b_shape.length\n        'number', // transpose_a\n        'number', // transpose_b\n        'number' // out_id\n    ]);\n}\n\nfunction batchMatMul(args: {\n    inputs: BatchMatMulInputs,\n    backend:
BackendWasm,\n    attrs: BatchMatMulAttrs\n}) {\n    const {inputs, backend, attrs} = args;\n    const {a, b} = inputs;\n\n    const
[transposeA, transposeB] = attrs;\n\n    if (a.dtype !== 'float32' || b.dtype !== 'float32') {\n        throw new Error(\n
            `BatchMatMul for non non-float32 tensors not yet supported.`);\n    }\n\n    const aRank = a.shape.length;\n    const
bRank = b.shape.length;\n\n    const innerShapeA = transposeA ? a.shape[aRank - 2] : a.shape[aRank - 1];\n    const

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=====
*\n\nimport { backend_util, KernelConfig, KernelFunc, Slice, slice_util, SliceAttrs, SliceInputs, TypedArray, util }
from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport { sliceImplCPU } from
'./kernel_utils/shared';\n\nexport function slice(\n  args: { inputs: SliceInputs, attrs: SliceAttrs, backend:
BackendWasm }) {\n  const { inputs: { x }, attrs: { begin, size }, backend } = args;\n\n  const [begin_, size_] =
slice_util.parseSliceParams(x, begin, size);\n\n  const isContinuous = slice_util.isSliceContinuous(x.shape, begin_,
size_);\n  const xVals = backend.readSync(x.dataId);\n  const out = backend.makeOutput(size_, x.dtype);\n  const
xStrides = util.computeStrides(x.shape);\n  const outData = backend.dataIdMap.get(out.dataId);\n\n  if (isContinuous) {\n    const flatOffset = slice_util.computeFlatOffset(begin_, xStrides);\n\n    if (x.dtype ===
'string') {\n      outData.stringBytes =\n        (xVals as Uint8Array[])\n          .slice(flatOffset, flatOffset +
util.sizeFromShape(size_));\n    } else {\n      const outVals = backend.typedArrayFromHeap(out);\n      outVals.set(\n        (xVals as TypedArray)\n          .subarray(flatOffset, flatOffset +
util.sizeFromShape(size_));\n    }\n\n    return out;\n  }\n\n  if (x.dtype === 'string') {\n    const res =
sliceImplCPU(xVals, begin_, size_, x.shape, x.dtype);\n    outData.stringBytes = res as Uint8Array[];\n    return
out;\n  }\n\n  const outVals = backend.typedArrayFromHeap(out);\n  const rank = x.shape.length;\n  if (rank === 2)
{\n    slice2d(\n      xVals as TypedArray, xStrides[0], outVals, begin_ as [number, number],\n      size_ as
[number, number]);\n  } else if (rank === 3) {\n    slice3d(\n      xVals
as TypedArray, xStrides[0], xStrides[1], outVals,\n      begin_ as [number, number, number], size_ as [number,
number, number]);\n  } else if (rank === 4) {\n    slice4d(\n      xVals as TypedArray, xStrides[0], xStrides[1],
xStrides[2], outVals,\n      begin_ as [number, number, number, number],\n      size_ as [number, number, number,
number]);\n  } else {\n    const res =\n      sliceImplCPU(xVals, begin_, size_, x.shape, x.dtype) as TypedArray;\n    outVals.set(res);\n  }\n\n  return out;\n}\n\nfunction slice2d(\n  xVals: backend_util.TypedArray, xStride:
number,\n  outVals: backend_util.TypedArray, begin: [number, number],\n  size: [number, number]): void {\n  let
outOffset = 0;\n  const beginI = begin[0];\n  const beginJ = begin[1];\n  const endI = beginI + size[0];\n  for (let i =
beginI; i < endI; i++) {\n    const xOffset = i * xStride + beginJ;\n    outVals.set(xVals.subarray(xOffset, xOffset +
size[1]), outOffset);\n    outOffset += size[1];\n  }\n}\n\nfunction
slice3d(\n  xVals: backend_util.TypedArray, xStride1: number, xStride2: number,\n  outVals:
backend_util.TypedArray, begin: [number, number, number],\n  size: [number, number, number]): void {\n  let
outOffset = 0;\n  const beginI = begin[0];\n  const beginJ = begin[1];\n  const beginK = begin[2];\n  const endI =
beginI + size[0];\n  const endJ = beginJ + size[1];\n  for (let i = beginI; i < endI; i++) {\n    for (let j = beginJ; j <
endJ; j++) {\n      const xOffset = i * xStride1 + j * xStride2 + beginK;\n      outVals.set(xVals.subarray(xOffset,
xOffset + size[2]), outOffset);\n      outOffset += size[2];\n    }\n  }\n}\n\nfunction slice4d(\n  xVals:
backend_util.TypedArray, xStride1: number, xStride2: number,\n  xStride3: number, outVals:
backend_util.TypedArray,\n  begin: [number, number, number, number],\n  size: [number, number, number,
number]): void {\n  let outOffset = 0;\n  const beginI = begin[0];\n  const beginJ = begin[1];\n  const beginK =
begin[2];\n\n  const endI = beginI + size[0];\n  const endJ = beginJ + size[1];\n  const endK = beginK + size[2];\n  const beginL =
begin[3];\n  for (let i = beginI; i < endI; i++) {\n    for (let j = beginJ; j < endJ; j++) {\n      for (let k = beginK; k <
endK; k++) {\n        const xOffset = i * xStride1 + j * xStride2 + k * xStride3 + beginL;\n        outVals.set(xVals.subarray(xOffset, xOffset + size[3]), outOffset);\n        outOffset += size[3];\n      }\n    }\n  }\n}\n\nexport const sliceConfig: KernelConfig = {\n  kernelName: Slice,\n  backendName: 'wasm',\n  kernelFunc:
slice as {} as KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n *
Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF
ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n *

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limitations under the License.\n *

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=====\n
*\n\nimport {backend_util, BatchToSpaceND, BatchToSpaceNDAttrs, BatchToSpaceNDInputs, KernelConfig,
KernelFunc} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport
{reshape} from './Reshape';\n\nimport {slice} from './Slice';\n\nimport {transpose} from './Transpose';\n\nfunction
batchToSpaceND(args: {\n  inputs: BatchToSpaceNDInputs,\n  backend: BackendWasm,\n  attrs:
BatchToSpaceNDAttrs\n}) {\n  const {inputs, backend, attrs} = args;\n  const {x} = inputs;\n  const {blockShape,
crops} = attrs;\n\n  const prod = blockShape.reduce((a, b) => a * b);\n\n  const reshaped =
backend_util.getReshaped(x.shape, blockShape, prod);\n  const
permuted = backend_util.getPermuted(reshaped.length, blockShape.length);\n  const reshapedPermuted =\n
backend_util.getReshapedPermuted(x.shape, blockShape, prod);\n  const sliceBeginCoords =\n
backend_util.getSliceBeginCoords(crops, blockShape.length);\n  const sliceSize =\n
backend_util.getSliceSize(reshapedPermuted, crops, blockShape.length);\n\n  const xReshaped = reshape({inputs:
{x}, backend, attrs: {shape: reshaped}});\n  const xTransposed =\n  transpose({inputs: {x: xReshaped}, backend,
attrs: {perm: permuted}});\n  const xTransposedReshaped = reshape(\n    {inputs: {x: xTransposed}, backend,
attrs: {shape: reshapedPermuted}});\n  const result = slice({\n    inputs: {x: xTransposedReshaped},\n    backend,\n
attrs: {begin: sliceBeginCoords, size: sliceSize}\n  });\n\n  backend.disposeData(xReshaped.dataId);\n
backend.disposeData(xTransposed.dataId);\n  backend.disposeData(xReshaped.dataId);\n\n  return
result;\n}\n\nexport const batchToSpaceNDConfig: KernelConfig
= {\n  kernelName: BatchToSpaceND,\n  backendName: 'wasm',\n  kernelFunc: batchToSpaceND as {} as
KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
```

```
=====\n
*\n\nimport {Cast, CastAttrs, CastInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\n\nimport
{TensorInfo} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from '../backend_wasm';\n\nexport function cast(\n  args: {inputs: CastInputs, attrs: CastAttrs,
backend: BackendWasm});\n  TensorInfo {\n    const {inputs: {x}, attrs: {dtype}, backend} = args;\n    const out =
backend.makeOutput(x.shape, dtype);\n    const inVals = backend.typedArrayFromHeap(x);\n    const outVals =
backend.typedArrayFromHeap(out);\n    outVals.set(inVals);\n    return out;\n  })\n\nexport const castConfig:
KernelConfig = {\n  kernelName: Cast,\n  backendName: 'wasm',\n  kernelFunc: cast as {} as
KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
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on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License
for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n
*\n\nimport {KernelConfig, Ceil} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'/unary_kernel';\n\nexport const ceilConfig: KernelConfig = createUnaryKernelConfig(Ceil);\n\n"/**\n *
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2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
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```

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```
=====\n*\n\nimport { ClipByValue, ClipByValueAttrs, ClipByValueInputs, KernelConfig, KernelFunc } from\n '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nlet wasmClip: (xId: number, min:\n number, max: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n  wasmClip =\n  backend.wasm.cwrap(ClipByValue, null /* void */, [\n    'number', // x_id\n    'number', // min\n    'number', //\n    max\n    'number' // out_id\n  ]);\n\n  function clip(args: {\n    inputs: ClipByValueInputs,\n    backend:\n    BackendWasm,\n    attrs: ClipByValueAttrs\n  }) {\n    const {inputs, backend, attrs} = args;\n    const {x} = inputs;\n    const {clipValueMin, clipValueMax} = attrs;\n    const xId = backend.dataIdMap.get(x.dataId).id;\n    const out =\n    backend.makeOutput(x.shape, x.dtype);\n    const outId = backend.dataIdMap.get(out.dataId).id;\n\n    wasmClip(xId, clipValueMin, clipValueMax, outId);\n    return out;\n  }\n\n  export const clipByValueConfig:\n  KernelConfig = {\n    kernelName: ClipByValue,\n    backendName: 'wasm',\n    setupFunc: setup,\n    kernelFunc: clip\n  } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed\n * under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the\n * License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n * on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n * implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n * License.\n */\n\n=====\n\n*\n\nimport
```

```
{ backend_util, Concat, ConcatAttrs, ConcatInputs, KernelConfig, KernelFunc, util } from '@tensorflow/tfjs-\n core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport { concatImplCPU } from\n '../kernel_utils/shared';\n\nimport { identity } from './Identity';\n\nimport { reshape } from './Reshape';\n\nexport function\n concat(\n  args: {inputs: ConcatInputs, backend: BackendWasm, attrs: ConcatAttrs}) {\n    const {inputs, backend}\n    = args;\n\n    const axis = util.parseAxisParam(args.attrs.axis, inputs[0].shape)[0];\n\n    let outShape =\n    backend_util.computeOutShape(inputs.map(t => t.shape), axis);\n\n    // Keep only non-empty tensors (ignore tensors\n    with 0 in their shape).\n    const $inputs = inputs.filter(t => util.sizeFromShape(t.shape) > 0);\n\n    if ($inputs.length ===\n    1) {\n      return identity({inputs: {x: $inputs[0]}, backend});\n    }\n\n    const out = backend.makeOutput(outShape,\n    inputs[0].dtype);\n\n    if (util.sizeFromShape(outShape) === 0) {\n      return out;\n    }\n\n    const shapes =\n    $inputs.map(t\n    => t.shape);\n\n    backend_util.assertParamsConsistent(shapes, axis);\n\n    if ($inputs[0].dtype === 'string') {\n      // Any concat of n-dimensional tensors across any axis can be reduced to\n      // a concatenation of two-dimensional\n      tensors across the axis 1 by first\n      // partitioning the axes of the original tensors into those less than the\n      // axis\n      to be concatenated and the rest. Then reshape the tensors\n      // into a two-dimensional tensor by collapsing these\n      two sets of axes and\n      // concatenate the resulting matrices across the axis 1, finally reshaping\n      // the result to\n      have the proper shape.\n      const inputs2D = $inputs.map(t => {\n        const innerSize =\n        util.sizeFromShape(t.shape.slice(axis));\n        const shape = [-1, innerSize];\n        return reshape({inputs: {x: t},\n        backend, attrs: {shape}});\n      });\n\n      const inputsValShapes = inputs2D.map(t => {\n        return {vals:\n        backend.readSync(t.dataId, shape: t.shape);\n      });\n\n      // Concat 2d tensors\n      along axis=1.\n      outShape =\n      backend_util.computeOutShape(inputs2D.map(t => t.shape), 1 /* axis */);\n\n      const simplyConcat = inputs2D[0].shape[0] === 1;\n      const outVals = concatImplCPU(\n      inputsValShapes, outShape, inputs[0].dtype,\n      simplyConcat) as string[];\n\n      const finalOutShape\n      =\n      backend_util.computeOutShape($inputs.map(t => t.shape), axis);\n\n      out.shape = finalOutShape;\n\n      const outData = backend.dataIdMap.get(out.dataId);\n      outData.stringBytes =\n      backend_util.fromStringArrayToUint8(outVals);\n\n      inputs2D.forEach(t => backend.disposeData(t.dataId));\n\n    }\n  }\n}
```

```

return out;\n }\n\n const batchDim = util.sizeFromShape($inputs[0].shape.slice(0, axis));\n let sumInnerDims =
0;\n const innerDims = $inputs.map(input => {\n const innerDim = util.sizeFromShape(input.shape.slice(axis));\n
sumInnerDims += innerDim;\n return innerDim;\n });\n const inVals = $inputs.map(input =>
backend.typedArrayFromHeap(input));\n
const outVals = backend.typedArrayFromHeap(out);\n for (let b = 0; b < batchDim; b++) {\n let outOffset = b *
sumInnerDims;\n for (let i = 0; i < inVals.length; i++) {\n const innerDim = innerDims[i];\n const inOffset =
b * innerDim;\n const vals = inVals[i].subarray(inOffset, inOffset + innerDim);\n outVals.set(vals,
outOffset);\n outOffset += innerDim;\n }\n }\n return out;\n }\n\nexport const concatConfig: KernelConfig =
{\n kernelName: Concat,\n backendName: 'wasm',\n kernelFunc: concat as { } as KernelFunc,\n};\n"/**\n *
@license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is
distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n */
=====
*\n\nimport { backend_util, Conv2D, Conv2DAttrs, Conv2DInputs, KernelConfig, KernelFunc, Tensor4D } from
'@tensorflow/tfjs-core';\n\nimport { BackendWasm } from './backend_wasm';\n\nlet wasmConv2d: (\n xId:
number, batchSize: number, inputHeight: number, inputWidth: number,\n filterId: number, filterHeight: number,
filterWidth: number, padTop: number,\n padRight: number, padBottom: number, padLeft: number, isSamePad:
number,\n dilationHeight: number, dilationWidth: number, strideHeight: number,\n strideWidth: number,
inputChannels: number, outputChannels: number,\n outId: number) => void;\n\nfunction setup(backend:
BackendWasm) {\n wasmConv2d = backend.wasm.cwrap(Conv2D,
null /* void */, [\n 'number', // xId\n 'number', // batchSize\n 'number', // inputHeight\n 'number', //
inputWidth\n 'number', // filterId\n 'number', // filterHeight\n 'number', // filterWidth\n 'number', //
padTop\n 'number', // padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', // isSamePad\n
'number', // dilationHeight\n 'number', // dilationWidth\n 'number', // strideHeight\n 'number', //
strideWidth\n 'number', // inputChannels\n 'number', // outputChannels\n 'number', // outId\n
]);\n}\n\nfunction conv2d(\n args: { inputs: Conv2DInputs, backend: BackendWasm, attrs: Conv2DAttrs }) {\n
const { inputs, attrs, backend } = args;\n\n const { x, filter } = inputs;\n const xId =
backend.dataIdMap.get(x.dataId).id;\n const filterId = backend.dataIdMap.get(filter.dataId).id;\n\n const { strides,
dilations, pad, dimRoundingMode, dataFormat } = attrs;\n const $dataFormat =
backend_util.convertConv2DDataFormat(dataFormat);\n
const convInfo = backend_util.computeConv2DInfo((x as Tensor4D).shape, (filter as Tensor4D).shape,
strides, dilations,\n pad, dimRoundingMode, false, $dataFormat);\n\n const filterHeight =
convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const
padRight = convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n const padLeft =
convInfo.padInfo.left;\n const dilationHeight = convInfo.dilationHeight;\n const dilationWidth =
convInfo.dilationWidth;\n const strideHeight = convInfo.strideHeight;\n const strideWidth =
convInfo.strideWidth;\n const inputChannels = convInfo.inChannels;\n const outputChannels =
convInfo.outChannels;\n const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;\n\n if
(convInfo.dataFormat !== 'channelsLast') {\n throw new Error(\n `wasm backend Conv2D does not support
dataFormat: ` +\n ` ${convInfo.dataFormat}`. Please
use 'channelsLast'.`);\n }\n\n const out = backend.makeOutput(convInfo.outShape, 'float32');\n const outId =
backend.dataIdMap.get(out.dataId).id;\n wasmConv2d(\n xId, x.shape[0], x.shape[1], x.shape[2], filterId,
filterHeight,\n filterWidth, padTop, padRight, padBottom, padLeft, isSamePad,\n dilationHeight,
dilationWidth, strideHeight, strideWidth, inputChannels,\n outputChannels, outId);\n return out;\n }\n\nexport

```

const conv2DConfig: KernelConfig = {\n kernelName: Conv2D,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: conv2d as { } as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * <http://www.apache.org/licenses/LICENSE-2.0>\n * Unless required by applicable law or agreed to in writing, software\n * distributed under

the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */

```
=====\n*\n\nimport { backend_util, Conv2DBackpropInput, Conv2DBackpropInputAttrs, Conv2DBackpropInputInputs, KernelConfig, KernelFunc, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\n\nlet wasmConv2DBackpropInput: (\n  dyId: number, filterId: number, batchSize: number, filterHeight: number,\n  filterWidth: number, inHeight: number, inWidth: number, inChannels: number,\n  outHeight: number, outWidth: number, outChannels: number, strideHeight: number, strideWidth: number,\n  topPad: number, leftPad: number, fltS0: number, fltS1: number, fltS2: number, xBatchStride: number,\n  xRowStride: number, xColStride: number, xChannelStride: number,\n  yBatchStride: number, yRowStride: number, yColStride: number, yChannelStride: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n  wasmConv2DBackpropInput = backend.wasm.cwrap(Conv2DBackpropInput, null, [\n    'number', // dyId\n    'number', // filterId\n    'number', // batchSize\n    'number', // filterHeight\n    'number', // filterWidth\n    'number', // inHeight\n    'number', // inWidth\n    'number', // inChannels\n    'number', // outHeight\n    'number', // outWidth\n    'number', // outChannels\n    'number', // strideHeight\n    'number', // strideWidth\n    'number', // topPad\n    'number', // leftPad\n    'number', // fltS0\n    'number', // fltS1\n    'number', // fltS2\n    'number', // xBatchStride\n    'number', // xRowStride\n    'number', // xColStride\n    'number', // xChannelStride\n    'number', // yBatchStride\n    'number', // yRowStride\n    'number', // yColStride\n    'number', // yChannelStride\n    'number', // outId\n  ]);\n\n  function conv2DBackpropInput(args: {\n    backend: BackendWasm,\n    inputs: Conv2DBackpropInputInputs,\n    attrs: Conv2DBackpropInputAttrs\n  }): TensorInfo {\n    const { backend, inputs, attrs } = args;\n    const { dy, filter } = inputs;\n    const { strides, pad, dataFormat, dimRoundingMode, inputShape } = attrs;\n\n    const dilations = 1;\n    const $dataFormat = backend_util.convertConv2DDataFormat(dataFormat);\n    const convInfo = backend_util.computeConv2DInfo(\n      inputShape, filter.shape as [number, number, number, number], strides,\n      dilations, pad, dimRoundingMode, false /* depthwise */, $dataFormat);\n    const { batchSize, filterHeight, filterWidth, inChannels, inHeight,\n      inWidth, outChannels, outHeight, outWidth, strideHeight, strideWidth } =\n      convInfo;\n\n    const topPad = filterHeight - 1 - convInfo.padInfo.top;\n    const leftPad = filterWidth - 1 - convInfo.padInfo.left;\n\n    const isChannelsLast = convInfo.dataFormat === 'channelsLast';\n    const dxStrides = util.computeStrides(convInfo.inShape);\n    const dyStrides = util.computeStrides(dy.shape);\n    const [fltS0, fltS1, fltS2] = util.computeStrides(filter.shape);\n    const xBatchStride = dxStrides[0];\n    const xRowStride = isChannelsLast ? dxStrides[1] : dxStrides[2];\n    const xColStride = isChannelsLast ? dxStrides[2] : 1;\n    const xChannelStride = isChannelsLast ? 1 : dxStrides[1];\n    const yBatchStride = dyStrides[0];\n    const yRowStride = isChannelsLast ? dyStrides[1] : dyStrides[2];\n    const yColStride = isChannelsLast ? dyStrides[2] : 1;\n    const yChannelStride = isChannelsLast ? 1 : dyStrides[1];\n\n    const out = backend.makeOutput(convInfo.inShape, 'float32');\n    const outId = backend.dataIdMap.get(out.dataId).id;\n    const dyId = backend.dataIdMap.get(dy.dataId).id;\n    const filterId = backend.dataIdMap.get(filter.dataId).id;\n\n    wasmConv2DBackpropInput(\n      dyId, filterId, batchSize, filterHeight, filterWidth, inHeight, inWidth,\n      inChannels, outHeight, outWidth, outChannels, strideHeight, strideWidth,\n      topPad, leftPad, fltS0, fltS1, fltS2, xBatchStride, xRowStride,\n      xColStride, xChannelStride,
```

```

yBatchStride, yRowStride, yColStride,\n    yChannelStride, outId);\n return out;\n}\n\nexport const
conv2DBackpropInputConfig: KernelConfig = {\n kernelName: Conv2DBackpropInput,\n backendName:
'wasm',\n setupFunc: setup,\n kernelFunc: conv2DBackpropInput as {} as KernelFunc\n};\n", "/*\n * @license\n *
Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
'License');\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an 'AS IS' BASIS,\n *
WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport { Cos, KernelConfig } from '@tensorflow/tfjs-core';\n\nimport { createUnaryKernelConfig } from
'/unary_kernel';\n\nexport const cosConfig: KernelConfig = createUnaryKernelConfig(Cos);\n", "/*\n * @license\n *
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'License');\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an 'AS IS' BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the
specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport { Cosh, KernelConfig } from '@tensorflow/tfjs-core';\n\nimport { createUnaryKernelConfig } from
'/unary_kernel';\n\nexport const coshConfig: KernelConfig = createUnaryKernelConfig(Cosh);\n", "/*\n * @license\n *
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2.0 (the 'License');\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an 'AS IS' BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport { CropAndResize, CropAndResizeAttrs, CropAndResizeInputs, KernelConfig, KernelFunc,
TensorInfo } from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from './backend_wasm';\n\nimport { cast }
from './Cast';\n\n// Must match enum in CropAndResize.cc\nenum InterpolationMethod {\n bilinear = 0,\n nearest
= 1\n}\n\nlet wasmCropAndResize: (\n imagesId: number, boxesId: number, boxIndId: number, numBoxes:
number,\n imagesShape: Uint8Array, cropHeight: number, cropWidth: number,\n method: number,
extrapolationValue: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n
wasmCropAndResize = backend.wasm.cwrap(CropAndResize, null /*void*/, [\n 'number', // imagesId\n
'number', // boxesId\n 'number', // boxIndId\n 'number', // numBoxes\n 'array', // images shape\n
'number', // cropHeight\n 'number', // cropWidth\n 'number', // method\n
'number', // extrapolation value\n 'number' // out id\n ]);\n}\n\nfunction cropAndResize(args: {\n backend:
BackendWasm,\n inputs: CropAndResizeInputs,\n attrs: CropAndResizeAttrs\n}): TensorInfo {\n const {backend,
inputs, attrs} = args;\n const {method, extrapolationValue, cropSize} = attrs;\n const {image, boxes, boxInd} =
inputs;\n\n const numBoxes = boxes.shape[0];\n\n const [cropHeight, cropWidth] = cropSize as [number,
number];\n\n const outShape = [numBoxes, cropHeight, cropWidth, image.shape[3]];\n\n let imagesData =
backend.dataIdMap.get(image.dataId);\n let castedData;\n if (image.dtype !== 'float32') {\n castedData =
cast({backend, inputs: {x: image}, attrs: {dtype: 'float32'}});\n imagesData =
backend.dataIdMap.get(castedData.dataId);\n }\n\n const imagesId = imagesData.id;\n const boxesId =
backend.dataIdMap.get(boxes.dataId).id;\n const boxIndId = backend.dataIdMap.get(boxInd.dataId).id;\n const

```



```

out = backend.makeOutput(outShape, 'float32');\n
  const outId = backend.dataIdMap.get(out.dataId).id;\n\n  const imagesShapeBytes = new Uint8Array(new
Int32Array(image.shape).buffer);\n\n  wasmCropAndResize(\n    imagesId, boxesId, boxIndId, numBoxes,
imagesShapeBytes, cropHeight,\n    cropWidth,\n    InterpolationMethod[method as {} as keyof typeof
InterpolationMethod],\n    extrapolationValue, outId);\n\n  if (castedData != null) {\n
backend.disposeData(castedData.dataId);\n  }\n\n  return out;\n}\n\nexport const cropAndResizeConfig:
KernelConfig = {\n  kernelName: CropAndResize,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc:
cropAndResize as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport { backend_util, KernelConfig, KernelFunc, Cumsum, CumsumAttrs, CumsumInputs, TensorInfo, util }
from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from './backend_wasm';\n\nimport { CppDType } from
 './types';\n\nimport { transpose } from './Transpose';\n\nlet wasmCumsum: (xId: number, exclusive: number, reverse:
number,\n    finalDim: number, outId: number, dtype: CppDType) => void;\n\nfunction setup(backend:
BackendWasm) {\n  wasmCumsum = backend.wasm.cwrap(Cumsum, null /* void */, [\n    'number', // x_id\n
'number', // exclusive\n    'number', // reverse\n    'number', // final_dim\n
'number', // out_id\n    'number' // dtype\n  ]);\n\n  export function cumsum(\n    args: { inputs: CumsumInputs,
backend: BackendWasm, attrs: CumsumAttrs }): TensorInfo {\n    const { inputs, backend, attrs } = args;\n    const { x }
= inputs;\n    const { axis, exclusive, reverse } = attrs;\n    const xRank = x.shape.length;\n\n    util.assert(x.dtype ===
'float32' || x.dtype === 'int32',\n    () => `cumsum does not support ${x.dtype} tensors in the WASM backend`);\n    //
permute required axis to inner most axis\n    const permutation = backend_util.getAxesPermutation([axis], xRank);\n
let permutedX = x;\n    if (permutation !== null) {\n      permutedX = transpose({ inputs: { x }, attrs: { perm:
permutation }, backend});\n    }\n    const permutedAxis = backend_util.getInnerMostAxes(1, xRank)[0];\n
backend_util.assertAxesAreInnerMostDims('cumsum', [permutedAxis], xRank);\n\n    const permutedOut =
backend.makeOutput(permutedX.shape, permutedX.dtype);\n    const finalDim = permutedX.shape[permutedAxis];\n
const permutedXId
= backend.dataIdMap.get(permutedX.dataId).id;\n    const permutedOutId =
backend.dataIdMap.get(permutedOut.dataId).id;\n    wasmCumsum(permutedXId, exclusive ? 1 : 0, reverse ? 1 : 0,
finalDim,\n    permutedOutId, CppDType[x.dtype]);\n\n    // transpose data back if permuted\n    let out =
permutedOut;\n    if (permutation !== null) {\n      const undoPermutation =
backend_util.getUndoAxesPermutation(permutation);\n      out = transpose(\n        { inputs: { x: permutedOut },
attrs: { perm: undoPermutation }, backend});\n    }\n    backend.disposeData(permutedX.dataId);\n
backend.disposeData(permutedOut.dataId);\n  }\n\n  return out;\n}\n\nexport const cumsumConfig: KernelConfig =
{\n  kernelName: Cumsum,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: cumsum as {} as
KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n *
distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND,
either express or implied.\n * See the License for the specific language governing permissions and\n * limitations
under the License.\n *
=====\n
*/\n\nimport { DepthToSpace, DepthToSpaceAttrs, DepthToSpaceInputs, KernelConfig, KernelFunc, TensorInfo,

```

```

util } from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nlet wasmDepthToSpace:
(\n  xId: number, blockSize: number, channelsLast: number, xStrides: Uint8Array,\n  xStridesLength: number, outputShape: Uint8Array, outputStrides: Uint8Array,\n  outSize: number, outId: number) => void;\n\nfunction
setup(backend: BackendWasm): void {\n  wasmDepthToSpace
= backend.wasm.cwrap(DepthToSpace, null /*void*/, [\n  'number', // xId\n  'number', // blockSize\n  'number',
// channelsLast\n  'array', // xStrides\n  'number', // xStridesLength\n  'array', // outputShape\n  'array', //
outputStrides\n  'number', // outSize\n  'number', // outId\n  ]);\n}\n\nexport function depthToSpace(args: {\n
backend: BackendWasm,\n  inputs: DepthToSpaceInputs,\n  attrs: DepthToSpaceAttrs\n}): TensorInfo {\n  const
{backend, inputs, attrs} = args;\n  const {x} = inputs;\n  const {blockSize, dataFormat} = attrs;\n\n  const batchSize
= x.shape[0];\n  const inputHeight = (dataFormat === 'NHWC') ? x.shape[1] : x.shape[2];\n  const inputWidth =
(dataFormat === 'NHWC') ? x.shape[2] : x.shape[3];\n  const inputDepth = (dataFormat === 'NHWC') ? x.shape[3]
: x.shape[1];\n\n  const outputHeight = inputHeight * blockSize;\n  const outputWidth = inputWidth * blockSize;\n
const outputDepth = inputDepth / (blockSize * blockSize);\n\n
  const outputShape = (dataFormat === 'NHWC') ?\n    [batchSize, outputHeight, outputWidth, outputDepth] :\n
[batchSize, outputDepth, outputHeight, outputWidth];\n\n  const out = backend.makeOutput(outputShape,
'float32');\n\n  const xData = backend.dataIdMap.get(x.dataId);\n  const xId = xData.id;\n  const xStridesBytes =\n
new Uint8Array(new Int32Array(util.computeStrides(x.shape)).buffer);\n\n  const outputShapeBytes = new
Uint8Array(new Int32Array(outputShape).buffer);\n\n  const outStridesBytes =\n    new Uint8Array(new
Int32Array(util.computeStrides(outputShape)).buffer);\n\n  const outId = backend.dataIdMap.get(out.dataId).id;\n
const channelsLast = dataFormat === 'NHWC' ? 1 : 0;\n  wasmDepthToSpace(\n    xId, blockSize, channelsLast,
xStridesBytes, x.shape.length - 1,\n    outputShapeBytes, outStridesBytes, outputShape.length, outId);\n\n  return
out;\n}\n\nexport const depthToSpaceConfig: KernelConfig = {\n  kernelName: DepthToSpace,\n  backendName:
'wasm',\n
  setupFunc: setup,\n  kernelFunc: depthToSpace as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019
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http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport { backend_util, DepthwiseConv2dNative, DepthwiseConv2dNativeAttrs,
DepthwiseConv2dNativeInputs, KernelConfig, KernelFunc, Tensor4D } from '@tensorflow/tfjs-core';\n\nimport
{ BackendWasm } from
'../backend_wasm';\n\nlet wasmDepthwiseConv2d: (\n  xId: number, batchSize: number, inputHeight: number,
inputWidth: number,\n  filterId: number, filterHeight: number, filterWidth: number, padTop: number,\n
padRight: number, padBottom: number, padLeft: number, isSamePad: number,\n  dilationHeight: number,
dilationWidth: number, strideHeight: number,\n  strideWidth: number, inputChannels: number, outputChannels:
number,\n  outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n  wasmDepthwiseConv2d =\n
backend.wasm.cwrap(DepthwiseConv2dNative, null /* void */, [\n  'number', // xId\n  'number', //
batchSize\n  'number', // inputHeight\n  'number', // inputWidth\n  'number', // filterId\n  'number', //
filterHeight\n  'number', // filterWidth\n  'number', // padTop\n  'number', // padRight\n  'number', //
padBottom\n  'number', // padLeft\n  'number', // isSamePad\n  'number',
// dilationHeight\n  'number', // dilationWidth\n  'number', // strideHeight\n  'number', // strideWidth\n
'number', // inputChannels\n  'number', // outputChannels\n  'number', // outId\n  ]);\n}\n\nfunction
depthwiseConv2d(args: {\n  inputs: DepthwiseConv2dNativeInputs,\n  backend: BackendWasm,\n  attrs:
DepthwiseConv2dNativeAttrs\n}) {\n  const {inputs, attrs, backend} = args;\n\n  const {x, filter} = inputs;\n  const
xId = backend.dataIdMap.get(x.dataId).id;\n  const filterId = backend.dataIdMap.get(filter.dataId).id;\n  const

```

```

{strides, dilations, pad, dimRoundingMode} = attrs;\n\n const $dilations = dilations === null ? [1, 1] : dilations;\n\n const convInfo = backend_util.computeConv2DInfo(\n    (x as Tensor4D).shape, (filter as Tensor4D).shape,\n    strides,\n    ($dilations as number | [number, number]), pad, dimRoundingMode,\n    true /* depthwise */);\n\n const filterHeight = convInfo.filterHeight;\n const filterWidth\n = convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const padRight = convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n const padLeft = convInfo.padInfo.left;\n const dilationHeight =\n convInfo.dilationHeight;\n const dilationWidth = convInfo.dilationWidth;\n const strideHeight =\n convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n const inputChannels =\n convInfo.inChannels;\n const outputChannels = convInfo.outChannels;\n const isSamePad = convInfo.padInfo.type\n === 'SAME' ? 1 : 0;\n\n if (convInfo.dataFormat !== 'channelsLast') {\n    throw new Error(\n        `wasm backend\n    DepthwiseConv2dNative does not support dataFormat:`\n        +\n        `${convInfo.dataFormat}`.\n        Please use\n        'channelsLast'.`);\n }\n\n const out = backend.makeOutput(convInfo.outShape, 'float32');\n const outId =\n backend.dataIdMap.get(out.dataId).id;\n\n wasmDepthwiseConv2d(\n    xId, x.shape[0], x.shape[1], x.shape[2],\n    filterId, filterHeight,\n    filterWidth,\n    padTop, padRight, padBottom, padLeft, isSamePad,\n    dilationHeight, dilationWidth, strideHeight, strideWidth,\n    inputChannels,\n    outputChannels, outId);\n return out;\n}\n\nexport const depthwiseConv2dNativeConfig:\nKernelConfig = {\n    kernelName: DepthwiseConv2dNative,\n    backendName: 'wasm',\n    setupFunc: setup,\n    kernelFunc: depthwiseConv2d as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2021 Google LLC. All\n    Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this\n    file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *  

http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n    software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n    OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n    governing permissions and\n * limitations\n    under the License.\n */\n\n=====\n\n*/\nimport {Elu, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from\n './unary_kernel';\n\nexport const eluConfig: KernelConfig = createUnaryKernelConfig(Elu);\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n    "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n    License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n    agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n    OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n    the specific language governing permissions and\n * limitations\n    under the License.\n */\n\n=====\n\n*/\nimport {Equal, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from\n './binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const equalConfig: KernelConfig =\n createBinaryKernelConfig(Equal, supportsFullBroadcast, 'bool');\n\n"/**\n * @license\n * Copyright 2019 Google\n    LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n    "License");\n * you may not\n    use this file except in compliance with the License.\n * You may obtain a copy of the\n    License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n    agreed to in writing,\n    software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n    OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n    the specific language governing permissions and\n * limitations\n    under the License.\n */\n\n=====\n\n*/\nimport {Exp, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from\n './unary_kernel';\n\nexport const expConfig: KernelConfig = createUnaryKernelConfig(Exp, 'float32');\n\n"/**\n * @license\n * Copyright 2019 Google\n    LLC. All Rights Reserved.\n * Licensed under the Apache License, Version

```

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```
=====\n
*/\n\nimport {ExpandDims, ExpandDimsAttrs, ExpandDimsInputs,
  KernelConfig, KernelFunc, util} from '@tensorflow/tfjs-core';
\n\nimport {BackendWasm} from './backend_wasm';
\n\nimport {reshape} from './Reshape';
\n\nexport function expandDims(args: {
  inputs: ExpandDimsInputs,
  attrs: ExpandDimsAttrs,
  backend: BackendWasm
}) {
  const {inputs, attrs, backend} = args;
  const {input} = inputs;
  const {dim} = attrs;
  const inputRank = input.shape.length;
  const newShape = input.shape.slice();
  let $dim = dim;
  if (dim < 0) {
    // Negative value is counted from the tail of rank.
    util.assert(
      -(inputRank + 1) <= dim,
      () => `Axis must be in the interval [${-(inputRank + 1)}, ${inputRank}]`);
    $dim = inputRank + dim + 1;
  }
  newShape.splice($dim, 0, 1);
  return reshape({inputs: {x: input}, backend, attrs: {shape: newShape}});
}\n\n\nexport const expandDimsConfig: KernelConfig = {
  kernelName: ExpandDims,
  backendName: 'wasm',
  kernelFunc: expandDims as {} as KernelFunc,
};
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\n
```

```
=====\n
*/\n\nimport {KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';
\n\nimport {Fill, FillAttrs} from '@tensorflow/tfjs-core';
\n\nimport {BackendWasm} from './backend_wasm';
\n\nexport function fill(args: {
  attrs: FillAttrs,
  backend: BackendWasm
}) {
  const {attrs: {shape, value, dtype}, backend} = args;
  const out = backend.makeOutput(shape, dtype);
  const outVals = backend.typedArrayFromHeap(out);
  outVals.fill(value as number);
  return out;
}\n\n\nexport const fillConfig: KernelConfig = {
  kernelName: Fill,
  backendName: 'wasm',
  kernelFunc: fill as {} as KernelFunc,
};
\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
\n
```

```
=====\n
*/\n\nimport {FlipLeftRight, FlipLeftRightInputs, KernelConfig, KernelFunc, TensorInfo} from '@tensorflow/tfjs-core';
\n\nimport {BackendWasm} from './backend_wasm';
\n\nlet wasmFlipLeftRight: (\n  xId: number, batch: number, imageHeight: number, imageWidth: number,\n  numChannels: number, outId: number) => void;
\n\nfunction setup(backend: BackendWasm) {
  wasmFlipLeftRight = backend.wasm.cwrap(FlipLeftRight, null /* void */, [
    'number', // xId
    'number', // batch
    'number', // imageHeight
    'number', // imageWidth
    'number', // numChannels
    'number', // outId
  ]);
}\n\n\nexport function flipLeftRight(
  args: {inputs: FlipLeftRightInputs, backend: BackendWasm}): TensorInfo {
  const {inputs, backend} = args;
  const {image} = inputs;
  const out = backend.makeOutput(image.shape, image.dtype);
  const imageId = backend.dataIdMap.get(image.dataId).id;
  const outId = backend.dataIdMap.get(out.dataId).id;
  const [batch, imageHeight, imageWidth, numChannels] = image.shape;
  wasmFlipLeftRight(
    imageId, batch, imageHeight, imageWidth, numChannels, outId);
  return out;
}\n\n\nexport const flipLeftRightConfig:
```

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KernelConfig = {\n kernelName: FlipLeftRight,\n backendName: 'wasm',\n kernelFunc: flipLeftRight as { } as
KernelFunc,\n setupFunc: setup\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n
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compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the
License.\n *

```

```

=====\n
*\n\nimport {Floor, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'./unary_kernel';\n\nexport const floorConfig: KernelConfig = createUnaryKernelConfig(Floor);\n", "/*\n *
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law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *

```

```

=====\n
*\n\nimport {FloorDiv, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from
'./binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const floorDivConfig: KernelConfig =\ncreateBinaryKernelConfig(FloorDiv, supportsFullBroadcast);\n", "/*\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

```

```

=====\n
*\n\nimport {FusedBatchNorm, FusedBatchNormAttrs, FusedBatchNormInputs, KernelConfig, KernelFunc,
TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nlet
wasmBatchNorm: (\n  xId: number, meanId: number, varianceId: number, offsetId: number,\n  scaleId: number,
varianceEpsilon: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n
wasmBatchNorm = backend.wasm.cwrap(\n  FusedBatchNorm, null /* void */,\n  ['number', 'number',
'number', 'number', 'number', 'number', 'number']);\n}\n\nfunction fusedBatchNorm(args: {\n  backend:
BackendWasm,\n  inputs: FusedBatchNormInputs,\n  attrs: FusedBatchNormAttrs\n}): TensorInfo {\n  const
{backend, inputs, attrs} = args;\n  const {varianceEpsilon} = attrs;\n  const {x, mean, variance, offset, scale} =
inputs;\n  const xId = backend.dataIdMap.get(x.dataId).id;\n  const meanId =
backend.dataIdMap.get(mean.dataId).id;\n  const varianceId = backend.dataIdMap.get(variance.dataId).id;\n
const offsetId = offset != null ? backend.dataIdMap.get(offset.dataId).id : 0;\n  const scaleId = scale != null ?
backend.dataIdMap.get(scale.dataId).id : 0;\n\n  const out = backend.makeOutput(x.shape, x.dtype);\n  // Short-
circuit zero-sized tensors.\n  if (util.sizeFromShape(x.shape) === 0) {\n    return out;\n  }\n\n  const outId =
backend.dataIdMap.get(out.dataId).id;\n\n  wasmBatchNorm(\n    xId, meanId, varianceId, offsetId, scaleId,
varianceEpsilon, outId);\n  return out;\n}\n\nexport const fusedBatchNormConfig: KernelConfig = {\n  kernelName:
FusedBatchNorm,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: fusedBatchNorm as { } as
KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
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```

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```
=====\n*\n\nimport { backend_util, FusedConv2D, FusedConv2DAttrs, FusedConv2DInputs, KernelConfig, KernelFunc, Tensor4D } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { FusibleActivation } from './types';\n\nlet wasmFusedConv2d:\n  (xId: number, batchSize: number, inputHeight: number, inputWidth: number,\n   filterId: number, filterHeight: number, filterWidth: number,\n   biasId: number, padTop: number, padRight: number, padBottom: number,\n   padLeft: number, isSamePad: number, dilationHeight: number,\n   dilationWidth: number, strideHeight: number, strideWidth: number,\n   inputChannels: number, outputChannels: number, activation: number,\n   preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>\n  void;\n\nfunction setup(backend: BackendWasm) {\n  wasmFusedConv2d = backend.wasm.cwrap(FusedConv2D, null /* void */, [\n    'number', // xId\n    'number', // batchSize\n    'number', // inputHeight\n    'number', // inputWidth\n    'number', // filterId\n    'number', // filterHeight\n    'number', // filterWidth\n    'number', // biasId\n    'number', // padTop\n    'number', // padRight\n    'number', // padBottom\n    'number', // padLeft\n    'number', // isSamePad\n    'number', // dilationHeight\n    'number', // dilationWidth\n    'number', // strideHeight\n    'number', // strideWidth\n    'number', // inputChannels\n    'number', // outputChannels\n    'number', // activation\n    'number', // preluActivationWeightsId\n    'number', // leakyreluAlpha\n    'number', // outId\n  ]);\n}\n\nfunction fusedConv2d(args: {\n  inputs: FusedConv2DInputs,\n  backend: BackendWasm,\n  attrs: FusedConv2DAttrs\n}) {\n  const { inputs, attrs, backend } = args;\n  const { x, filter, bias, preluActivationWeights } = inputs;\n  const { strides, pad, dilations, dataFormat, dimRoundingMode, activation, leakyreluAlpha } = attrs;\n  const convInfo = backend_util.computeConv2DInfo(\n    (x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations,\n    pad, dimRoundingMode);\n  const fusedActivation = FusibleActivation[activation as {}] as keyof typeof FusibleActivation;\n  if (fusedActivation == null) {\n    throw new Error(` ${activation} activation not yet supported for FusedConv2D ` +\n      `in the wasm backend.`);\n  }\n  const xId = backend.dataIdMap.get(x.dataId).id;\n  const filterId = backend.dataIdMap.get(filter.dataId).id;\n  const outputChannels = convInfo.outChannels;\n\n  let biasId = 0;\n  if (bias != null) {\n    const biasData = backend.dataIdMap.get(bias.dataId);\n    if (biasData.shape.length !== 1) {\n      throw new Error(` FusedConv2D only supports rank-1 bias but got ` +\n        `rank ${biasData.shape.length}.`);\n    }\n    if (biasData.shape[0] !== outputChannels) {\n      throw new Error(` FusedConv2D bias shape (${biasData.shape}) does not ` +\n        `match the number of output channels (${outputChannels}).`);\n    }\n    biasId = biasData.id;\n  }\n  const filterHeight = convInfo.filterHeight;\n  const filterWidth = convInfo.filterWidth;\n  const padTop = convInfo.padInfo.top;\n  const padRight = convInfo.padInfo.right;\n  const padBottom = convInfo.padInfo.bottom;\n  const padLeft = convInfo.padInfo.left;\n  const dilationHeight = convInfo.dilationHeight;\n  const dilationWidth = convInfo.dilationWidth;\n  const strideHeight = convInfo.strideHeight;\n  const strideWidth = convInfo.strideWidth;\n\n  const inputChannels = convInfo.inChannels;\n  const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;\n  const batchSize = convInfo.batchSize;\n  const inHeight = convInfo.inHeight;\n  const inWidth = convInfo.inWidth;\n  if (dataFormat !== 'NHWC') {\n    throw new Error(` wasm backend FusedConv2D does not support dataFormat:` +\n      ` ${dataFormat}'. Please use 'NHWC'.`);\n  }\n  const out = backend.makeOutput(convInfo.outShape, 'float32');\n  const outId = backend.dataIdMap.get(out.dataId).id;\n  const preluActivationWeightsId = preluActivationWeights == null ? 0 :\n    backend.dataIdMap.get(preluActivationWeights.dataId).id;\n  wasmFusedConv2d(\n    xId, batchSize, inHeight, inWidth, filterId, filterHeight, filterWidth,\n    biasId, padTop, padRight, padBottom, padLeft, isSamePad,
```

```

dilationHeight,\n    dilationWidth, strideHeight, strideWidth, inputChannels, outputChannels,\n    fusedActivation,
preluActivationWeightsId, leakyreluAlpha ||
0, outId);\n\n return out;\n}\n\nexport const fusedConv2DConfig: KernelConfig = {\n kernelName:
FusedConv2D,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: fusedConv2d as {} as
KernelFunc\n};\n", "/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====
*\n\nimport {backend_util, FusedDepthwiseConv2D, FusedDepthwiseConv2DAttrs,
FusedDepthwiseConv2DInputs, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from './backend_wasm';\n\nimport {FusableActivation} from './types';\n\nlet
wasmFusedDepthwiseConv2d:\n (xId: number, batchSize: number, inputHeight: number, inputWidth: number,\n filterId: number, filterHeight: number, filterWidth: number,\n biasId: number, padTop: number, padRight:
number, padBottom: number,\n padLeft: number, isSamePad: number, dilationHeight: number,\n dilationWidth: number, strideHeight: number, strideWidth: number,\n inputChannels: number, outputChannels:
number, activation: number,\n preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>\n
void;\n\nfunction setup(backend: BackendWasm) {\n    wasmFusedDepthwiseConv2d =\n    backend.wasm.cwrap(FusedDepthwiseConv2D, null /* void */, [\n        'number', // xId\n        'number', //
batchSize\n        'number', // inputHeight\n        'number', // inputWidth\n        'number', // filterId\n        'number', // filterHeight\n        'number', // filterWidth\n        'number', // biasId\n        'number', // padTop\n        'number', // padRight\n        'number', // padBottom\n        'number', // padLeft\n        'number', // isSamePad\n        'number', // dilationHeight\n        'number', //
dilationWidth\n        'number', // strideHeight\n        'number', // strideWidth\n        'number', // inputChannels\n        'number', // outputChannels\n        'number', // activation\n        'number', // preluActivationWeightsId\n        'number', // leakyreluAlpha\n        'number', // outId\n    ]);\n\n    function fusedDepthwiseConv2d(args: {\n
inputs: FusedDepthwiseConv2DInputs,\n backend: BackendWasm,\n attrs: FusedDepthwiseConv2DAttrs\n}) {\n
const {inputs, attrs, backend} = args;\n    const {x, filter, bias, preluActivationWeights} = inputs;\n    const {\n
strides,\n pad,\n dilations,\n
dataFormat,\n dimRoundingMode,\n activation,\n leakyreluAlpha\n } = attrs;\n\n    const convInfo =
backend_util.computeConv2DInfo(\n        (x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations,\n
pad, dimRoundingMode, true /* depthwise */);\n\n    const fusedActivation =\n        FusableActivation[activation as {} as
keyof typeof FusableActivation];\n    if (fusedActivation == null) {\n        throw new Error(\n            `${activation}
activation not yet supported for FusedDepthwiseConv2D`\n            +\n            `in the wasm backend.`);\n    }\n\n    const xId =
backend.dataIdMap.get(x.dataId).id;\n    const filterId = backend.dataIdMap.get(filter.dataId).id;\n\n    const
outputChannels = convInfo.outChannels;\n\n    let biasId = 0;\n    if (bias != null) {\n        const biasData =
backend.dataIdMap.get(bias.dataId);\n        if (biasData.shape.length !== 1) {\n            throw new Error(\n
`FusedDepthwiseConv2D only supports rank-1 bias but got`\n            +\n            `rank ${biasData.shape.length}`);\n
        }\n        if (biasData.shape[0] !== outputChannels) {\n            throw new Error(\n
`FusedDepthwiseConv2D bias
shape (${biasData.shape}) does not`\n            +\n            `match the number of output channels (${outputChannels})`);\n
        }\n        biasId = biasData.id;\n    }\n\n    const filterHeight = convInfo.filterHeight;\n    const filterWidth =
convInfo.filterWidth;\n    const padTop = convInfo.padInfo.top;\n    const padRight = convInfo.padInfo.right;\n    const
padBottom = convInfo.padInfo.bottom;\n    const padLeft = convInfo.padInfo.left;\n    const dilationHeight =
convInfo.dilationHeight;\n    const dilationWidth = convInfo.dilationWidth;\n    const strideHeight =
convInfo.strideHeight;\n    const strideWidth = convInfo.strideWidth;\n    const inputChannels =

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convInfo.inChannels;\n const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;\n const batchSize =
convInfo.batchSize;\n const inHeight = convInfo.inHeight;\n const inWidth = convInfo.inWidth;\n\n if
(dataFormat !== 'NHWC') {\n  throw
  new Error(\n    `wasm backend FusedDepthwiseConv2D does not support dataFormat:` +\n    `${dataFormat}`'.
Please use 'NHWC':`);\n }\n\n const out = backend.makeOutput(convInfo.outShape, 'float32');\n const outId =
backend.dataIdMap.get(out.dataId).id;\n const preluActivationWeightsId = preluActivationWeights === null ?\n 0
:\n  backend.dataIdMap.get(preluActivationWeights.dataId).id;\n\n wasmFusedDepthwiseConv2d(\n  xId,
batchSize, inHeight, inWidth, filterId, filterHeight, filterWidth,\n  biasId, padTop, padRight, padBottom, padLeft,
isSamePad, dilationHeight,\n  dilationWidth, strideHeight, strideWidth, inputChannels, outputChannels,\n
fusedActivation, preluActivationWeightsId, leakyreluAlpha || 0, outId);\n\n return out;\n}\n\nexport const
fusedDepthwiseConv2DConfig: KernelConfig = {\n  kernelName: FusedDepthwiseConv2D,\n  backendName:
'wasm',\n  setupFunc: setup,\n  kernelFunc: fusedDepthwiseConv2d as { } as KernelFunc\n};\n\n"/**\n * @license\n
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *

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=====\n
*/\n\nimport {gather_util, GatherNd, GatherNdInputs, KernelConfig, TensorInfo} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {CppType} from './types';\n\nlet
wasmGatherNd: (\n  xId: number, dtype: CppDType, indicesId: number, numSlices: number,\n
  sliceRank: number, sliceSize: number, strides: Uint8Array, outId: number) =>\n  void;\n\nfunction
setup(backend: BackendWasm): void {\n  wasmGatherNd = backend.wasm.cwrap(GatherNd, null /*void*/, [\n
'number', // xId\n 'number', // dtype\n 'number', // indicesId\n 'number', // numSlices\n 'number', //
sliceRank\n 'number', // sliceSize\n 'array', // strides\n 'number' // outId\n ]);\n}\n\nfunction gatherNd(args:
{backend: BackendWasm, inputs: GatherNdInputs}):\n  TensorInfo {\n  const {backend, inputs} = args;\n  const
{params, indices} = inputs;\n\n  const [resultShape, numSlices, sliceSize, strides] =\n
gather_util.prepareAndValidate(params, indices);\n\n  const out = backend.makeOutput(resultShape,
params.dtype);\n  if (numSlices === 0) {\n    return out;\n  }\n\n  const indicesShape = indices.shape;\n  const
sliceRank = indicesShape[indicesShape.length - 1];\n\n  const xData = backend.dataIdMap.get(params.dataId);\n
const xId = xData.id;\n
  const indicesData = backend.dataIdMap.get(indices.dataId);\n  const indicesId = indicesData.id;\n\n  const
stridesBytes = new Uint8Array(new Int32Array(strides).buffer);\n\n  const outId =
backend.dataIdMap.get(out.dataId).id;\n  wasmGatherNd(\n    xId, CppDType[params.dtype], indicesId,
numSlices, sliceRank, sliceSize,\n    stridesBytes, outId);\n\n  return out;\n}\n\nexport const gatherNdConfig:
KernelConfig = {\n  kernelName: GatherNd,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc:
gatherNd\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the 'License');\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless
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on an 'AS IS' BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

```

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=====\n
*/\n\nimport {backend_util, GatherV2, GatherV2Attrs, GatherV2Inputs, KernelConfig, KernelFunc, Tensor,
TensorInfo, TypedArray, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from
'./backend_wasm';\n\nimport {reshape} from './Reshape';\n\nimport {CppType} from './types';\n\nlet wasmGather:

```



```

(\n  xId: number, dtype: CppDType, xStrides: Uint8Array, stridesSize: number,\n  indicesId: number, batchSize:
number, outStrides: Uint8Array,\n  outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n
wasmGather = backend.wasm.cwrap('Gather', null /*void*/, [\n  'number', // xId\n  'number', // dtype\n  'array',
// xStrides\n  'number', // stridesSize\n  'number', // indicesId\n  'number', // batchSize\n
  'array', // outStrides\n  'number' // outId\n  ]);\n\nfunction gatherV2(\n  args: {backend: BackendWasm,
inputs: GatherV2Inputs, attrs: GatherV2Attrs}): \n  TensorInfo {\n  const {backend, inputs, attrs} = args;\n  const
{x, indices} = inputs;\n  const {axis, batchDims} = attrs;\n  \n  // Throw error when any index is out of bound.\n
const parsedAxis = util.parseAxisParam(axis, x.shape)[0];\n  const indicesVals = backend.readSync(indices.dataId)
as TypedArray;\n  const axisDim = x.shape[parsedAxis];\n  for (let i = 0; i < indicesVals.length; ++i) {\n  const
index = indicesVals[i];\n  util.assert(\n    index <= axisDim - 1 && index >= 0,\n    () =>\n      `GatherV2:
the index value ${index} is not in [0, ${axisDim - 1}]`);\n  }\n\n  const shapeInfo =
backend_util.segment_util.collectGatherOpShapeInfo(\n    x as Tensor, indices as Tensor, parsedAxis,
batchDims);\n\n  const flattenX = reshape({\n    inputs: {x},\n    attrs: {\n      shape: [\n
shapeInfo.batchSize, shapeInfo.outerSize, shapeInfo.dimSize,\n      shapeInfo.sliceSize\n    ]\n    },\n    backend\n
  });\n\n  const indicesSize = util.sizeFromShape(indices.shape);\n  const flattenIndex = reshape({\n    inputs: {x:
indices},\n    attrs: {shape: [shapeInfo.batchSize, indicesSize / shapeInfo.batchSize]},\n    backend\n  });\n  const
flattenOutputShape = [\n    shapeInfo.batchSize, shapeInfo.outerSize, indicesSize / shapeInfo.batchSize,\n
shapeInfo.sliceSize\n  ];\n\n  const out = backend.makeOutput(flattenOutputShape, x.dtype);\n  if
(util.sizeFromShape(x.shape) === 0) {\n    return out;\n  }\n\n  const stridesSize = flattenX.shape.length - 1;\n\n  const
xData = backend.dataIdMap.get(flattenX.dataId);\n  const xId = xData.id;\n\n  const indicesData =
backend.dataIdMap.get(flattenIndex.dataId);\n  const indicesId = indicesData.id;\n\n  const outId =
backend.dataIdMap.get(out.dataId).id;\n\n  const xStridesBytes = new Uint8Array(\n    new
Int32Array(util.computeStrides(flattenX.shape)).buffer);\n\n  const outStridesBytes = new Uint8Array(\n    new
Int32Array(util.computeStrides(flattenOutputShape)).buffer);\n\n  wasmGather(\n    xId, CppDType[x.dtype],
xStridesBytes, stridesSize, indicesId,\n    shapeInfo.batchSize, outStridesBytes, outId);\n\n  backend.disposeData(flattenX.dataId);\n  backend.disposeData(flattenIndex.dataId);\n\n  // reshape\n  out.shape =
shapeInfo.outputShape;\n  return out;\n  }\n\nexport const gatherV2Config: KernelConfig = {\n  kernelName:
GatherV2,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: gatherV2 as { } as KernelFunc\n};\n\n", "/**\n
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under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF
ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n *
limitations under the License.\n *
=====\n
*\nimport {Greater, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
'./binary_kernel';\n\nconst supportsFullBroadcast = false;\nexport const greaterConfig: KernelConfig =\ncreateBinaryKernelConfig(Greater, supportsFullBroadcast, 'bool');\n\n", "/**\n
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use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
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* distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR
CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing
permissions and\n * limitations under the License.\n *
=====\n

```

```
*\nimport { GreaterEqual, KernelConfig } from '@tensorflow/tfjs-core';\n\nimport { createBinaryKernelConfig }\nfrom './binary_kernel';\n\nconst supportsFullBroadcast = false;\nexport const greaterEqualConfig: KernelConfig =\n  createBinaryKernelConfig(GreaterEqual, supportsFullBroadcast, 'bool');\n\n"/**\n * @license\n * Copyright 2019\n * Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you\n * may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in\n * writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT\n * WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific\n * language governing permissions and\n * limitations under the License.\n */
```

```
=====\n\n*\nimport { KernelConfig, KernelFunc, LeakyRelu, LeakyReluAttrs, LeakyReluInputs, TensorInfo, util } from\n '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { CppDType } from\n './types';\n\nlet wasmFunc: (\n  xId: number, dtype: number, leakyreluAlpha: number, outId: number) =>\n  void;\n\nfunction setupFunc(backend: BackendWasm): void {\n  wasmFunc = backend.wasm.cwrap(LeakyRelu,\n    null /* void */, [\n      'number', // x_id\n      'number', // dtype\n      'number', // leakyrelu_alpha\n      'number', //\n      out_id\n    ]);\n\n  export function leakyRelu(\n    args: {\n      inputs: LeakyReluInputs, attrs: LeakyReluAttrs,\n      backend: BackendWasm\n    }):\n    TensorInfo {\n      const {inputs: {x}, attrs: {alpha}, backend} = args;\n\n      const xId =\n        backend.dataIdMap.get(x.dataId).id;\n      // According to TF API, LeakyRelu returns float32 when input is either\n      float32\n      // or int32.\n      const out = backend.makeOutput(x.shape, 'float32');\n\n      if (util.sizeFromShape(x.shape)\n        !== 0) {\n        const outId = backend.dataIdMap.get(out.dataId).id;\n        wasmFunc(xId, CppDType[x.dtype], alpha,\n          outId);\n      }\n\n      return out;\n    }\n\n  export const leakyReluConfig: KernelConfig = {\n    kernelName: LeakyRelu,\n    backendName: 'wasm',\n    setupFunc,\n    kernelFunc: leakyRelu as {} as KernelFunc\n  }; \n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable\n * law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT\n * WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n\n*\nimport { KernelConfig, Less } from '@tensorflow/tfjs-core';\n\nimport { createBinaryKernelConfig } from\n './binary_kernel';\n\nconst supportsFullBroadcast = false;\nexport const lessConfig: KernelConfig =\n  createBinaryKernelConfig(Less, supportsFullBroadcast, 'bool');\n\n"/**\n * @license\n * Copyright 2019 Google\n * LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not\n * use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law\n * or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT\n * WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n\n*\nimport { KernelConfig, LessEqual } from '@tensorflow/tfjs-core';\n\nimport { createBinaryKernelConfig } from\n './binary_kernel';\n\nconst supportsFullBroadcast = false;\nexport const lessEqualConfig: KernelConfig =\n  createBinaryKernelConfig(LessEqual, supportsFullBroadcast, 'bool');\n\n"/**\n * @license\n * Copyright 2019\n * Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you\n * may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable\n * law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT\n * WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n */
```

```

=====
*\nimport {KernelConfig, Log} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'./unary_kernel';\nexport const logConfig: KernelConfig = createUnaryKernelConfig(Log);\n", "/**\n * @license\n *
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'License');\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
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implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

```

```

=====
*\nimport {KernelConfig, LogicalAnd} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from
'./binary_kernel';\nconst supportsFullBroadcast = false;\nexport const logicalAndConfig: KernelConfig =\ncreateBinaryKernelConfig(LogicalAnd, supportsFullBroadcast, 'bool');\n", "/**\n * @license\n * Copyright 2019
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http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
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express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *

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=====
*\n\nimport {backend_util, KernelConfig, KernelFunc, Max, MaxAttrs, MaxInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport
{permuteAxesAndTranspose} from './kernel_utils';\nimport {CppType} from './types';\n\nlet wasmMax: (xId:
number, dtype: number, reduceSize: number, outId: number) =>\n void;\n\nfunction setup(backend:
BackendWasm): void {\n  wasmMax = backend.wasm.cwrap(Max, null /*void*/, [\n    'number', // x_id\n    'number', // dtype\n    'number', // reduce_size\n    'number', // out_id\n  ]);\n\n  function max(args: {backend:
BackendWasm, inputs: MaxInputs, attrs: MaxAttrs}): \n    TensorInfo {\n    const
{backend, inputs, attrs} = args;\n    const {reductionIndices: axis, keepDims} = attrs;\n    const {x} = inputs;\n    const
xId = backend.dataIdMap.get(x.dataId).id;\n    let inputId = xId;\n    let input = x;\n\n    const {transposed, axes,
originalAxes, inputWasTransposed} =\n      permuteAxesAndTranspose(x, axis, backend);\n\n    if
(inputWasTransposed) {\n      const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n      input =
transposed;\n      inputId = transposedId;\n    }\n\n    const inputRank = input.shape.length;\n    backend_util.assertAxesAreInnerMostDims('max', axes, inputRank);\n    const [outShape, reduceShape] =\n      backend_util.computeOutAndReduceShapes(input.shape, axes);\n    const reduceSize =
util.sizeFromShape(reduceShape);\n\n    const out = backend.makeOutput(outShape, x.dtype);\n    if
(util.sizeFromShape(input.shape) !== 0) {\n      const outId = backend.dataIdMap.get(out.dataId).id;\n      wasmMax(inputId, CCppType[x.dtype], reduceSize, outId);\n    }\n\n    if (inputWasTransposed)
{\n      // dispose of the transposed tensor.\n      backend.disposeData(transposed.dataId);\n    }\n\n    if (keepDims) {\n      // reshape\n      const newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n      out.shape =
newShape;\n    }\n\n    return out;\n  }\n\n  export const maxConfig: KernelConfig = {\n    kernelName: Max,\n    backendName: 'wasm',\n    setupFunc: setup,\n    kernelFunc: max as {} as KernelFunc\n  };
}\n", "/**\n * @license\n *
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permissions and limitations under the License.

```
=====  
*\nimport {KernelConfig, Maximum} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from  
 './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const maximumConfig: KernelConfig =\n createBinaryKernelConfig(Maximum, supportsFullBroadcast);\n"/**\n * @license\n * Copyright 2019 Google  
 LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not  
 use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *  
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 OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language  
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and limitations under the License.

```
=====  
*\nimport {backend_util, KernelConfig, KernelFunc, MaxPool, MaxPoolAttrs, MaxPoolInputs, Tensor4D, util}  
 from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nlet wasmMaxPool: (\n  xId:  
 number, batchSize: number, inputHeight: number, inputWidth: number,\n  filterHeight: number, filterWidth:  
 number, padTop: number, padRight: number,\n  padBottom: number, padLeft: number, dilationHeight: number,\n  dilationWidth: number, strideHeight: number, strideWidth: number,\n  inputChannels: number, outputChannels:  
 number, outId: number) => void;\nfunction setup(backend: BackendWasm) {\n  wasmMaxPool =  
 backend.wasm.cwrap(MaxPool, null /* void */, [\n    'number', // xId\n    'number', // batchSize\n    'number', //  
 inputHeight\n    'number', // inputWidth\n    'number', // filterHeight\n    'number', // filterWidth\n    'number', // padTop\n    'number', // padRight\n    'number', // padBottom\n    'number', // padLeft\n    'number', //  
 dilationHeight\n    'number', // dilationWidth\n    'number', // strideHeight\n    'number', // strideWidth\n    'number', //  
 inputChannels\n    'number', // outputChannels\n    'number', // outId\n  ]);\n  function maxPool(\n    args:  
 {inputs: MaxPoolInputs, backend: BackendWasm, attrs: MaxPoolAttrs}) {\n    const {inputs, attrs, backend} =  
 args;\n    const x = inputs.x as Tensor4D;\n    const xId = backend.dataIdMap.get(x.dataId).id;\n    // TF API  
 supports int32 input. CPU and WebGL backend also support int32\n    // input. WASM backend doesn't support it  
 because it uses xnpack which only\n    // supports float32.\n    // Add the following assert only for the WASM  
 backend instead of at core op\n    // level.\n    // TODO: add support for int32 input.\n    util.assert(\n      x.dtype  
 === 'float32',\n      () =>\n        `Error in MaxPool: only float32 input  
 is supported. Got ${x.dtype}.`);\n    const {filterSize, strides, pad, dimRoundingMode} = attrs;\n    const convInfo =  
 backend_util.computePool2DInfo(\n      x.shape, filterSize, strides, 1 /* dilations */, pad, dimRoundingMode);\n    const filterHeight = convInfo.filterHeight;\n    const filterWidth = convInfo.filterWidth;\n    const padTop =  
 convInfo.padInfo.top;\n    const padRight = convInfo.padInfo.right;\n    const padBottom = convInfo.padInfo.bottom;\n    const padLeft = convInfo.padInfo.left;\n    const dilationHeight = convInfo.dilationHeight;\n    const dilationWidth =  
 convInfo.dilationWidth;\n    const strideHeight = convInfo.strideHeight;\n    const strideWidth =  
 convInfo.strideWidth;\n    const inputChannels = convInfo.inChannels;\n    const outputChannels =  
 convInfo.outChannels;\n    if (convInfo.dataFormat !== 'channelsLast') {\n      throw new Error(\n        `wasm  
 backend does not support dataFormat: ` +\n        `${convInfo.dataFormat}`. Please use 'channelsLast'.`);\n    }\n    const out =  
 backend.makeOutput(convInfo.outShape, 'float32');\n    const outId = backend.dataIdMap.get(out.dataId).id;\n    wasmMaxPool(\n      xId, x.shape[0], x.shape[1], x.shape[2], filterHeight, filterWidth,\n      padTop, padRight,  
 padBottom, padLeft, dilationHeight, dilationWidth,\n      strideHeight, strideWidth, inputChannels, outputChannels,  
 outId);\n    return out;\n  }\n  export const maxPoolConfig: KernelConfig = {\n    kernelName: MaxPool,\n    backendName: 'wasm',\n    setupFunc: setup,\n    kernelFunc: maxPool as {} as KernelFunc\n  };\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the  
 "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
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OR CONDITIONS OF ANY KIND, either express or implied. See the License for the specific language governing permissions and limitations under the License.

```
=====
*
import { backend_util, KernelConfig, KernelFunc, Mean, MeanAttrs, MeanInputs, TensorInfo, util } from
'@tensorflow/tfjs-core';
import { BackendWasm } from '../backend_wasm';
import { cast } from './Cast';
import { permuteAxesAndTranspose } from './kernel_utils';
let wasmMean: (xId: number, reduceSize: number, outId:
number) => void;
function setup(backend: BackendWasm): void {
  wasmMean =
backend.wasm.cwrap(Mean, null /*void*/, ['number, number, number']);
}
export function mean({
  backend: BackendWasm,
  inputs: MeanInputs,
  attrs: MeanAttrs
}: {
  backend: BackendWasm,
  inputs: MeanInputs,
  attrs: MeanAttrs
}) => void {
  const { backend, inputs,
  attrs } = args;
  const { axis, keepDims } = attrs;
  const { x } = inputs;
  const xId =
backend.dataIdMap.get(x.dataId).id;

  let inputId = xId;
  let input = x;
  const { transposed, axes, originalAxes, inputWasTransposed } =
permuteAxesAndTranspose(x, axis, backend);
  let reductionAxes = axes;
  if (inputWasTransposed) {
    const
transposedId = backend.dataIdMap.get(transposed.dataId).id;
    if (transposedId !== xId) {
      // transpose was
not a no-op. We will need to dispose of this
      // once we are done.
      input = transposed;
      inputId =
transposedId;
      reductionAxes = backend_util.getInnerMostAxes(
reductionAxes.length,
input.shape.length);
    }
  }
  backend_util.assertAxesAreInnerMostDims('mean', reductionAxes,
input.shape.length);
  const [outShape, reduceShape] =
backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);
  const reduceSize =
util.sizeFromShape(reduceShape);
  let castedInput = input;
  if (input.dtype !== 'float32') {
    castedInput =
cast({ backend, inputs: { x: input }, attrs: { dtype:
'float32' });
    inputId = backend.dataIdMap.get(castedInput.dataId).id;
  }
  const out =
backend.makeOutput(outShape, 'float32');
  if (util.sizeFromShape(input.shape) !== 0) {
    const outId =
backend.dataIdMap.get(out.dataId).id;
    wasmMean(inputId, reduceSize, outId);
  }
  if
(inputWasTransposed) {
    // dispose of the transposed tensor.
    backend.disposeData(transposed.dataId);
  }
  if (keepDims) {
    // reshape
    const newShape = backend_util.expandShapeToKeepDim(out.shape,
originalAxes);
    out.shape = newShape;
  }
  if (input.dtype !== 'float32') {
    backend.disposeData(castedInput.dataId);
  }
  return out;
}
export const meanConfig: KernelConfig = {
  kernelName: Mean,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: mean as KernelFunc
};
"/*
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 * limitations under the License.
 *
=====
```

```

*
import { backend_util, KernelConfig, KernelFunc, Min, MinAttrs, MinInputs, TensorInfo, util } from
'@tensorflow/tfjs-core';
import { BackendWasm } from '../backend_wasm';
import { permuteAxesAndTranspose } from './kernel_utils';
import { CppDType } from './types';
let wasmMin: (xId:
number, dtype: number, reduceSize: number, outId: number) => void;
function setup(backend:
BackendWasm): void {
  wasmMin = backend.wasm.cwrap(Min,
null /*void*/, [
    'number', // x_id
    'number', // dtype
    'number', // reduce_size
    'number', // out_id
  ]);
}
function min({
  backend: BackendWasm,
  inputs: MinInputs,
  attrs: MinAttrs
}: {
  backend: BackendWasm,
  inputs: MinInputs,
  attrs: MinAttrs
}) => void {
  const { backend, inputs,
  attrs } = args;
  const { axis, keepDims } = attrs;
  const { x } = inputs;
  const xId =
```

```

backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const {transposed, axes, originalAxes,
inputWasTransposed} =\n   permuteAxesAndTranspose(x, axis, backend);\n\n if (inputWasTransposed) {\n
const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n   if (transposedId !== xId) {\n     // transpose
was not a no-op. We will need to dispose of this\n     // once we are done.\n     input = transposed;\n     inputId =
transposedId;\n   }\n }\n\n const inputRank = input.shape.length;\n\n backend_util.assertAxesAreInnerMostDims('min', axes, inputRank);\n const [outShape, reduceShape] =\n   backend_util.computeOutAndReduceShapes(input.shape, axes);\n const reduceSize =
util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, input.dtype);\n if
(util.sizeFromShape(input.shape) !== 0) {\n   const outId = backend.dataIdMap.get(out.dataId).id;\n   wasmMin(inputId, CppDType[x.dtype], reduceSize, outId);\n } }\n\n if (inputWasTransposed) {\n // dispose of the
transposed tensor.\n   backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n   const
newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n   out.shape = newShape;\n }\n\n return out;\n}\n\nexport const minConfig: KernelConfig = {\n kernelName: Min,\n backendName: 'wasm',\n
setupFunc: setup,\n kernelFunc: min as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google
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"AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n
* See the License for the specific language governing permissions and\n * limitations under the License.\n
*\n
*=====\n
*/\nimport {KernelConfig, Minimum} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
'/binary_kernel';\nconst supportsFullBroadcast = false;\nexport const minimumConfig: KernelConfig =\ncreateBinaryKernelConfig(Minimum, supportsFullBroadcast);\n"/**\n * @license\n * Copyright 2021 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not
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*\n
*=====\n
*/\n\nimport {KernelConfig, KernelFunc, MirrorPad, MirrorPadAttrs, MirrorPadInputs} from '@tensorflow/tfjs-
core';\nimport {BackendWasm} from './backend_wasm';\nimport {CppType} from './types';\n\n// Must match
enum in MirrorPad.cc\nenum MirrorPaddingMode {\n  reflect = 0,\n  symmetric = 1\n}\n\nlet wasmMirrorPad: (\n
xId: number, xShapeBytes: Uint8Array, xShapeLength: number, xDtype: number,\n  prePaddingsBytes:
Uint8Array, postPaddingsBytes: Uint8Array, mode: number,\n  outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n  wasmMirrorPad =
backend.wasm.cwrap(MirrorPad, null /* void */, [\n    'number', // xId\n    'array', // x.shape\n    'number', //
x.shape.length\n    'number', // x.dtype\n    'array', // pre-paddings\n    'array', // post-paddings\n    'number', //
mode\n    'number', // outId\n  ]);\n}\n\nfunction mirrorPad(args: {\n  inputs: MirrorPadInputs,\n  backend:
BackendWasm,\n  attrs: MirrorPadAttrs\n}) {\n  const {inputs: {x}, backend, attrs: {paddings, mode}} = args;\n\n
const outShape = paddings.map(\n    (p, i) => p[0] /* beforePad */ + x.shape[i] + p[1] /* afterPad */);\n  const xId =
backend.dataIdMap.get(x.dataId).id;\n  const out = backend.makeOutput(outShape, x.dtype);\n  const outId =
backend.dataIdMap.get(out.dataId).id;\n  const xShapeBytes = new Uint8Array(new
Int32Array(x.shape).buffer);\n\n  const prePaddingsFlat = paddings.map(padTuple => padTuple[0]);\n  const
postPaddingsFlat = paddings.map(padTuple
=> padTuple[1]);\n  const prePaddingsBytes =\n    new Uint8Array(new Int32Array(prePaddingsFlat).buffer);\n\n
const postPaddingsBytes =\n    new Uint8Array(new Int32Array(postPaddingsFlat).buffer);\n\n

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wasmMirrorPad(\n    xId, xShapeBytes, x.shape.length, CppDType[x.dtype], prePaddingsBytes,\npostPaddingsBytes, MirrorPaddingMode[mode], outId);\n return out;\n}\n\nexport const mirrorPadConfig:\nKernelConfig = {\n kernelName: MirrorPad,\n backendName: 'wasm',\n kernelFunc: mirrorPad as { } as\nKernelFunc,\n setupFunc: setup\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in\n compliance with the License.\n * You may obtain a copy of the License at\n *\n *  
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=====\n\n *\n\nimport { KernelConfig, Multiply } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from\n './binary_kernel';\nconst supportsFullBroadcast = true;\nexport const multiplyConfig: KernelConfig =\ncreateBinaryKernelConfig(Multiply, supportsFullBroadcast);\n", "/*\n * @license\n * Copyright 2020 Google\n LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not\n use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *  
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=====\n\n *\n\nimport { KernelConfig, Neg } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from\n './unary_kernel';\nexport const negConfig: KernelConfig = createUnaryKernelConfig(Neg);\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or\n agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *  
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n *  
* See the License for the specific language governing permissions and\n * limitations under the License.\n *  
=====\n\n *\n\nimport { BackendWasm } from '../backend_wasm';\n\n// Analogous to `struct Result` in\n `non_max_suppression_impl.h`\ninterface Result {\n pSelectedIndices: number;\n selectedSize: number;\n pSelectedScores: number;\n pValidOutputs: number;\n}\n\n/*\n * Parse the result of the c++ method, which has the\n shape equivalent to\n * `Result`\n */\nexport function parseResultStruct(\n backend: BackendWasm, resOffset:\n number): Result {\n const result = new Int32Array(backend.wasm.HEAPU8.buffer, resOffset, 4);\n const\n pSelectedIndices = result[0];\n const selectedSize = result[1];\n const pSelectedScores = result[2];\n const\n pValidOutputs = result[3];\n // Since the result was allocated on the heap, we have to delete it.\n backend.wasm._free(resOffset);\n return { pSelectedIndices, selectedSize,\n pSelectedScores, pValidOutputs };\n}\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights\n Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file\n except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *  
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n governing permissions and\n * limitations under the License.\n *  
=====\n\n *\n\nimport { KernelConfig, KernelFunc, NonMaxSuppressionV3, NonMaxSuppressionV3Attrs,\nNonMaxSuppressionV3Inputs, TensorInfo } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from

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'./backend_wasm';\n\nimport { parseResultStruct } from
'./NonMaxSuppression_util';\n\nlet wasmFunc: (\n  boxesId: number, scoresId: number, maxOutputSize:
number,\n  iouThreshold: number, scoreThreshold: number) => number;\n\nfunction setup(backend:
BackendWasm): void {\n  wasmFunc = backend.wasm.cwrap(\n    NonMaxSuppressionV3,\n    'number', //
Result*\n    [\n    'number', // boxesId\n    'number', // scoresId\n    'number', // maxOutputSize\n
'number', // iouThreshold\n    'number', // scoreThreshold\n    ]);\n\nfunction kernelFunc(args: {\n backend:
BackendWasm,\n inputs: NonMaxSuppressionV3Inputs,\n attrs: NonMaxSuppressionV3Attrs\n}): TensorInfo {\n
const {backend, inputs, attrs} = args;\n const {iouThreshold, maxOutputSize, scoreThreshold} = attrs;\n const
{boxes, scores} = inputs;\n\n const boxesId = backend.dataIdMap.get(boxes.dataId).id;\n const scoresId =
backend.dataIdMap.get(scores.dataId).id;\n\n const resOffset =\n  wasmFunc(boxesId, scoresId, maxOutputSize,
iouThreshold,
scoreThreshold);\n\n const {pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs} =\n
parseResultStruct(backend, resOffset);\n\n // Since we are not using scores for V3, we have to delete it from the
heap.\n backend.wasm._free(pSelectedScores);\n backend.wasm._free(pValidOutputs);\n\n const
selectedIndicesTensor =\n  backend.makeOutput([selectedSize], 'int32', pSelectedIndices);\n\n return
selectedIndicesTensor;\n}\n\nexport const nonMaxSuppressionV3Config: KernelConfig = {\n kernelName:
NonMaxSuppressionV3,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: kernelFunc as {} as
KernelFunc,\n};\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
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WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport { KernelConfig, KernelFunc, NonMaxSuppressionV4, NonMaxSuppressionV4Attrs,
NonMaxSuppressionV4Inputs, TensorInfo } from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from
'./backend_wasm';\n\nimport { parseResultStruct } from './NonMaxSuppression_util';\n\nlet wasmFunc: (\n
boxesId: number, scoresId: number, maxOutputSize: number,\n  iouThreshold: number, scoreThreshold: number,\n
padToMaxOutputSize: boolean) => number;\n\nfunction setup(backend: BackendWasm): void {\n  wasmFunc =
backend.wasm.cwrap(\n    NonMaxSuppressionV4,\n    'number', // Result*\n    [\n    'number', // boxesId\n
'number',
// scoresId\n    'number', // maxOutputSize\n    'number', // iouThreshold\n    'number', // scoreThreshold\n
'bool', // padToMaxOutputSize\n    ]);\n\nfunction nonMaxSuppressionV4(args: {\n backend:
BackendWasm,\n inputs: NonMaxSuppressionV4Inputs,\n attrs: NonMaxSuppressionV4Attrs\n}): TensorInfo[]
{\n const {backend, inputs, attrs} = args;\n const {iouThreshold, maxOutputSize, scoreThreshold,
padToMaxOutputSize} =\n  attrs;\n const {boxes, scores} = inputs;\n const boxesId =
backend.dataIdMap.get(boxes.dataId).id;\n const scoresId = backend.dataIdMap.get(scores.dataId).id;\n\n const
resOffset = wasmFunc(\n  boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold,\n
padToMaxOutputSize);\n\n const {pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs} =\n
parseResultStruct(backend, resOffset);\n\n // Since we are not using scores for V4, we have to delete it from the
heap.\n backend.wasm._free(pSelectedScores);\n\n
const selectedIndicesTensor =\n  backend.makeOutput([selectedSize], 'int32', pSelectedIndices);\n\n const
validOutputsTensor = backend.makeOutput([], 'int32', pValidOutputs);\n\n return [selectedIndicesTensor,
validOutputsTensor];\n}\n\nexport const nonMaxSuppressionV4Config: KernelConfig = {\n kernelName:
NonMaxSuppressionV4,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: nonMaxSuppressionV4 as {}
as KernelFunc,\n};\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under
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```
=====\n*\n\nimport { KernelConfig, KernelFunc, NonMaxSuppressionV5, NonMaxSuppressionV5Attrs, NonMaxSuppressionV5Inputs, TensorInfo } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport { parseResultStruct } from './NonMaxSuppression_util';\n\nlet wasmFunc:\n  (boxesId: number, scoresId: number, maxOutputSize: number,\n    iouThreshold: number, scoreThreshold: number, softNmsSigma: number) =>\n    number;\n\nfunction setup(backend: BackendWasm): void {\n  wasmFunc = backend.wasm.cwrap(\n    NonMaxSuppressionV5,\n    'number', // Result*\n    [\n      'number', // boxesId\n      'number', // scoresId\n      'number', // maxOutputSize\n      'number', // iouThreshold\n      'number', // scoreThreshold\n      'number', // softNmsSigma\n    ]);\n}\n\nfunction kernelFunc(args: {\n  backend: BackendWasm,\n  inputs: NonMaxSuppressionV5Inputs,\n  attrs: NonMaxSuppressionV5Attrs\n}): TensorInfo[] {\n  const { backend, inputs, attrs } = args;\n  const { iouThreshold, maxOutputSize, scoreThreshold, softNmsSigma } = attrs;\n  const { boxes, scores } = inputs;\n  const boxesId = backend.dataIdMap.get(boxes.dataId).id;\n  const scoresId = backend.dataIdMap.get(scores.dataId).id;\n  const resOffset = wasmFunc(\n    boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold,\n    softNmsSigma);\n  const { pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs } =\n    parseResultStruct(backend, resOffset);\n  // Since we are not using validOutputs for V5, we have to delete it from\n  // the\n  // heap.\n  backend.wasm._free(pValidOutputs);\n  const selectedIndicesTensor =\n    backend.makeOutput([selectedSize], 'int32', pSelectedIndices);\n  const selectedScoresTensor =\n    backend.makeOutput([selectedSize], 'float32', pSelectedScores);\n  return [selectedIndicesTensor, selectedScoresTensor];\n}\n\nexport const nonMaxSuppressionV5Config:\n  KernelConfig = {\n    kernelName: NonMaxSuppressionV5,\n    backendName: 'wasm',\n    setupFunc: setup,\n    kernelFunc: kernelFunc as { } as KernelFunc,\n  };,\n  "/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport\n  { KernelConfig, NotEqual } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from './binary_kernel';\n\nconst supportsFullBroadcast = false;\nexport const notEqualConfig: KernelConfig =\n  createBinaryKernelConfig(NotEqual, supportsFullBroadcast, 'bool');,\n  "/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport\n  { KernelConfig, KernelFunc, OneHot, OneHotAttrs, OneHotInputs } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\n\nlet wasmOneHot: (\n  indicesId: number, depth: number, onValue:
```

```

number, offValue: number,\n  outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n
wasmOneHot = backend.wasm.cwrap(OneHot, null /* void */, [\n  'number', // indices_id\n  'number', // depth,\n  'number', // onValue\n  'number', // offValue\n  'number' // out_id\n ]);\n\nfunction oneHot(\n  args:
{inputs: OneHotInputs, attrs: OneHotAttrs, backend: BackendWasm}) {\n  const {inputs, backend, attrs} = args;\n
const {indices} = inputs;\n  const {depth, onValue, offValue} = attrs;\n\n  const out =
backend.makeOutput([...indices.shape, depth], 'int32');\n  const outId = backend.dataIdMap.get(out.dataId).id;\n\n
const indicesData = backend.dataIdMap.get(indices.dataId);\n  const indicesId = indicesData.id;\n\n
wasmOneHot(indicesId, depth,
  onValue, offValue, outId);\n\n  return out;\n}\n\nexport const oneHotConfig: KernelConfig = {\n  kernelName:
OneHot,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: oneHot as {} as KernelFunc,\n};\n\n", "/*\n *
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {KernelConfig, KernelFunc, OnesLike, OnesLikeInputs} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nfunction onesLike(args: {inputs:
OnesLikeInputs, backend: BackendWasm}) {\n  const {inputs: {x}, backend} = args;\n  const out =
backend.makeOutput(x.shape, x.dtype);\n  const outVals = backend.typedArrayFromHeap(out);\n  outVals.fill(1);\n
return out;\n}\n\nexport const onesLikeConfig: KernelConfig = {\n  kernelName: OnesLike,\n  backendName:
'wasm',\n  kernelFunc: onesLike as {} as KernelFunc,\n};\n\n", "/*\n *
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OR CONDITIONS OF ANY KIND, either express
or implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====\n
*/\n\nimport {KernelConfig, KernelFunc, Pack, PackAttrs, PackInputs, TensorInfo, util} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {concat} from './Concat';\n\nimport
{expandDims} from './ExpandDims';\n\nexport function pack(\n  args: {inputs: PackInputs, backend:
BackendWasm, attrs: PackAttrs});\n  TensorInfo {\n    const {inputs, backend, attrs} = args;\n    const {axis} =
attrs;\n\n    if (inputs.length === 1) {\n      return expandDims(\n        {inputs: {input: inputs[0]}, backend, attrs: {dim:
axis}});\n    }\n\n    const shape = inputs[0].shape;\n    const dtype = inputs[0].dtype;\n\n    inputs.forEach(t => {\n
util.assertShapesMatch(\n      shape, t.shape,\n      'All tensors passed to stack must have matching shapes');\n
util.assert(\n
      dtype === t.dtype,\n      () => 'All tensors passed to stack must have matching dtypes');\n    });\n\n    const
intermediateTensorInfos: TensorInfo[] = [];\n    const expandedTensors = inputs.map(t => {\n      const expandedT =\n
expandDims({inputs: {input: t}, backend, attrs: {dim: axis}});\n      intermediateTensorInfos.push(expandedT);\n
return expandedT;\n    });\n\n    const result = concat({inputs: expandedTensors, backend, attrs: {axis}});\n\n
intermediateTensorInfos.forEach(t => backend.disposeData(t.dataId));\n\n    return result;\n  }\n\n  export const
packConfig: KernelConfig = {\n    kernelName: Pack,\n    backendName: 'wasm',\n    kernelFunc: pack as {} as
KernelFunc,\n  };
\n\n", "/*\n *
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```

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```
=====  
*  
import {KernelConfig, KernelFunc, PadV2, PadV2Attrs, PadV2Inputs, util} from '@tensorflow/tfjs-core';  
import {BackendWasm} from './backend_wasm';  
import {fill} from './Fill';  
import {CppType} from './types';  
let wasmPadV2: (xId: number, xShapeBytes: Uint8Array, xShapeLength: number, xDtype: number,  
prePaddingsBytes: Uint8Array, postPaddingsBytes: Uint8Array, constantValue: number, outId: number) => void;  
function setup(backend: BackendWasm) {  
  wasmPadV2 = backend.wasm.cwrap(PadV2, null  
/* void *, [number, // xId array, // x.shape number, // x.shape.length number, // x.dtype array, // pre-paddings array, // post-paddings number, // constantValue number, // outId]);  
function pad(args: {inputs: PadV2Inputs, backend: BackendWasm, attrs: PadV2Attrs}) {  
  const {inputs: {x}, backend, attrs: {paddings, constantValue}} = args;  
  const outShape = paddings.map((p, i) => p[0] /* beforePad */ + x.shape[i] + p[1] /* afterPad */);  
  if (util.sizeFromShape(x.shape) === 0) {  
    // Short-circuit the computation, since x doesn't have value, only the shape is used to compute output shape to pad.  
    return fill(backend, attrs: {shape: outShape, value: constantValue, dtype: x.dtype});  
  }  
  const xId = backend.dataIdMap.get(x.dataId).id;  
  const out = backend.makeOutput(outShape, x.dtype);  
  const outTensorData = backend.dataIdMap.get(out.dataId);  
  const outId = outTensorData.id;  
  const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);  
  const prePaddingsFlat = paddings.map(padTuple => padTuple[0]);  
  const postPaddingsFlat = paddings.map(padTuple => padTuple[1]);  
  const prePaddingsBytes = new Uint8Array(new Int32Array(prePaddingsFlat).buffer);  
  const postPaddingsBytes = new Uint8Array(new Int32Array(postPaddingsFlat).buffer);  
  wasmPadV2(xId, xShapeBytes, x.shape.length, CCppType[x.dtype], prePaddingsBytes, postPaddingsBytes, constantValue, outId);  
  return out;  
}  
export const padV2Config: KernelConfig = {  
  kernelName: PadV2,  
  backendName: 'wasm',  
  kernelFunc: pad as KernelFunc,  
  setupFunc: setup;  
};  
/**  
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 */
```

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```
=====  
*  
import {KernelConfig, Pow} from '@tensorflow/tfjs-core';  
import {createBinaryKernelConfig} from './binary_kernel';  
const supportsFullBroadcast = false;  
export const powConfig: KernelConfig = createBinaryKernelConfig(Pow, supportsFullBroadcast);  
/**  
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```
=====  
*  
import {KernelConfig, KernelFunc, Prelu, PreluInputs} from '@tensorflow/tfjs-core';  
import {BackendWasm} from './backend_wasm';  
import {cast} from './Cast';  
let wasmPrelu: (xId: number, weightsId: number, outId: number) => void;  
function setup(backend: BackendWasm) {  
  wasmPrelu =
```

```

backend.wasm.cwrap(Prelu, null /* void */, [\n 'number', // x_id\n 'number', // weights_id\n 'number' //
out_id\n ]);\n\nfunction prelu(args: {inputs: PreluInputs, backend: BackendWasm}) {\n const {inputs, backend}
= args;\n const {x, alpha} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n
const weightsId = backend.dataIdMap.get(alpha.dataId).id;\n\n let inputId = xId;\n const input = x;\n let
castedInput = input;\n if (input.dtype !== 'float32') {\n castedInput = cast({backend, inputs: {x}, attrs: {dtype:
'float32'}});\n inputId = backend.dataIdMap.get(castedInput.dataId).id;\n }\n\n const out =
backend.makeOutput(x.shape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmPrelu(inputId, weightsId, outId);\n\n if (input.dtype !== 'float32') {\n
backend.disposeData(castedInput.dataId);\n }\n return out;\n}\n\nexport const preluConfig: KernelConfig = {\n
kernelName: Prelu,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: prelu as {} as
KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
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WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {backend_util, KernelConfig, KernelFunc, Prod, ProdAttrs, ProdInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport
{permuteAxesAndTranspose} from './kernel_utils';\n\nimport {CppType} from './types';\n\nlet wasmProd: (\n
xId: number, reduceSize: number,\n dtype: number, outId: number) => void;\n\nfunction setup(backend:
BackendWasm): void {\n wasmProd = backend.wasm.cwrap(Prod, null /*void*/, [\n 'number',\n 'number',\n
'number',\n 'number'\n
]);\n\nfunction prod(args: {\n backend: BackendWasm,\n inputs: ProdInputs,\n attrs: ProdAttrs\n}):
TensorInfo {\n const {backend, inputs, attrs} = args;\n const {axis, keepDims} = attrs;\n const {x} = inputs;\n
const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const {transposed, axes,
originalAxes, inputWasTransposed} =\n permuteAxesAndTranspose(x, axis, backend);\n\n let reductionAxes =
axes;\n if (inputWasTransposed) {\n const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n if
(transposedId !== xId) {\n // transpose was not a no-op. We will need to dispose of this\n // once we are
done.\n input = transposed;\n inputId = transposedId;\n reductionAxes =
backend_util.getInnerMostAxes(\n reductionAxes.length, input.shape.length);\n }\n }\n\n
backend_util.assertAxesAreInnerMostDims(\n 'prod', reductionAxes, input.shape.length);\n const [outShape,
reduceShape]
=\n backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n const reduceSize =
util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, input.dtype);\n if
(util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmProd(inputId, reduceSize, CppType[out.dtype], outId);\n }\n\n if (inputWasTransposed) {\n // dispose of
the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const
newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n
return out;\n}\n\nexport const prodConfig: KernelConfig = {\n kernelName: Prod,\n backendName: 'wasm',\n
setupFunc: setup,\n kernelFunc: prod as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020 Google
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=====
*\n\nimport { KernelConfig, KernelFunc, Range, RangeAttrs, TensorInfo } from '@tensorflow/tfjs-core';\n\nimport
{ BackendWasm } from './backend_wasm';\n\nimport { rangeImplCPU } from './kernel_utils/shared';\n\nexport const
range =\n  (args: { backend: BackendWasm, attrs: RangeAttrs }): TensorInfo => {\n    const { backend, attrs } =
args;\n    const { start, stop, step, dtype } = attrs;\n    const values = rangeImplCPU(start, stop, step, dtype);\n\n    const
out = backend.makeOutput([values.length], dtype);\n    const outVals = backend.typedArrayFromHeap(out);\n\n    outVals.set(values);\n    return out;\n  };\n\nexport const rangeConfig: KernelConfig = {\n  kernelName: Range,\n  backendName: 'wasm',\n  kernelFunc: range as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019
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=====
*\n\nimport { KernelConfig, RealDiv } from '@tensorflow/tfjs-core';\n\nimport { createBinaryKernelConfig } from
'/binary_kernel';\n\nconst supportsFullBroadcast = true;\n\nexport const realDivConfig: KernelConfig =\n  createBinaryKernelConfig(RealDiv, supportsFullBroadcast);\n\n"/**\n * @license\n * Copyright 2019 Google LLC.
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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=====
*\n\nimport { KernelConfig, Relu } from '@tensorflow/tfjs-core';\n\nimport { createUnaryKernelConfig } from
'/unary_kernel';\n\nexport const reluConfig: KernelConfig = createUnaryKernelConfig(Relu);\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport { KernelConfig, Relu6 } from '@tensorflow/tfjs-core';\n\nimport
{ createUnaryKernelConfig } from './unary_kernel';\n\nexport const relu6Config: KernelConfig =
  createUnaryKernelConfig(Relu6);\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n *
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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=====
*\n\nimport { KernelConfig, KernelFunc, ResizeBilinear, ResizeBilinearAttrs, ResizeBilinearInputs, TensorInfo,
util } from '@tensorflow/tfjs-core';\n\nimport

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{BackendWasm} from './backend_wasm';\n\nimport {cast} from './Cast';\n\nlet wasmResizeBilinear: (\n  xId:
number, batch: number, oldHeight: number, oldWidth: number,\n  numChannels: number, newHeight: number,
newWidth: number,\n  alignCorners: number, halfPixelCenters: number, outId: number) => void;\n\nfunction
setup(backend: BackendWasm): void {\n  wasmResizeBilinear = backend.wasm.cwrap(ResizeBilinear, null
/*void*/, [\n  'number', // xId\n  'number', // batch\n  'number', // oldHeight\n  'number', // oldWidth\n
'number', // numChannels\n  'number', // newHeight\n  'number', // newWidth\n  'number', // alignCorners\n
'number', // halfPixelCenters\n  'number' // outId\n ]);\n\nfunction resizeBilinear(args: {\n  backend:
BackendWasm,\n  inputs: ResizeBilinearInputs,\n  attrs: ResizeBilinearAttrs\n}): TensorInfo {\n  const {backend,
inputs, attrs} = args;\n  const {images} = inputs;\n  const {alignCorners, halfPixelCenters, size}
= attrs;\n  const [newHeight, newWidth] = size;\n  const [batch, oldHeight, oldWidth, numChannels] =
images.shape;\n  const outShape = [batch, newHeight, newWidth, numChannels];\n  let xData =
backend.dataIdMap.get(images.dataId);\n  let castedData;\n  if (xData.dtype !== 'float32') {\n  castedData =\n
cast({backend, inputs: {x: images}, attrs: {dtype: 'float32'}});\n  xData =
backend.dataIdMap.get(castedData.dataId);\n  }\n  const xId = xData.id;\n  const out =
backend.makeOutput(outShape, 'float32');\n  if (util.sizeFromShape(images.shape) === 0) {\n  return out;\n  }\n
const outId = backend.dataIdMap.get(out.dataId).id;\n  wasmResizeBilinear(\n  xId, batch, oldHeight,
oldWidth, numChannels, newHeight, newWidth,\n  alignCorners ? 1 : 0, halfPixelCenters ? 1 : 0, outId);\n  if
(castedData !== null) {\n  backend.disposeData(castedData.dataId);\n  }\n  return out;\n  }\n\nexport const
resizeBilinearConfig: KernelConfig = {\n  kernelName: ResizeBilinear,\n
  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: resizeBilinear as {} as KernelFunc\n};\n", "/*\n *
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {KernelConfig, KernelFunc, Reverse, ReverseAttrs, ReverseInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport
{identity} from './Identity';\n\nimport {reshape} from './Reshape';\n\nlet wasmReverse: (\n  xId: number, axes:
Uint8Array, axesLength: number, outShape: Uint8Array,\n  outShapeLength: number, outId: number) =>
void;\n\nfunction setup(backend: BackendWasm) {\n  wasmReverse = backend.wasm.cwrap(Reverse, null, [\n
'number', // x_id\n  'array', // axes\n  'number', // axes_length\n  'array', // out_shape\n  'number', //
out_shape_length\n  'number' // out_id\n ]);\n\nexport function reverse(\n  args: {inputs: ReverseInputs,
backend: BackendWasm, attrs: ReverseAttrs});\n  TensorInfo {\n  const {inputs, backend, attrs} = args;\n  const
{x} = inputs;\n  const {dims} = attrs;\n  const axes = util.parseAxisParam(dims, x.shape);\n  if (x.shape.length
=== 0) {\n  return identity({inputs: {x}, backend});\n  }\n  const out = backend.makeOutput(x.shape, x.dtype);\n
const xId = backend.dataIdMap.get(x.dataId).id;\n  const outId = backend.dataIdMap.get(out.dataId).id;\n
const axesBytes = new Uint8Array(new Int32Array(axes).buffer);\n  const outShapeBytes = new Uint8Array(new
Int32Array(x.shape).buffer);\n  wasmReverse(\n  xId, axesBytes, axes.length, outShapeBytes, x.shape.length,
outId);\n  const reshaped =\n  reshape({inputs: {x: out}, attrs: {shape: x.shape}, backend});\n  backend.disposeData(out.dataId);\n  return reshaped;\n  }\n\nexport const reverseConfig: KernelConfig = {\n
kernelName: Reverse,\n  backendName: 'wasm',\n  kernelFunc: reverse as {} as KernelFunc,\n  setupFunc:
setup\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
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```
=====
*/\nimport { KernelConfig, KernelFunc, RotateWithOffset, RotateWithOffsetAttrs, RotateWithOffsetInputs,
TensorInfo } from '@tensorflow/tfjs-core';\nimport { backend_util } from '@tensorflow/tfjs-core';\nimport
{ BackendWasm } from '../backend_wasm';\n\nlet wasmRotate: (\n  xId: number, batch: number, imageHeight:
number, imageWidth: number,\n  numChannels: number, radians: number, centerX: number, centerY: number,\n  fillBytes: Uint8Array, fillLength: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n
wasmRotate = backend.wasm.cwrap(RotateWithOffset, null /* void */, [\n  'number', // xId\n  'number', //
batch\n  'number', // imageHeight\n  'number', // imageWidth\n
  'number', // numChannels\n  'number', // radians\n  'number', // centerX\n  'number', // centerY\n  'array', //
fillBytes\n  'number', // fillLength\n  'number', // outId\n  ]);\n}\n\nexport function rotateWithOffset(args: {\n
inputs: RotateWithOffsetInputs,\n  backend: BackendWasm,\n  attrs: RotateWithOffsetAttrs\n}): TensorInfo {\n
const { inputs, backend, attrs } = args;\n  const { image } = inputs;\n  const { radians, fillValue, center } =
attrs;\n  const out = backend.makeOutput(image.shape, image.dtype);\n  const imageId =
backend.dataIdMap.get(image.dataId).id;\n  const outId = backend.dataIdMap.get(out.dataId).id;\n  const [batch,
imageHeight, imageWidth, numChannels] = image.shape;\n  const [centerX, centerY] =\n
backend_util.getImageCenter(center, imageHeight, imageWidth);\n  const fillIsBlack = fillValue === 0;\n  const
fullOpacityValue = 255;\n  const fillValues = typeof fillValue === 'number' ?\n    [fillValue, fillValue, fillValue,
fillIsBlack ? 0 : fullOpacityValue] :\n    [...fillValue, fullOpacityValue];\n  const fillBytes = new Uint8Array(new
Int32Array(fillValues).buffer);\n  wasmRotate(\n    imageId, batch, imageHeight, imageWidth, numChannels,\n
radians, centerX,\n    centerY, fillBytes, fillValues.length, outId);\n  return out;\n}\n\nexport const
rotateWithOffsetConfig: KernelConfig = {\n  kernelName: RotateWithOffset,\n  backendName: 'wasm',\n
kernelFunc: rotateWithOffset as {} as KernelFunc,\n  setupFunc: setup\n};\n\n"/**\n * @license\n * Copyright 2021
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OR CONDITIONS
OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions
and\n * limitations under the License.\n */
=====
```

```
*/\nimport { KernelConfig, Round } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from
'/unary_kernel';\n\nexport const roundConfig: KernelConfig = createUnaryKernelConfig(Round);\n\n"/**\n *
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the specific
language governing permissions and\n * limitations under the License.\n */
=====
```

```
*/\nimport { KernelConfig, Rsqrt } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from
'/unary_kernel';\n\nexport const rsqrtConfig: KernelConfig = createUnaryKernelConfig(Rsqrt);\n\n"/**\n *
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```
=====\n*\n\nimport { KernelConfig, KernelFunc, scatter_util, ScatterNd, ScatterNdAttrs, ScatterNdInputs, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { CppDType } from './types';\n\nlet wasmScatterNd: (\n  indicesId: number, updatesId: number, dtype: CppDType, sliceRank: number,\n  numUpdates: number, sliceSize: number, strides: Uint8Array,\n  outputSize: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n  wasmScatterNd = backend.wasm.cwrap(ScatterNd, null /*void*/, [\n    'number', // indicesId\n    'number', // updatesId\n    'number', // dtype\n    'number', // sliceRank\n    'number', // numUpdates\n    'number', // sliceSize\n    'array', // strides\n    'number', // outputSize\n    'number' // outId\n  ]);\n\n  function scatterNd(\n    args: {\n      backend: BackendWasm, inputs: ScatterNdInputs, attrs: ScatterNdAttrs\n    }):\n    TensorInfo {\n    const { backend, inputs, attrs } = args;\n    const { indices, updates } = inputs;\n    const { shape } = attrs;\n\n    const out = backend.makeOutput(shape, updates.dtype);\n    if (util.sizeFromShape(shape) === 0) {\n      return out;\n    }\n\n    const { sliceRank, numUpdates, sliceSize, strides, outputSize } =\n      scatter_util.calculateShapes(updates, indices, shape);\n\n    const indicesData = backend.dataIdMap.get(indices.dataId);\n    const indicesId = indicesData.id;\n\n    const updatesData = backend.dataIdMap.get(updates.dataId);\n    const updatesId = updatesData.id;\n\n    const stridesBytes = new Uint8Array(new Int32Array(strides).buffer);\n\n    const outId = backend.dataIdMap.get(out.dataId).id;\n\n    wasmScatterNd(\n      indicesId, updatesId, CppDType[updates.dtype], sliceRank, numUpdates,\n      sliceSize, stridesBytes, outputSize, outId);\n\n    return out;\n  }\n\n  export const scatterNdConfig: KernelConfig = {\n    kernelName: ScatterNd,\n    backendName: 'wasm',\n    setupFunc: setup,\n    kernelFunc: scatterNd as {} as KernelFunc\n  };}\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport { KernelConfig, KernelFunc, Select, SelectInputs, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\n\nlet wasmSelect: (\n  conditionId: number, tId: number, eId: number, offset: number,\n  outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n  wasmSelect = backend.wasm.cwrap('SelectV2', null, [\n    'number', // conditionId\n    'number', // tId\n    'number', // eId\n    'number', // offset\n    'number', // outId\n  ]);\n\n  function select(args: { inputs: SelectInputs, backend: BackendWasm }) {\n    const { inputs, backend } = args;\n    const { condition, t, e } = inputs;\n\n    const conditionId = backend.dataIdMap.get(condition.dataId).id;\n    const tId = backend.dataIdMap.get(t.dataId).id;\n    const eId = backend.dataIdMap.get(e.dataId).id;\n\n    const out = backend.makeOutput(t.shape, t.dtype);\n    const outId = backend.dataIdMap.get(out.dataId).id;\n\n    const cRank = condition.shape.length;\n    const tRank = t.shape.length;\n\n    const offset = cRank === 0 || cRank > 1 || tRank === 1 ?\n      1 : util.sizeFromShape(t.shape.slice(1));\n\n    wasmSelect(conditionId, tId, eId, offset, outId);\n\n    return out;\n  }\n\n  export const selectConfig:\n    KernelConfig = {\n    kernelName: Select,\n    backendName: 'wasm',\n    kernelFunc: select as {} as KernelFunc,\n    setupFunc: setup\n  };}\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed
```


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```
=====\n*\n\nimport { KernelConfig, KernelFunc, Sigmoid, SigmoidInputs, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\n\nlet wasmFunc: (xId: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n  wasmFunc = backend.wasm.cwrap(Sigmoid, null /* void */, ['number', 'number']);\n}\n\nfunction sigmoid(args: { backend: BackendWasm, inputs: SigmoidInputs }):\n  TensorInfo {\n  const { backend, inputs: { x } } = args;\n  const xId = backend.dataIdMap.get(x.dataId).id;\n  const out = backend.makeOutput(x.shape, x.dtype);\n  const outId = backend.dataIdMap.get(out.dataId).id;\n  // Short-circuit zero-sized tensors.\n  if (util.sizeFromShape(out.shape) === 0) {\n    return out;\n  }\n  wasmFunc(xId, outId);\n  return out;\n}\n\nexport const sigmoidConfig: KernelConfig = {\n  kernelName: 'Sigmoid',\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: sigmoid as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n
```

```
=====\n*\n\nimport { KernelConfig, Sin } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from '../unary_kernel';\n\nexport const sinConfig: KernelConfig = createUnaryKernelConfig(Sin);\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n
```

```
=====\n*\n\nimport { KernelConfig, KernelFunc, Softmax, SoftmaxAttrs, SoftmaxInputs, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\n\nlet wasmFunc: (xId: number, outId: number, channels: number, batch: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n  wasmFunc = backend.wasm.cwrap(Softmax, null /* void */, [\n    'number', // xId\n    'number', // outId\n    'number', // channels\n    'number' // batch\n  ]);\n}\n\nfunction softmax(\n  args: { backend: BackendWasm, inputs: SoftmaxInputs, attrs: SoftmaxAttrs }):\n  TensorInfo {\n  const { backend, inputs: { logits }, attrs: { dim } } = args;\n  const xId = backend.dataIdMap.get(logits.dataId).id;\n  const out = backend.makeOutput(logits.shape, logits.dtype);\n  const outId = backend.dataIdMap.get(out.dataId).id;\n  const channels = logits.shape[dim];\n  const batch = util.sizeFromShape(logits.shape) / channels;\n  // Short-circuit zero-sized tensors.\n  if (util.sizeFromShape(out.shape) === 0) {\n    return out;\n  }\n  wasmFunc(xId, outId, channels, batch);\n  return out;\n}\n\nexport const softmaxConfig: KernelConfig = {\n  kernelName: Softmax,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: softmax as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
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OR CONDITIONS OF ANY KIND, either express or implied. See the License for the specific language governing permissions and limitations under the License.

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=====
*\n\nimport { backend_util, KernelConfig, KernelFunc, ReshapeAttrs, ReshapeInputs, SpaceToBatchND,
SpaceToBatchNDAttrs, SpaceToBatchNDInputs, TensorInfo, TransposeAttrs, TransposeInputs, util } from
'@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport { padV2Config } from
'./PadV2';\nimport { reshape } from './Reshape';\nimport { transpose } from './Transpose';\n\nfunction
spaceToBatchND(args: {\n  inputs: SpaceToBatchNDInputs,\n  backend: BackendWasm,\n  attrs:
SpaceToBatchNDAttrs\n}) {\n  const { inputs, backend,
  attrs } = args;\n  const { x } = inputs;\n  const { blockShape, paddings } = attrs;\n\n  const prod =
util.sizeFromShape(blockShape);\n\n  const completePaddings: Array<[number, number]> = [[0, 0]];\n
completePaddings.push(...(paddings as Array<[number, number]>));\n\n  for (let i = 1 + blockShape.length; i <
x.shape.length; ++i) {\n    completePaddings.push([0, 0]);\n  }\n\n  const paddedX = padV2Config.kernelFunc({\n
inputs: { x },\n  backend,\n  attrs: { paddings: completePaddings, constantValue: 0 }\n}) as TensorInfo;\n\n  const
reshapedPaddedShape =\n    backend_util.getReshaped(paddedX.shape, blockShape, prod, false);\n\n  const
permutedReshapedPaddedPermutation = backend_util.getPermuted(\n    reshapedPaddedShape.length,
blockShape.length, false);\n\n  const flattenShape =\n    backend_util.getReshapedPermuted(paddedX.shape,
blockShape, prod, false);\n\n  const reshapeInputs: ReshapeInputs = { x: paddedX };\n  const reshapeAttrs:
ReshapeAttrs = { shape: reshapedPaddedShape };\n\n  const paddedXReshaped =\n    reshape({ inputs: reshapeInputs, backend, attrs: reshapeAttrs });\n\n  const
transposeInputs: TransposeInputs = { x: paddedXReshaped };\n  const transposeAttrs:\n    TransposeAttrs = { perm:
permutedReshapedPaddedPermutation };\n  const paddedXT =\n    transpose({ inputs: transposeInputs, backend,
attrs: transposeAttrs });\n\n  const resultReshapeInputs: ReshapeInputs = { x: paddedXT };\n  const
resultReshapeAttrs: ReshapeAttrs = { shape: flattenShape };\n  const result = reshape(\n    { inputs:
resultReshapeInputs, backend, attrs: resultReshapeAttrs });\n\n  backend.disposeData(paddedX.dataId);\n
backend.disposeData(paddedXReshaped.dataId);\n  backend.disposeData(paddedXT.dataId);\n\n  return
result;\n}\n\nexport const spaceToBatchNDConfig: KernelConfig = {\n  kernelName: SpaceToBatchND,\n  backendName: 'wasm',\n  kernelFunc: spaceToBatchND as {} as KernelFunc\n};\n"/**\n * @license\n *
Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under
the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n */
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*\n\nimport { KernelConfig, KernelFunc, SplitV, SplitVAttrs, SplitVInputs, util } from '@tensorflow/tfjs-
core';\nimport { backend_util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from
'../backend_wasm';\n\nimport { slice } from './Slice';\n\nexport function splitV(\n  args: { inputs: SplitVInputs, attrs:
SplitVAttrs, backend: BackendWasm }) {\n  const { inputs,
  attrs, backend } = args;\n  const { x } = inputs;\n  const { numOrSizeSplits, axis } = attrs;\n\n  const $axis =
util.parseAxisParam(axis, x.shape)[0];\n\n  const splitSizes = backend_util.prepareSplitSize(x, numOrSizeSplits,
$axis);\n  const begin = new Array(x.shape.length).fill(0);\n  const size = x.shape.slice();\n  return splitSizes.map(
=> {\n    const xSliceSize = [...size];\n    xSliceSize[$axis] = s;\n    const xSlice =\n      slice({ inputs: { x }, attrs:
{ begin, size: xSliceSize }, backend });\n    begin[$axis] += s;\n    return xSlice;\n  });\n}\n\nexport const
splitVConfig: KernelConfig = {\n  kernelName: SplitV,\n  backendName: 'wasm',\n  kernelFunc: splitV as {} as
KernelFunc\n};\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
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```
=====\n*\n\nimport {KernelConfig, Sqrt} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from './unary_kernel';\nexport const sqrtConfig: KernelConfig = createUnaryKernelConfig(Sqrt);\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport {KernelConfig, Square} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from './unary_kernel';\nexport const squareConfig: KernelConfig = createUnaryKernelConfig(Square);\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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```
=====\n*\n\nimport {KernelConfig, SquaredDifference} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from './binary_kernel';\nconst supportsFullBroadcast = true;\nexport const squaredDifferenceConfig: KernelConfig =\n  createBinaryKernelConfig(SquaredDifference, supportsFullBroadcast);\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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```
=====\n*\n\nimport {KernelConfig, KernelFunc, Step, StepAttrs, StepInputs, TensorInfo} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {CppDType} from './types';\nlet wasmStep: (xId: number, alpha: number, dtype: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n  wasmStep = backend.wasm.cwrap(Step, null /*void*/, [\n    'number', // x_id\n    'number', // alpha\n    'number', // dtype\n    'number', // out_id\n  ]);\n\n  function step(\n    args: {\n      backend: BackendWasm,\n      inputs: StepInputs,\n      attrs: StepAttrs\n    }): TensorInfo {\n    const {backend, inputs, attrs} = args;\n    const {alpha} = attrs;\n    const {x} = inputs;\n    const xId = backend.dataIdMap.get(x.dataId).id;\n    const out = backend.makeOutput(x.shape, x.dtype);\n    const outId = backend.dataIdMap.get(out.dataId).id;\n    wasmStep(xId, alpha, CppDType[x.dtype], outId);\n    return out;\n  }\n\n  export const stepConfig: KernelConfig = {\n    kernelName: Step,\n    backendName: 'wasm',\n    setupFunc: setup,\n    kernelFunc: step as {} as KernelFunc\n  };\n", "/*\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the
License.\n *

```
=====\n*\n\nimport { KernelConfig, KernelFunc, slice_util, StridedSlice, StridedSliceAttrs, StridedSliceInputs, TensorInfo,  
util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { reshape } from  
 './Reshape';\nimport { slice } from './Slice';\n\nlet wasmStridedSlice: (\n  xId: number, xStridesBytes: Uint8Array,  
  xRank: number,\n  beginBytes: Uint8Array, endBytes: Uint8Array, stridesBytes: Uint8Array,\n  outShapeBytes:  
  Uint8Array, outStridesBytes: Uint8Array,\n  outShapeLength: number, outId: number) => void;\n\nfunction  
setup(backend: BackendWasm): void {\n  wasmStridedSlice = backend.wasm.cwrap(StridedSlice, null /*void*/, [\n    'number', // xId\n    'array', // xStrides\n    'number', // xRank\n    'array', // beginBytes\n    'array', // endBytes\n    'array', // stridesBytes\n    'array', // outShapeBytes\n    'array', // outStridesBytes\n    'number',  
    // outShapeLength\n    'number', // outId\n  ]);\n\n  export function stridedSlice(args: {\n    backend:  
    BackendWasm,\n    inputs: StridedSliceInputs,\n    attrs: StridedSliceAttrs\n  }): TensorInfo {\n    const { backend, inputs,  
    attrs } = args;\n    const { x } = inputs;\n\n    const {\n      begin,\n      end,\n      strides,\n      beginMask,\n      endMask,\n      ellipsisMask,\n      newAxisMask,\n      shrinkAxisMask\n    } = attrs;\n\n    const {\n      finalShapeSparse,\n      finalShape,\n      isIdentity,\n      sliceDim0,\n      isSimpleSlice,\n      begin: $begin,\n      end: $end,\n      strides: $strides\n    } =\n      slice_util.sliceInfo(\n        x.shape, begin, end, strides, beginMask, endMask, ellipsisMask,\n        newAxisMask, shrinkAxisMask);\n\n    let result;\n\n    if (isIdentity) {\n      // Optimization #1, slice is a no-op plus  
reshape\n      result = reshape({ inputs: { x }, backend, attrs: { shape: finalShape } });\n    } else if (sliceDim0 ||  
isSimpleSlice) {\n      // Optimization #2, slice is memory contiguous  
(only occurs in dim 0)\n      util.assert(\n        x.shape.length >= 1,\n        () => `Input must have rank at least 1, got:  
${x.shape.length}`);\n      const size = slice_util.computeOutShape($begin, $end, $strides);\n      // To tolerate  
begin[0] > end[0] (a 0-output slice), we min(begin, end).\n      const sliced = slice({ inputs: { x }, backend, attrs:  
{ begin: $begin, size } });\n      result =\n        reshape({ inputs: { x: sliced }, backend, attrs: { shape: finalShape } });\n      backend.disposeData(sliced.dataId);\n    } else {\n      const out = backend.makeOutput(finalShapeSparse,  
'float32');\n      const xId = backend.dataIdMap.get(x.dataId).id;\n      const xStridesBytes =\n        new  
        Uint8Array(new Int32Array(util.computeStrides(x.shape)).buffer);\n      const beginBytes = new Uint8Array(new  
        Int32Array($begin).buffer);\n      const endBytes = new Uint8Array(new Int32Array($end).buffer);\n      const  
        stridesBytes = new Uint8Array(new Int32Array($strides).buffer);\n      const outputShapeBytes =\n        new  
        Uint8Array(new Int32Array(finalShapeSparse).buffer);\n      const outStridesBytes = new Uint8Array(\n        new  
        Int32Array(util.computeStrides(finalShapeSparse)).buffer);\n      const outId =  
        backend.dataIdMap.get(out.dataId).id;\n      wasmStridedSlice(\n        xId, xStridesBytes, x.shape.length,  
        beginBytes, endBytes, stridesBytes,\n        outputShapeBytes, outStridesBytes, finalShapeSparse.length, outId);\n      result = reshape({ inputs: { x: out }, backend, attrs: { shape: finalShape } });\n      backend.disposeData(out.dataId);\n    }\n\n    return result;\n  }\n\n  export const stridedSliceConfig: KernelConfig = {\n    kernelName: StridedSlice,\n    backendName: 'wasm',\n    setupFunc: setup,\n    kernelFunc: stridedSlice as { } as KernelFunc\n  }; \n  /**\n   * @license\n   * Copyright 2019 Google LLC. All Rights Reserved.\n   * Licensed under the Apache License, Version  
2.0 (the \"License\");\n   * you may not use this file except in compliance with the License.\n   * You may obtain a  
copy of the License  
at\n   * http://www.apache.org/licenses/LICENSE-2.0\n   * Unless required by applicable law or agreed to in  
writing, software\n   * distributed under the License is distributed on an \"AS IS\" BASIS,\n   * WITHOUT  
WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n   * See the License for the specific  
language governing permissions and\n   * limitations under the License.\n   */\n}\n\n=====\n\n
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```

*\nimport {KernelConfig, Sub} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
'./binary_kernel';\nconst supportsFullBroadcast = true;\nexport const subConfig: KernelConfig =\ncreateBinaryKernelConfig(Sub, supportsFullBroadcast);\n", "/*\n * @license\n * Copyright 2019 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n
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distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *
=====
*\n\nimport {backend_util, KernelConfig, KernelFunc, Sum, SumAttrs, SumInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport
{permuteAxesAndTranspose} from './kernel_utils';\nimport {CppType} from './types';\n\nlet wasmSum: (xId:
number, reduceSize: number, dtype: number, outId: number) =>\n void;\n\nfunction setup(backend:
BackendWasm): void {\n  wasmSum = backend.wasm.cwrap(Sum, null /*void*/, [\n    'number', // input_id\n
'number', // reduce_size\n    'number', // dtype\n    'number', // out_id\n  ]);\n}\n\nfunction sum(args: {backend: BackendWasm, inputs: SumInputs, attrs:
SumAttrs}): \n  TensorInfo {\n  const {backend, inputs, attrs} = args;\n  const {axis, keepDims} = attrs;\n  const
{x} = inputs;\n  const xId = backend.dataIdMap.get(x.dataId).id;\n  let inputId = xId;\n  let input = x;\n  const
{transposed, axes, originalAxes, inputWasTransposed} =\n    permuteAxesAndTranspose(x, axis, backend);\n  \n  let reductionAxes = axes;\n  if (inputWasTransposed) {\n    const transposedId =
backend.dataIdMap.get(transposed.dataId).id;\n    if (transposedId !== xId) {\n      // transpose was not a no-op. We
will need to dispose of this\n      // once we are done.\n      input = transposed;\n      inputId = transposedId;\n
      reductionAxes = backend_util.getInnerMostAxes(\n        reductionAxes.length, input.shape.length);\n    }\n  }\n  \n  backend_util.assertAxesAreInnerMostDims(\n    'sum', reductionAxes, input.shape.length);\n  const [outShape,
reduceShape]
  =\n    backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n  const reduceSize =
util.sizeFromShape(reduceShape);\n  \n  const out = backend.makeOutput(outShape, input.dtype);\n  if
(util.sizeFromShape(input.shape) !== 0) {\n    const outId = backend.dataIdMap.get(out.dataId).id;\n
    wasmSum(inputId, reduceSize, CCppType[out.dtype], outId);\n  }\n  \n  if (inputWasTransposed) {\n    // dispose of
the transposed tensor.\n    backend.disposeData(transposed.dataId);\n  }\n  \n  if (keepDims) {\n    // reshape\n    const
newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n    out.shape = newShape;\n  }\n  \n
return out;\n}\n\nexport const sumConfig: KernelConfig = {\n  kernelName: Sum,\n  backendName: 'wasm',\n
setupFunc: setup,\n  kernelFunc: sum as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2021 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not
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in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {KernelConfig, Tan} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'./unary_kernel';\nexport const tanConfig: KernelConfig = createUnaryKernelConfig(Tan);\n", "/*\n * @license\n *
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```

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```
=====  
* \nimport {KernelConfig, Tanh} from '@tensorflow/tfjs-core'; \nimport {createUnaryKernelConfig} from  
 './unary_kernel'; \nexport const tanhConfig: KernelConfig = createUnaryKernelConfig(Tanh); \n", /*  
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 * the specific language governing permissions and \n * limitations under the License. \n *
```

```
=====  
* \nimport {KernelConfig, KernelFunc, Tile, TileAttrs, TileInputs} from '@tensorflow/tfjs-core'; \nimport  
 {BackendWasm} from './backend_wasm'; \nimport {CppType} from './types'; \nlet wasmTile: ( \n  xId:  
  number, xShape: Uint8Array, xShapeSize: number, newShape: Uint8Array, \n  newShapeSize: number, dtype:  
  number, outId: number) => void; \nfunction setup(backend: BackendWasm) { \n  wasmTile =  
  backend.wasm.cwrap(Tile, null /* void */, [ \n    'number', // x_id \n    'array', // x_shape \n    'number', //  
  x_shape.length \n    'array', // new_shape \n    'number', // new_shape.length \n    'number' // out_id \n  ]); \n  function tile( \n    args: {inputs: TileInputs, backend: BackendWasm, attrs: TileAttrs}) { \n    const {inputs,  
  backend, attrs} = args; \n    const {x} = inputs; \n    const xId = backend.dataIdMap.get(x.dataId).id; \n    const {reps} =  
  attrs; \n    const newShape: number[] = new Array(x.shape.length); \n    for (let i = 0; i < newShape.length; i++) { \n      newShape[i] = x.shape[i] * reps[i]; \n    } \n    const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer); \n    const newShapeBytes = new Uint8Array(new Int32Array(newShape).buffer); \n    const out =  
  backend.makeOutput(newShape, x.dtype); \n    const outId = backend.dataIdMap.get(out.dataId).id; \n    wasmTile( \n      xId, xShapeBytes, x.shape.length, newShapeBytes, newShape.length, \n      CppDType[out.dtype], outId); \n    return  
  out; \n  } \n  export const tileConfig: KernelConfig = { \n    kernelName: Tile, \n    backendName: 'wasm', \n    setupFunc:  
  setup, \n    kernelFunc: tile as {} as KernelFunc; \n  }; \n", /*  
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 * governing permissions and \n * limitations under the License. \n *
```

```
=====  
* \nimport {KernelConfig, KernelFunc, TensorInfo, TopK, TopKAttrs, TopKInputs} from '@tensorflow/tfjs-  
core'; \nimport {BackendWasm} from './backend_wasm'; \nimport {CppType} from './types'; \nlet wasmTopK:  
 ( \n  xId: number, xShapeBytes: Uint8Array, xShapeLength: number, \n  xDType: CppDType, k: number, sorted:  
  boolean, outValuesId:  
  number, \n  outIndicesId: number) => void; \nfunction setup(backend: BackendWasm) { \n  wasmTopK =  
  backend.wasm.cwrap(TopK, null /* void */, [ \n    'number', // xId \n    'array', // x_shape \n    'number', //  
  x_shape.length \n    'number', // x_dtype \n    'number', // k \n    'bool', // sorted \n    'number', // outValuesId \n    'number', // outIndicesId \n  ]); \n  export const topk: \n    (args: {inputs: TopKInputs, backend: BackendWasm,  
  attrs: TopKAttrs}) => \n    TensorInfo[] | TensorInfo = ({inputs, backend, attrs}) => { \n      const {x} = inputs; \n      const {k, sorted} = attrs; \n      const xId = backend.dataIdMap.get(x.dataId).id; \n      const xShapeBytes  
  = new Uint8Array(new Int32Array(x.shape).buffer); \n      const outputShape = x.shape.slice(); \n      outputShape[outputShape.length - 1] = k; \n      const outValues = backend.makeOutput(outputShape, x.dtype); \n    } \n  } \n
```

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    const outValuesId = backend.dataIdMap.get(outValues.dataId).id;\n
    const outIndices = backend.makeOutput(outputShape, 'int32');\n    const outIndicesId =
backend.dataIdMap.get(outIndices.dataId).id;\n\n    wasmTopK(\n        xId, xShapeBytes, x.shape.length,\n        CppDType[x.dtype], k, sorted,\n        outValuesId, outIndicesId);\n    return [outValues, outIndices];\n
};\n\nexport const topKConfig: KernelConfig = {\n    kernelName: TopK,\n    backendName: 'wasm',\n    setupFunc:
setup,\n    kernelFunc: topk as { } as KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2021 Google LLC. All
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http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS
OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions
and\n * limitations under the License.\n *
=====\n
*/\n\nimport { KernelConfig, KernelFunc, TensorInfo, Transform, TransformAttrs, TransformInputs, util } from
'@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nlet wasmTransform: (\n    imageId:
number, transformsId: number, isBatchTransform: boolean,\n    batch: number, outHeight: number, outWidth:
number, numChannels: number,\n    imageWidth: number, imageHeight: number, strides: Uint8Array,\n    stridesLength: number, interpolationModeId: number, fillModeId: number,\n    fillValue: number, outId: number)
=> void;\n\nfunction setup(backend: BackendWasm): void {\n    wasmTransform = backend.wasm.cwrap(Transform,\n    null /*void*/, [\n        'number', // imageId\n        'number', // transformsId\n        'bool', // isBatchTransform\n        'number', // batch\n        'number', // outHeight\n        'number', // outWidth\n        'number', // numChannels\n        'number', // imageWidth\n        'number', // imageHeight\n        'array', // strides\n        'number', // stridesLength\n        'number', // interpolationModeId\n        'number', // fillModeId\n        'number', // fillValue\n        'number' // outId\n    ]);\n\n    function transform(\n        args:\n        { backend: BackendWasm, inputs: TransformInputs, attrs:
TransformAttrs }):\n        TensorInfo {\n        const { backend, inputs, attrs } = args;\n        const { image, transforms } = inputs;\n        const { interpolation, fillMode, fillValue, outputShape } = attrs;\n        const [batch, imageHeight, imageWidth, numChannels] = image.shape;\n        const [outHeight, outWidth] =\n            outputShape !== null ? outputShape :
[imageHeight, imageWidth];\n        const outShape =\n            [batch, outHeight, outWidth,\n            numChannels] as
[number, number, number, number];\n        const strides =\n            new Uint8Array(new
Int32Array(util.computeStrides(image.shape)).buffer);\n\n        const out = backend.makeOutput(outShape, image.dtype);\n        const outId =
backend.dataIdMap.get(out.dataId).id;\n\n        const imageData = backend.dataIdMap.get(image.dataId);\n        const
imageId = imageData.id;\n\n        const transformsData = backend.dataIdMap.get(transforms.dataId);\n        const
transformsId = transformsData.id;\n\n        const interpolationModeId = interpolation === 'nearest' ? 1 : 2;\n        let
fillModeId;\n        switch (fillMode) {\n            case 'constant':\n                fillModeId = 1;\n                break;\n            case 'reflect':\n                fillModeId = 2;\n                break;\n            case 'wrap':\n                fillModeId = 3;\n                break;\n            case 'nearest':\n                fillModeId = 4;\n                break;\n            default:\n                fillModeId = 1;\n                break;\n        }\n\n        wasmTransform(\n            imageId, transformsId,\n            (transforms.shape[0] > 1), batch, outHeight,\n            outWidth, numChannels, imageWidth, imageHeight, strides,\n            image.shape.length - 1, interpolationModeId, fillModeId, fillValue,\n            outId);\n\n        return out;\n    }\n\n    export const transformConfig: KernelConfig = {\n        kernelName: Transform,\n        backendName:
'wasm',\n        setupFunc: setup,\n        kernelFunc: transform as { } as KernelFunc\n    };
\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this
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OR CONDITIONS
OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions
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=====\\n
*\\n\\nimport {KernelConfig, KernelFunc, TensorInfo, Unpack, UnpackAttrs, UnpackInputs}
  from '@tensorflow/tfjs-core';\\n\\nimport {BackendWasm} from './backend_wasm';\\n\\nimport {slice} from
  './Slice';\\n\\nfunction unpack(\\n  args: {inputs: UnpackInputs, backend: BackendWasm, attrs: UnpackAttrs}):\\n
  TensorInfo[] {\\n  const {inputs, backend, attrs} = args;\\n  const {value} = inputs;\\n  let {axis} = attrs;\\n  if (axis <
  0) {\\n    axis += value.shape.length;\\n  }\\n  const numOutputs = value.shape[axis];\\n  const rank =
  value.shape.length;\\n  const outShape: number[] = new Array(rank - 1);\\n  let outIndex = 0;\\n  for (let i = 0; i < rank;
  i++) {\\n    if (i !== axis) {\\n      outShape[outIndex++] = value.shape[i];\\n    }\\n  }\\n  const outs: TensorInfo[] = new
  Array(numOutputs);\\n  const begin = new Array(rank).fill(0);\\n  const size = value.shape.slice();\\n  size[axis] = 1;\\n
  for (let i = 0; i < outs.length; i++) {\\n    begin[axis] = i;\\n    outs[i] = slice({inputs: {x: value}, attrs: {begin, size},
  backend});\\n  }\\n  return outs.map(({dataId, dtype},
  shape: outShape));\\n}\\n\\nexport const unpackConfig: KernelConfig = {\\n  kernelName: Unpack,\\n  backendName:
  'wasm',\\n  kernelFunc: unpack as {} as KernelFunc,\\n};\\n", "/*\\n * @license\\n * Copyright 2020 Google LLC. All
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  software\\n * distributed under the License is distributed on an "AS IS" BASIS,\\n * WITHOUT WARRANTIES
  OR CONDITIONS OF ANY KIND, either express or implied.\\n * See the License for the specific language
  governing permissions and\\n * limitations under the License.\\n *
=====\\n
*\\n\\nimport {KernelConfig, KernelFunc, ZerosLike, ZerosLikeInputs} from '@tensorflow/tfjs-core';\\n\\nimport
  {BackendWasm}
  from './backend_wasm';\\n\\nfunction zerosLike(args: {inputs: ZerosLikeInputs, backend: BackendWasm}) {\\n
  const {inputs: {x}, backend} = args;\\n  const out = backend.makeOutput(x.shape, x.dtype);\\n  const outVals =
  backend.typedArrayFromHeap(out);\\n  outVals.fill(0);\\n  return out;\\n}\\n\\nexport const zerosLikeConfig:
  KernelConfig = {\\n  kernelName: ZerosLike,\\n  backendName: 'wasm',\\n  kernelFunc: zerosLike as {} as
  KernelFunc,\\n};\\n", "/*\\n * @license\\n * Copyright 2020 Google LLC. All Rights Reserved.\\n * Licensed under the
  Apache License, Version 2.0 (the "License");\\n * you may not use this file except in compliance with the
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  Unless required by applicable law or agreed to in writing, software\\n * distributed under the License is distributed
  on an "AS IS" BASIS,\\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
  implied.\\n * See the License for
  the specific language governing permissions and\\n * limitations under the License.\\n *
=====\\n *\\n//
We explicitly import the modular kernels so they get registered in the\\n// global registry when we compile the
  library. A modular build would replace\\n// the contents of this file and import only the kernels that are
  needed.\\nimport {KernelConfig, registerKernel} from '@tensorflow/tfjs-core';\\nimport {fusedMatMulConfig}
  from './kernels/_FusedMatMul';\\nimport {absConfig} from './kernels/Abs';\\nimport {addConfig} from
  './kernels/Add';\\nimport {addNConfig} from './kernels/AddN';\\nimport {allConfig} from './kernels/All';\\nimport
  {anyConfig} from './kernels/Any';\\nimport {argMaxConfig} from './kernels/ArgMax';\\nimport {avgPoolConfig}
  from './kernels/AvgPool';\\nimport {batchMatMulConfig} from './kernels/BatchMatMul';\\nimport
  {batchToSpaceNDConfig} from './kernels/BatchToSpaceND';\\nimport {castConfig} from './kernels/Cast';\\nimport
  {ceilConfig} from './kernels/Ceil';\\nimport {clipByValueConfig} from './kernels/ClipByValue';\\nimport
  {concatConfig} from './kernels/Concat';\\nimport {conv2DConfig} from './kernels/Conv2D';\\nimport
  {conv2DBackpropInputConfig} from './kernels/Conv2DBackpropInput';\\nimport {cosConfig} from
  './kernels/Cos';\\nimport {coshConfig} from './kernels/Cosh';\\nimport {cropAndResizeConfig} from
  './kernels/CropAndResize';\\nimport {cumsumConfig} from './kernels/Cumsum';\\nimport {depthToSpaceConfig}
  from './kernels/DepthToSpace';\\nimport {depthwiseConv2dNativeConfig} from

```



```

./kernels/DepthwiseConv2dNative';\nimport {eluConfig} from './kernels/Elu';\nimport {equalConfig} from
./kernels/Equal';\nimport {expConfig} from './kernels/Exp';\nimport {expandDimsConfig} from
./kernels/ExpandDims';\nimport {fillConfig} from './kernels/Fill';\nimport {flipLeftRightConfig} from
./kernels/FlipLeftRight';\nimport {floorConfig} from './kernels/Floor';\nimport {floorDivConfig} from
./kernels/FloorDiv';\nimport
{fusedBatchNormConfig} from './kernels/FusedBatchNorm';\nimport {fusedConv2DConfig} from
./kernels/FusedConv2D';\nimport {fusedDepthwiseConv2DConfig} from
./kernels/FusedDepthwiseConv2D';\nimport {gatherNdConfig} from './kernels/GatherNd';\nimport
{gatherV2Config} from './kernels/GatherV2';\nimport {greaterConfig} from './kernels/Greater';\nimport
{greaterEqualConfig} from './kernels/GreaterEqual';\nimport {identityConfig} from './kernels/Identity';\nimport
{leakyReluConfig} from './kernels/LeakyRelu';\nimport {lessConfig} from './kernels/Less';\nimport
{lessEqualConfig} from './kernels/LessEqual';\nimport {logConfig} from './kernels/Log';\nimport
{logicalAndConfig} from './kernels/LogicalAnd';\nimport {maxConfig} from './kernels/Max';\nimport
{maximumConfig} from './kernels/Maximum';\nimport {maxPoolConfig} from './kernels/MaxPool';\nimport
{meanConfig} from './kernels/Mean';\nimport {minConfig} from './kernels/Min';\nimport {minimumConfig} from
./kernels/Minimum';\nimport
{mirrorPadConfig} from './kernels/MirrorPad';\nimport {multiplyConfig} from './kernels/Multiply';\nimport
{negConfig} from './kernels/Neg';\nimport {nonMaxSuppressionV3Config} from
./kernels/NonMaxSuppressionV3';\nimport {nonMaxSuppressionV4Config} from
./kernels/NonMaxSuppressionV4';\nimport {nonMaxSuppressionV5Config} from
./kernels/NonMaxSuppressionV5';\nimport {notEqualConfig} from './kernels/NotEqual';\nimport {oneHotConfig}
from './kernels/OneHot';\nimport {onesLikeConfig} from './kernels/OnesLike';\nimport {packConfig} from
./kernels/Pack';\nimport {padV2Config} from './kernels/PadV2';\nimport {powConfig} from
./kernels/Pow';\nimport {preluConfig} from './kernels/Prelu';\nimport {prodConfig} from './kernels/Prod';\nimport
{rangeConfig} from './kernels/Range';\nimport {realDivConfig} from './kernels/RealDiv';\nimport {reluConfig}
from './kernels/Relu';\nimport {relu6Config} from './kernels/Relu6';\nimport {reshapeConfig} from
./kernels/Reshape';\nimport {resizeBilinearConfig}
from './kernels/ResizeBilinear';\nimport {reverseConfig} from './kernels/Reverse';\nimport
{rotateWithOffsetConfig} from './kernels/RotateWithOffset';\nimport {roundConfig} from
./kernels/Round';\nimport {rsqrtConfig} from './kernels/Rsqrt';\nimport {scatterNdConfig} from
./kernels/ScatterNd';\nimport {selectConfig} from './kernels/Select';\nimport {sigmoidConfig} from
./kernels/Sigmoid';\nimport {sinConfig} from './kernels/Sin';\nimport {sliceConfig} from './kernels/Slice';\nimport
{softmaxConfig} from './kernels/Softmax';\nimport {spaceToBatchNDConfig} from
./kernels/SpaceToBatchND';\nimport {splitVConfig} from './kernels/SplitV';\nimport {sqrtConfig} from
./kernels/Sqrt';\nimport {squareConfig} from './kernels/Square';\nimport {squaredDifferenceConfig} from
./kernels/SquaredDifference';\nimport {stepConfig} from './kernels/Step';\nimport {stridedSliceConfig} from
./kernels/StridedSlice';\nimport {subConfig} from './kernels/Sub';\nimport {sumConfig} from
./kernels/Sum';\nimport
{tanConfig} from './kernels/Tan';\nimport {tanhConfig} from './kernels/Tanh';\nimport {tileConfig} from
./kernels/Tile';\nimport {topKConfig} from './kernels/TopK';\nimport {transformConfig} from
./kernels/Transform';\nimport {transposeConfig} from './kernels/Transpose';\nimport {unpackConfig} from
./kernels/Unpack';\nimport {zerosLikeConfig} from './kernels/ZerosLike';\n\n// List all kernel configs here\nconst
kernelConfigs: KernelConfig[] = [\n  absConfig,\n  addConfig,\n  addNConfig,\n  allConfig,\n  anyConfig,\n  argMaxConfig,\n  avgPoolConfig,\n  batchMatMulConfig,\n  batchToSpaceNDConfig,\n  castConfig,\n  ceilConfig,\n  clipByValueConfig,\n  concatConfig,\n  conv2DConfig,\n  conv2DBackpropInputConfig,\n  cosConfig,\n  coshConfig,\n  cropAndResizeConfig,\n  cumsumConfig,\n  depthToSpaceConfig,\n  depthwiseConv2dNativeConfig,\n  eluConfig,\n  equalConfig,\n  expConfig,\n  expandDimsConfig,\n  fillConfig,\n  flipLeftRightConfig,\n  floorConfig,\n  floorDivConfig,\n  fusedMatMulConfig,\n

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    fusedBatchNormConfig,\n fusedConv2DConfig,\n fusedDepthwiseConv2DConfig,\n gatherNdConfig,\n
gatherV2Config,\n greaterConfig,\n greaterEqualConfig,\n identityConfig,\n leakyReluConfig,\n lessConfig,\n
lessEqualConfig,\n logConfig,\n logicalAndConfig,\n maxConfig,\n maximumConfig,\n maxPoolConfig,\n
meanConfig,\n minConfig,\n minimumConfig,\n mirrorPadConfig,\n multiplyConfig,\n negConfig,\n
nonMaxSuppressionV3Config,\n nonMaxSuppressionV4Config,\n nonMaxSuppressionV5Config,\n
notEqualConfig,\n oneHotConfig,\n onesLikeConfig,\n packConfig,\n padV2Config,\n powConfig,\n
preluConfig,\n prodConfig,\n rangeConfig,\n realDivConfig,\n reluConfig,\n relu6Config,\n reshapeConfig,\n
resizeBilinearConfig,\n reverseConfig,\n rotateWithOffsetConfig,\n rsqrtConfig,\n roundConfig,\n
scatterNdConfig,\n selectConfig,\n sigmoidConfig,\n sinConfig,\n sliceConfig,\n softmaxConfig,\n
spaceToBatchNDConfig,\n splitVConfig,\n sqrtConfig,\n
squareConfig,\n squaredDifferenceConfig,\n stepConfig,\n stridedSliceConfig,\n subConfig,\n sumConfig,\n
tanConfig,\n tanhConfig,\n tileConfig,\n topKConfig,\n transformConfig,\n transposeConfig,\n unpackConfig,\n
zerosLikeConfig\n];\n\nfor (const kernelConfig of kernelConfigs) {\n  registerKernel(kernelConfig);\n}\n", "/*\n *
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {env} from '@tensorflow/tfjs-core';\n\nconst ENV = env();\n\n/**\n * True if SIMD is supported.\n
*\n// From: https://github.com/GoogleChromeLabs/wasm-feature-detect\nENV.registerFlag(\n // This typed array
passed in to WebAssembly.validate is WebAssembly binary\n // code. In this case it is a small program that
contains SIMD\n // instructions.\n 'WASM_HAS_SIMD_SUPPORT', async () => WebAssembly.validate(new
Uint8Array([\n 0, 97, 115, 109, 1, 0, 0, 0, 1, 4, 1, 96, 0, 0, 3,\n 2, 1, 0, 10, 9, 1, 7, 0, 65, 0, 253, 15, 26,
11\n ]));\n\n/**\n * True if threads are supported.\n *\n// From: https://github.com/GoogleChromeLabs/wasm-
feature-detect\nENV.registerFlag('WASM_HAS_MULTITHREAD_SUPPORT', async () => {\n //
TODO(annxingyuan): Enable node support once this is resolved:\n //
https://github.com/tensorflow/tfjs/issues/3830\n if (ENV.get('IS_NODE')) {\n  return false;\n }\n\n try {\n
  // Test for transferability of SABs (needed for Firefox)\n //
https://groups.google.com/forum/#!msg/mozilla.dev.platform/IHkBZIHETpA/dwsMNchWEQAJ\n new
MessageChannel().port1.postMessage(new SharedArrayBuffer(1));\n // This typed array is a WebAssembly
program containing threaded\n // instructions.\n  return WebAssembly.validate(new Uint8Array([\n 0, 97,
115, 109, 1, 0, 0, 0, 1, 4, 1, 96, 0, 0, 3, 2, 1, 0, 5,\n 4, 1, 3, 1, 1, 10, 11, 1, 9, 0, 65, 0, 254, 16, 2, 0, 26,
11\n ]));\n } catch (e) {\n  return false;\n }\n});\n", "\nvar WasmBackendModuleThreadedSimd = (function() {\n
var _scriptDir = typeof document !== 'undefined' && document.currentScript ? document.currentScript.src :
undefined;\n if (typeof __filename !== 'undefined') _scriptDir = _scriptDir || __filename;\n return
(function(WasmBackendModuleThreadedSimd) {\n  WasmBackendModuleThreadedSimd =
WasmBackendModuleThreadedSimd || {};\n\nfunction
GROWABLE_HEAP_I8(){if(wasmMemory.buffer!==buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}
return
HEAP8}function
GROWABLE_HEAP_U8(){if(wasmMemory.buffer!==buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}
return HEAPU8}function
GROWABLE_HEAP_I32(){if(wasmMemory.buffer!==buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}
return HEAP32}function
GROWABLE_HEAP_U32(){if(wasmMemory.buffer!==buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}
return HEAPU32}function

```

```

GROWABLE_HEAP_F64(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer
)}return HEAPF64}var Module=typeof
WasmBackendModuleThreadedSimd!="undefined"?WasmBackendModuleThreadedSimd:{};var
readyPromiseResolve,readyPromiseReject;Module["ready"]=new
Promise(function(resolve,reject){readyPromiseResolve=resolve;readyPromiseReject=reject});var
moduleOverrides={};var key;for(key in
Module){if(Module.hasOwnProperty(key)){moduleOverrides[key]=Module[key]}}var arguments_=[];var
thisProgram=("./this.program");var quit_=function(status,toThrow){throw
toThrow};var ENVIRONMENT_IS_WEB=false;var ENVIRONMENT_IS_WORKER=false;var
ENVIRONMENT_IS_NODE=false;var ENVIRONMENT_IS_SHELL=false;ENVIRONMENT_IS_WEB=typeof
window==="object";ENVIRONMENT_IS_WORKER=typeof
importScripts==="function";ENVIRONMENT_IS_NODE=typeof process==="object"&&typeof
process.versions==="object"&&typeof
process.versions.node==="string";ENVIRONMENT_IS_SHELL=!ENVIRONMENT_IS_WEB&&!ENVIRONM
ENT_IS_NODE&&!ENVIRONMENT_IS_WORKER;var
ENVIRONMENT_IS_PTHREAD=Module["ENVIRONMENT_IS_PTHREAD"]||false;if(ENVIRONMENT_IS_P
THREAD){buffer=Module["buffer"];var scriptDirectory="";function
locateFile(path){if(Module["locateFile"]){return Module["locateFile"](path,scriptDirectory)}return
scriptDirectory+path}var read_,readAsync,readBinary,setWindowTitle;var nodeFS;var
nodePath;if(ENVIRONMENT_IS_NODE){if(ENVIRONMENT_IS_WORKER){scriptDirectory=require("path").
dirname(scriptDirectory)+"^"}else{scriptDirectory=__dirname+"^"}read_=function
shell_read(filename,binary){if(!nodeFS)nodeFS=require("fs");if(!nodePath)nodePath=require("path");filename=n
odePath["normalize"](filename);return
nodeFS["readFileSync"](filename,binary?null:"utf8");}readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret};if(process["argv"].length>1){thisProgram=process["argv"][1].replace(/\\/g,"^")}arguments_=process["arg
v"].slice(2);process["on"]("uncaughtException",function(ex){if(!(ex instanceof ExitStatus)){throw
ex}});process["on"]("unhandledRejection",abort);quit_=function(status){process["exit"](status)};Module["insp
ect"]=function(){return"[Emscripten Module object]"};var
nodeWorkerThreads;try{nodeWorkerThreads=require("worker_threads")}catch(e){console.error("The
\"worker_threads\" module is not supported in this node.js build - perhaps a newer version is needed?");throw
e}global.Worker=nodeWorkerThreads.Worker}else if(ENVIRONMENT_IS_SHELL){if(typeof
read!="undefined"){read_=function shell_read(f){return read(f)}}readBinary=function readBinary(f){var
data;if(typeof readbuffer==="function"){return new
Uint8Array(readbuffer(f))}data=read(f,"binary");assert(typeof data==="object");return data};if(typeof
scriptArgs!="undefined"){arguments_=scriptArgs}else if(typeof
arguments!="undefined"){arguments_=arguments}if(typeof
quit==="function"){quit_=function(status){quit(status)}}if(typeof print!="undefined"){if(typeof
console==="undefined")console={};console.log=print;console.warn=console.error=typeof
printErr!="undefined"?printErr:print}else
if(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER){if(ENVIRONMENT_IS_WORKER){scriptDire
ctory=self.location.href}else if(typeof
document!="undefined"&&document.currentScript){scriptDirectory=document.currentScript.src}if(typeof
_scriptDir !=="undefined" &&
_scriptDir){scriptDirectory=_scriptDir}if(scriptDirectory.indexOf("blob:")!==0){scriptDirectory=scriptDirectory.s
ubstr(0,scriptDirectory.lastIndexOf("^")+1)}else{scriptDirectory=""}if(ENVIRONMENT_IS_NODE){read_=fun
ction

```

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shell_read(filename,binary){if(!nodeFS)nodeFS=require("\fs\");if(!nodePath)nodePath=require("\path\");filename=normalizePath(normalize\)(filename);return
nodeFS[\readFileSync\](filename,binary?null:\utf8\);readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret}}else{read_=function(url){var xhr=new XMLHttpRequest;xhr.open(\GET",url,false);xhr.send(null);return
xhr.responseText};if(ENVIRONMENT_IS_WORKER){readBinary=function(url){var xhr=new
XMLHttpRequest;xhr.open(\GET",url,false);xhr.responseType="arraybuffer";xhr.send(null);return new
Uint8Array(xhr.response)}}readAsync=function(url,onload,onerror){var xhr=new
XMLHttpRequest;xhr.open(\GET",url,true);xhr.responseType="arraybuffer";xhr.onload=function(){if(xhr.status
==200||xhr.status==0&&xhr.response){onload(xhr.response);return}onerror();}xhr.onerror=onerror;xhr.send(null)}
}setWindowTitle=function(title){document.title=title}else{if(ENVIRONMENT_IS_NODE){if(typeof
performance===\undefined\){global.performance=require("\perf_hooks\").performance}}var
out=Module[\print\]||console.log.bind(console);var err=Module[\printErr\]||console.warn.bind(console);for(key
in
moduleOverrides){if(moduleOverrides.hasOwnProperty(key)){Module[key]=moduleOverrides[key]}}moduleOverr
ides=null;if(Module[\arguments\])arguments_=Module[\arguments\];if(Module[\thisProgram\])thisProgram=
Module[\thisProgram\];if(Module[\quit\])quit_=Module[\quit\];function
warnOnce(text){if(!warnOnce.shown)warnOnce.shown={};if(!warnOnce.shown[text]){warnOnce.shown[text]=1;er
r(text)}}var Atomics_load=Atomics.load;var Atomics_store=Atomics.store;var
Atomics_compareExchange=Atomics.compareExchange;var
wasmBinary;if(Module[\wasmBinary\])wasmBinary=Module[\wasmBinary\];var
noExitRuntime=Module[\noExitRuntime\]||true;if(typeof WebAssembly!=="object\"){abort(\no
native wasm support detected\)}var wasmMemory;var wasmModule;var ABORT=false;var
EXITSTATUS;function assert(condition,text){if(!condition){abort("Assertion failed: \"+text)}}function
getCFunc(ident){var func=Module[\_"+ident];assert(func,\Cannot call unknown function \"+ident+", make sure
it is exported");return func}function ccall(ident,returnType,argTypes,args,opts){var
toC={\string\":function(str){var ret=0;if(str===null&&str===undefined&&str===0){var
len=(str.length<<2)+1;ret=stackAlloc(len);stringToUTF8(str,ret,len)}return ret},\array\":function(arr){var
ret=stackAlloc(arr.length);writeArrayToMemory(arr,ret);return ret}};function
convertReturnValue(ret){if(returnType===\string\)return UTF8ToString(ret);if(returnType===\boolean\)return
Boolean(ret);return ret}var func=getCFunc(ident);var cArgs=[];var stack=0;if(args){for(var
i=0;i<args.length;i++){var
converter=toC[argTypes[i]];if(converter){if(stack===0)stack=stackSave();cArgs[i]=converter(args[i])}else{cArgs[i
]=args[i]}}var
ret=func.apply(null,cArgs);ret=convertReturnValue(ret);if(stack!==0)stackRestore(stack);return ret}function
cwrap(ident,returnType,argTypes,opts){argTypes=argTypes||[];var
numericArgs=argTypes.every(function(type){return type===\number\});var
numericRet=returnType!=="string";if(numericRet&&numericArgs&&!opts){return getCFunc(ident)}return
function(){return ccall(ident,returnType,argTypes,arguments,opts)}}function
UTF8ArrayToString(heap,idx,maxBytesToRead){var endIdx=idx+maxBytesToRead;var
str="";while(!(idx>=endIdx)){var u0=heap[idx++];if(!u0)return
str;if(!(u0&128)){str+=String.fromCharCode(u0);continue}var
u1=heap[idx++]&63;if((u0&224)===192){str+=String.fromCharCode((u0&31)<<6|u1);continue}var
u2=heap[idx++]&63;if((u0&240)===224){u0=(u0&15)<<12|u1<<6|u2}else{u0=(u0&7)<<18|u1<<12|u2<<6|heap[id
x++]&63}if(u0<65536){str+=String.fromCharCode(u0)}else{var ch=u0-
65536;str+=String.fromCharCode(55296|ch>>10,56320|ch&1023)}}return str}function
UTF8ToString(ptr,maxBytesToRead){return

```

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ptr?UTF8ArrayToString(GROWABLE_HEAP_U8(),ptr,maxBytesToRead):\")function
stringToUTF8Array(str,heap,outIdx,maxBytesToWrite){if(!(maxBytesToWrite>0))return 0;var startIdx=outIdx;var
endIdx=outIdx+maxBytesToWrite-1;for(var i=0;i<str.length;++i){var
u=str.charCodeAtAt(i);if(u>=55296&&u<=57343){var
u1=str.charCodeAtAt(++i);u=65536+((u&1023)<<10)|u1&1023}if(u<=127){if(outIdx>=endIdx)break;heap[outIdx++]
=u}else if(u<=2047){if(outIdx+1>=endIdx)break;heap[outIdx++]=192|u>>6;heap[outIdx++]=128|u&63}else
if(u<=65535){if(outIdx+2>=endIdx)break;heap[outIdx++]=224|u>>12;heap[outIdx++]=128|u>>6&&63;heap[outIdx
++]=128|u&63}else{if(outIdx+3>=endIdx)break;heap[outIdx++]=240|u>>18;heap[outIdx++]=128|u>>12&&63;heap[
outIdx++]=128|u>>6&&63;heap[outIdx++]=128|u&63}}heap[outIdx]=0;return outIdx-startIdx}function
stringToUTF8(str,outPtr,maxBytesToWrite){return
stringToUTF8Array(str,GROWABLE_HEAP_U8(),outPtr,maxBytesToWrite)}function lengthBytesUTF8(str){var
len=0;for(var i=0;i<str.length;++i){var
u=str.charCodeAtAt(i);if(u>=55296&&u<=57343)u=65536+((u&1023)<<10)|str.charCodeAtAt(++i)&1023;if(u<=127)+
+len;else if(u<=2047)len+=2;else if(u<=65535)len+=3;else len+=4}return len}function
writeArrayToMemory(array,buffer){GROWABLE_HEAP_I8().set(array,buffer)}function
alignUp(x,multiple){if(x%multiple>0){x+=multiple-x%multiple}return x}var
buffer,HEAP8,HEAPU8,HEAP16,HEAPU16,HEAP32,HEAPU32,HEAPF32,HEAPF64;function
updateGlobalBufferAndViews(buf){buffer=buf;Module["HEAP8"]=HEAP8=new
Int8Array(buf);Module["HEAP16"]=HEAP16=new Int16Array(buf);Module["HEAP32"]=HEAP32=new
Int32Array(buf);Module["HEAPU8"]=HEAPU8=new Uint8Array(buf);Module["HEAPU16"]=HEAPU16=new
Uint16Array(buf);Module["HEAPU32"]=HEAPU32=new
Uint32Array(buf);Module["HEAPF32"]=HEAPF32=new
Float32Array(buf);Module["HEAPF64"]=HEAPF64=new Float64Array(buf)}var
INITIAL_MEMORY=Module["INITIAL_MEMORY"]||16777216;if(ENVIRONMENT_IS_PTHREAD){wasmM
emory=Module["wasmMemory"];buffer=Module["buffer"]}else{if(Module["wasmMemory"]){wasmMemory=
Module["wasmMemory"]}else{wasmMemory=new
WebAssembly.Memory({"initial":INITIAL_MEMORY/65536,"maximum":2147483648/65536,"shared":true});
if(!(wasmMemory.buffer instanceof SharedArrayBuffer)){err("requested a shared WebAssembly.Memory but the
returned buffer is not a SharedArrayBuffer, indicating that while the browser has SharedArrayBuffer it does not
have WebAssembly threads support - you may need to set a
flag");if(ENVIRONMENT_IS_NODE){console.log("(on node you may need: --experimental-wasm-threads --
experimental-wasm-bulk-memory and also use a recent version)")}throw Error("bad
memory")}}if(wasmMemory){buffer=wasmMemory.buffer}INITIAL_MEMORY=buffer.byteLength;updateGlob
alBufferAndViews(buffer);var wasmTable;var __ATPRERUN__=[];var __ATINIT__=[];var __ATMAIN__=[];var
__ATEXIT__=[];var __ATPOSTRUN__=[];var runtimeInitialized=false;var
runtimeExited=false;if(!ENVIRONMENT_IS_PTHREAD)__ATINIT__.push({func:function(){__wasm_call_ctor
s()}});function
preRun(){if(ENVIRONMENT_IS_PTHREAD)return;if(Module["preRun"]){if(typeof
Module["preRun"]=="function")Module["preRun"]=[Module["preRun"]];while(Module["preRun"].length){a
ddOnPreRun(Module["preRun"].shift())}callRuntimeCallbacks(__ATPRERUN__)}function
initRuntime(){runtimeInitialized=true;if(ENVIRONMENT_IS_PTHREAD)return;callRuntimeCallbacks(__ATINIT
__)}function
preMain(){if(ENVIRONMENT_IS_PTHREAD)return;callRuntimeCallbacks(__ATMAIN__)}function
exitRuntime(){if(ENVIRONMENT_IS_PTHREAD)return;runtimeExited=true}function
postRun(){if(ENVIRONMENT_IS_PTHREAD)return;if(Module["postRun"]){if(typeof
Module["postRun"]=="function")Module["postRun"]=[Module["postRun"]];while(Module["postRun"].lengt
h){addOnPostRun(Module["postRun"].shift())}callRuntimeCallbacks(__ATPOSTRUN__)}function
addOnPreRun(cb){__ATPRERUN__.unshift(cb)}function addOnPostRun(cb){__ATPOSTRUN__.unshift(cb)}var

```

```

runDependencies=0;var runDependencyWatcher=null;var dependenciesFulfilled=null;function
  addRunDependency(id){assert(!ENVIRONMENT_IS_PTHREAD,\'addRunDependency cannot be used in a
pthread
worker\');runDependencies++;if(Module[\'"monitorRunDependencies"\']){Module[\'"monitorRunDependencies"\'](ru
nDependencies)}}function removeRunDependency(id){runDependencies--
;if(Module[\'"monitorRunDependencies"\']){Module[\'"monitorRunDependencies"\'](runDependencies)}if(runDepend
encies==0){if(runDependencyWatcher!=null){clearInterval(runDependencyWatcher);runDependencyWatcher=null}
}if(dependenciesFulfilled){var
callback=dependenciesFulfilled;dependenciesFulfilled=null;callback()}}Module[\'"preloadedImages"\']={};Module
[\'"preloadedAudios"\']={};function
abort(what){if(Module[\'"onAbort"\']){Module[\'"onAbort"\'](what)}if(ENVIRONMENT_IS_PTHREAD)console.err
or(\'"Pthread aborting at \'+(new
Error).stack);what+=\'"\';err(what);ABORT=true;EXITSTATUS=1;what=\'"abort(\'"+what+\'"'. Build with -s
ASSERTIONS=1 for more info.\';var e=new WebAssembly.RuntimeError(what);readyPromiseReject(e);throw
e}function hasPrefix(str,prefix){return
String.prototype.startsWith?str.startsWith(prefix):str.indexOf(prefix)===0}var
dataURIPrefix=\'"data:application/octet-stream;base64,\';function isDataURI(filename){return
hasPrefix(filename,dataURIPrefix)}var fileURIPrefix=\'"file:/\';function isFileURI(filename){return
hasPrefix(filename,fileURIPrefix)}var wasmBinaryFile=\'"tfjs-backend-wasm-threaded-
simd.wasm"\';if(!isDataURI(wasmBinaryFile)){wasmBinaryFile=locateFile(wasmBinaryFile)}function
getBinary(file){try{if(file===wasmBinaryFile&&wasmBinary){return new
Uint8Array(wasmBinary)}if(readBinary){return readBinary(file)}else{throw\'"both async and sync fetching of the
wasm failed"\'}}catch(err){abort(err)}}function
getBinaryPromise(){if(!wasmBinary&&(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER)){if(typeof
fetch===\'"function"\''&&!isFileURI(wasmBinaryFile)){return fetch(wasmBinaryFile,{credentials:\'"same-
origin"\'}).then(function(response){if(!response[\'"ok"\']){throw\'"failed to load wasm binary file at
\'"+wasmBinaryFile+\'"\'}return
response[\'"arrayBuffer"\']()).catch(function(){return getBinary(wasmBinaryFile)}})}else{if(readAsync){return new
Promise(function(resolve,reject){readAsync(wasmBinaryFile,function(response){resolve(new
Uint8Array(response)),reject}))})}return Promise.resolve().then(function(){return
getBinary(wasmBinaryFile)})}function createWasm(){var info={\'"a"\':asmLibraryArg};function
receiveInstance(instance,module){var
exports=instance.exports;Module[\'"asm"\']=exports;wasmTable=Module[\'"asm"\']["I"];wasmModule=module;if(!E
NVIRONMENT_IS_PTHREAD){var
numWorkersToLoad=PThread.unusedWorkers.length;PThread.unusedWorkers.forEach(function(w){PThread.load
WasmModuleToWorker(w,function(){if(--numWorkersToLoad)removeRunDependency(\'"wasm-
instantiate"\')})})}if(!ENVIRONMENT_IS_PTHREAD){addRunDependency(\'"wasm-instantiate"\')}function
receiveInstantiatedSource(output){receiveInstance(output[\'"instance"\'],output[\'"module"\'])}function
instantiateArrayBuffer(receiver){return getBinaryPromise().then(function(binary){return
WebAssembly.instantiate(binary,info)).then(receiver,function(reason){err(\'"failed to asynchronously prepare
wasm: \'"+reason);abort(reason)})}function instantiateAsync(){if(!wasmBinary&&typeof
WebAssembly.instantiateStreaming===\'"function"\''&&!isDataURI(wasmBinaryFile)&&!isFileURI(wasmBinaryFil
e)&&typeof fetch===\'"function"\')}{return fetch(wasmBinaryFile,{credentials:\'"same-
origin"\'}).then(function(response){var result=WebAssembly.instantiateStreaming(response,info);return
result.then(receiveInstantiatedSource,function(reason){err(\'"wasm streaming compile failed: \'"+reason);err(\'"falling
back to ArrayBuffer instantiation"\');return instantiateArrayBuffer(receiveInstantiatedSource)}))}else{return
instantiateArrayBuffer(receiveInstantiatedSource)}if(Module[\'"instantiateWasm"\']){try{var
exports=Module[\'"instantiateWasm"\'](info,receiveInstance);return exports}catch(e){err(\'"Module.instantiateWasm

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callback failed with error: \"+e);return false }} instantiateAsync().catch(readyPromiseReject);return{ }} var
ASM_CONSTS={10520:function(){throw\"Canceled!\"},10538:function($0,$1){setTimeout(function(){__emscript
en_do_dispatch_to_thread($0,$1),0)}};function initPthreadsJS(){PThread.initRuntime()}function
callRuntimeCallbacks(callbacks){while(callbacks.length>0){var callback=callbacks.shift();if(typeof
callback===\"function\"){callback(Module);continue}var func=callback.func;if(typeof
func===\"number\"){if(callback.arg===undefined){wasmTable.get(func)}else{wasmTable.get(func)(callback.arg)
}}else{func(callback.arg===undefined?null:callback.arg)}}}var
ERRNO_CODES={EPERM:63,ENOENT:44,ESRCH:71,EINTR:27,EIO:29,ENXIO:60,E2BIG:1,ENOEXEC:45,E
BADF:8,ECHILD:12,EAGAIN:6,EWOULDBLOCK:6,ENOMEM:48,EACCES:2,EFAULT:21,ENOTBLK:105,EB
USY:10,EEXIST:20,EXDEV:75,ENODEV:43,ENODIR:54,EISDIR:31,EINVAL:28,ENFILE:41,EMFILE:33,EN
OTTY:59,ETXTBSY:74,EFBIG:22,ENOSPC:51,ESPIPE:70,EROFS:69,EMLINK:34,EPIPE:64,EDOM:18,ERAN
GE:68,ENOMSG:49,EIDRM:24,ECHRNG:106,EL2NSYNC:156,EL3HLT:107,EL3RST:108,ELNRNG:109,EUNA
TCH:110,ENOC SI:111,EL2HLT:112,EDEADLK:16,ENOLCK:46,EBADE:113,EBADR:114,EXFULL:115,ENO A
NO:104,EBADRQC:103,EBADSLT:102,EDEADLOCK:16,EBFONT:101,ENOSTR:100,ENODATA:116,ETIME:
117,ENOSR:118,ENONET:119,ENOPKG:120,EREMOTE:121,ENOLINK:47,EADV:122,ESRMNT:123,ECOMM
:124,EPROTO:65,EMULTIHOP:36,EDOTDOT:125,EBADMSG:9,ENOTUNIQ:126,EBADFD:127,EREMCHG:1
28,ELIBACC:129,ELIBBAD:130,ELIBSCN:131,ELIBMAX:132,ELIBEXEC:133,ENOSYS:52,ENOTEMPTY:55,
ENAMETOOLONG:37,ELOOP:32,EOPNOTSUPP:138,EPFNOSUPPORT:139,ECONNRESET:15,ENOBUFS:42,
EAFNOSUPPORT:5,EPROTOTYPE:67,ENOTSOCK:57,ENOPROTOOPT:50,ESHUTDOWN:140,ECONNREFU
SED:14,EADDRINUSE:3,ECONNABORTED:13,ENETUNREACH:40,ENETDOWN:38,ETIMEDOUT:73,EHOS
TDOWN:142,EHOSTUNREACH:23,EINPROGRESS:26,EALREADY:7,EDESTADDRREQ:17,EMSGSIZE:35,E
PROTONOSUPPORT:66,ESOCKTNOSUPPORT:137,EADDRNOTAVAIL:4,ENETRESET:39,EISCONN:30,EN
OTCONN:53,ETOOMANYREFS:141,EUSERS:136,EDQUOT:19,ESTALE:72,ENOTSUP:138,ENOMEDIUM:14
8,EILSEQ:25,E_OVERFLOW:61,ECANCELED:11,ENOTRECOVERABLE:56,EOWNERDEAD:62,ESTRPIPE:13
5};function
__emscripten_futex_wake(addr,count){if(addr<=0||addr>GROWABLE_HEAP_I8().length||addr&3!=0||count<0)retu
rn-28;if(count==0)return 0;if(count>=2147483647)count=Infinity;var
mainThreadWaitAddress=Atomics.load(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2);var
mainThreadWoken=0;if(mainThreadWaitAddress==addr){var
loadedAddr=Atomics.compareExchange(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2,mainTh
readWaitAddress,0);if(loadedAddr==mainThreadWaitAddress){--count;mainThreadWoken=1;if(count<=0)return
1}}var ret=Atomics.notify(GROWABLE_HEAP_I32(),addr>>2,count);if(ret>=0)return
ret+mainThreadWoken;throw\"Atomics.notify returned an unexpected value
\"+ret}Module[\"_emscripten_futex_wake\"]=_emscripten_futex_wake;function
killThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw\"Internal Error! killThread() can only ever be
called from main application thread!\";if(!pthread_ptr)throw\"Internal Error! Null pthread_ptr in
killThread!\";GROWABLE_HEAP_I32()[pthread_ptr+12>>2]=0;var
pthread=PThread.pthreads[pthread_ptr];pthread.worker.terminate();PThread.freeThreadData(pthread);PThread.runni
ngWorkers.splice(PThread.runningWorkers.indexOf(pthread.worker),1);pthread.worker pthread=undefined}functio
n cancelThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw\"Internal Error! cancelThread() can only
ever be called from main application thread!\";if(!pthread_ptr)throw\"Internal Error! Null pthread_ptr in
cancelThread!\";var
pthread=PThread.pthreads[pthread_ptr];pthread.worker.postMessage({\"cmd\": \"cancel\"})}function
cleanupThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw\"Internal Error! cleanupThread() can only
ever be called from main application thread!\";if(!pthread_ptr)throw\"Internal Error! Null pthread_ptr in
cleanupThread!\";var
pthread=PThread.pthreads[pthread_ptr];if(pthread){GROWABLE_HEAP_I32()[pthread_ptr+12>>2]=0;var
worker=pthread.worker;PThread.returnWorkerToPool(worker)}}}var

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PThread={unusedWorkers:[],runningWorkers:[],initMainThreadBlock:function(){var
pthreadPoolSize=8;for(var
i=0;i<pthreadPoolSize;++i){PThread.allocateUnusedWorker()}},initRuntime:function(){var
tb=_malloc(228);for(var
i=0;i<228/4;++i)GROWABLE_HEAP_U32()[tb/4+i]=0;GROWABLE_HEAP_I32()[tb+12>>2]=tb;var
headPtr=tb+152;GROWABLE_HEAP_I32()[headPtr>>2]=headPtr;var tlsMemory=_malloc(512);for(var
i=0;i<128;++i)GROWABLE_HEAP_U32()[tlsMemory/4+i]=0;Atomics.store(GROWABLE_HEAP_U32(),tb+100
>>2,tlsMemory);Atomics.store(GROWABLE_HEAP_U32(),tb+40>>2,tb);__emscripten_thread_init(tb,1,ENVIRON
MENT_IS_WORKER,1);__emscripten_register_main_browser_thread_id(tb)},initWorker:function(){},pthreads:{},t
hreadExitHandlers:[],setThreadStatus:function(){},runExitHandlers:function(){while(PThread.threadExitHandlers.l
ength>0){PThread.threadExitHandlers.pop()}if(ENVIRONMENT_IS_PTHREAD&&_pthread_self())__pthread
_tsd_run_dtors(),runExitHandlersAndDeinitThread:function(tb,exitCode){Atomics.store(GROWABLE_HEAP_U
32(),tb+56>>2,1);Atomics.store(GROWABLE_HEAP_U32(),tb+60>>2,0);PThread.runExitHandlers();Atomics.stor
e(GROWABLE_HEAP_U32(),tb+4>>2,exitCode);Atomics.store(GROWABLE_HEAP_U32(),tb+0>>2,1);_emscri
pten_futex_wake(tb+0,2147483647);__emscripten_thread_init(0,0,0)},threadExit:function(exitCode){var
tb=_pthread_self();if(tb){PThread.runExitHandlersAndDeinitThread(tb,exitCode);if(ENVIRONMENT_IS_PTHRE
AD){postMessage({"cmd\\":\\"exit\\"})}},threadCancel:function(){PThread.runExitHandlersAndDeinitThread(_pthr
ead_self(),-1);postMessage({"cmd\\":\\"cancelDone\\"})},terminateAllThreads:function(){for(var t in
PThread.pthreads){var
pthread=PThread.pthreads[t];if(pthread&&pthread.worker){PThread.returnWorkerToPool(pthread.worker)}PThre
ad.pthreads={};for(var i=0;i<PThread.unusedWorkers.length;++i){var
worker=PThread.unusedWorkers[i];worker.terminate()}PThread.unusedWorkers=[];for(var
i=0;i<PThread.runningWorkers.length;++i){var worker=PThread.runningWorkers[i];var
pthread=worker pthread;PThread.freeThreadData(pthread);worker.terminate()}PThread.runningWorkers=[]},freeTh
readData:function(pthread){if(!pthread)return;if(pthread.threadInfoStruct){var
tlsMemory=GROWABLE_HEAP_I32()[pthread.threadInfoStruct+100>>2];GROWABLE_HEAP_I32()[pthread.thr
eadInfoStruct+100>>2]=0;_free(tlsMemory);_free(pthread.threadInfoStruct)}pthread.threadInfoStruct=0;if(pthread.
allocatedOwnStack&&pthread.stackBase)_free(pthread.stackBase);pthread.stackBase=0;if(pthread.worker)pthread.
worker pthread=null},returnWorkerToPool:function(worker){PThread.runWithoutMainThreadQueuedCalls(funcio
n){delete
PThread.pthreads[worker pthread.threadInfoStruct];PThread.unusedWorkers.push(worker);PThread.runningWorker
s.splice(PThread.runningWorkers.indexOf(worker),1);PThread.freeThreadData(worker pthread);worker pthread=un
defined}},runWithoutMainThreadQueuedCalls:function(func){GROWABLE_HEAP_I32()[__emscripten_allow_m
ain_runtime_queued_calls>>2]=0;try{func()}finally{GROWABLE_HEAP_I32()[__emscripten_allow_main_runti
me_queued_calls>>2]=1}},receiveObjectTransfer:function(data){},loadWasmModuleToWorker:function(worker,o
nFinishedLoading){worker.onmessage=function(e){var
d=e[\\data\\"];var
cmd=d[\\cmd\\"];if(worker pthread)PThread.currentProxiedOperationCallerThread=worker pthread.threadInfoStruct;
if(d[\\targetThread\\"]&&d[\\targetThread\\"]!=_pthread_self()){var
thread=PThread.pthreads[d.targetThread];if(thread){thread.worker.postMessage(e.data,d[\\transferList\\"])
}else{console.error('Internal error! Worker sent a message \\'+cmd+'\\' to target pthread '+d[\\targetThread\\']+\\', but that
thread no longer
exists!')}PThread.currentProxiedOperationCallerThread=undefined;return}if(cmd===\\"processQueuedMainThread
Work\\"){__emscripten_main_thread_process_queued_calls()}else
if(cmd===\\"spawnThread\\"){spawnThread(e.data)}else
if(cmd===\\"cleanupThread\\"){cleanupThread(d[\\thread\\"])
}else
if(cmd===\\"killThread\\"){killThread(d[\\thread\\"])
}else
if(cmd===\\"cancelThread\\"){cancelThread(d[\\thread\\"])
}else

```



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if(cmd===\loaded\){ worker.loaded=true;if(onFinishedLoading)onFinishedLoading(worker);if(worker.runPthread)
{ worker.runPthread();delete
worker.runPthread } else if(cmd===\print\"){ out(\Thread \"+d[\\"threadId\"]+\": \"+d[\\"text\"]) } else
if(cmd===\printErr\"){ err(\Thread \"+d[\\"threadId\"]+\": \"+d[\\"text\"]) } else if(cmd===\alert\"){ alert(\Thread
\"+d[\\"threadId\"]+\": \"+d[\\"text\"]) } else if(cmd===\exit\"){ var
detached=worker.pthread&&Atomics.load(GROWABLE_HEAP_U32(),worker.pthread.threadInfoStruct+64>>2);if
(detached){ PThread.returnWorkerToPool(worker) } } else
if(cmd===\exitProcess\"){ try { exit(d[\\"returnCode\"]) } catch(e) { if(e instanceof ExitStatus) return; throw e } } else
if(cmd===\cancelDone\"){ PThread.returnWorkerToPool(worker) } else
if(cmd===\objectTransfer\"){ PThread.receiveObjectTransfer(e.data) } else
if(e.data.target===\setimmediate\"){ worker.postMessage(e.data) } else { err(\worker sent an unknown command
\"+cmd) } PThread.currentProxiedOperationCallerThread=undefined; worker.onerror=function(e) { err(\pthread sent
an error! \"+e.filename+\": \"+e.lineno+\":
\"+e.message) }; if(ENVIRONMENT_IS_NODE) { worker.on(\message\",function(data) { worker.onmessage({ data:d
ata }) }); worker.on(\error\",function(data) { worker.onerror(data) }); worker.on(\exit\",function(data) { }) } worker.post
Message({\"cmd\":\\"load\", \"urlOrBlob\":Module[\\"mainScriptUrlOrBlob\"]|_scriptDir,\\"wasmMemory\":wasmMe
memory,\\"wasmModule\":wasmModule }}, allocateUnusedWorker:function() { var
pthreadMainJs=locateFile(\\"tfjs-backend-wasm-threaded-simd.worker.js\"); PThread.unusedWorkers.push(new
Worker(pthreadMainJs)), getNewWorker:function() { if(PThread.unusedWorkers.length==0) { PThread.allocateUnus
edWorker(); PThread.loadWasmModuleToWorker(PThread.unusedWorkers[0]) } if(PThread.unusedWorkers.length>
0) return PThread.unusedWorkers.pop(); else return null }, busySpinWait:function(msecs) { var
t=performance.now()+msecs; while(performance.now()<t) { } }; function
establishStackSpace(stackTop,stackMax) { _emscripten_stack_set_limits(stackTop,stackMax); stackRestore(stackTop
)} Module[\\"establishStackSpace\"]=establishStackSpace; function getNoExitRuntime() { return
noExitRuntime } Module[\\"getNoExitRuntime\"]=getNoExitRuntime; function invokeEntryPoint(ptr, arg) { return
wasmTable.get(ptr)(arg) } Module[\\"invokeEntryPoint\"]=invokeEntryPoint; function
__assert_fail(condition,filename,line,func) { abort(\\"Assertion failed: \"+UTF8ToString(condition)+\", at:
\"+[filename?UTF8ToString(filename):\"unknown filename\",line,func?UTF8ToString(func):\"unknown
function\"]) } function __call_main(argc,argv) { var returnCode=_main(argc,argv) } var
_emscripten_get_now;if(ENVIRONMENT_IS_NODE) { _emscripten_get_now=function() { var
t=process[\\"hrtime\"]; return t[0]*1e3+t[1]/1e6 } } else
if(ENVIRONMENT_IS_PTHREAD) { _emscripten_get_now=function() { return performance.now()-
Module[\\"__performance_now_clock_drift\"]] } } else if(typeof
dateNow!=\"undefined\") { _emscripten_get_now=dateNow } else _emscripten_get_now=function() { return
performance.now() }; function setErrNo(value) { GROWABLE_HEAP_I32()[__errno_location()>>2]=value; return
value } function _atexit(func, arg) { if(ENVIRONMENT_IS_PTHREAD) return
_emscripten_proxy_to_main_thread_js(1,1,func, arg) } function
_emscripten_notify_thread_queue(targetThreadId,mainThreadId) { if(targetThreadId==mainThreadId) { postMessag
e({\"cmd\":\\"processQueuedMainThreadWork\"]) } } else
if(ENVIRONMENT_IS_PTHREAD) { postMessage({\"targetThread\":targetThreadId,\\"cmd\":\\"processThreadQueu
e\"]) } } else { var pthread=PThread.pthreads[targetThreadId]; var
worker=pthread&&pthread.worker; if(!worker) { return } worker.postMessage({\"cmd\":\\"processThreadQueue\"]) } } ret
urn 1 } function _abort() { abort() } function _emscripten_asm_const_int(code, sigPtr, argbuf) { var
args=readAsmConstArgs(sigPtr, argbuf); return ASM_CONSTS[code].apply(null, args) } function
_emscripten_conditional_set_current_thread_status(expectedStatus, newStatus) { } function
_emscripten_futex_wait(addr, val, timeout) { if(addr<=0 || addr>GROWABLE_HEAP_I8().length || addr&3!=0) return-
28; if(!ENVIRONMENT_IS_WEB) { var
ret=Atomics.wait(GROWABLE_HEAP_I32(), addr>>2, val, timeout); if(ret===\\"timed-out\") return-

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73;if(ret===\"not-equal\")return-6;if(ret===\"ok\")return
0;throw\"Atoms.wait returned an unexpected value
\'+ret}else{if(Atoms.load(GROWABLE_HEAP_I32(),addr>>2)!=val){return-6}var
tNow=performance.now();var tEnd=tNow+timeout;var
lastAddr=Atoms.exchange(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2,addr);while(1){tNo
w=performance.now();if(tNow>tEnd){lastAddr=Atoms.exchange(GROWABLE_HEAP_I32(),__emscripten_mai
n_thread_futex>>2,0);return-
73}lastAddr=Atoms.exchange(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2,0);if(lastAddr==
0){break}_emscripten_main_thread_process_queued_calls();if(Atoms.load(GROWABLE_HEAP_I32(),addr>>2)!
=val){return-
6}lastAddr=Atoms.exchange(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2,addr)}return
0}}function
_emscripten_memcpy_big(dest,src,num){GROWABLE_HEAP_U8().copyWithin(dest,src,src+num)}function
_emscripten_num_logical_cores(){if(ENVIRONMENT_IS_NODE)return require(\"os\").cpus().length;return
navigator[\"hardwareConcurrency\"]}function
_emscripten_proxy_to_main_thread_js(index,sync){var numCallArgs=arguments.length-2;var
stack=stackSave();var serializedNumCallArgs=numCallArgs;var args=stackAlloc(serializedNumCallArgs*8);var
b=args>>3;for(var i=0;i<numCallArgs;i++){var arg=arguments[2+i];GROWABLE_HEAP_F64()[b+i]=arg}var
ret=_emscripten_run_in_main_runtime_thread_js(index,serializedNumCallArgs,args,sync);stackRestore(stack);retur
n ret}var _emscripten_receive_on_main_thread_js_callArgs=[];var readAsmConstArgsArray=[];function
readAsmConstArgs(sigPtr,buf){readAsmConstArgsArray.length=0;var
ch;buf>>=2;while(ch=GROWABLE_HEAP_U8()[sigPtr++){var
double=ch<105;if(double&&buf&1)buf++;readAsmConstArgsArray.push(double?GROWABLE_HEAP_F64()[buf
++>>1]:GROWABLE_HEAP_I32()[buf]);++buf}return readAsmConstArgsArray}function
_emscripten_receive_on_main_thread_js(index,numCallArgs,args){_emscripten_receive_on_main_thread_js_callA
rgs.length=numCallArgs;var b=args>>3;for(var
i=0;i<numCallArgs;i++){_emscripten_receive_on_main_thread_js_callArgs[i]=GROWABLE_HEAP_F64()[b+i]}v
ar
isEmAsmConst=index<0;var func=!isEmAsmConst?proxiedFunctionTable[index]:ASM_CONSTS[-index-
1];return func.apply(null,_emscripten_receive_on_main_thread_js_callArgs)}function
_emscripten_get_heap_size(){return GROWABLE_HEAP_U8().length}function
emscripten_realloc_buffer(size){try{wasmmemory.grow(size-
buffer.byteLength+65535>>>16);updateGlobalBufferAndViews(wasmMemory.buffer);return
1}catch(e){}}function _emscripten_resize_heap(requestedSize){var
oldSize=_emscripten_get_heap_size();if(requestedSize<=oldSize){return false}var
maxHeapSize=2147483648;if(requestedSize>maxHeapSize){return false}for(var
cutDown=1;cutDown<=4;cutDown*=2){var
overGrownHeapSize=oldSize*(1+.2/cutDown);overGrownHeapSize=Math.min(overGrownHeapSize,requestedSize
+100663296);var
newSize=Math.min(maxHeapSize,alignUp(Math.max(requestedSize,overGrownHeapSize),65536));var
replacement=emscripten_realloc_buffer(newSize);if(replacement){return true}}return false}var
JSEvents={inEventHandler:0,removeAllEventListeners:function(){for(var
i=JSEvents.eventHandlers.length-1;i>=0;--
i){JSEvents._removeHandler(i)}JSEvents.eventHandlers=[];JSEvents.deferredCalls=[]},registerRemoveEventListene
rs:function(){if(!JSEvents.removeEventListenersRegistered){__ATEXIT__.push(JSEvents.removeAllEventListene
rs);JSEvents.removeEventListenersRegistered=true}},deferredCalls:[],deferCall:function(targetFunction,precedence
,argsList){function arraysHaveEqualContent(arrA,arrB){if(arrA.length!=arrB.length)return false;for(var i in
arrA){if(arrA[i]!=arrB[i])return false}return true}for(var i in JSEvents.deferredCalls){var

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call=JSEvents.deferredCalls[i];if(call.targetFunction==targetFunction&&arraysHaveEqualContent(call.argsList,args
List))){return }}JSEvents.deferredCalls.push({targetFunction:targetFunction,precedence:precedence,argsList:argsList
});JSEvents.deferredCalls.sort(function(x,y){return
x.precedence<y.precedence})),removeDeferredCalls:function(targetFunction){for(var
i=0;i<JSEvents.deferredCalls.length;++i){if(JSEvents.deferredCalls[i].targetFunction==targetFunction){JSEvents.d
eferredCalls.splice(i,1);--i}},canPerformEventHandlerRequests:function(){return
JSEvents.inEventHandler&&JSEvents.currentEventHandler.allowsDeferredCalls},runDeferredCalls:function(){if(!J
SEvents.canPerformEventHandlerRequests()){return }for(var i=0;i<JSEvents.deferredCalls.length;++i){ var
call=JSEvents.deferredCalls[i];JSEvents.deferredCalls.splice(i,1);--
i;call.targetFunction.apply(null,call.argsList)},eventHandlers:[],removeAllHandlersOnTarget:function(target,event
TypeString){for(var
i=0;i<JSEvents.eventHandlers.length;++i){if(JSEvents.eventHandlers[i].target==target&&(!eventTypeString||event
TypeString==JSEvents.eventHandlers[i].eventTypeString)){JSEvents._removeHandler(i--
)}}},_removeHandler:function(i){var
h=JSEvents.eventHandlers[i];h.target.removeEventListener(h.eventTypeString,h.eventListenerFunc,h.useCapture);J
SEvents.eventHandlers.splice(i,1)},registerOrRemoveHandler:function(eventHandler){var
jsEventHandler=function
jsEventHandler(event){++JSEvents.inEventHandler;JSEvents.currentEventHandler=eventHandler;JSEvents.runDef
erredCalls();eventHandler.handlerFunc(event);JSEvents.runDeferredCalls();--
JSEvents.inEventHandler};if(eventHandler.callbackfunc){eventHandler.eventListenerFunc=jsEventHandler;eventH
andler.target.addEventListener(eventHandler.eventTypeString,jsEventHandler,eventHandler.useCapture);JSEvents.e
ventHandlers.push(eventHandler);JSEvents.registerRemoveEventListeners()}else{for(var
i=0;i<JSEvents.eventHandlers.length;++i){if(JSEvents.eventHandlers[i].target==eventHandler.target&&JSEvents.e
ventHandlers[i].eventTypeString==eventHandler.eventTypeString){JSEvents._removeHandler(i--
)}}},queueEventHandlerOnThread_iiii:function(targetThread,eventHandlerFunc,eventTypeId,eventData,userData)
{var stackTop=stackSave();var
varargs=stackAlloc(12);GROWABLE_HEAP_I32()[varargs>>2]=eventTypeId;GROWABLE_HEAP_I32()[varargs
+4>>2]=eventData;GROWABLE_HEAP_I32()[varargs+8>>2]=userData;__emscripten_call_on_thread(0,targetThr
ead,637534208,eventHandlerFunc,eventData,varargs);stackRestore(stackTop)},getTargetThreadForEventCallback:f
unction(targetThread){switch(targetThread){case
1:return 0;case 2:return PThread.currentProxiedOperationCallerThread;default:return
targetThread}},getNodeNameForTarget:function(target){if(!target)return "";if(target==window)return "#window";
if(target==screen)return "#screen";return
target&&target.nodeName?target.nodeName:""},fullscreenEnabled:function(){return
document.fullscreenEnabled||document.webkitFullscreenEnabled}};function stringToNewUTF8(jsString){var
length=lengthBytesUTF8(jsString)+1;var cString=_malloc(length);stringToUTF8(jsString,cString,length);return
cString}function
_emscripten_set_offscreencanvas_size_on_target_thread_js(targetThread,targetCanvas,width,height){var
stackTop=stackSave();var varargs=stackAlloc(12);var
targetCanvasPtr=0;if(targetCanvas){targetCanvasPtr=stringToNewUTF8(targetCanvas)}GROWABLE_HEAP_I32(
)[varargs>>2]=targetCanvasPtr;GROWABLE_HEAP_I32()[varargs+4>>2]=width;GROWABLE_HEAP_I32()[var
args+8>>2]=height;__emscripten_call_on_thread(0,targetThread,657457152,0,targetCanvasPtr,varargs);stackRestor
e(stackTop)}function
_emscripten_set_offscreencanvas_size_on_target_thread(targetThread,targetCanvas,width,height){targetCanvas=tar
getCanvas?UTF8ToString(targetCanvas):"";_emscripten_set_offscreencanvas_size_on_target_thread_js(targetThr
ead,targetCanvas,width,height)}function maybeCStringToJsString(cString){return
cString>2?UTF8ToString(cString):cString}var specialHTMLTargets=[0,typeof
document!=="undefined"?document:0,typeof window!=="undefined"?window:0];function

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findEventTarget(target){target=maybeCStringToJsString(target);var
domElement=specialHTMLTargets[target]||(typeof
document!=="undefined"?document.querySelector(target):undefined);return domElement}function
findCanvasEventTarget(target){return findEventTarget(target)}function
_emsripten_set_canvas_element_size_calling_thread(target,width,height){var
canvas=findCanvasEventTarget(target);if(!canvas)return-
4;if(canvas.canvasSharedPtr){GROWABLE_HEAP_I32()[canvas.canvasSharedPtr>>2]=width;GROWABLE_HEA
P_I32()[canvas.canvasSharedPtr+4>>2]=height}if(canvas.offscreenCanvas!|canvas.controlTransferredOffscreen){if
(canvas.offscreenCanvas)canvas=canvas.offscreenCanvas;var
autoResizeViewport=false;if(canvas.GLctxObject&&canvas.GLctxObject.GLctx){var
prevViewport=canvas.GLctxObject.GLctx.getParameter(2978);autoResizeViewport=prevViewport[0]===0&&prev
Viewport[1]===0&&prevViewport[2]===canvas.width&&prevViewport[3]===canvas.height}canvas.width=width;
canvas.height=height;if(autoResizeViewport){canvas.GLctxObject.GLctx.viewport(0,0,width,height)}}else
if(canvas.canvasSharedPtr){var
targetThread=GROWABLE_HEAP_I32()[canvas.canvasSharedPtr+8>>2];_emsripten_set_offscreencanvas_size_o
n_target_thread(targetThread,target,width,height);return 1}else{return-4}return 0}function
_emsripten_set_canvas_element_size_main_thread(target,width,height){if(ENVIRONMENT_IS_PTHREAD)retur
n
_emsripten_proxy_to_main_thread_js(2,1,target,width,height);return
_emsripten_set_canvas_element_size_calling_thread(target,width,height)}function
_emsripten_set_canvas_element_size(target,width,height){var
canvas=findCanvasEventTarget(target);if(canvas){return
_emsripten_set_canvas_element_size_calling_thread(target,width,height)}else{return
_emsripten_set_canvas_element_size_main_thread(target,width,height)}}function
_emsripten_set_current_thread_status(newStatus){}function
_emsripten_set_thread_name(threadId,name){}function __webgl_enable_ANGLE_instanced_arrays(ctx){var
ext=ctx.getExtension("ANGLE_instanced_arrays");if(ext){ctx["vertexAttribDivisor"]=function(index,divisor){ex
t["vertexAttribDivisorANGLE"](index,divisor)};ctx["drawArraysInstanced"]=function(mode,first,count,primcou
nt){ext["drawArraysInstancedANGLE"](mode,first,count,primcount)};ctx["drawElementsInstanced"]=function(
mode,count,type,indices,primcount){ext["drawElementsInstancedANGLE"](mode,count,type,indices,primcount)};
return
1}}function __webgl_enable_OES_vertex_array_object(ctx){var
ext=ctx.getExtension("OES_vertex_array_object");if(ext){ctx["createVertexArray"]=function(){return
ext["createVertexArrayOES"]();ctx["deleteVertexArray"]=function(vao){ext["deleteVertexArrayOES"](vao)};
ctx["bindVertexArray"]=function(vao){ext["bindVertexArrayOES"](vao)};ctx["isVertexArray"]=function(vao)
{return ext["isVertexArrayOES"](vao)};return 1}}function __webgl_enable_WEBGL_draw_buffers(ctx){var
ext=ctx.getExtension("WEBGL_draw_buffers");if(ext){ctx["drawBuffers"]=function(n,bufs){ext["drawBuffers
WEBGL"](n,bufs)};return 1}}function
__webgl_enable_WEBGL_multi_draw(ctx){return!(ctx.multiDrawWebgl=ctx.getExtension("WEBGL_multi_dra
w"))}var
GL={counter:1,buffers:[],programs:[],framebuffers:[],renderbuffers:[],textures:[],uniforms:[],shaders:[],vaos:[],cont
exts:{},offscreenCanvases:{},timerQueriesEXT:[],programInfos:{},stringCache:{},unpackAlignment:4,recordError:
function
recordError(errorCode){if(!GL.lastError){GL.lastError=errorCode}},getNewId:function(table){var
ret=GL.counter++;for(var i=table.length;i<ret;i++){table[i]=null}return
ret},getSource:function(shader,count,string,length){var source="";for(var i=0;i<count;++i){var
len=length?GROWABLE_HEAP_I32()[length+i*4>>2]:-
1;source+=UTF8ToString(GROWABLE_HEAP_I32()[string+i*4>>2],len<0?undefined:len)}return

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source},createContext:function(canvas,webGLContextAttributes){var
ctx=canvas.getContext("\webgl",webGLContextAttributes);if(!ctx)return 0;var
handle=GL.registerContext(ctx,webGLContextAttributes);return
handle},registerContext:function(ctx,webGLContextAttributes){var
handle=_malloc(8);GROWABLE_HEAP_I32()[handle+4>>2]=_pthread_self();var
context={handle:handle,attributes:webGLContextAttributes,version:webGLContextAttributes.majorVersion,GLctx:
ctx};if(ctx.canvas)ctx.canvas.GLctxObject=context;GL.contexts[handle]=context;if(typeof
webGLContextAttributes.enableExtensionsByDefault==="\undefined"||webGLContextAttributes.enableExtensions
ByDefault){GL.initExtensions(context)}return
handle},makeContextCurrent:function(contextHandle){GL.currentContext=GL.contexts[contextHandle];Module.ctx
=GLctx=GL.currentContext&&GL.currentContext.GLctx;return!(contextHandle&&!GLctx)},getContext:function(c
ontextHandle){return
GL.contexts[contextHandle]},deleteContext:function(contextHandle){if(GL.currentContext===GL.contexts[context
Handle])GL.currentContext=null;if(typeof
JSEvents==="\object")JSEvents.removeAllHandlersOnTarget(GL.contexts[contextHandle].GLctx.canvas);if(GL.co
ntexts[contextHandle]&&GL.contexts[contextHandle].GLctx.canvas)GL.contexts[contextHandle].GLctx.canvas.GL
ctxObject=undefined;_free(GL.contexts[contextHandle].handle);GL.contexts[contextHandle]=null},initExtensions:f
unction(context){if(!context)context=GL.currentContext;if(context.initExtensionsDone)return;context.initExtension
sDone=true;var
GLctx=context.GLctx;__webgl_enable_ANGLE_instanced_arrays(GLctx);__webgl_enable_OES_vertex_array_obj
ect(GLctx);__webgl_enable_WEBGL_draw_buffers(GLctx);GLctx.disjointTimerQueryExt=GLctx.getExtension("\
EXT_disjoint_timer_query");__webgl_enable_WEBGL_multi_draw(GLctx);var
exts=GLctx.getSupportedExtensions()||[];exts.forEach(function(ext){if(ext.indexOf("\lose_context")<0&&ext.inde
xOf("\debug")<0){GLctx.getExtension(ext)}}),populateUniformTable:function(program){var
p=GL.programs[program];var
ptable=GL.programInfos[program]={uniforms:{},maxUniformLength:0,maxAttributeLength:-
1,maxUniformBlockNameLength:-1};var utable=ptable.uniforms;var
numUniforms=GLctx.getProgramParameter(p,35718);for(var i=0;i<numUniforms;++i){var
u=GLctx.getActiveUniform(p,i);var
name=u.name;ptable.maxUniformLength=Math.max(ptable.maxUniformLength,name.length+1);if(name.slice(-
1)==="\"){name=name.slice(0,name.lastIndexOf("\["))}var loc=GLctx.getUniformLocation(p,name);if(loc){var
id=GL.getNewId(GL.uniforms);utable[name]=[u.size,id];GL.uniforms[id]=loc;for(var
j=1;j<u.size;++j){var
n=name+"\["+j+"\]";loc=GLctx.getUniformLocation(p,n);id=GL.getNewId(GL.uniforms);GL.uniforms[id]=loc}}
};var __emscripten_webgl_power_preferences=["default","\low-power","\high-performance"];function
__emscripten_webgl_do_create_context(target,attributes){var a=attributes>>2;var
powerPreference=GROWABLE_HEAP_I32()[a+(24>>2)];var
contextAttributes={"alpha":!!GROWABLE_HEAP_I32()[a+(0>>2)],"depth":!!GROWABLE_HEAP_I32()[a+(4
>>2)],"stencil":!!GROWABLE_HEAP_I32()[a+(8>>2)],"antialias":!!GROWABLE_HEAP_I32()[a+(12>>2)],"\p
remultipliedAlpha":!!GROWABLE_HEAP_I32()[a+(16>>2)],"preserveDrawingBuffer":!!GROWABLE_HEAP_
I32()[a+(20>>2)],"powerPreference":__emscripten_webgl_power_preferences[powerPreference],"\failIfMajorPerf
ormanceCaveat":!!GROWABLE_HEAP_I32()[a+(28>>2)],majorVersion:GROWABLE_HEAP_I32()[a+(32>>2)],
minorVersion:GROWABLE_HEAP_I32()[a+(36>>2)],enableExtensionsByDefault:GROWABLE_HEAP_I32()[a+(
40>>2)],explicitSwapControl:GROWABLE_HEAP_I32()[a+(44>>2)],proxyContextToMainThread:GROWABLE_
HEAP_I32()[a+(48>>2)],renderViaOffscreenBackBuffer:GROWABLE_HEAP_I32()[a+(52>>2)]};var
canvas=findCanvasEventTarget(target);if(!canvas){return 0}if(contextAttributes.explicitSwapControl){return
0}var contextHandle=GL.createContext(canvas,contextAttributes);return contextHandle}function
__emscripten_webgl_create_context(a0,a1){return __emscripten_webgl_do_create_context(a0,a1)}var

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SYSCALLS={ mappings:{ },buffers:[null,[],[]],printChar:function(stream,curr){ var
buffer=SYSCALLS.buffers[stream];if(curr===0||curr===10){(stream===1?out:err)(UTF8ArrayToString(buffer,0));
buffer.length=0}else{ buffer.push(curr) },varargs:undefined,get:function(){ SYSCALLS.varargs+=4;var
ret=GROWABLE_HEAP_I32()[SYSCALLS.varargs-4>>2];return ret},getStr:function(ptr){ var
ret=UTF8ToString(ptr);return ret},get64:function(low,high){return low } };function
_fd_close(fd){if(ENVIRONMENT_IS_PTHREAD)return _emscripten_proxy_to_main_thread_js(3,1,fd);return
0}function _fd_seek(fd,offset_low,offset_high,whence,newOffset){if(ENVIRONMENT_IS_PTHREAD)return
_emscripten_proxy_to_main_thread_js(4,1,fd,offset_low,offset_high,whence,newOffset)}function
_fd_write(fd,iiov,iiovcnt,pnum){if(ENVIRONMENT_IS_PTHREAD)return
_emscripten_proxy_to_main_thread_js(5,1,fd,iiov,iiovcnt,pnum);var num=0;for(var i=0;i<iiovcnt;i++){ var
ptr=GROWABLE_HEAP_I32()[iiov+i*8>>2];var len=GROWABLE_HEAP_I32()[iiov+(i*8+4)>>2];for(var
j=0;j<len;j++){SYSCALLS.printChar(fd,GROWABLE_HEAP_U8()[ptr+j])}num+=len}GROWABLE_HEAP_I32
()[pnum>>2]=num;return 0}function _pthread_cleanup_pop(execute){ var
routine=PThread.threadExitHandlers.pop();if(execute)routine()}function
_pthread_cleanup_push(routine,arg){PThread.threadExitHandlers.push(function(){ wasmTable.get(routine)(arg))}}f
unction spawnThread(threadParams){if(ENVIRONMENT_IS_PTHREAD)throw"Internal Error! spawnThread()
can only ever be called from main application thread!";var
worker=PThread.getNewWorker();if(worker.pthread!==undefined)throw"Internal
error!";if(!threadParams.pthread_ptr)throw"Internal
error, no pthread ptr!";PThread.runningWorkers.push(worker);var tlsMemory=_malloc(128*4);for(var
i=0;i<128;++i){ GROWABLE_HEAP_I32()[tlsMemory+i*4>>2]=0}var
stackHigh=threadParams.stackBase+threadParams.stackSize;var
pthread=PThread.pthreads[threadParams.pthread_ptr]={ worker:worker,stackBase:threadParams.stackBase,stackSize
:threadParams.stackSize,allocatedOwnStack:threadParams.allocatedOwnStack,threadInfoStruct:threadParams.pthrea
d_ptr};var
tis=pthread.threadInfoStruct>>2;Atomics.store(GROWABLE_HEAP_U32(),tis+(64>>2),threadParams.detached);A
tomics.store(GROWABLE_HEAP_U32(),tis+(100>>2),tlsMemory);Atomics.store(GROWABLE_HEAP_U32(),tis
+(40>>2),pthread.threadInfoStruct);Atomics.store(GROWABLE_HEAP_U32(),tis+(80>>2),threadParams.stackSiz
e);Atomics.store(GROWABLE_HEAP_U32(),tis+(76>>2),stackHigh);Atomics.store(GROWABLE_HEAP_U32(),t
is+(104>>2),threadParams.stackSize);Atomics.store(GROWABLE_HEAP_U32(),tis+(104+8>>2),stackHigh);Atom
ics.store(GROWABLE_HEAP_U32(),tis+(104+12>>2),threadParams.detached);var
global_libc=_emscripten_get_global_libc();var
global_locale=global_libc+40;Atomics.store(GROWABLE_HEAP_U32(),tis+(172>>2),global_locale);worker.pthr
ead=pthread;var
msg={\"cmd\": \"run\", \"start_routine\": threadParams.startRoutine, \"arg\": threadParams.arg, \"threadInfoStruct\": thre
adParams.pthread_ptr, \"stackBase\": threadParams.stackBase, \"stackSize\": threadParams.stackSize };worker.runPthre
ad=function(){ msg.time=performance.now();worker.postMessage(msg,threadParams.transferList);if(worker.loaded
){ worker.runPthread();delete worker.runPthread } }function
_pthread_create(pthread_ptr,attr,start_routine,arg){if(typeof SharedArrayBuffer===\"undefined\"){err(\"Current
environment does not support SharedArrayBuffer, pthreads are not available!\");return
6}if(!pthread_ptr){err(\"pthread_create called with a null thread pointer!\");return 28}var transferList=[];var
error=0;if(ENVIRONMENT_IS_PTHREAD&&(transferList.length===0||error)){ return
_emscripten_sync_run_in_main_thread_4(687865856,pthread_ptr,attr,start_routine,arg)}if(error)return
error;var stackSize=0;var stackBase=0;var detached=0;if(attr&&attr!=-
1){ stackSize=GROWABLE_HEAP_I32()[attr>>2];stackSize+=81920;stackBase=GROWABLE_HEAP_I32()[attr+
8>>2];detached=GROWABLE_HEAP_I32()[attr+12>>2]!==0}else{ stackSize=2097152}var
allocatedOwnStack=stackBase===0;if(allocatedOwnStack){stackBase=_memalign(16,stackSize)}else{stackBase-
=stackSize;assert(stackBase>0)}var threadInfoStruct=_malloc(228);for(var

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i=0;i<228>>2;++)GROWABLE_HEAP_U32()[(threadInfoStruct>>2)+i]=0;GROWABLE_HEAP_I32()[pthread_ptr>>2]=threadInfoStruct;GROWABLE_HEAP_I32()[threadInfoStruct+12>>2]=threadInfoStruct;var
headPtr=threadInfoStruct+152;GROWABLE_HEAP_I32()[headPtr>>2]=headPtr;var
threadParams={stackBase:stackBase,stackSize:stackSize,allocatedOwnStack:allocatedOwnStack,detached:detached
,startRoutine:start_routine,pthread_ptr:threadInfoStruct,arg:arg,transferList:transferList};if(ENVIRONMENT_IS_P
THREAD){threadParams.cmd="\spawnThread";postMessage(threadParams,transferList)}else{spawnThread(thread
Params)}return
0}function __pthread_testcancel_js(){if(!ENVIRONMENT_IS_PTHREAD)return;var
tb=__pthread_self();if(!tb)return;var
cancelDisabled=Atomics.load(GROWABLE_HEAP_U32(),tb+56>>2);if(cancelDisabled)return;var
canceled=Atomics.load(GROWABLE_HEAP_U32(),tb+0>>2);if(canceled==2)throw\Canceled!\}function
__emscripten_check_blocking_allowed(){if(ENVIRONMENT_IS_NODE)return;if(ENVIRONMENT_IS_WORKE
R)return;warnOnce(\Blocking on the main thread is very dangerous, see
https://emscripten.org/docs/porting/pthreads.html#blocking-on-the-main-browser-thread)}function
__emscripten_do_pthread_join(thread,status,block){if(!thread){err(\pthread_join attempted on a null thread
pointer!\);return
ERRNO_CODES.ESRCH}if(ENVIRONMENT_IS_PTHREAD&&__pthread_self()==thread){err(\PThread
\'+thread+\'' is attempting to join to itself!\);return ERRNO_CODES.EDEADLK}else
if(!ENVIRONMENT_IS_PTHREAD&&__emscripten_main_browser_thread_id()==thread){err(\Main
thread \'+thread+\'' is attempting to join to itself!\);return ERRNO_CODES.EDEADLK}var
self=GROWABLE_HEAP_I32()[thread+12>>2];if(self!==thread){err(\pthread_join attempted on thread
\'+thread+\', which does not point to a valid thread, or does not exist anymore!\);return
ERRNO_CODES.ESRCH}var
detached=Atomics.load(GROWABLE_HEAP_U32(),thread+64>>2);if(detached){err(\Attempted to join thread
\'+thread+\', which was already detached!\);return
ERRNO_CODES.EINVAL}if(block){__emscripten_check_blocking_allowed()}for(;;){var
threadStatus=Atomics.load(GROWABLE_HEAP_U32(),thread+0>>2);if(threadStatus==1){var
threadExitCode=Atomics.load(GROWABLE_HEAP_U32(),thread+4>>2);if(status)GROWABLE_HEAP_I32()[sta
tus>>2]=threadExitCode;Atomics.store(GROWABLE_HEAP_U32(),thread+64>>2,1);if(!ENVIRONMENT_IS_PT
HREAD)cleanupThread(thread);else postMessage({\cmd":\cleanupThread",\thread":thread});return
0}if(!block){return
ERRNO_CODES.EBUSY}}__pthread_testcancel_js();if(!ENVIRONMENT_IS_PTHREAD)__emscripten_main_thre
ad_process_queued_calls();__emscripten_futex_wait(thread+0,threadStatus,ENVIRONMENT_IS_PTHREAD?100:1
)}}function
__pthread_join(thread,status){return __emscripten_do_pthread_join(thread,status,true)}function
__sysconf(name){if(ENVIRONMENT_IS_PTHREAD)return
__emscripten_proxy_to_main_thread_js(6,1,name);switch(name){case 30:return 16384;case 85:var
maxHeapSize=2147483648;return maxHeapSize/16384;case 132:case 133:case 12:case 137:case 138:case 15:case
235:case 16:case 17:case 18:case 19:case 20:case 149:case 13:case 10:case 236:case 153:case 9:case 21:case 22:case
159:case 154:case 14:case 77:case 78:case 139:case 82:case 68:case 67:case 164:case 11:case 29:case 47:case
48:case 95:case 52:case 51:case 46:return 200809;case 27:case 246:case 127:case 128:case 23:case 24:case 160:case
161:case 181:case 182:case 242:case 183:case 184:case 243:case 244:case 245:case 165:case 178:case 179:case
49:case 50:case 168:case 169:case 175:case 170:case 171:case 172:case
97:case 76:case 32:case 173:case 35:case 80:case 81:case 79:return-1;case 176:case 177:case 7:case 155:case 8:case
157:case 125:case 126:case 92:case 93:case 129:case 130:case 131:case 94:case 91:return 1;case 74:case 60:case
69:case 70:case 4:return 1024;case 31:case 42:case 72:return 32;case 87:case 26:case 33:return 2147483647;case
34:case 1:return 47839;case 38:case 36:return 99;case 43:case 37:return 2048;case 0:return 2097152;case 3:return
65536;case 28:return 32768;case 44:return 32767;case 75:return 16384;case 39:return 1e3;case 89:return 700;case

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71:return 256;case 40:return 255;case 2:return 100;case 180:return 64;case 25:return 20;case 5:return 16;case
6:return 6;case 73:return 4;case 84:{if(typeof navigator===\"object\")return
navigator[\"hardwareConcurrency\"]||1;return 1}}setErrNo(28);return-
1}if(!ENVIRONMENT_IS_PTHREAD)PThread.initMainThreadBlock();var GLctx;var
proxiedFunctionTable=[null,_atexit,_emscripten_set_canvas_element_size_main_thread,_fd_close,_fd_seek,_fd_wr
ite,_sysconf];var
asmLibraryArg={\"e\":__assert_fail,\"r\":__call_main,\"x\":_emscripten_notify_thread_queue,\"b\":_abort,\"y\":
_emscripten_asm_const_int,\"j\":_emscripten_conditional_set_current_thread_status,\"d\":_emscripten_futex_wait,\"
c\":_emscripten_futex_wake,\"f\":_emscripten_get_now,\"p\":_emscripten_memcpy_big,\"A\":_emscripten_num_l
ogical_cores,\"u\":_emscripten_receive_on_main_thread_js,\"q\":_emscripten_resize_heap,\"v\":_emscripten_set_ca
nvas_element_size,\"i\":_emscripten_set_current_thread_status,\"s\":_emscripten_set_thread_name,\"w\":_emscript
en_webgl_create_context,\"l\":_fd_close,\"n\":_fd_seek,\"g\":_fd_write,\"o\":initPthreadsJS,\"a\":wasmMemory||Mo
dule[\"wasmMemory\"],\"z\":_pthread_cleanup_pop,\"k\":_pthread_cleanup_push,\"h\":_pthread_create,\"m\":_pthr
ead_join,\"t\":_sysconf};var asm=createWasm();var
__wasm_call_ctors=Module[\"__wasm_call_ctors\"]=function(){return(__wasm_call_ctors=Module[\"__wasm
_call_ctors\"]=Module[\"asm\"][\"B\"]).apply(null,arguments)};var
_init=Module[\"_init\"]=function(){return(_init=Module[\"_init\"]=Module[\"asm\"][\"C\"]).apply(null,arguments)};
var
_init_with_threads_count=Module[\"_init_with_threads_count\"]=function(){return(_init_with_threads_count=Mod
ule[\"_init_with_threads_count\"]=Module[\"asm\"][\"D\"]).apply(null,arguments)};var
_get_threads_count=Module[\"_get_threads_count\"]=function(){return(_get_threads_count=Module[\"_get_threads
_count\"]=Module[\"asm\"][\"E\"]).apply(null,arguments)};var
_register_tensor=Module[\"_register_tensor\"]=function(){return(_register_tensor=Module[\"_register_tensor\"]=M
odule[\"asm\"][\"F\"]).apply(null,arguments)};var
_dispose_data=Module[\"_dispose_data\"]=function(){return(_dispose_data=Module[\"_dispose_data\"]=Module[\"
asm\"][\"G\"]).apply(null,arguments)};var
_dispose=Module[\"_dispose\"]=function(){return(_dispose=Module[\"_dispose\"]=Module[\"asm\"][\"H\"]).apply(
null,arguments)};var
_Abs=Module[\"_Abs\"]=function(){return(_Abs=Module[\"_Abs\"]=Module[\"asm\"][\"J\"]).apply(null,arguments
)};var
_Add=Module[\"_Add\"]=function(){return(_Add=Module[\"_Add\"]=Module[\"asm\"][\"K\"]).apply(null,argumen
ts)};var
_AddN=Module[\"_AddN\"]=function(){return(_AddN=Module[\"_AddN\"]=Module[\"asm\"][\"L\"]).apply(null,ar
guments)};var
_All=Module[\"_All\"]=function(){return(_All=Module[\"_All\"]=Module[\"asm\"][\"M\"]).apply(null,arguments)};
var
_Any=Module[\"_Any\"]=function(){return(_Any=Module[\"_Any\"]=Module[\"asm\"][\"N\"]).apply(null,argumen
ts)};var
_ArgMax=Module[\"_ArgMax\"]=function(){return(_ArgMax=Module[\"_ArgMax\"]=Module[\"asm\"][\"O\"]).ap
ply(null,arguments)};var
_AvgPool=Module[\"_AvgPool\"]=function(){return(_AvgPool=Module[\"_AvgPool\"]=Module[\"asm\"][\"P\"]).a
pply(null,arguments)};var
_BatchMatMul=Module[\"_BatchMatMul\"]=function(){return(_BatchMatMul=Module[\"_BatchMatMul\"]=Modu
le[\"asm\"][\"Q\"]).apply(null,arguments)};var
_Ceil=Module[\"_Ceil\"]=function(){return(_Ceil=Module[\"_Ceil\"]=Module[\"asm\"][\"R\"]).apply(null,argument
s)};var
_ClipByValue=Module[\"_ClipByValue\"]=function(){return(_ClipByValue=Module[\"_ClipByValue\"]=Module[\"
asm\"][\"S\"]).apply(null,arguments)};var

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_Conv2D=Module["_Conv2D"]=function(){return(_Conv2D=Module["_Conv2D"]=Module["asm"][["T"]]).apply(null,arguments)};var
_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=function(){return(_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=Module["asm"][["U"]]).apply(null,arguments)};var
_Cos=Module["_Cos"]=function(){return(_Cos=Module["_Cos"]=Module["asm"][["V"]]).apply(null,arguments)};var
_Cosh=Module["_Cosh"]=function(){return(_Cosh=Module["_Cosh"]=Module["asm"][["W"]]).apply(null,arguments)};var
_CropAndResize=Module["_CropAndResize"]=function(){return(_CropAndResize=Module["_CropAndResize"]=Module["asm"][["X"]]).apply(null,arguments)};var
_Cumsum=Module["_Cumsum"]=function(){return(_Cumsum=Module["_Cumsum"]=Module["asm"][["Y"]]).apply(null,arguments)};var
_DepthToSpace=Module["_DepthToSpace"]=function(){return(_DepthToSpace=Module["_DepthToSpace"]=Module["asm"][["Z"]]).apply(null,arguments)};var
_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=function(){return(_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=Module["asm"][["_"]]).apply(null,arguments)};var
_Elu=Module["_Elu"]=function(){return(_Elu=Module["_Elu"]=Module["asm"][["$"]]).apply(null,arguments)};var
_Equal=Module["_Equal"]=function(){return(_Equal=Module["_Equal"]=Module["asm"][["aa"]]).apply(null,arguments)};var
_Exp=Module["_Exp"]=function(){return(_Exp=Module["_Exp"]=Module["asm"][["ba"]]).apply(null,arguments)};var
_FlipLeftRight=Module["_FlipLeftRight"]=function(){return(_FlipLeftRight=Module["_FlipLeftRight"]=Module["asm"][["ca"]]).apply(null,arguments)};var
_Floor=Module["_Floor"]=function(){return(_Floor=Module["_Floor"]=Module["asm"][["da"]]).apply(null,arguments)};var
_FloorDiv=Module["_FloorDiv"]=function(){return(_FloorDiv=Module["_FloorDiv"]=Module["asm"][["ea"]]).apply(null,arguments)};var
_FusedBatchNorm=Module["_FusedBatchNorm"]=function(){return(_FusedBatchNorm=Module["_FusedBatchNorm"]=Module["asm"][["fa"]]).apply(null,arguments)};var
_FusedConv2D=Module["_FusedConv2D"]=function(){return(_FusedConv2D=Module["_FusedConv2D"]=Module["asm"][["ga"]]).apply(null,arguments)};var
_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=function(){return(_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=Module["asm"][["ha"]]).apply(null,arguments)};var
_Gather=Module["_Gather"]=function(){return(_Gather=Module["_Gather"]=Module["asm"][["ia"]]).apply(null,arguments)};var
_GatherNd=Module["_GatherNd"]=function(){return(_GatherNd=Module["_GatherNd"]=Module["asm"][["ja"]]).apply(null,arguments)};var
_Greater=Module["_Greater"]=function(){return(_Greater=Module["_Greater"]=Module["asm"][["ka"]]).apply(null,arguments)};var
_GreaterEqual=Module["_GreaterEqual"]=function(){return(_GreaterEqual=Module["_GreaterEqual"]=Module["asm"][["la"]]).apply(null,arguments)};var
_LeakyRelu=Module["_LeakyRelu"]=function(){return(_LeakyRelu=Module["_LeakyRelu"]=Module["asm"][["ma"]]).apply(null,arguments)};var
_Less=Module["_Less"]=function(){return(_Less=Module["_Less"]=Module["asm"][["na"]]).apply(null,arguments)};var
_LessEqual=Module["_LessEqual"]=function(){return(_LessEqual=Module["_LessEqual"]=Module["asm"][["oa"]]).apply(null,arguments)};var

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_Log=Module["_Log"]=function(){return(_Log=Module["_Log"]=Module["asm"][\["pa\"]).apply(null,arguments)};var
_LogicalAnd=Module["_LogicalAnd"]=function(){return(_LogicalAnd=Module["_LogicalAnd"]=Module["asm"][\["qa\"]).apply(null,arguments)};var
_Max=Module["_Max"]=function(){return(_Max=Module["_Max"]=Module["asm"][\["ra\"]).apply(null,arguments)};var
_MaxPool=Module["_MaxPool"]=function(){return(_MaxPool=Module["_MaxPool"]=Module["asm"][\["sa\"]).apply(null,arguments)};var
_Maximum=Module["_Maximum"]=function(){return(_Maximum=Module["_Maximum"]=Module["asm"][\["ta\"]).apply(null,arguments)};var
_Mean=Module["_Mean"]=function(){return(_Mean=Module["_Mean"]=Module["asm"][\["ua\"]).apply(null,arguments)};var
_Min=Module["_Min"]=function(){return(_Min=Module["_Min"]=Module["asm"][\["va\"]).apply(null,arguments)};var
_Minimum=Module["_Minimum"]=function(){return(_Minimum=Module["_Minimum"]=Module["asm"][\["wa\"]).apply(null,arguments)};var
_MirrorPad=Module["_MirrorPad"]=function(){return(_MirrorPad=Module["_MirrorPad"]=Module["asm"][\["xa\"]).apply(null,arguments)};var
_Multiply=Module["_Multiply"]=function(){return(_Multiply=Module["_Multiply"]=Module["asm"][\["ya\"]).apply(null,arguments)};var
_Neg=Module["_Neg"]=function(){return(_Neg=Module["_Neg"]=Module["asm"][\["za\"]).apply(null,arguments)};var
_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=function(){return(_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=Module["asm"][\["Aa\"]).apply(null,arguments)};var
_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=function(){return(_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=Module["asm"][\["Ba\"]).apply(null,arguments)};var
_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=function(){return(_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=Module["asm"][\["Ca\"]).apply(null,arguments)};var
_NotEqual=Module["_NotEqual"]=function(){return(_NotEqual=Module["_NotEqual"]=Module["asm"][\["Da\"]).apply(null,arguments)};var
_OneHot=Module["_OneHot"]=function(){return(_OneHot=Module["_OneHot"]=Module["asm"][\["Ea\"]).apply(null,arguments)};var
_PadV2=Module["_PadV2"]=function(){return(_PadV2=Module["_PadV2"]=Module["asm"][\["Fa\"]).apply(null,arguments)};var
_Pow=Module["_Pow"]=function(){return(_Pow=Module["_Pow"]=Module["asm"][\["Ga\"]).apply(null,arguments)};var
_Prelu=Module["_Prelu"]=function(){return(_Prelu=Module["_Prelu"]=Module["asm"][\["Ha\"]).apply(null,arguments)};var
_Prod=Module["_Prod"]=function(){return(_Prod=Module["_Prod"]=Module["asm"][\["Ia\"]).apply(null,arguments)};var
_RealDiv=Module["_RealDiv"]=function(){return(_RealDiv=Module["_RealDiv"]=Module["asm"][\["Ja\"]).apply(null,arguments)};var
_Relu=Module["_Relu"]=function(){return(_Relu=Module["_Relu"]=Module["asm"][\["Ka\"]).apply(null,arguments)};var
_Relu6=Module["_Relu6"]=function(){return(_Relu6=Module["_Relu6"]=Module["asm"][\["La\"]).apply(null,arguments)};var
_ResizeBilinear=Module["_ResizeBilinear"]=function(){return(_ResizeBilinear=Module["_ResizeBilinear"]=Module["asm"][\["Ma\"]).apply(null,arguments)};var

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 Reverse=Module["_Reverse"]=function(){return(_Reverse=Module["_Reverse"]=Module["asm"][["Na"]]).apply(
 ly(null,arguments));var
 RotateWithOffset=Module["_RotateWithOffset"]=function(){return(_RotateWithOffset=Module["_RotateWith
 Offset"]=Module["asm"][["Oa"]]).apply(null,arguments);var
 Round=Module["_Round"]=function(){return(_Round=Module["_Round"]=Module["asm"][["Pa"]]).apply(nul
 l,arguments);var
 Rsqrt=Module["_Rsqrt"]=function(){return(_Rsqrt=Module["_Rsqrt"]=Module["asm"][["Qa"]]).apply(null,arg
 uments);var
 ScatterNd=Module["_ScatterNd"]=function(){return(_ScatterNd=Module["_ScatterNd"]=Module["asm"][["Ra
 \"]]).apply(null,arguments);var
 SelectV2=Module["_SelectV2"]=function(){return(_SelectV2=Module["_SelectV2"]=Module["asm"][["Sa"]]).
 apply(null,arguments);var
 Sigmoid=Module["_Sigmoid"]=function(){return(_Sigmoid=Module["_Sigmoid"]=Module["asm"][["Ta"]]).ap
 ply(null,arguments);var
 Sin=Module["_Sin"]=function(){return(_Sin=Module["_Sin"]=Module["asm"][["Ua"]]).apply(null,arguments)
 };var
 Softmax=Module["_Softmax"]=function(){return(_Softmax=Module["_Softmax"]=Module["asm"][["Va"]]).a
 pply(null,arguments);var
 Sqrt=Module["_Sqrt"]=function(){return(_Sqrt=Module["_Sqrt"]=Module["asm"][["Wa"]]).apply(null,argume
 nts);var
 Square=Module["_Square"]=function(){return(_Square=Module["_Square"]=Module["asm"][["Xa"]]).apply(n
 ull,arguments);var
 SquaredDifference=Module["_SquaredDifference"]=function(){return(_SquaredDifference=Module["_Squared
 Difference"]=Module["asm"][["Ya"]]).apply(null,arguments);var
 Step=Module["_Step"]=function(){return(_Step=Module["_Step"]=Module["asm"][["Za"]]).apply(null,argume
 nts);var
 StridedSlice=Module["_StridedSlice"]=function(){return(_StridedSlice=Module["_StridedSlice"]=Module["as
 m"][["_a"]]).apply(null,arguments);var
 Sub=Module["_Sub"]=function(){return(_Sub=Module["_Sub"]=Module["asm"][["$a"]]).apply(null,argument
 s);var
 Sum=Module["_Sum"]=function(){return(_Sum=Module["_Sum"]=Module["asm"][["ab"]]).apply(null,argume
 nts);var
 Tan=Module["_Tan"]=function(){return(_Tan=Module["_Tan"]=Module["asm"][["bb"]]).apply(null,argument
 s);var
 Tanh=Module["_Tanh"]=function(){return(_Tanh=Module["_Tanh"]=Module["asm"][["cb"]]).apply(null,argu
 ments);var
 Tile=Module["_Tile"]=function(){return(_Tile=Module["_Tile"]=Module["asm"][["db"]]).apply(null,argument
 s);var
 TopK=Module["_TopK"]=function(){return(_TopK=Module["_TopK"]=Module["asm"][["eb"]]).apply(null,ar
 guments);var
 Transform=Module["_Transform"]=function(){return(_Transform=Module["_Transform"]=Module["asm"][["fb
 b"]]).apply(null,arguments);var
 Transpose=Module["_Transpose"]=function(){return(_Transpose=Module["_Transpose"]=Module["asm"][["gb
 b"]]).apply(null,arguments);var
 FusedMatMul=Module["__FusedMatMul"]=function(){return(__FusedMatMul=Module["__FusedMatMul"]=
 Module["asm"][["hb"]]).apply(null,arguments);var
 malloc=Module["_malloc"]=function(){return(_malloc=Module["_malloc"]=Module["asm"][["ib"]]).apply(nul
 l,arguments);var

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_free=Module["_free"]=function(){return(_free=Module["_free"]=Module["asm"][\`jb\`]).apply(null,arguments
)};var
__errno_location=Module["__errno_location"]=function(){return(__errno_location=Module["__errno_locati
on"]=Module["asm"][\`kb\`]).apply(null,arguments)};var
_emscripten_get_global_libc=Module["_emscripten_get_global_libc"]=function(){return(_emscripten_get_global
_libc=Module["_emscripten_get_global_libc"]=Module["asm"][\`lb\`]).apply(null,arguments)};var
_thread_self=Module["_thread_self"]=function(){return(_thread_self=Module["_thread_self"]=Module["asm"]
[\`mb\`]).apply(null,arguments)};var
__pthread_tsd_run_dtors=Module["__pthread_tsd_run_dtors"]=function(){return(__pthread_tsd_run_dtors=Module["__pthread_tsd_run_dtors"]=Module["asm"][\`nb\`]).apply(null,arguments)};var
_emscripten_main_thread_process_queued_calls=Module["_emscripten_main_thread_process_queued_calls"]=function(){return(_emscripten_main_thread_process_queued_calls=Module["_emscripten_main_thread_process_queued_calls"]=Module["asm"][\`ob\`]).apply(null,arguments)};var
_emscripten_current_thread_process_queued_calls=Module["_emscripten_current_thread_process_queued_calls"]=function(){return(_emscripten_current_thread_process_queued_calls=Module["_emscripten_current_thread_process_queued_calls"]=Module["asm"][\`pb\`]).apply(null,arguments)};var
_emscripten_register_main_browser_thread_id=Module["_emscripten_register_main_browser_thread_id"]=function(){return(_emscripten_register_main_browser_thread_id=Module["_emscripten_register_main_browser_thread_id"]=Module["asm"][\`qb\`]).apply(null,arguments)};var
_emscripten_main_browser_thread_id=Module["_emscripten_main_browser_thread_id"]=function(){return(_emscripten_main_browser_thread_id=Module["_emscripten_main_browser_thread_id"]=Module["asm"][\`rb\`]).apply(null,arguments)};var
__emscripten_do_dispatch_to_thread=Module["__emscripten_do_dispatch_to_thread"]=function(){return(__emscripten_do_dispatch_to_thread=Module["__emscripten_do_dispatch_to_thread"]=Module["asm"][\`sb\`]).apply(null,arguments)};var
_emscripten_sync_run_in_main_thread_4=Module["_emscripten_sync_run_in_main_thread_4"]=function(){return(_emscripten_sync_run_in_main_thread_4=Module["_emscripten_sync_run_in_main_thread_4"]=Module["asm"][\`tb\`]).apply(null,arguments)};var
_emscripten_run_in_main_runtime_thread_js=Module["_emscripten_run_in_main_runtime_thread_js"]=function(){return(_emscripten_run_in_main_runtime_thread_js=Module["_emscripten_run_in_main_runtime_thread_js"]=Module["asm"][\`ub\`]).apply(null,arguments)};var
__emscripten_call_on_thread=Module["__emscripten_call_on_thread"]=function(){return(__emscripten_call_on_thread=Module["__emscripten_call_on_thread"]=Module["asm"][\`vb\`]).apply(null,arguments)};var
_emscripten_tls_init=Module["_emscripten_tls_init"]=function(){return(_emscripten_tls_init=Module["_emscripten_tls_init"]=Module["asm"][\`wb\`]).apply(null,arguments)};var
__emscripten_thread_init=Module["__emscripten_thread_init"]=function(){return(__emscripten_thread_init=Module["__emscripten_thread_init"]=Module["asm"][\`xb\`]).apply(null,arguments)};var
stackSave=Module["stackSave"]=function(){return(stackSave=Module["stackSave"]=Module["asm"][\`yb\`]).apply(null,arguments)};var
stackRestore=Module["stackRestore"]=function(){return(stackRestore=Module["stackRestore"]=Module["asm"][\`zb\`]).apply(null,arguments)};var
stackAlloc=Module["stackAlloc"]=function(){return(stackAlloc=Module["stackAlloc"]=Module["asm"][\`Ab\`]).apply(null,arguments)};var
_emscripten_stack_set_limits=Module["_emscripten_stack_set_limits"]=function(){return(_emscripten_stack_set_limits=Module["_emscripten_stack_set_limits"]=Module["asm"][\`Bb\`]).apply(null,arguments)};var
_memalign=Module["_memalign"]=function(){return(_memalign=Module["_memalign"]=Module["asm"][\`Cb\`]).apply(null,arguments)};var
__emscripten_allow_main_runtime_queued_calls=Module["__emscripten_allow_main_runtime_queued_calls"]=1

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0512;var
__emscripten_main_thread_futex=Module[\"__emscripten_main_thread_futex\"]=12148;Module[\"cwrap\"]=cwrap
;Module[\"PThread\"]=PThread;Module[\"PThread\"]=PThread;Module[\"wasmMemory\"]=wasmMemory;Module
[\"ExitStatus\"]=ExitStatus;var
  calledRun;function ExitStatus(status){this.name=\"ExitStatus\";this.message=\"Program terminated with
exit(\"+status+)\");this.status=status }dependenciesFulfilled=function
runCaller(){ if(!calledRun)run();if(!calledRun)dependenciesFulfilled=runCaller };function
run(args){ args=args||arguments_;if(runDependencies>0){ return }if(ENVIRONMENT_IS_PTHREAD){ readyPromis
eResolve(Module);initRuntime();postMessage({\"cmd\": \"loaded\");return }preRun();if(runDependencies>0){ retur
n }function
doRun(){ if(calledRun)return;calledRun=true;Module[\"calledRun\"]=true;if(ABORT)return;initRuntime();preMain(
);readyPromiseResolve(Module);if(Module[\"onRuntimeInitialized\"])Module[\"onRuntimeInitialized\"]();postRun(
)}if(Module[\"setStatus\"]){ Module[\"setStatus\"](\"Running...\");setTimeout(function(){ setTimeout(function(){ Mo
dule[\"setStatus\"](\"\");},1);doRun(),1)}else {doRun() }}Module[\"run\"]=run;function
exit(status,implicit){ if(implicit&&&noExitRuntime&&status===0){ return }if(!implicit){ if(ENVIRONMENT_IS_PT
HREAD){ postMessage({\"cmd\": \"exitProcess\", \"returnCode\": status});throw
  new
ExitStatus(status)}else { }if(noExitRuntime){ }else {PThread.terminateAllThreads();EXITSTATUS=status;exitRunti
me();if(Module[\"onExit\"])Module[\"onExit\"](status);ABORT=true }quit_(status,new
ExitStatus(status))}if(Module[\"preInit\"])if(typeof
Module[\"preInit\"]!==\"function\")Module[\"preInit\"]=[Module[\"preInit\"]];while(Module[\"preInit\"].length>0){
Module[\"preInit\"].pop() }if(ENVIRONMENT_IS_PTHREAD){ noExitRuntime=false;PThread.initWorker() }run
();\n\n\n return WasmBackendModuleThreadedSimd.ready\n\n\n\n);)\nif (typeof exports === 'object' && typeof
module === 'object')\n  module.exports = WasmBackendModuleThreadedSimd;\nelse if (typeof define ===
'function' && define['amd'])\n  define([], function() { return WasmBackendModuleThreadedSimd; });\nelse if
(typeof exports === 'object')\n  exports[\"WasmBackendModuleThreadedSimd\"]
 = WasmBackendModuleThreadedSimd;\n,\"export const wasmWorkerContents = 'var Module={ };function
threadPrintErr(){ var text=Array.prototype.slice.call(arguments).join(\" \");console.error(text)}function
threadAlert(){ var text=Array.prototype.slice.call(arguments).join(\"
\");postMessage({ cmd: \"alert\", text: text, threadId: Module[\"_pthread_self\"]()})}var
err=threadPrintErr;this.alert=threadAlert;Module[\"instantiateWasm\"]=function(info,receiveInstance){ var
instance=new
WebAssembly.Instance(Module[\"wasmModule\"],info);Module[\"wasmModule\"]=null;receiveInstance(instance);r
eturn instance.exports};function
moduleLoaded(){ }this.onmessage=function(e){ try {if(e.data.cmd===\"load\") { Module[\"wasmModule\"]=e.data. wasmModule;Module[\"wasmMemory\"]=e.data. wasmMemory;Module[\"buffer\"]=Module[\"wasmMemory\"].buffer;
Module[\"ENVIRONMENT_IS_PTHREAD\"]=true;if(typeof
e.data.urlOrBlob===\"string\") { importScripts(e.data.urlOrBlob)}else { var
objectUrl=URL.createObjectURL(e.data.urlOrBlob);importScripts(objectUrl);URL.revokeObjectURL(objectUrl) }
WasmBackendModuleThreadedSimd(Module).then(function(instance){ Module=instance;moduleLoaded()})}else
if(e.data.cmd===\"objectTransfer\") { Module[\"PThread\"].receiveObjectTransfer(e.data)}else
if(e.data.cmd===\"run\") { Module[\"_performance_now_clock_drift\"]=performance.now()-
e.data.time;Module[\"_emscripten_thread_init\"](e.data.threadInfoStruct,0,0);var max=e.data.stackBase;var
top=e.data.stackBase+e.data.stackSize;Module[\"establishStackSpace\"](top,max);Module[\"_emscripten_tls_init\"](
);Module[\"PThread\"].receiveObjectTransfer(e.data);Module[\"PThread\"].setThreadStatus(Module[\"_pthread_self
\"](),1);try { var
result=Module[\"invokeEntryPoint\"](e.data.start_routine,e.data.arg);if(!Module[\"getNoExitRuntime\"]())Module[\"
PThread\"].threadExit(result)} catch(ex) { if(ex===\"Canceled!\"){ Module[\"PThread\"].threadCancel() } else
```

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if(ex!="unwind"){if(ex instanceof
Module["ExitStatus"]){if(Module["getNoExitRuntime"]()){else{Module["PThread"].threadExit(ex.status)}}el
se{Module["PThread"].threadExit(-2);throw
ex}}}}else
if(e.data.cmd==="cancel"){if(Module["_pthread_self"]()){Module["PThread"].threadCancel()}else
if(e.data.target==="setimmediate"){}}else
if(e.data.cmd==="processThreadQueue"){if(Module["_pthread_self"]()){Module["_emscripten_current_thread_
process_queued_calls"]()){}}else{err("worker.js received unknown command
"+e.data.cmd);err(e.data)}}catch(ex){err("worker.js onmessage() captured an uncaught exception:
"+ex);if(ex&&ex.stack)err(ex.stack);throw ex}};if(typeof process==="object"&&typeof
process.versions==="object"&&typeof process.versions.node==="string"){self={location:{href:__filename}};var
onmessage=this.onmessage;var
nodeWorkerThreads=require("worker_threads");global.Worker=nodeWorkerThreads.Worker;var
parentPort=nodeWorkerThreads.parentPort;parentPort.on("message",function(data){onmessage({data:data})});var
nodeFS=require("fs");var nodeRead=function(filename){return
nodeFS.readFileSync(filename,"utf8");};function
globalEval(x){global.require=require;global.Module=Module;eval.call(null,x)}importScripts=function(f){globalEva
l(nodeRead(f));postMessage=function(msg){parentPort.postMessage(msg)};if(typeof
performance==="undefined"){performance={now:function(){return Date.now()}}};","nvar
WasmBackendModule = (function() {\n var _scriptDir = typeof document !== 'undefined' &&
document.currentScript ? document.currentScript.src : undefined;\n if (typeof __filename !== 'undefined')
_scriptDir = _scriptDir || __filename;\n return (\nfunction(WasmBackendModule) {\n WasmBackendModule =
WasmBackendModule || {};\n\nvar Module=typeof
WasmBackendModule!=="undefined"?WasmBackendModule:{};var
readyPromiseResolve,readyPromiseReject;Module["ready"]=new
Promise(function(resolve,reject){readyPromiseResolve=resolve;readyPromiseReject=reject});var
moduleOverrides={};var key;for(key in
Module){if(Module.hasOwnProperty(key)){moduleOverrides[key]=Module[key]}}var
arguments_=[];var thisProgram= "./this.program";var quit_=function(status,toThrow){throw toThrow};var
ENVIRONMENT_IS_WEB=false;var ENVIRONMENT_IS_WORKER=false;var
ENVIRONMENT_IS_NODE=false;var ENVIRONMENT_IS_SHELL=false;ENVIRONMENT_IS_WEB=typeof
window==="object";ENVIRONMENT_IS_WORKER=typeof
importScripts==="function";ENVIRONMENT_IS_NODE=typeof process==="object"&&typeof
process.versions==="object"&&typeof
process.versions.node==="string";ENVIRONMENT_IS_SHELL=!ENVIRONMENT_IS_WEB&&!ENVIRONM
ENT_IS_NODE&&!ENVIRONMENT_IS_WORKER;var scriptDirectory="";function
locateFile(path){if(Module["locateFile"]){return Module["locateFile"](path,scriptDirectory)}return
scriptDirectory+path}var read_,readAsync,readBinary,setWindowTitle;var nodeFS;var
nodePath;if(ENVIRONMENT_IS_NODE){if(ENVIRONMENT_IS_WORKER){scriptDirectory=require("path").
dirname(scriptDirectory)+"^"}else{scriptDirectory=__dirname+"^"}read_=function
shell_read(filename,binary){if(!nodeFS)nodeFS=require("fs");if(!nodePath)nodePath=require("path");filename=n
odePath["normalize"](filename);return
nodeFS["readFileSync"](filename,binary?null:"utf8");};readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret};if(process["argv"].length>1){thisProgram=process["argv"][1].replace(/\\/g,"^")}arguments_=process["arg
v"].slice(2);process["on"]("uncaughtException",function(ex){if(!(ex instanceof ExitStatus)){throw
ex}});process["on"]("unhandledRejection",abort);quit_=function(status){process["exit"](status)};Module["insp
ect"]=function(){return"[Emscripten Module object]"}else if(ENVIRONMENT_IS_SHELL){if(typeof

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read!=="undefined"){read_=function shell_read(f){return read(f)}readBinary=function readBinary(f){var
data;if(typeof readbuffer==="function"){return new
Uint8Array(readbuffer(f))}data=read(f,"binary");assert(typeof data==="object");return data};if(typeof
scriptArgs!="undefined"){arguments_=scriptArgs}else
if(typeof arguments!="undefined"){arguments_=arguments}if(typeof
quit==="function"){quit_=function(status){quit(status)}if(typeof print!="undefined"){if(typeof
console==="undefined")console={};console.log=print;console.warn=console.error=typeof
printErr!="undefined"?printErr:print}}else
if(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER){if(ENVIRONMENT_IS_WORKER){scriptDire
ctory=self.location.href}else if(typeof
document!="undefined"&&document.currentScript){scriptDirectory=document.currentScript.src}if(!_scriptDir){s
criptDirectory=_scriptDir}if(scriptDirectory.indexOf("blob:")!==0){scriptDirectory=scriptDirectory.substr(0,script
Directory.lastIndexOf("/")+1)}else{scriptDirectory=""}}read_=function(url){var xhr=new
XMLHttpRequest;xhr.open("GET",url,false);xhr.send(null);return
xhr.responseText};if(ENVIRONMENT_IS_WORKER){readBinary=function(url){var xhr=new
XMLHttpRequest;xhr.open("GET",url,false);xhr.responseType="arraybuffer";xhr.send(null);return
new Uint8Array(xhr.response)}}readAsync=function(url,onload,onerror){var xhr=new
XMLHttpRequest;xhr.open("GET",url,true);xhr.responseType="arraybuffer";xhr.onload=function(){if(xhr.status
===200||xhr.status===0&&xhr.response){onload(xhr.response);return}onerror();}xhr.onerror=onerror;xhr.send(null)
}setWindowTitle=function(title){document.title=title}else{var
out=Module["print"]||console.log.bind(console);var err=Module["printErr"]||console.warn.bind(console);for(key
in
moduleOverrides){if(moduleOverrides.hasOwnProperty(key)){Module[key]=moduleOverrides[key]}}moduleOverr
ides=null;if(Module["arguments"])arguments_=Module["arguments"];if(Module["thisProgram"])thisProgram=
Module["thisProgram"];if(Module["quit"])quit_=Module["quit"];var
wasmBinary;if(Module["wasmBinary"])wasmBinary=Module["wasmBinary"];var
noExitRuntime=Module["noExitRuntime"]||true;if(typeof WebAssembly!="object"){abort("no native wasm
support detected")}var wasmMemory;var
ABORT=false;var EXITSTATUS;function assert(condition,text){if(!condition){abort("Assertion failed:
"+text)}}function getCFunc(ident){var func=Module["_"+ident];assert(func,"Cannot call unknown function
"+ident+", make sure it is exported");return func}function ccall(ident,returnType,argTypes,args,opts){var
toC={"string":function(str){var ret=0;if(str===null&&str!==undefined&&str===0){var
len=(str.length<<2)+1;ret=stackAlloc(len);stringToUTF8(str,ret,len)}return ret},\array":function(arr){var
ret=stackAlloc(arr.length);writeArrayToMemory(arr,ret);return ret}};function
convertReturnValue(ret){if(returnType==="string")return UTF8ToString(ret);if(returnType==="boolean")return
Boolean(ret);return ret}var func=getCFunc(ident);var cArgs=[];var stack=0;if(args){for(var
i=0;i<args.length;i++){var
converter=toC[argTypes[i]];if(converter){if(stack===0)stack=stackSave();cArgs[i]=converter(args[i])}else{cArgs[i
]=args[i]}}var ret=func.apply(null,cArgs);ret=convertReturnValue(ret);if(stack!==0)stackRestore(stack);return
ret}function cwrap(ident,returnType,argTypes,opts){argTypes=argTypes||[];var
numericArgs=argTypes.every(function(type){return type==="number"});var
numericRet=returnType!="string";if(numericRet&&numericArgs&&!opts){return getCFunc(ident)}return
function(){return ccall(ident,returnType,argTypes,arguments,opts)}}var UTF8Decoder=typeof
TextDecoder!="undefined"?new TextDecoder("utf8"):undefined;function
UTF8ArrayToString(heap,idx,maxBytesToRead){var endIdx=idx+maxBytesToRead;var
endPtr=idx;while(heap[endPtr]&&(endPtr<endIdx))++endPtr;if(endPtr-
idx>16&&heap.subarray&&UTF8Decoder){return UTF8Decoder.decode(heap.subarray(idx,endPtr))}else{var
str="";while(idx<endPtr){var u0=heap[idx++];if(!(u0&128)){str+=String.fromCharCode(u0);continue}var

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u1=heap[idx++]&63;if((u0&224)==192){str+=String.fromCharCode((u0&31)<<6|u1);continue}var
u2=heap[idx++]&63;if((u0&240)==224){u0=(u0&15)<<12|u1<<6|u2}else{u0=(u0&7)<<18|u1<<12|u2<<6|heap[id
x++]&63}if(u0<65536){str+=String.fromCharCode(u0)}else{var
ch=u0-65536;str+=String.fromCharCode(55296|ch>>10,56320|ch&1023)}}return str}function
UTF8ToString(ptr,maxBytesToRead){return
ptr?UTF8ArrayToString(HEAPU8,ptr,maxBytesToRead):""}function
stringToUTF8Array(str,heap,outIdx,maxBytesToWrite){if(!(maxBytesToWrite>0))return 0;var startIdx=outIdx;var
endIdx=outIdx+maxBytesToWrite-1;for(var i=0;i<str.length;++i){var
u=str.charCodeAt(i);if(u>=55296&&u<=57343){var
u1=str.charCodeAt(++i);u=65536+((u&1023)<<10|u1&1023)}if(u<=127){if(outIdx>=endIdx)break;heap[outIdx++]
=u}else if(u<=2047){if(outIdx+1>=endIdx)break;heap[outIdx++]=192|u>>6;heap[outIdx++]=128|u&63}else
if(u<=65535){if(outIdx+2>=endIdx)break;heap[outIdx++]=224|u>>12;heap[outIdx++]=128|u>>6&63;heap[outIdx
++]=128|u&63}else{if(outIdx+3>=endIdx)break;heap[outIdx++]=240|u>>18;heap[outIdx++]=128|u>>12&63;heap[
outIdx++]=128|u>>6&63;heap[outIdx++]=128|u&63}}heap[outIdx]=0;return outIdx-startIdx}function
stringToUTF8(str,outPtr,maxBytesToWrite){return
stringToUTF8Array(str,HEAPU8,outPtr,maxBytesToWrite)}function
writeArrayToMemory(array,buffer){HEAP8.set(array,buffer)}function
alignUp(x,multiple){if(x%multiple>0){x+=multiple-x%multiple}return x}var
buffer,HEAP8,HEAPU8,HEAP16,HEAPU16,HEAP32,HEAPU32,HEAPF32,HEAPF64;function
updateGlobalBufferAndViews(buf){buffer=buf;Module["HEAP8"]=HEAP8=new
Int8Array(buf);Module["HEAP16"]=HEAP16=new Int16Array(buf);Module["HEAP32"]=HEAP32=new
Int32Array(buf);Module["HEAPU8"]=HEAPU8=new Uint8Array(buf);Module["HEAPU16"]=HEAPU16=new
Uint16Array(buf);Module["HEAPU32"]=HEAPU32=new
Uint32Array(buf);Module["HEAPF32"]=HEAPF32=new
Float32Array(buf);Module["HEAPF64"]=HEAPF64=new Float64Array(buf)}var
INITIAL_MEMORY=Module["INITIAL_MEMORY"]||16777216;var wasmTable;var __ATPRERUN__=[];var
__ATINIT__=[];var __ATMAIN__=[];var __ATPOSTRUN__=[];var
runtimeInitialized=false;__ATINIT__.push({func:function(){__wasm_call_ctors()}});function
preRun(){if(Module["preRun"]){if(typeof
Module["preRun"]=="function")Module["preRun"]=[Module["preRun"]];while(Module["preRun"].length){a
ddOnPreRun(Module["preRun"].shift())}callRuntimeCallbacks(__ATPRERUN__)}function
initRuntime(){runtimeInitialized=true;callRuntimeCallbacks(__ATINIT__)}function
preMain(){callRuntimeCallbacks(__ATMAIN__)}function postRun(){if(Module["postRun"]){if(typeof
Module["postRun"]=="function")Module["postRun"]=[Module["postRun"]];while(Module["postRun"].lengt
h){addOnPostRun(Module["postRun"].shift())}callRuntimeCallbacks(__ATPOSTRUN__)}function
addOnPreRun(cb){__ATPRERUN__.unshift(cb)}function addOnPostRun(cb){__ATPOSTRUN__.unshift(cb)}var
runDependencies=0;var runDependencyWatcher=null;var dependenciesFulfilled=null;function
addRunDependency(id){runDependencies++;if(Module["monitorRunDependencies"]){Module["monitorRunDep
endencies"](runDependencies)}function removeRunDependency(id){runDependencies--
;if(Module["monitorRunDependencies"]){Module["monitorRunDependencies"](runDependencies)}if(runDepend
encies==0){if(runDependencyWatcher!==null){clearInterval(runDependencyWatcher);runDependencyWatcher=nu
ll}if(dependenciesFulfilled){var
callback=dependenciesFulfilled;dependenciesFulfilled=null;callback()}}Module["preloadedImages"]={};Module
["preloadedAudios"]={};function
abort(what){if(Module["onAbort"]){Module["onAbort"](what)}what+="\n";err(what);ABORT=true;EXITSTAT
US=1;what+="abort(\n"+what+"\n). Build with -s ASSERTIONS=1 for more info.";var e=new
WebAssembly.RuntimeError(what);readyPromiseReject(e);throw e}function hasPrefix(str,prefix){return
String.prototype.startsWith?str.startsWith(prefix):str.indexOf(prefix)===0}var

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dataURIPrefix="data:application/octet-stream;base64,";function isDataURI(filename){return
hasPrefix(filename,dataURIPrefix)}var fileURIPrefix="file://^";function isFileURI(filename){return
hasPrefix(filename,fileURIPrefix)}var wasmBinaryFile="tfjs-backend-
wasm.wasm";if(!isDataURI(wasmBinaryFile)){wasmBinaryFile=locateFile(wasmBinaryFile)}function
getBinary(file){try{if(file===wasmBinaryFile&&wasmBinary){return new
Uint8Array(wasmBinary)}if(readBinary){return readBinary(file)}else{throw"both async and sync fetching of the
wasm failed"}}catch(err){abort(err)}}function
getBinaryPromise(){if(!wasmBinary&&(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER)){if(typeof
fetch==="function"&&!isFileURI(wasmBinaryFile)){return fetch(wasmBinaryFile,{credentials:"same-
origin"}).then(function(response){if(!response["ok"]){throw"failed to load wasm binary file at
"+wasmBinaryFile+""}return response["arrayBuffer"]()).catch(function(){return
getBinary(wasmBinaryFile)})}else{if(readAsync){return new
Promise(function(resolve,reject){readAsync(wasmBinaryFile,function(response){resolve(new
Uint8Array(response))},reject)}))}}return Promise.resolve().then(function(){return
getBinary(wasmBinaryFile)})}function createWasm(){var info={"a":asmLibraryArg};function
receiveInstance(instance,module){var
exports=instance.exports;Module["asm"]=exports;wasmMemory=Module["asm"]["j"];updateGlobalBufferAnd
Views(wasmMemory.buffer);wasmTable=Module["asm"]["r"];removeRunDependency("wasm-
instantiate")}addRunDependency("wasm-instantiate");function
receiveInstantiatedSource(output){receiveInstance(output["instance"])}function
instantiateArrayBuffer(receiver){return getBinaryPromise().then(function(binary){return
WebAssembly.instantiate(binary,info)}).then(receiver,function(reason){err("failed to asynchronously prepare
wasm: "+reason);abort(reason)})}function instantiateAsync(){if(!wasmBinary&&typeof
WebAssembly.instantiateStreaming==="function"&&!isDataURI(wasmBinaryFile)&&!isFileURI(wasmBinaryFil
e)&&typeof fetch==="function"){return fetch(wasmBinaryFile,{credentials:"same-
origin"}).then(function(response){var result=WebAssembly.instantiateStreaming(response,info);return
result.then(receiveInstantiatedSource,function(reason){err("wasm streaming compile failed: "+reason);err("falling
back to ArrayBuffer
instantiation");return instantiateArrayBuffer(receiveInstantiatedSource)}))}else{return
instantiateArrayBuffer(receiveInstantiatedSource)}if(Module["instantiateWasm"]){try{var
exports=Module["instantiateWasm"](info,receiveInstance);return exports}catch(e){err("Module.instantiateWasm
callback failed with error: "+e);return false}}instantiateAsync().catch(rejectPromise);return{}}function
callRuntimeCallbacks(callbacks){while(callbacks.length>0){var callback=callbacks.shift();if(typeof
callback==="function"){callback(Module);continue}var func=callback.func;if(typeof
func==="number"){if(callback.arg===undefined){wasmTable.get(func)}else{wasmTable.get(func)(callback.arg)
}}else{func(callback.arg===undefined?null:callback.arg)}}function _abort(){abort()}function
_emscripten_memcpy_big(dest,src,num){HEAPU8.copyWithin(dest,src,src+num)}function
_emscripten_get_heap_size(){return HEAPU8.length}function
emscripten_realloc_buffer(size){try{wasmMemory.grow(size-
buffer.byteLength+65535>>>16);updateGlobalBufferAndViews(wasmMemory.buffer);return
1}catch(e){}}function _emscripten_resize_heap(requestedSize){var oldSize=_emscripten_get_heap_size();var
maxHeapSize=2147483648;if(requestedSize>maxHeapSize){return false}for(var
cutDown=1;cutDown<=4;cutDown*=2){var
overGrownHeapSize=oldSize*(1+.2/cutDown);overGrownHeapSize=Math.min(overGrownHeapSize,requestedSize
+100663296);var
newSize=Math.min(maxHeapSize,alignUp(Math.max(requestedSize,overGrownHeapSize),65536));var
replacement=_emscripten_realloc_buffer(newSize);if(replacement){return true}}return false}var
SYSCALLS={mappings:{},buffers:[null,[],[]],printChar:function(stream,curr){var

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```

buffer=SYSCALLS.buffers[stream];if(curr===0||curr===10){(stream===1?out:err)(UTF8ArrayToString(buffer,0));
buffer.length=0}else{buffer.push(curr)},varargs:undefined,get:function(){SYSCALLS.varargs+=4;var
ret=HEAP32[SYSCALLS.varargs-4>>2];return ret},getStr:function(ptr){var ret=UTF8ToString(ptr);return
ret},get64:function(low,high){return
low}},function _fd_close(fd){return 0}function _fd_seek(fd,offset_low,offset_high,whence,newOffset){}function
_fd_write(fd,iiov,iiovcnt,pnum){var num=0;for(var i=0;i<iiovcnt;i++){var ptr=HEAP32[iiov+i*8>>2];var
len=HEAP32[iiov+(i*8+4)>>2];for(var
j=0;j<len;j++){SYSCALLS.printChar(fd,HEAPU8[ptr+j])}num+=len}HEAP32[pnum>>2]=num;return 0}function
_thread_create(){return 6}function _pthread_join(){return 28}function
setErrNo(value){HEAP32[___errno_location()>>2]=value;return value}function
_sysconf(name){switch(name){case 30:return 16384;case 85:var maxHeapSize=2147483648;return
maxHeapSize/16384;case 132:case 133:case 12:case 137:case 138:case 15:case 235:case 16:case 17:case 18:case
19:case 20:case 149:case 13:case 10:case 236:case 153:case 9:case 21:case 22:case 159:case 154:case 14:case
77:case 78:case 139:case 82:case 68:case 67:case 164:case 11:case 29:case 47:case 48:case 95:case 52:case 51:case
46:return 200809;case 27:case 246:case 127:case 128:case 23:case 24:case 160:case
161:case 181:case 182:case 242:case 183:case 184:case 243:case 244:case 245:case 165:case 178:case 179:case
49:case 50:case 168:case 169:case 175:case 170:case 171:case 172:case 97:case 76:case 32:case 173:case 35:case
80:case 81:case 79:return-1;case 176:case 177:case 7:case 155:case 8:case 157:case 125:case 126:case 92:case
93:case 129:case 130:case 131:case 94:case 91:return 1;case 74:case 60:case 69:case 70:case 4:return 1024;case
31:case 42:case 72:return 32;case 87:case 26:case 33:return 2147483647;case 34:case 1:return 47839;case 38:case
36:return 99;case 43:case 37:return 2048;case 0:return 2097152;case 3:return 65536;case 28:return 32768;case
44:return 32767;case 75:return 16384;case 39:return 1e3;case 89:return 700;case 71:return 256;case 40:return
255;case 2:return 100;case 180:return 64;case 25:return 20;case 5:return 16;case 6:return 6;case 73:return 4;case
84:{if(typeof navigator===\"object\")return navigator[\"hardwareConcurrency\"]||1;return 1}}setErrNo(28);return-
1}var
asmLibraryArg={\"a\":_abort,\"d\":_emscripten_memcpy_big,\"e\":_emscripten_resize_heap,\"f\":_fd_close,\"c\":_f
d_seek,\"b\":_fd_write,\"h\":_pthread_create,\"g\":_pthread_join,\"i\":_sysconf};var asm=createWasm();var
___wasm_call_ctors=Module[\"___wasm_call_ctors\"]=function(){return(___wasm_call_ctors=Module[\"___wasm
_call_ctors\"]=Module[\"asm\"][\"k\"]).apply(null,arguments)};var
_init=Module[\"_init\"]=function(){return(_init=Module[\"_init\"]=Module[\"asm\"][\"l\"]).apply(null,arguments)};
var
_init_with_threads_count=Module[\"_init_with_threads_count\"]=function(){return(_init_with_threads_count=Mod
ule[\"_init_with_threads_count\"]=Module[\"asm\"][\"m\"]).apply(null,arguments)};var
_get_threads_count=Module[\"_get_threads_count\"]=function(){return(_get_threads_count=Module[\"_get_threads
_count\"]=Module[\"asm\"][\"n\"]).apply(null,arguments)};var
_register_tensor=Module[\"_register_tensor\"]=function(){return(_register_tensor=Module[\"_register_tensor\"]=M
odule[\"asm\"][\"o\"]).apply(null,arguments)};var
_dispose_data=Module[\"_dispose_data\"]=function(){return(_dispose_data=Module[\"_dispose_data\"]=Module[\"
asm\"][\"p\"]).apply(null,arguments)};var
_dispose=Module[\"_dispose\"]=function(){return(_dispose=Module[\"_dispose\"]=Module[\"asm\"][\"q\"]).apply(n
ull,arguments)};var
_Abs=Module[\"_Abs\"]=function(){return(_Abs=Module[\"_Abs\"]=Module[\"asm\"][\"s\"]).apply(null,arguments
)};var
_Add=Module[\"_Add\"]=function(){return(_Add=Module[\"_Add\"]=Module[\"asm\"][\"t\"]).apply(null,argument
s)};var
_AddN=Module[\"_AddN\"]=function(){return(_AddN=Module[\"_AddN\"]=Module[\"asm\"][\"u\"]).apply(null,ar
guments)};var
_All=Module[\"_All\"]=function(){return(_All=Module[\"_All\"]=Module[\"asm\"][\"v\"]).apply(null,arguments)};

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var
_Any=Module["_Any"]=function(){return(_Any=Module["_Any"]=Module["asm"])[\w]).apply(null,arguments)};var
_ArgMax=Module["_ArgMax"]=function(){return(_ArgMax=Module["_ArgMax"]=Module["asm"])[\x]).apply(null,arguments)};var
_AvgPool=Module["_AvgPool"]=function(){return(_AvgPool=Module["_AvgPool"]=Module["asm"])[\y]).apply(null,arguments)};var
_BatchMatMul=Module["_BatchMatMul"]=function(){return(_BatchMatMul=Module["_BatchMatMul"]=Module["asm"])[\z]).apply(null,arguments)};var
_Ceil=Module["_Ceil"]=function(){return(_Ceil=Module["_Ceil"]=Module["asm"])[\A]).apply(null,arguments)};var
_ClipByValue=Module["_ClipByValue"]=function(){return(_ClipByValue=Module["_ClipByValue"]=Module["asm"])[\B]).apply(null,arguments)};var
_Conv2D=Module["_Conv2D"]=function(){return(_Conv2D=Module["_Conv2D"]=Module["asm"])[\C]).apply(null,arguments)};var
_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=function(){return(_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=Module["asm"])[\D]).apply(null,arguments)};var
_Cos=Module["_Cos"]=function(){return(_Cos=Module["_Cos"]=Module["asm"])[\E]).apply(null,arguments)};var
_Cosh=Module["_Cosh"]=function(){return(_Cosh=Module["_Cosh"]=Module["asm"])[\F]).apply(null,arguments)};var
_CropAndResize=Module["_CropAndResize"]=function(){return(_CropAndResize=Module["_CropAndResize"]=Module["asm"])[\G]).apply(null,arguments)};var
_Cumsum=Module["_Cumsum"]=function(){return(_Cumsum=Module["_Cumsum"]=Module["asm"])[\H]).apply(null,arguments)};var
_DepthToSpace=Module["_DepthToSpace"]=function(){return(_DepthToSpace=Module["_DepthToSpace"]=Module["asm"])[\I]).apply(null,arguments)};var
_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=function(){return(_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=Module["asm"])[\J]).apply(null,arguments)};var
_Elu=Module["_Elu"]=function(){return(_Elu=Module["_Elu"]=Module["asm"])[\K]).apply(null,arguments)};var
_Equal=Module["_Equal"]=function(){return(_Equal=Module["_Equal"]=Module["asm"])[\L]).apply(null,arguments)};var
_Exp=Module["_Exp"]=function(){return(_Exp=Module["_Exp"]=Module["asm"])[\M]).apply(null,arguments)};var
_FlipLeftRight=Module["_FlipLeftRight"]=function(){return(_FlipLeftRight=Module["_FlipLeftRight"]=Module["asm"])[\N]).apply(null,arguments)};var
_Floor=Module["_Floor"]=function(){return(_Floor=Module["_Floor"]=Module["asm"])[\O]).apply(null,arguments)};var
_FloorDiv=Module["_FloorDiv"]=function(){return(_FloorDiv=Module["_FloorDiv"]=Module["asm"])[\P]).apply(null,arguments)};var
_FusedBatchNorm=Module["_FusedBatchNorm"]=function(){return(_FusedBatchNorm=Module["_FusedBatchNorm"]=Module["asm"])[\Q]).apply(null,arguments)};var
_FusedConv2D=Module["_FusedConv2D"]=function(){return(_FusedConv2D=Module["_FusedConv2D"]=Module["asm"])[\R]).apply(null,arguments)};var
_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=function(){return(_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=Module["asm"])[\S]).apply(null,arguments)};var
_Gather=Module["_Gather"]=function(){return(_Gather=Module["_Gather"]=Module["asm"])[\T]).apply(null,arguments)};var

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,arguments));var
_GatherNd=Module["_GatherNd"]=function(){return(_GatherNd=Module["_GatherNd"]=Module["asm"])[\["U"
)].apply(null,arguments)};var
_Greater=Module["_Greater"]=function(){return(_Greater=Module["_Greater"]=Module["asm"])[\["V"]].apply(
null,arguments)};var
_GreaterEqual=Module["_GreaterEqual"]=function(){return(_GreaterEqual=Module["_GreaterEqual"]=Module[
"asm"])[\["W"]].apply(null,arguments)};var
_LeakyRelu=Module["_LeakyRelu"]=function(){return(_LeakyRelu=Module["_LeakyRelu"]=Module["asm"])[\
"X"]].apply(null,arguments)};var
_Less=Module["_Less"]=function(){return(_Less=Module["_Less"]=Module["asm"])[\["Y"]].apply(null,argume
nts)};var
_LessEqual=Module["_LessEqual"]=function(){return(_LessEqual=Module["_LessEqual"]=Module["asm"])[\["
Z"]].apply(null,arguments)};var
_Log=Module["_Log"]=function(){return(_Log=Module["_Log"]=Module["asm"])[\["_"]].apply(null,arguments
)};var
_LogicalAnd=Module["_LogicalAnd"]=function(){return(_LogicalAnd=Module["_LogicalAnd"]=Module["asm
"])[\["$"]].apply(null,arguments)};var
_Max=Module["_Max"]=function(){return(_Max=Module["_Max"]=Module["asm"])[\["aa"]].apply(null,argume
nts)};var
_MaxPool=Module["_MaxPool"]=function(){return(_MaxPool=Module["_MaxPool"]=Module["asm"])[\["ba"]].
apply(null,arguments)};var
_Maximum=Module["_Maximum"]=function(){return(_Maximum=Module["_Maximum"]=Module["asm"])[\["c
a"]].apply(null,arguments)};var
_Mean=Module["_Mean"]=function(){return(_Mean=Module["_Mean"]=Module["asm"])[\["da"]].apply(null,ar
guments)};var
_Min=Module["_Min"]=function(){return(_Min=Module["_Min"]=Module["asm"])[\["ea"]].apply(null,argumen
ts)};var
_Minimum=Module["_Minimum"]=function(){return(_Minimum=Module["_Minimum"]=Module["asm"])[\["fa
"]].apply(null,arguments)};var
_MirrorPad=Module["_MirrorPad"]=function(){return(_MirrorPad=Module["_MirrorPad"]=Module["asm"])[\["g
a"]].apply(null,arguments)};var
_Multiply=Module["_Multiply"]=function(){return(_Multiply=Module["_Multiply"]=Module["asm"])[\["ha
"]].apply(null,arguments)};var
_Neg=Module["_Neg"]=function(){return(_Neg=Module["_Neg"]=Module["asm"])[\["ia"]].apply(null,argument
s)};var
_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=function(){return(_NonMaxSuppressionV3=Mod
ule["_NonMaxSuppressionV3"]=Module["asm"])[\["ja"]].apply(null,arguments)};var
_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=function(){return(_NonMaxSuppressionV4=Mod
ule["_NonMaxSuppressionV4"]=Module["asm"])[\["ka"]].apply(null,arguments)};var
_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=function(){return(_NonMaxSuppressionV5=Mod
ule["_NonMaxSuppressionV5"]=Module["asm"])[\["la"]].apply(null,arguments)};var
_NotEqual=Module["_NotEqual"]=function(){return(_NotEqual=Module["_NotEqual"]=Module["asm"])[\["ma
"]].apply(null,arguments)};var
_OneHot=Module["_OneHot"]=function(){return(_OneHot=Module["_OneHot"]=Module["asm"])[\["na
"]].apply(null,arguments)};var
_PadV2=Module["_PadV2"]=function(){return(_PadV2=Module["_PadV2"]=Module["asm"])[\["oa
"]].apply(null,arguments)};var
_Pow=Module["_Pow"]=function(){return(_Pow=Module["_Pow"]=Module["asm"])[\["pa
"]].apply(null,argume

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nts));var
_Prelu=Module["_Prelu"]=function(){return(_Prelu=Module["_Prelu"]=Module["asm"][\`"qa"\`]).apply(null,arguments)};var
_Prod=Module["_Prod"]=function(){return(_Prod=Module["_Prod"]=Module["asm"][\`"ra"\`]).apply(null,arguments)};var
_RealDiv=Module["_RealDiv"]=function(){return(_RealDiv=Module["_RealDiv"]=Module["asm"][\`"sa"\`]).apply(null,arguments)};var
_Reluv=Module["_Reluv"]=function(){return(_Reluv=Module["_Reluv"]=Module["asm"][\`"ta"\`]).apply(null,arguments)};var
_Reluv6=Module["_Reluv6"]=function(){return(_Reluv6=Module["_Reluv6"]=Module["asm"][\`"ua"\`]).apply(null,arguments)};var
_ResizeBilinear=Module["_ResizeBilinear"]=function(){return(_ResizeBilinear=Module["_ResizeBilinear"]=Module["asm"][\`"va"\`]).apply(null,arguments)};var
_Reverse=Module["_Reverse"]=function(){return(_Reverse=Module["_Reverse"]=Module["asm"][\`"wa"\`]).apply(null,arguments)};var
_RotateWithOffset=Module["_RotateWithOffset"]=function(){return(_RotateWithOffset=Module["_RotateWithOffset"]=Module["asm"][\`"xa"\`]).apply(null,arguments)};var
_Round=Module["_Round"]=function(){return(_Round=Module["_Round"]=Module["asm"][\`"ya"\`]).apply(null,arguments)};var
_Rsqrt=Module["_Rsqrt"]=function(){return(_Rsqrt=Module["_Rsqrt"]=Module["asm"][\`"za"\`]).apply(null,arguments)};var
_ScatterNd=Module["_ScatterNd"]=function(){return(_ScatterNd=Module["_ScatterNd"]=Module["asm"][\`"Aa"\`]).apply(null,arguments)};var
_SelectV2=Module["_SelectV2"]=function(){return(_SelectV2=Module["_SelectV2"]=Module["asm"][\`"Ba"\`]).apply(null,arguments)};var
_Sigmoid=Module["_Sigmoid"]=function(){return(_Sigmoid=Module["_Sigmoid"]=Module["asm"][\`"Ca"\`]).apply(null,arguments)};var
_Sin=Module["_Sin"]=function(){return(_Sin=Module["_Sin"]=Module["asm"][\`"Da"\`]).apply(null,arguments)};var
_Softmax=Module["_Softmax"]=function(){return(_Softmax=Module["_Softmax"]=Module["asm"][\`"Ea"\`]).apply(null,arguments)};var
_Sqrt=Module["_Sqrt"]=function(){return(_Sqrt=Module["_Sqrt"]=Module["asm"][\`"Fa"\`]).apply(null,arguments)};var
_Square=Module["_Square"]=function(){return(_Square=Module["_Square"]=Module["asm"][\`"Ga"\`]).apply(null,arguments)};var
_SquaredDifference=Module["_SquaredDifference"]=function(){return(_SquaredDifference=Module["_SquaredDifference"]=Module["asm"][\`"Ha"\`]).apply(null,arguments)};var
_Step=Module["_Step"]=function(){return(_Step=Module["_Step"]=Module["asm"][\`"Ia"\`]).apply(null,arguments)};var
_StridedSlice=Module["_StridedSlice"]=function(){return(_StridedSlice=Module["_StridedSlice"]=Module["asm"][\`"Ja"\`]).apply(null,arguments)};var
_Sub=Module["_Sub"]=function(){return(_Sub=Module["_Sub"]=Module["asm"][\`"Ka"\`]).apply(null,arguments)};var
_Sum=Module["_Sum"]=function(){return(_Sum=Module["_Sum"]=Module["asm"][\`"La"\`]).apply(null,arguments)};var
_Tan=Module["_Tan"]=function(){return(_Tan=Module["_Tan"]=Module["asm"][\`"Ma"\`]).apply(null,arguments)};var
_Tanh=Module["_Tanh"]=function(){return(_Tanh=Module["_Tanh"]=Module["asm"][\`"Na"\`]).apply(null,arguments)};var

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ments));var
_Tile=Module["_Tile"]=function(){return(_Tile=Module["_Tile"]=Module["asm"]["Oa"]).apply(null,arguments)};var
_TopK=Module["_TopK"]=function(){return(_TopK=Module["_TopK"]=Module["asm"]["Pa"]).apply(null,arguments)};var
_Transform=Module["_Transform"]=function(){return(_Transform=Module["_Transform"]=Module["asm"]["Qa"]).apply(null,arguments)};var
_Transpose=Module["_Transpose"]=function(){return(_Transpose=Module["_Transpose"]=Module["asm"]["Ra"]).apply(null,arguments)};var
__FusedMatMul=Module["__FusedMatMul"]=function(){return(__FusedMatMul=Module["__FusedMatMul"]=Module["asm"]["Sa"]).apply(null,arguments)};var
_malloc=Module["_malloc"]=function(){return(_malloc=Module["_malloc"]=Module["asm"]["Ta"]).apply(null,arguments)};var
_free=Module["_free"]=function(){return(_free=Module["_free"]=Module["asm"]["Ua"]).apply(null,arguments)};var
__errno_location=Module["__errno_location"]=function(){return(__errno_location=Module["__errno_location"]=Module["asm"]["Va"]).apply(null,arguments)};var
stackSave=Module["stackSave"]=function(){return(stackSave=Module["stackSave"]=Module["asm"]["Wa"]).apply(null,arguments)};var
stackRestore=Module["stackRestore"]=function(){return(stackRestore=Module["stackRestore"]=Module["asm"]["Xa"]).apply(null,arguments)};var
stackAlloc=Module["stackAlloc"]=function(){return(stackAlloc=Module["stackAlloc"]=Module["asm"]["Ya"]).apply(null,arguments)};Module["cwrap"]=cwrap;var calledRun;function
ExitStatus(status){this.name="ExitStatus";this.message="Program terminated with
exit("+status+")";this.status=status}dependenciesFulfilled=function
runCaller(){if(!calledRun)run();if(!calledRun)dependenciesFulfilled=runCaller};function
run(args){args=args||arguments_;if(runDependencies>0){return}preRun();if(runDependencies>0){return}function
doRun(){if(calledRun)return;calledRun=true;Module["calledRun"]=true;if(ABORT)return;initRuntime();preMain(
);readyPromiseResolve(Module);if(Module["onRuntimeInitialized"])Module["onRuntimeInitialized"]();postRun(
)}if(Module["setStatus"]){Module["setStatus"]("Running...");setTimeout(function(){setTimeout(function(){Module["setStatus"](""),1);doRun()},1)}else{doRun()}}Module["run"]=run;if(Module["preInit"]){if(typeof
Module["preInit"]=="function")Module["preInit"]=[Module["preInit"]];while(Module["preInit"].length>0){
Module["preInit"].pop()}run();\n\n\n return WasmBackendModule.ready\n\n\n);nif (typeof exports ===
'object' && typeof module === 'object')\n module.exports = WasmBackendModule;\nelse if (typeof define ===
'function' && define['amd'])\n define([], function() { return WasmBackendModule; });\nelse if (typeof exports ===
'object')\n exports["WasmBackendModule"] = WasmBackendModule;\n",/**\n * @license\n * Copyright 2019
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\nimport './flags_wasm';\nimport {backend_util, BackendTimingInfo, DataStorage, DataType, deprecationWarn,
engine, env, KernelBackend, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasmModule,
WasmFactoryConfig} from './wasm-out/tfjs-backend-wasm';\nimport {BackendWasmThreadedSimdModule} from
'./wasm-out/tfjs-backend-wasm-threaded-simd';\nimport wasmFactoryThreadedSimd from './wasm-out/tfjs-
backend-wasm-threaded-simd.js';\n// @ts-ignore\nimport {wasmWorkerContents} from './wasm-out/tfjs-backend-

```

```

wasm-threaded-simd.worker.js';\nimport wasmFactory from './wasm-out/tfjs-backend-wasm.js';\n\ninterface
TensorData {\n id: number;\n memoryOffset: number;\n shape: number[];\n dtype: DataType;\n refCount:
number;\n /** Only used for string tensors, storing encoded bytes. */\n stringBytes?: Uint8Array[];\n}\n\nexport
type DataId = object; // object instead of {} to force non-primitive.\n\nexport class BackendWasm extends
KernelBackend {\n // 0 is reserved for null data ids.\n private dataIdNextNumber = 1;\n dataIdMap:
DataStorage<TensorData>;\n\n constructor(public
wasm: BackendWasmModule|BackendWasmThreadedSimdModule) {\n super();\n
this.wasm.tfjs.initWithThreadsCount(threadsCount);\n actualThreadsCount = this.wasm.tfjs.getThreadsCount();\n
this.dataIdMap = new DataStorage(this, engine());\n }\n\n write(values: backend_util.BackendValues, shape:
number[], dtype: DataType):\n DataId {\n const dataId = {id: this.dataIdNextNumber++};\n
this.move(dataId, values, shape, dtype, 1);\n return dataId;\n }\n\n numDataIds(): number {\n return
this.dataIdMap.numDataIds();\n }\n\n async time(f: () => void): Promise<BackendTimingInfo> {\n const start =
util.now();\n f();\n const kernelMs = util.now() - start;\n return {kernelMs};\n }\n\n move(\n dataId:
DataId, values: backend_util.BackendValues, shape: number[],\n dtype: DataType, refCount: number): void {\n
const id = this.dataIdNextNumber++;\n if (dtype === 'string') {\n const stringBytes = values as Uint8Array[];\n
this.dataIdMap.set(\n
dataId,\n {id, stringBytes, shape, dtype, memoryOffset: null, refCount});\n return;\n }\n\n const
size = util.sizeFromShape(shape);\n const numBytes = size * util.bytesPerElement(dtype);\n const
memoryOffset = this.wasm._malloc(numBytes);\n this.dataIdMap.set(dataId, {id, memoryOffset, shape, dtype,
refCount});\n\n this.wasm.tfjs.registerTensor(id, size, memoryOffset);\n\n if (values != null) {\n
this.wasm.HEAPU8.set(\n new Uint8Array(\n (values as backend_util.TypedArray).buffer,\n
(values as backend_util.TypedArray).byteOffset, numBytes),\n memoryOffset);\n }\n }\n\n async
read(dataId: DataId): Promise<backend_util.BackendValues> {\n return this.readSync(dataId);\n }\n\n
readSync(dataId: DataId): backend_util.BackendValues {\n const {memoryOffset, dtype, shape, stringBytes} =\n
this.dataIdMap.get(dataId);\n if (dtype === 'string') {\n return
stringBytes;\n }\n const bytes = this.wasm.HEAPU8.slice(\n memoryOffset,\n memoryOffset +
util.sizeFromShape(shape) * util.bytesPerElement(dtype));\n return typedArrayFromBuffer(bytes.buffer, dtype);\n
}\n\n /**\n * Dispose the memory if the dataId has 0 refCount. Return true if the memory\n * is released, false
otherwise.\n * @param dataId\n * @param force Optional, remove the data regardless of refCount\n */\n
disposeData(dataId: DataId, force = false): boolean {\n if (this.dataIdMap.has(dataId)) {\n const data =
this.dataIdMap.get(dataId);\n data.refCount--;\n if (!force && data.refCount > 0) {\n return false;\n
}\n\n this.wasm._free(data.memoryOffset);\n this.wasm.tfjs.disposeData(data.id);\n
this.dataIdMap.delete(dataId);\n }\n return true;\n }\n\n /** Return refCount of a `TensorData`.\n */\n
refCount(dataId: DataId): number {\n if (this.dataIdMap.has(dataId)) {\n const tensorData =
this.dataIdMap.get(dataId);\n
return tensorData.refCount;\n }\n return 0;\n }\n\n incRef(dataId: DataId) {\n const data =
this.dataIdMap.get(dataId);\n if (data != null) {\n data.refCount++;\n }\n }\n\n floatPrecision(): 32 {\n
return 32;\n }\n\n // Returns the memory offset of a tensor. Useful for debugging and unit\n // testing.\n
getMemoryOffset(dataId: DataId): number {\n return this.dataIdMap.get(dataId).memoryOffset;\n }\n\n
dispose() {\n this.wasm.tfjs.dispose();\n if ('PThread' in this.wasm) {\n
this.wasm.PThread.terminateAllThreads();\n }\n this.wasm = null;\n }\n\n memory() {\n return {unreliable:
false};\n }\n\n /**\n * Make a tensor info for the output of an op. If `memoryOffset` is not\n * present, this
method allocates memory on the WASM heap. If `memoryOffset`\n * is present, the memory was allocated
elsewhere (in c++) and we just record\n * the pointer where that memory lives.\n */\n makeOutput(shape:
number[], dtype: DataType, memoryOffset?: number):\n TensorInfo {\n let dataId: {};\n if (memoryOffset
== null) {\n dataId = this.write(null /* values */, shape, dtype);\n } else {\n const id =
this.dataIdNextNumber++;\n dataId = {id};\n this.dataIdMap.set(dataId, {id, memoryOffset, shape, dtype,
refCount: 1});\n const size = util.sizeFromShape(shape);\n this.wasm.tfjs.registerTensor(id, size,

```



```

WasmBackendModuleThreadedSimd = ` +\n      wasmFactoryThreadedSimd.toString()),\n      { type:
'text/javascript'});\n      wasm = wasmFactoryThreadedSimd(factoryConfig);\n    } else {\n      // The wasmFactory
works for both vanilla and SIMD binaries.\n      wasm = wasmFactory(factoryConfig);\n    }\n\n    // The WASM
module has been successfully created by the factory.\n    // Any error will be caught by the onAbort callback defined
above.\n    wasm.then((module) => {\n      initialized = true;\n      initAborted = false;\n\n      const voidReturnType:
string
= null;\n      // Using the tfjs namespace to avoid conflict with emscripten's API.\n      module.tfjs = {\n        init:
module.cwrap('init', null, []),\n        initWithThreadsCount:\n          module.cwrap('init_with_threads_count', null,
['number']),\n        getThreadsCount: module.cwrap('get_threads_count', 'number', []),\n        registerTensor:
module.cwrap(\n          'register_tensor', null,\n          [\n            'number', // id\n            'number', // size\n            'number', // memoryOffset\n          ]),\n        disposeData: module.cwrap('dispose_data', voidReturnType,
['number']),\n        dispose: module.cwrap('dispose', voidReturnType, []),\n      };\n\n      resolve({ wasm: module });\n    });\n  });\n\n  function typedArrayFromBuffer(\n    buffer: ArrayBuffer, dtype: DataType):
backend_util.TypedArray {\n    switch (dtype) {\n      case 'float32':\n        return new Float32Array(buffer);\n      case
'int32':\n        return new Int32Array(buffer);\n      case 'bool':\n        return new Uint8Array(buffer);\n      default:\n        throw new Error(`Unknown dtype ${dtype}`);\n    }\n  }\n\n  const wasmBinaryNames = [\n    'tfjs-backend-wasm.wasm', 'tfjs-backend-wasm-simd.wasm',\n    'tfjs-backend-wasm-threaded-simd.wasm'\n  ] as const;\n  type WasmBinaryName = typeof
wasmBinaryNames[number];\n\n  let wasmPath: string = null;\n  let wasmPathPrefix: string = null;\n  let wasmFileMap:
{[key in WasmBinaryName]?: string} = {};\n  let initAborted = false;\n  let customFetch = false;\n\n  /**\n   *
@deprecated Use `setWasmPaths` instead.\n   * Sets the path to the `.wasm` file which will be fetched when the
wasm\n   * backend is initialized. See\n   * https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-wasm/README.md#using-bundlers\n   * for more details.\n   * @param path wasm file path or url\n   * @param
usePlatformFetch optional boolean to use platform fetch to download\n   * the wasm file, default to false.\n   */\n   *
@doc {heading: 'Environment', namespace: 'wasm'}\n   */\n  export
function setWasmPath(path: string, usePlatformFetch = false): void {\n    deprecationWarn(\n      'setWasmPath has
been deprecated in favor of setWasmPaths and '\n      ' will be removed in a future release.);\n    if (initAborted) {\n      throw new Error(\n        'The WASM backend was already initialized. Make sure you call '\n        ' `setWasmPath()`\n        before you call `tf.setBackend()` or `tf.ready()`);\n    }\n    wasmPath = path;\n    customFetch =
usePlatformFetch;\n  }\n\n  /**\n   * Configures the locations of the WASM binaries.\n   */\n   * ``js\n   * setWasmPaths({\n   * 'tfjs-backend-wasm.wasm': 'renamed.wasm',\n   * 'tfjs-backend-wasm-simd.wasm': 'renamed-simd.wasm',\n   *
'tfjs-backend-wasm-threaded-simd.wasm': 'renamed-threaded-simd.wasm'\n   * });\n   * tf.setBackend('wasm');\n   *
```\n   * @param prefixOrFileMap This can be either a string or object:\n   * - (string) The path to the directory
where the WASM binaries are located.\n * Note that this prefix will be used to load each binary
(vanilla,\n * SIMD-enabled, threading-enabled, etc.).\n * - (object) Mapping from names of WASM binaries to
custom\n * full paths specifying the locations of those binaries. This is useful if\n * your WASM binaries are
not all located in the same directory, or if your\n * WASM binaries have been renamed.\n * @param
usePlatformFetch optional boolean to use platform fetch to download\n * the wasm file, default to false.\n */\n *
@doc {heading: 'Environment', namespace: 'wasm'}\n */\n export function setWasmPaths(\n prefixOrFileMap:
string|{[key in WasmBinaryName]?: string},\n usePlatformFetch = false): void {\n if (initAborted) {\n throw
new Error(\n 'The WASM backend was already initialized. Make sure you call '\n ' `setWasmPaths()`\n before you call `tf.setBackend()` or '\n ' `tf.ready()`);\n }\n\n if (typeof prefixOrFileMap === 'string') {\n wasmPathPrefix = prefixOrFileMap;\n } else {\n wasmFileMap = prefixOrFileMap;\n const missingPaths =\n wasmBinaryNames.filter(name => wasmFileMap[name] === null);\n if
(missingPaths.length > 0) {\n throw new Error(\n `There were no entries found for the following binaries: `
+\n `${missingPaths.join(',')}. Please either call setWasmPaths with a\n `map providing a path for
each binary, or with a string indicating\n `the directory where all the binaries can be found.`);\n }\n }\n }\n\n customFetch = usePlatformFetch;\n\n /**\n * Used in unit tests.\n */\n export function resetWasmPath(): void {\n

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wasmPath = null;\n wasmPathPrefix = null;\n wasmFileMap = {};\n customFetch = false;\n initAborted = false;\n}\n\nlet threadsCount = -1;\nlet actualThreadsCount = -1;\n\n/**\n * Sets the number of threads that will be used by XNNPACK to create\n * threadpool (default to the number of logical CPU cores).\n *\n * This must be called before calling `tf.setBackend('wasm')`.\n */\nexport function setThreadsCount(numThreads: number) {\n threadsCount = numThreads;\n}\n\n/**\n * Gets the actual threads count that is used by XNNPACK.\n *\n * It is set after the backend is initialized.\n */\nexport function getThreadsCount(): number {\n if (actualThreadsCount === -1) {\n throw new Error(`WASM backend not initialized.`);\n }\n return actualThreadsCount;\n}\n\n"/** @license See the LICENSE file. */\n\n// This code is auto-generated, do not modify this file!\n\nconst version = '3.11.0';\nexport {version};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

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=====\n\n*/\n\nimport './flags_wasm';\nimport {registerBackend} from '@tensorflow/tfjs-core';\nimport {BackendWasm, init} from './backend_wasm';\nexport {BackendWasm, getThreadsCount, setThreadsCount, setWasmPath, setWasmPaths} from './backend_wasm';\nexport {version as version_wasm} from './version';\n\nconst WASM_PRIORITY = 2;\nregisterBackend('wasm', async () => {\n const {wasm} = await init();\n return new BackendWasm(wasm);\n},\n\nWASM_PRIORITY);\n\n],\n\nnames":["_FusedMatMul","util","Abs","backend_util","Add","AddN","Identity","setup","Transpose","All","Any","wasmFunc","ArgMax","AvgPool","Reshape","BatchMatMul","slice_util","buffer","sliceImplCPU","Slice","BatchToSpaceND","Cast","Ceil","ClipByValue","concatImplCPU","Concat","Conv2D","Conv2DBackpropInput","Cos","Cosh","CropAndResize","Cumsum","DepthToSpace","DepthwiseConv2dNative","Elu","supportsFullBroadcast","Equal","Exp","ExpandDims","Fill","FlipLeftRight","Floor","FloorDiv","FusedBatchNorm","FusedConv2D","FusedDepthwiseConv2D","GatherNd","GatherV2","Greater","GreaterEqual","setupFunc","LeakyRelu","Less","LessEqual","Log","LogicalAnd","Max","Maximum","MaxPool","Mean","Min","Minimum","MirrorPad","Multiply","Neg","NonMaxSuppressionV3","NonMaxSuppressionV4","NonMaxSuppressionV5","kernelFunc","NotEqual","OneHot","OnesLike","Pack","PadV2","Pow","Prelu","Prod","rangeImplCPU","Range","RealDiv","Relu","Relu6","ResizeBilinear","Reverse","RotateWithOffset","Round","Rsqrt","ScatterNd","Select","Sigmoid","Sin","Softmax","SpaceToBatchND","SplitV","Sqrt","Square","SquaredDifference","Step","StridedSlice","Sub","Sum","Tan","Tanh","Tile","TopK","Transform","Unpack","ZerosLike","registerKernel","env","require$$0","require$$1","require$$2","global","require$$3","require$$4","tslib_1.__extends","DataStorage","engine","KernelBackend","wasmFactoryThreadedSimd","wasmFactory","deprecationWarn","registerBackend"],"mappings":";;AAAA;AAiBA;AACa,IAAY,QAMX;AAND,WAAY,QAAQ;IACIB,6CAAW,CAAA;IACX,yCAAS,CAAA;IACT,uCAAQ,CAAA;IACR,2CAAU,CAAA;IACV,iDAaA,CAAA;AACf,CAAC,EANW,QAAQ,KAAQ,QAQ,QAMnB;AAED;AACa,IAAY,iBAQX;AARD,WAAY,iBAaiB;IAC3B,6DAAU,CAAA;IACV,yDAAQ,CAAA;IACR,2DAAS,CAAA;IACT,2DAAS,CAAA;IACT,mEAAa,CAAA;IACb,+DAAW,CAAA;IACX,uDAAO,CAAA;AACT,CAAC,EARW,iBAaiB,KAAjB,iBAaiB;;AC3B7B;AAuBA,IAAI,eAKQ,CAAC;AAEb,SAAS,KAAK,CAAC,OAAoB;IACjC,eAAe,GAAG,OAAO,CAAC,IAAI,CAAC,KAAK,CAACA,qBAAy,EAAE,IAAI,aAAa;QACIE,QAAQ;QACR,OAAO;QACP,QAAQ;QACR,QAAQ;QACR,OAAO;QACP,QAAQ;QACR,QAAQ;QACR,QAAQ;QACR,QAAQ;QACR,QAAQ;QACR,QAAQ;KACT,CAAC,CAAC;AACL,CAAC;AAED,SAAS,gBAAgB,CAAC,IAIzB;IACQ,IAAA,oBAAM,EAAE,sBAAO,EAAE,kBAAK,CAAS;IAC/B,IAAA,YAAC,EAAE,YAAC,EAAE,kBAAI,EAAE,sDAAsB,CAAW;IAEpD,IAAI,CAAC,CAAC,KAAK,KAAK,SAAS,IAAI,CAAC,CAAC,KAAK,KAAK,SAAS,EAAE;QACID,MAAM,IAAI,KAAK,CACX,6DAA6D,CAAC,CAAC;KACpE;IAEM,IAAA,6BAAU,EAAE,6BAAU,EAAE,6BAAU,EAAE,qCAAc,CAAU;IACnE,IAAM,GA
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K;CACjB;;ACtHD;:::;AAqBA;:::;SAQgB,uBAAB,CACnC,CAAA,EAAE,IAAqB,EAAE,OAAoB;IAM5  
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AY,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,WAAW,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;QA  
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\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/tf-backend-wasm.node.js.map

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\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/starter/parcel/index.html

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\*/

/\*\*

\* @deprecated Use `setWasmPaths` instead.

\* Sets the path to the `wasm` file which will be fetched when the wasm

\* backend is initialized. See

\* <https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-wasm/README.md#using-bundlers>

\* for more details.

\* @param path wasm file path or url

\* @param usePlatformFetch optional boolean to use platform fetch to download

\* the wasm file, default to false.

\*

\* @doc {heading: 'Environment', namespace: 'wasm'}

\*/

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/tf-backend-wasm.fesm.js

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```
=====\n*\n\nimport { backend_util, KernelConfig, KernelFunc, Max, MaxAttrs, MaxInputs, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport { permuteAxesAndTranspose } from './kernel_utils';\nimport { CppDType } from './types';\n\nlet wasmMax: (xId: number, dtype: number, reduceSize: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmMax = backend.wasm.cwrap(Max, null /*void*/, [\n 'number', // x_id\n 'number', // dtype\n 'number', // reduce_size\n 'number', // out_id\n]);\n\n function max(args: { backend: BackendWasm, inputs: MaxInputs, attrs: MaxAttrs }): TensorInfo {\n const { backend, inputs, attrs } = args;\n const { reductionIndices: axis, keepDims } = attrs;\n const { x } = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const { transposed, axes, originalAxes, inputWasTransposed } =\n permuteAxesAndTranspose(x, axis, backend);\n\n if (inputWasTransposed) {\n const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n input = transposed;\n inputId = transposedId;\n }\n\n const inputRank = input.shape.length;\n backend_util.assertAxesAreInnerMostDims('max', axes, inputRank);\n const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, axes);\n const reduceSize =\n util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, x.dtype);\n\n if (util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmMax(inputId, CppDType[x.dtype], reduceSize, outId);\n }\n\n if (inputWasTransposed) {\n // dispose of the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n return out;\n }\n\n export const maxConfig: KernelConfig = {\n kernelName: Max,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: max as KernelFunc\n };\n}
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Found

in path(s):

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* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Max.js.map
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```
{"version":3,"file":"tf-backend-wasm.fesm.min.js","sources":["../src/kernels/types.ts","../src/kernels/_FusedMatMul.ts","../src/kernels/unary_kernel.ts","../src/kernels/Abs.ts","../src/kernels/binary_kernel.ts","../src/kernels/Add.ts","../src/kernels/AddN.ts","../src/kernels/Identity.ts","../src/kernels/Transpose.ts","../src/kernels/kernel_utils.ts","../src/kernels/All.ts","../src/kernels/Any.ts","../src/kernels/ArgMax.ts","../src/kernels/AvgPool.ts","../src/kernels/Reshape.ts","../src/kernels/BatchMatMul.ts","../node_modules/@tensorflow/tfjs-backend-cpu/dist/kernels/Slice.js","../src/kernels/Slice.ts","../src/kernels/BatchToSpaceND.ts","../src/kernels/Cast.ts","../src/kernels/Ceil.ts","../src/kernels/ClipByValue.ts","../src/kernels/Concat.ts","../node_modules/@tensorflow/tfjs-backend-cpu/dist/kernels/Concat_impl.js","../src/kernels/Conv2D.ts","../src/kernels/Conv2DBackpropInput.ts","../src/kernels/Cos.ts","../src/kernels/Cosh.ts","../src/kernels/CropAndResize.ts","../src/kernels/Cumsum.ts","../src/kernels/DepthToSpace.ts","../src/kernels/DepthwiseConv2dNative.ts","../src/kernels/Elu.ts","../src/kernels/Equal.ts","../src/kernels/Exp.ts","../src/kernels/ExpandDims.ts","../src/kernels/Fill.ts","../src/kernels/FlipLeftRight.ts","../src/kernels/Floor.ts","../src/kernels/FloorDiv.ts","../src/kernels/FusedBatchNorm.ts","../src/kernels/FusedConv2D.ts","../src/kernels/FusedDepthwiseConv2D.ts","../src/kernels/GatherNd.ts","../src/kernels/GatherV2.ts","../src/kernels/Greater.ts","../src/kernels/GreaterEqual.ts","../src/kernels/LeakyRelu.ts","../src/kernels/Less.ts","../src/kernels/LessEqual.ts","../src/kernels/Log.ts","../src/kernels/LogicalAnd.ts","../src/kernels/Max.ts","../src/kernels/Maximum.ts","../src/kernels/MaxPool.ts","../src/kernels/Mean.ts","../src/kernels/Min.ts","../src/kernels/Minimum.ts","../src/kernels/MirrorPad.ts","../src/kernels/Multiply.ts","../src/kernels/Neg.ts","../src/kernels/NonMaxSuppression_util.ts","../src/kernels/NonMaxSuppressionV3.ts","../src/kernels/NonMaxSuppressionV4.ts","../src/kernels/NonMaxSuppressionV5.ts","../src/kernels/NotEqual.ts","../src/kernels/OneHot.ts","../src/kernels/OnesLike.ts","../src/kernels/Pack.ts","../src/kernels/PadV2.ts","../src/kernels/Pow.ts","../src/kernels/Prelu.ts","../src/kernels/Prod.ts","../src/kernels/Range.ts","../node_modules/@tensorflow/tfjs-backend-cpu/dist/kernels/Range_impl.js","../src/kernels/RealDiv.ts","../src/kernels/Relu.ts","../src/kernels/Relu6.ts","../src/kernels/ResizeBilinear.ts","../src/kernels/Reverse.ts","../src/kernels/RotateWithOffset.ts","../src/kernels/Round.ts","../src/kernels/Rsqrt.ts","../src/kernels/ScatterNd.ts","../src/kernels/Select.ts","../src/kernels/Sigmoid.ts","../src/kernels/Sin.ts","../src/kernels/Softmax.ts","../src/kernels/SpaceToBatchND.ts","../src/kernels/SplitV.ts","../src/kernels/Sqrt.ts","../src/kernels/Square.ts","../src/kernels/SquaredDifference.ts","../src/kernels/Step.ts","../src/kernels/StridedSlice.ts","../src/kernels/Sub.ts","../src/kernels/Sum.ts","../src/kernels/Tan.ts","../src/kernels/Tanh.ts","../src/kernels/Tile.ts","../src/kernels/TopK.ts","../src/kernels/Transform.ts","../src/kernels/ZerosLike.ts","../src/register_all_kernels.ts","../src/kernels/Unpack.ts","../src/flags_wasm.ts","../wasm-out/tfjs-backend-wasm-threaded-simd.js","../wasm-out/tfjs-backend-wasm.js","../src/backend_wasm.ts","../wasm-out/tfjs-backend-wasm-threaded-simd.worker.js","../src/version.ts","../src/base.ts"],"sourcesContent":["/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n * =====\n *\n * This enum must align with the enum defined in cc/backend.h.\n * export enum CppDType {\n * float32 = 0,\n * int32 = 1,\n * bool = 2,\n * string = 3,\n * complex64 = 4\n * }\n * Must match enum in cc/fusable_activations.h.\n * export
```



enum FusableActivation {\n linear = 0,\n relu = 1,\n relu6 = 2,\n prelu = 3,\n leakyrelu = 4,\n sigmoid = 5,\n elu = 6}\n", "/\*\n \* @license\n \* Copyright 2019 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the \"License\");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \* http://www.apache.org/licenses/LICENSE-2.0\n \* Unless required by applicable law or agreed to in writing, software

\* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\n\nimport { _FusedMatMul, _FusedMatMulAttrs, _FusedMatMulInputs, KernelConfig, KernelFunc } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport { FusableActivation } from './types';\nlet wasmFusedMatMul: (\n aId: number, aShape: Uint8Array, aShapeSize: number, bId: number, bShape: Uint8Array, bShapeSize: number, transposeA: boolean, transposeB: boolean, activation: number, biasId: number, preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>\n void;\nfunction setup(backend: BackendWasm) {\n wasmFusedMatMul = backend.wasm.cwrap(_FusedMatMul, null /* void */, [\n
```

```
 'number', // a_id\n 'array', // a_shape\n 'number', // a_shape.length\n 'number', // b_id\n 'array', // b_shape\n 'number', // b_shape.length\n 'number', // transpose_a\n 'number', // transpose_b\n 'number', // activation\n 'number', // biasId\n 'number', // preluActivationWeightsId\n 'number', // leakyreluAlpha\n 'number' // out_id\n]);\nfunction fusedBatchMatMul(args: {\n inputs: _FusedMatMulInputs,\n backend: BackendWasm,\n attrs: _FusedMatMulAttrs\n}) {\n const {inputs, backend, attrs} = args;\n const {a, b, bias, preluActivationWeights} = inputs;\n if (a.dtype !== 'float32' || b.dtype !== 'float32') {\n throw new Error(`_FusedMatMul for non non-float32 tensors not yet supported.`);\n }\n const {transposeA, transposeB, activation, leakyreluAlpha} = attrs;\n const aId = backend.dataIdMap.get(a.dataId).id;\n const bId = backend.dataIdMap.get(b.dataId).id;\n let biasId = 0;\n if (bias != null) {\n const biasData = backend.dataIdMap.get(bias.dataId);\n if (biasData.shape.length !== 1) {\n throw new Error(`_FusedMatMul only supports rank-1 bias but got ` +\n `rank ${biasData.shape.length}.`);\n }\n biasId = biasData.id;\n }\n const preluActivationWeightsId = preluActivationWeights == null ?\n 0 : backend.dataIdMap.get(preluActivationWeights.dataId).id;\n const fusedActivation =\n FusableActivation[activation as {} as keyof typeof FusableActivation];\n if (fusedActivation == null) {\n throw new Error(`_${activation}_ activation not yet supported for FusedConv2D ` +\n `in the wasm backend.`);\n }\n const leftDim = transposeA ? a.shape[2] : a.shape[1];\n const rightDim = transposeB ? b.shape[1] : b.shape[2];\n const batchDim = a.shape[0];\n const out = backend.makeOutput([batchDim, leftDim, rightDim], a.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n const aShapeBytes = new Uint8Array(new Int32Array(a.shape).buffer);\n const bShapeBytes = new Uint8Array(new Int32Array(b.shape).buffer);\n wasmFusedMatMul(\n aId, aShapeBytes, a.shape.length, bId, bShapeBytes, b.shape.length,\n transposeA, transposeB, fusedActivation, biasId, preluActivationWeightsId,\n leakyreluAlpha || 0, outId);\n return out;\n}\nexport const fusedMatMulConfig: KernelConfig = {\n kernelName: _FusedMatMul,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: fusedBatchMatMul as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software
```

\* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES

OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\n\nimport { DataType, KernelConfig, TensorInfo, UnaryInputs, util } from '@tensorflow/tfjs-core';\nimport
```

```

{BackendWasm} from './backend_wasm';\n\nimport {CppType} from './types';\n\nexport function
createUnaryKernelConfig(\n kernelName: string, outType?: DataType): KernelConfig {\n let wasmFunc: (xId:
number, dtype: number, outId: number) => void;\n\n function setupFunc(backend: BackendWasm): void {\n
wasmFunc = backend.wasm.cwrap(kernelName, null /* void */, [\n 'number', // x_id\n 'number', // dtype\n
'number', // out_id\n]);\n }\n\n function kernelFunc(args: {backend: BackendWasm, inputs: UnaryInputs}):\n
TensorInfo {\n const {backend, inputs: {x}} = args;\n const xId = backend.dataIdMap.get(x.dataId).id;\n
 const out = backend.makeOutput(x.shape, outType || x.dtype);\n const outId =
backend.dataIdMap.get(out.dataId).id;\n\n // Short-circuit zero-sized tensors.\n if (util.sizeFromShape(out.shape)
=== 0) {\n return out;\n }\n\n wasmFunc(xId, CppDType[x.dtype], outId);\n return out;\n }\n\n return
{kernelName, backendName: 'wasm', setupFunc, kernelFunc};\n }\n }"/**\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions
and\n * limitations under the License.\n *
=====\n
*/\nimport {Abs, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'/unary_kernel';\n\nexport const absConfig: KernelConfig = createUnaryKernelConfig(Abs);\n }"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
"License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {backend_util, BinaryInputs, DataType, KernelConfig, TensorInfo, util} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {CppType} from './types';\n\nexport
function createBinaryKernelConfig(\n kernelName: string, supportsFullBroadcast: boolean,\n dtype?:
DataType): KernelConfig {\n let wasmFunc:\n (aId: number, aShape: Uint8Array, aShapeLen: number, bId:
number,\n bShape: Uint8Array, bShapeLen: number, dtype: number, outId: number) =>\n void;\n\n function setupFunc(backend: BackendWasm): void {\n
wasmFunc = backend.wasm.cwrap(kernelName, null /*
void */, [\n 'number', // a_id,\n 'array', // a_shape\n 'number', // a_shape.length\n 'number', // b_id\n
'array', // b_shape\n 'number', // b_shape.length\n 'number', // dtype\n 'number' // out_id\n]);\n }\n\n function kernelFunc(args: {backend: BackendWasm, inputs:
BinaryInputs}):\n TensorInfo {\n const {backend, inputs} = args;\n const {a, b} = inputs;\n const aId =
backend.dataIdMap.get(a.dataId).id;\n const bId = backend.dataIdMap.get(b.dataId).id;\n\n const outputType =
dtype != null ? dtype : a.dtype;\n const newShape = backend_util.assertAndGetBroadcastShape(a.shape,
b.shape);\n const out = backend.makeOutput(newShape, outputType);\n\n // Short-circuit zero-sized tensors.\n
if (util.sizeFromShape(newShape) === 0) {\n return out;\n }\n\n const aShapeBytes = new Uint8Array(new
Int32Array(a.shape).buffer);\n const bShapeBytes = new Uint8Array(new Int32Array(b.shape).buffer);\n const
outId = backend.dataIdMap.get(out.dataId).id;\n const kernelFunc = () => wasmFunc(\n aId, aShapeBytes,
a.shape.length, bId, bShapeBytes, b.shape.length,\n CppDType[a.dtype], outId);\n\n // Currently only some
float operations support full broadcast.\n if (supportsFullBroadcast && a.dtype ===
'float32') {\n kernelFunc();\n return out;\n }\n\n const aBroadcastDims =
backend_util.getBroadcastDims(a.shape, newShape);\n const bBroadcastDims =
backend_util.getBroadcastDims(b.shape, newShape);\n const loopsOverAllOfA = aBroadcastDims.every((v, i) =>

```

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v === i);\n const loopsOverAllOfB = bBroadcastDims.every((v, i) => v === i);\n if (loopsOverAllOfA &&
loopsOverAllOfB) {\n kernelFunc();\n return out;\n } else {\n throw new Error(\n `Broadcasting
along outer dims is not yet ` +\n `supported for ${a.dtype} ${kernelName}.`);\n }\n }\n\n return
{kernelName, backendName: 'wasm', setupFunc, kernelFunc};\n}\n"/**\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the `License`);\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless
required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an
`AS IS`\n BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {Add, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
'/binary_kernel';\n\nconst supportsFullBroadcast = true;\n\nexport const addConfig: KernelConfig =\ncreateBinaryKernelConfig(Add, supportsFullBroadcast);\n"/**\n * @license\n * Copyright 2019 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the `License`);\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by
applicable law or agreed to in writing, software\n * distributed under the License is distributed on an `AS IS`\n
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the
specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {AddN, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport
{BackendWasm} from '../backend_wasm';\nimport {CppType} from './types';\n\nlet wasmFunc:\n (inputIds:
Uint8Array, inputIdsLen: number, dtype: number, outId: number) =>\n void;\n\nfunction setupFunc(backend:
BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(AddN, null /* void */, [\n 'array', // input_ids\n
'number', // input_ids.length\n 'number', // dtype\n 'number', // out_id\n]);\n}\n\nfunction addn(args: {inputs:
TensorInfo[], backend: BackendWasm}) {\n const
{inputs, backend} = args;\n const out = backend.makeOutput(inputs[0].shape, inputs[0].dtype);\n\n // Short-circuit
zero-sized tensors.\n if (util.sizeFromShape(out.shape) === 0) {\n return out;\n }\n\n const inputIds =
inputs.map(x => backend.dataIdMap.get(x.dataId).id);\n const inputIdsBytes = new Uint8Array(new
Int32Array(inputIds).buffer);\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmFunc(inputIdsBytes,
inputIds.length, CCppType[out.dtype], outId);\n\n return out;\n}\n\nexport const addNConfig: KernelConfig = {\n
kernelName: AddN,\n backendName: 'wasm',\n setupFunc,\n kernelFunc: addn as {} as KernelFunc,\n};\n"/**\n *
@license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the `License`);\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable
law
or agreed to in writing, software\n * distributed under the License is distributed on an `AS IS`\n BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {Identity, IdentityInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\nimport
{TensorInfo} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\n\nexport function
identity(args: {inputs: IdentityInputs, backend: BackendWasm}):\n TensorInfo {\n const {inputs: {x}, backend} =
args;\n const out = backend.makeOutput(x.shape, x.dtype);\n const inVals = backend.typedArrayFromHeap(x);\n
const outVals = backend.typedArrayFromHeap(out);\n outVals.set(inVals);\n return out;\n}\n\nexport const
identityConfig: KernelConfig = {\n kernelName: Identity,\n backendName: 'wasm',\n

```

kernelFunc: identity as { } as KernelFunc,\n};\n"/\*\*\n \* @license\n \* Copyright 2019 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the \"License\");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \* \n \* http://www.apache.org/licenses/LICENSE-2.0\n \* \n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\n\nimport { KernelConfig, KernelFunc, TensorInfo, Transpose, TransposeAttrs, TransposeInputs } from\n '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { identity } from\n './Identity';\nimport { CppDType }\nfrom './types';\n\nlet wasmTranspose: (\n xId: number, xShape: Uint8Array, xShapeLength: number, dtype:\n CppDType,\n outId: number, perm: Uint8Array, permLength: number) => void;\n\nfunction setup(backend:\n BackendWasm) {\n wasmTranspose = backend.wasm.cwrap(Transpose, null /* void */, [\n 'number', // xId\n 'array', // x.shape\n 'number', // x.shape.length\n 'number', // dtype\n 'number', // outId\n 'array', // perm\n 'number', // perm.length\n]);\n\n export function transpose(\n args: {\n inputs: TransposeInputs, backend:\n BackendWasm, attrs: TransposeAttrs\n }):\n TensorInfo {\n const { inputs, backend, attrs } = args;\n // Reduce any dimensions with size one. Lower-rank transpose kernel performs\n // better due to simpler memory access pattern.\n const [reducedShape, perm] = removeOneSizeDims(inputs.x.shape, attrs.perm);\n let permIsNoOp = true;\n for (let i = 0; i < perm.length; i++) {\n if (perm[i] !== i) {\n permIsNoOp = false;\n }\n }\n const outShape = computeOutShape(inputs.x.shape, attrs.perm);\n const x = {\n dataId: inputs.x.dataId,\n shape: reducedShape,\n dtype: inputs.x.dtype\n };\n if (permIsNoOp) {\n const cloned = identity({ inputs, backend });\n cloned.shape = outShape;\n return cloned;\n }\n const out = backend.makeOutput(outShape, x.dtype);\n const xId = backend.dataIdMap.get(x.dataId).id;\n const outId = backend.dataIdMap.get(out.dataId).id;\n const permBytes = new Uint8Array(new Int32Array(perm).buffer);\n const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n wasmTranspose(\n xId, xShapeBytes, x.shape.length, CppDType[x.dtype], outId, permBytes,\n perm.length);\n return out;\n }\n\n function computeOutShape(inShape: number[], perm: number[]): number[] {\n const outShape = new Array(inShape.length);\n for (let i = 0; i < outShape.length; i++) {\n outShape[i] = inShape[perm[i]];\n }\n return outShape;\n }\n\n function removeOneSizeDims(\n shape: number[], perm: number[]): [number[], number[]] {\n const newShape: number[] = [];\n const newPerm: number[] = [];\n for (let i = 0; i < shape.length; ++i) {\n if (shape[i] !== 1) {\n newShape.push(shape[i]);\n }\n if (shape[perm[i]] !== 1) {\n newPerm.push(perm[i]);\n }\n }\n for (let i = 0; i < newPerm.length; ++i) {\n let minValIdx = -1;\n for (let j = 0; j < newPerm.length; ++j) {\n if (newPerm[j] >= i &&\n (minValIdx === -1 || newPerm[minValIdx] > newPerm[j])) {\n minValIdx = j;\n }\n }\n newPerm[minValIdx] = i;\n }\n return [newShape, newPerm];\n }\n\n export const transposeConfig:\n KernelConfig = {\n kernelName: Transpose,\n backendName: 'wasm',\n kernelFunc: transpose as { } as\n KernelFunc,\n setupFunc: setup,\n };\n}\n"/**\n * @license\n * Copyright 2020 Google Inc. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport { backend_util, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from\n '../backend_wasm';\nimport { transpose } from './Transpose';\n\n/**\n * Compute permutation axes and do a transpose if necessary.\n * \n * @param x input TensorInfo\n * @param axis reduction axes\n *
```

```

@param backend wasm backend instance\n *\/\nexport function permuteAxesAndTranspose(\n x: TensorInfo,
axis: number|number[],
 backend: BackendWasm): {\n transposed: TensorInfo|null,\n axes: number[],\n originalAxes: number[],\n inputWasTransposed: boolean\n} {\n const xShape = x.shape;\n const xRank = x.shape.length;\n\n const
originalAxes = util.parseAxisParam(axis, xShape);\n let axes = originalAxes;\n const permutedAxes =
backend_util.getAxesPermutation(axes, xRank);\n let xTransposed = null;\n let inputWasTransposed = false;\n if
(permutedAxes != null) {\n const newShape: number[] = new Array(xRank);\n for (let i = 0; i <
newShape.length; i++) {\n newShape[i] = xShape[permutedAxes[i]];\n }\n\n axes =
backend_util.getInnerMostAxes(axes.length, xRank);\n xTransposed =\n transpose({inputs: {x}, attrs: {perm:
permutedAxes}, backend});\n\n const xId = backend.dataIdMap.get(x.dataId).id;\n const transposedId =
backend.dataIdMap.get(xTransposed.dataId).id;\n if (transposedId !== xId) {\n inputWasTransposed = true;\n
 }\n }\n\n return {transposed:
xTransposed, originalAxes, axes, inputWasTransposed};\n}\n", "/**\n * @license\n * Copyright 2021 Google LLC.
All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport { All, AllAttrs, AllInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util } from
'@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport
{ permuteAxesAndTranspose } from
'./kernel_utils';\n\nlet wasmAll: (xId: number, reduceSize: number, outId: number) => void;\n\nfunction
setup(backend: BackendWasm): void {\n wasmAll = backend.wasm.cwrap(All, null /*void*/, ['number, number,
number']);\n}\n\nfunction all(args: { backend: BackendWasm, inputs: AllInputs, attrs: AllAttrs }):\n TensorInfo {\n
const { backend, inputs, attrs } = args;\n const { axis, keepDims } = attrs;\n const { x } = inputs;\n const xId =
backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const { transposed, axes, originalAxes,
inputWasTransposed } =\n permuteAxesAndTranspose(x, axis, backend);\n\n if (inputWasTransposed) {\n
const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n input = transposed;\n inputId =
transposedId;\n }\n\n const inputRank = input.shape.length;\n backend_util.assertAxesAreInnerMostDims('all',
axes, inputRank);\n const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape,
axes);\n const reduceSize = util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape,
x.dtype);\n if (util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasAll(inputId, reduceSize, outId);\n }\n\n if (inputWasTransposed) {\n // dispose of the transposed tensor.\n
backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const newShape =
backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n return
out;\n}\n\nexport const allConfig: KernelConfig = {\n kernelName: All,\n backendName: 'wasm',\n setupFunc:
setup,\n kernelFunc: all as { } as KernelFunc\n};\n", "/**\n * @license\n * Copyright 2021 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n
*\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is
distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *
=====\n

```

```

*\n\nimport { Any, AnyAttrs, AnyInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util } from
'@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport
{ permuteAxesAndTranspose } from './kernel_utils';\n\nlet wasmAny: (xId: number, reduceSize: number, outId:
number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmAny = backend.wasm.cwrap(Any,
null /*void*/, ['number, number, number']);\n}\n\nfunction any(args: { backend: BackendWasm, inputs: AnyInputs,
attrs: AnyAttrs }):\n TensorInfo {\n const { backend,
 inputs, attrs } = args;\n const { axis, keepDims } = attrs;\n const { x } = inputs;\n const xId =
backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const { transposed, axes, originalAxes,
inputWasTransposed } =\n permuteAxesAndTranspose(x, axis, backend);\n\n if (inputWasTransposed) {\n
const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n input = transposed;\n inputId =
transposedId;\n }\n\n const inputRank = input.shape.length;\n backend_util.assertAxesAreInnerMostDims('any',
axes, inputRank);\n const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, axes);\n const reduceSize =
util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, x.dtype);\n if
(util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmAny(inputId, reduceSize, outId);\n }\n\n if (inputWasTransposed) {\n // dispose of the transposed tensor.\n
backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const newShape =
backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n return
out;\n}\n\nexport const anyConfig: KernelConfig = {\n kernelName: Any,\n backendName: 'wasm',\n setupFunc:
setup,\n kernelFunc: any as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the
License.\n *
=====\n
*\n\nimport { ArgMax, ArgMaxAttrs, ArgMaxInputs, KernelConfig, KernelFunc, util } from '@tensorflow/tfjs-
core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport { permuteAxesAndTranspose } from
'./kernel_utils';\n\nimport { CppDType } from './types';\n\nlet wasmFunc: (\n xId: number, dtype: number, outerSize:
number, innerSize: number,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n
wasmFunc = backend.wasm.cwrap(ArgMax, null /* void */, [\n 'number', // x_id\n 'number', // dtype\n
'number', // outer_size\n 'number', // inner_size\n 'number' // out_id\n]);\n}\n\nfunction argmax(\n args:
{ inputs: ArgMaxInputs, backend: BackendWasm, attrs: ArgMaxAttrs }) {\n const { backend, inputs, attrs } = args;\n
const { axis } = attrs as {} as ArgMaxAttrs;\n const { x } = inputs as {} as ArgMaxInputs;\n const xId =
backend.dataIdMap.get(x.dataId).id;\n let
 inputId = xId;\n let input = x;\n\n const { transposed, axes, inputWasTransposed } =\n
permuteAxesAndTranspose(x, axis, backend);\n\n if (inputWasTransposed) {\n const transposedId =
backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId !== xId) {\n // transpose was not a no-op. We
will need to dispose of this\n // once we are done.\n input = transposed;\n inputId = transposedId;\n }\n
}\n\n const outShape = input.shape.slice(0, -1);\n const out = backend.makeOutput(outShape, 'int32');\n const
outId = backend.dataIdMap.get(out.dataId).id;\n const outerSize = util.sizeFromShape(out.shape);\n const
innerSize = input.shape[axes[0]];\n wasmFunc(inputId, CppDType[input.dtype], outerSize, innerSize, outId);\n\n if
(inputWasTransposed) {\n // dispose of the transposed tensor.\n backend.disposeData(transposed.dataId);\n
 }\n\n return out;\n}\n\nexport const argMaxConfig: KernelConfig = {\n kernelName: ArgMax,\n backendName:
'wasm',\n

```

kernelFunc: argmax as {} as KernelFunc,\n setupFunc: setup\n};\n"/\*\*\n \* @license\n \* Copyright 2019 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the \"License\");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \* http://www.apache.org/licenses/LICENSE-2.0\n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\n\nimport { AvgPool, AvgPoolAttrs, AvgPoolInputs, backend_util, KernelConfig, KernelFunc, Tensor4D } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nlet wasmAvgPool: (\n xId: number, batchSize: number, inputHeight: number, inputWidth: number,\n filterHeight: number, filterWidth: number, padTop: number, padRight: number,\n padBottom: number, padLeft: number, strideHeight: number,\n strideWidth: number, channels: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmAvgPool = backend.wasm.cwrap(AvgPool, null /* void */, [\n 'number', // xId\n 'number', // batchSize\n 'number', // inputHeight\n 'number', // inputWidth\n 'number', // filterHeight\n 'number', // filterWidth\n 'number', // padTop\n 'number', // padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', // strideHeight\n 'number', // strideWidth\n 'number', // channels\n 'number', // outId\n]);\n}\n\nfunction avgPool(\n args: { inputs: AvgPoolInputs, backend: BackendWasm, attrs: AvgPoolAttrs }) {\n const { inputs, attrs, backend } = args;\n const x = inputs.x as Tensor4D;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const { filterSize, strides, pad, dimRoundingMode } = attrs;\n const convInfo = backend_util.computePool2DInfo(\n x.shape, filterSize, strides, 1 /* dilations */, pad, dimRoundingMode);\n const filterHeight = convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const padRight = convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n const padLeft = convInfo.padInfo.left;\n const strideHeight = convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n const channels = convInfo.inChannels;\n if (convInfo.dataFormat !== 'channelsLast') {\n throw new Error(\n `wasm backend does not support dataFormat: "${convInfo.dataFormat}". Please use 'channelsLast'.`);\n }\n if (convInfo.dilationWidth !== 1 || convInfo.dilationHeight !== 1) {\n throw new Error(\n `was backend only supports average pooling with dilation = [1, 1],`);\n }\n const out = backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmAvgPool(\n xId, x.shape[0], x.shape[1], x.shape[2], filterHeight, filterWidth,\n padTop, padRight, padBottom, padLeft, strideHeight, strideWidth, channels,\n outId);\n return out;\n}\n\nexport const avgPoolConfig: KernelConfig = {\n kernelName: AvgPool,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: avgPool as {} as KernelFunc\n};\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport { KernelConfig, KernelFunc, Reshape, ReshapeAttrs, ReshapeInputs, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nexport function reshape(\n args: { inputs: ReshapeInputs, attrs: ReshapeAttrs, backend: BackendWasm }) {\n const { inputs, attrs } = args;\n const { x } = inputs;\n const { shape } = attrs;\n const xSize = util.sizeFromShape(x.shape);\n const $shape = util.inferFromImplicitShape(shape, xSize);\n util.assert(\n xSize === util.sizeFromShape($shape),\n () =>
```

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`new shape: ${$shape}, old shape: ${x.shape}. New shape and old `+`n `shape must have the same number of
elements.`);`n`n // Backend needs to track refCount
for the dataId for reshape op`n args.backend.incRef(x.dataId);`n return {dataId: x.dataId, shape: $shape, dtype:
x.dtype};`n`n`nexport const reshapeConfig: KernelConfig = {`n kernelName: Reshape,`n backendName: 'wasm',`n
kernelFunc: reshape as { } as KernelFunc`n};`n`n`"/**`n * @license`n * Copyright 2019 Google LLC. All Rights
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http://www.apache.org/licenses/LICENSE-2.0`n *`n * Unless required by applicable law or agreed to in writing,
software`n * distributed under the License is distributed on an "AS IS" BASIS,`n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.`n * See the License for the specific language
governing permissions and`n * limitations under the License.`n *
=====`n
*/`n`nimport {BatchMatMul, BatchMatMulAttrs, BatchMatMulInputs, KernelConfig, KernelFunc, util} from
'@tensorflow/tfjs-core';`n`nimport {BackendWasm} from '../backend_wasm';`n`nimport {reshape} from
'./Reshape';`n`nlet wasmBatchMatMul: (`n aId: number, aShape: Uint8Array, aShapeSize: number, bId: number,`n
bShape: Uint8Array, bShapeSize: number, transposeA: boolean,`n transposeB: boolean, outId: number) =>
void;`n`nfunction setup(backend: BackendWasm) {`n wasmBatchMatMul = backend.wasm.cwrap(BatchMatMul,
null /* void */, [`n 'number', // a_id`n 'array', // a_shape`n 'number', // a_shape.length`n 'number', // b_id`n
'array', // b_shape`n 'number', // b_shape.length`n 'number', // transpose_a`n 'number', // transpose_b`n
'number' // out_id`n]);`n`nfunction batchMatMul(args: {`n inputs: BatchMatMulInputs,`n backend:
BackendWasm,`n attrs: BatchMatMulAttrs`n}) {`n const {inputs, backend, attrs} = args;`n const {a, b} = inputs;`n
const
 {transposeA, transposeB} = attrs;`n`n if (a.dtype !== 'float32' || b.dtype !== 'float32') {`n throw new Error(`n
`BatchMatMul for non non-float32 tensors not yet supported.`);`n }`n`n const aRank = a.shape.length;`n const
bRank = b.shape.length;`n`n const innerShapeA = transposeA ? a.shape[aRank - 2] : a.shape[aRank - 1];`n const
innerShapeB = transposeB ? b.shape[bRank - 1] : b.shape[bRank - 2];`n`n const outerShapeA = transposeA ?
a.shape[aRank - 1] : a.shape[aRank - 2];`n const outerShapeB = transposeB ? b.shape[bRank - 2] : b.shape[bRank -
1];`n`n const outerDimsA = a.shape.slice(0, -2);`n const outerDimsB = b.shape.slice(0, -2);`n`n const batchDimA =
util.sizeFromShape(outerDimsA);`n const batchDimB = util.sizeFromShape(outerDimsB);`n`n const
batchDimsCompatible =`n batchDimA === batchDimB || batchDimA === 1 || batchDimB === 1;`n`n util.assert(`n
 aRank >= 2 && bRank >= 2 && batchDimsCompatible,`n () => `Error in matMul: the input
batch dimensions
must either be the `+`n `same or at least one input batch dimension must be 1. Got input `+`n `batch
dimensions of (${outerDimsA}) and (${outerDimsB}).`);`n`n const outShapeOuterDims =`n batchDimA >
batchDimB ? a.shape.slice(0, -2) : b.shape.slice(0, -2);`n const outShape =
outShapeOuterDims.concat([outerShapeA, outerShapeB]);`n`n util.assert(`n innerShapeA === innerShapeB,`n
() => `Error in matMul: inner shapes (${innerShapeA}) and (`+`n ``${innerShapeB}) of Tensors with shapes
${a.shape} and `+`n ``${b.shape} and transposeA=${transposeA}`+`n ` and transposeB=${transposeB}
must match.`);`n`n const a3dShape = transposeA ? [batchDimA, innerShapeA, outerShapeA] :`n
[batchDimA, outerShapeA, innerShapeA];`n const b3dShape = transposeB ? [batchDimB, outerShapeB,
innerShapeB] :`n [batchDimB, innerShapeB, outerShapeB];`n`n // The rest of the
implementation
is designed to operate on rank-3 tensors`n const a3d = reshape({inputs: {x: a}, backend, attrs: {shape:
a3dShape}});`n const b3d = reshape({inputs: {x: b}, backend, attrs: {shape: b3dShape}});`n`n const a3dId =
backend.dataIdMap.get(a3d.dataId).id;`n const b3dId = backend.dataIdMap.get(b3d.dataId).id;`n`n const leftDim =
transposeA ? a3d.shape[2] : a3d.shape[1];`n const rightDim = transposeB ? b3d.shape[1] : b3d.shape[2];`n const
batchDim = Math.max(batchDimA, batchDimB);`n`n const out = backend.makeOutput([batchDim, leftDim,
rightDim], a3d.dtype);`n const outId = backend.dataIdMap.get(out.dataId).id;`n`n const aShapeBytes = new

```











{ } as KernelFunc\n};\n", "/\*\n \* @license\n \* Copyright 2019 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the \"License\");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \* http://www.apache.org/licenses/LICENSE-2.0\n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\n\nimport {Cast, CastAttrs, CastInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\nimport {TensorInfo} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nexport function cast(\n args: {inputs: CastInputs, attrs: CastAttrs, backend: BackendWasm});\n TensorInfo {\n const {inputs: {x}, attrs: {dtype}, backend} = args;\n const out = backend.makeOutput(x.shape, dtype);\n const inVals = backend.typedArrayFromHeap(x);\n const outVals = backend.typedArrayFromHeap(out);\n outVals.set(inVals);\n return out;\n }\n\nexport const castConfig: KernelConfig = {\n kernelName: Cast,\n backendName: 'wasm',\n kernelFunc: cast as {} as KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport {KernelConfig, Ceil} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from '../unary_kernel';\nexport const ceilConfig: KernelConfig = createUnaryKernelConfig(Ceil);\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport {ClipByValue, ClipByValueAttrs, ClipByValueInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nlet wasmClip: (xId: number, min: number, max: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmClip = backend.wasm.cwrap(ClipByValue, null /* void */, [\n 'number', // x_id\n 'number', // min\n 'number', // max\n 'number' // out_id\n]);\n\n function clip(args: {\n inputs: ClipByValueInputs,\n backend: BackendWasm,\n attrs: ClipByValueAttrs\n }) {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {clipValueMin, clipValueMax} = attrs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out = backend.makeOutput(x.shape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmClip(xId, clipValueMin, clipValueMax, outId);\n return out;\n }\n\n export const clipByValueConfig: KernelConfig = {\n kernelName: ClipByValue,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: clip as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF
```

ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n
*\n\nimport { backend_util, Concat, ConcatAttrs, ConcatInputs, KernelConfig, KernelFunc, util } from
'@tensorflow/tfjs-core';\n\nimport { BackendWasm } from './backend_wasm';\n\nimport { concatImplCPU } from
'./kernel_utils/shared';\n\nimport { identity } from './Identity';\n\nimport { reshape } from './Reshape';\n\n\nexport function
concat(\n args: { inputs: ConcatInputs, backend: BackendWasm, attrs: ConcatAttrs }) {\n const { inputs, backend }
= args;\n\n const axis = util.parseAxisParam(args.attrs.axis, inputs[0].shape)[0];\n\n let outShape =
backend_util.computeOutShape(inputs.map(t => t.shape), axis);\n\n // Keep only non-empty tensors (ignore tensors
with 0 in their shape).\n const $inputs = inputs.filter(t => util.sizeFromShape(t.shape) > 0);\n if ($inputs.length ===
1) {\n return identity({ inputs: { x: $inputs[0] }, backend });\n }\n\n const out = backend.makeOutput(outShape,
inputs[0].dtype);\n\n if (util.sizeFromShape(outShape) === 0) {\n return out;\n }\n\n const shapes =
$inputs.map(t => t.shape);\n backend_util.assertParamsConsistent(shapes, axis);\n\n if ($inputs[0].dtype ===
'string') {\n // Any concat of n-dimensional tensors across any axis can be reduced to\n // a concatenation of two-
dimensional tensors across the axis 1 by first\n // partitioning the axes of the original tensors into those less than
the\n // axis to be concatenated and the rest. Then reshape the tensors\n // into a two-dimensional tensor by
collapsing these two sets of axes and\n // concatenate the resulting matrices across the axis 1, finally reshaping\n
// the result to have the proper shape.\n const inputs2D = $inputs.map(t => {\n const innerSize =
util.sizeFromShape(t.shape.slice(axis));\n const shape = [-1, innerSize];\n\n return reshape({ inputs: { x: t }, backend, attrs: { shape } });\n });\n\n const inputsValShapes = inputs2D.map(t
=> {\n return { vals: backend.readSync(t.dataId), shape: t.shape }; \n });\n\n // Concat 2d tensors along
axis=1.\n outShape =\n backend_util.computeOutShape(inputs2D.map(t => t.shape), 1 /* axis */);\n const
simplyConcat = inputs2D[0].shape[0] === 1;\n const outVals = concatImplCPU(\n inputsValShapes, outShape, inputs[0].dtype,\n simplyConcat) as string[];\n\n const finalOutShape
=\n backend_util.computeOutShape($inputs.map(t => t.shape), axis);\n\n out.shape = finalOutShape;\n\n const outData = backend.dataIdMap.get(out.dataId);\n outData.stringBytes =
backend_util.fromStringArrayToUint8(outVals);\n\n inputs2D.forEach(t => backend.disposeData(t.dataId));\n\n return out;\n }\n\n const batchDim = util.sizeFromShape($inputs[0].shape.slice(0, axis));\n let sumInnerDims =
0;\n const innerDims = $inputs.map(input => {\n const innerDim =
util.sizeFromShape(input.shape.slice(axis));\n sumInnerDims += innerDim;\n return innerDim;\n });\n const
inVals = $inputs.map(input => backend.typedArrayFromHeap(input));\n const outVals =
backend.typedArrayFromHeap(out);\n for (let b = 0; b < batchDim; b++) {\n let outOffset = b * sumInnerDims;\n for (let i = 0; i < inVals.length; i++) {\n const innerDim = innerDims[i];\n const inOffset = b * innerDim;\n const vals = inVals[i].subarray(inOffset, inOffset + innerDim);\n outVals.set(vals, outOffset);\n outOffset +=
innerDim;\n }\n }\n return out;\n}\n\n\nexport const concatConfig: KernelConfig = {\n kernelName: Concat,\n backendName: 'wasm',\n kernelFunc: concat as { } as KernelFunc,\n};\n\n", "/*\n * @license\n * Copyright 2020
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2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is
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express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *
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=====\n
*\n\nimport { backend_util, util } from '@tensorflow/tfjs-core';\n\nexport function concatImpl(inputs, outShape, dtype,
simplyConcat) {\n const outVals = util.getArrayFromDType(dtype, util.sizeFromShape(outShape));\n if
(simplyConcat && dtype !== 'string') {\n // Use built-in TypedArray.set() method for speed.\n let offset =
0;\n inputs.forEach(input => {\n const size = util.sizeFromShape(input.shape);\n
```



ZhbHMgPSB1dGlsLmdldEFycmF5RnJvbURUeXBIBKGR0eXBILCB1dGlsLnNpemVGcm9tU2hhcGUob3V0U2hhcGUoPktTcblxulCBpZiAoc2ltcGx5Q29uY2F0ICYmIGR0eXBIIICE9PSAnc3RyaW5nJykge1xulCAgIC8vIFVzZSBI dWlsdC1pbiBUeXBIZEFycmF5LnNldCgpIG1ldGhvZCBmb3Igc3BIZWQuXG4gICAgbGV0IG9mZnNldCA9IDA 7XG4gICAgW5wdXRzLmZvckVhY2goaW5wdXQgPT4ge1xulCAgICAgY29uc3Qgc2l6ZSA9IHV0aWwuc2l6Z UZyb2lTaGFwZShpbnB1dC5zaGFwZSk7XG5cbiAgICAgIChvdXRWYWxzIGFzIFR5cGVkQXJyYXkpLnNldCh pbnB1dC52YWxzIGFzIFR5cGVkQXJyYXksIG9mZnNldCk7XG4gICAgICBvZmZzZXQgKz0gc2l6ZTtcbiAgICB 9KTtcbiAgfSB1bHNlIHtcbiAgICBsZXQgY29sT2Zmc2V0ID0gMDtcbxulCAgIGlucHV0cy5mb3JFYWNoKGluc HV0ID0+IHtcbiAgICAgIGNvbnN0IGRIY29kZWREYXRhID0gZHR5cGUgPT09ICdzdHJpbmcnID9cbiAgICAgI CAgICBiYWNrZW5kX3V0aWwuZnJvbVVpbmQ4VG9TdHJpbmdBcnJheShpbnB1dC52YWxzIGFzIFVpbmQ4QX JyYXlbXSkge1xulCAgICAgICAgIGlucHV0LnZhbHMgYXMGvVhlwZWRBcnJheTtcbxulCAgICAgbGV0IHRJZ HggPSAwO1xulCAgICAgICBmb3IgcGxldCBYb3cgPSAwOyByb3cgPCBpbmB1dC5zaGFwZVswXTsgKytyb3cp IHtcbiAgICAgICAgY29uc3QgcmlvZSvSWR4ID0gcm93ICogb3V0U2hhcGVbMV0gKyBjb2xPZmZzZXQ7XG4gICA gICAgIGZvciAobGV0IGNvbCA9IDA7IGNvbCA8IGlucHV0LnNoYXBIWzFdOyArk2NvbCkge1xulCAgICAgIC AgIG91dFZhbHNbcmVzSWR4ICsgY29sXSA9IGRIY29kZWREYXRhW3RlZHR5cGUgPT09ICdzdHJpbmcnID9cbiA gICAgIH1cbiAgICAgICAgY29sT2Zmc2V0ICs9IGlucHV0LnNoYXBIWzFdO1xulCAgIH0pO1xulCB9XG5cbiAgc mV0dXJuIG91dFZhbHM7XG59XG4iXX0=","/\*\*\n

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```
=====\n*\n\nimport {backend_util, Conv2D, Conv2DAttrs, Conv2DInputs, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nlet wasmConv2d: (\n xId: number, batchSize: number, inputHeight: number, inputWidth: number,\n filterId: number, filterHeight: number, filterWidth: number, padTop: number,\n padRight: number, padBottom: number, padLeft: number, isSamePad: number,\n dilationHeight: number, dilationWidth: number, strideHeight: number,\n strideWidth: number, inputChannels: number, outputChannels: number,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmConv2d = backend.wasm.cwrap(Conv2D, null /* void */, [\n 'number', // xId\n 'number', // batchSize\n 'number', // inputHeight\n 'number', // inputWidth\n 'number', // filterId\n 'number', // filterHeight\n 'number', // filterWidth\n 'number', // padTop\n 'number', // padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', // isSamePad\n 'number', // dilationHeight\n 'number', // dilationWidth\n 'number', // strideHeight\n 'number', // strideWidth\n 'number', // inputChannels\n 'number', // outputChannels\n 'number', // outId\n]);\n\n function conv2d(\n args: {inputs: Conv2DInputs, backend: BackendWasm, attrs: Conv2DAttrs}) {\n const {inputs, attrs, backend} = args;\n const {x, filter} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const filterId = backend.dataIdMap.get(filter.dataId).id;\n const {strides, dilations, pad, dimRoundingMode, dataFormat} = attrs;\n const $dataFormat = backend_util.convertConv2DDataFormat(dataFormat);\n const convInfo = backend_util.computeConv2DInfo(\n (x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations,\n pad, dimRoundingMode, false, $dataFormat);\n const filterHeight = convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const padRight = convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n const padLeft = convInfo.padInfo.left;\n const dilationHeight = convInfo.dilationHeight;\n const dilationWidth = convInfo.dilationWidth;\n const strideHeight = convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n const inputChannels = convInfo.inChannels;\n const outputChannels =
```



```

convInfo.outChannels;\n const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;\n\n if
(convInfo.dataFormat !== 'channelsLast') {\n throw new Error(\n `wasm backend Conv2D does not support
dataFormat:` +\n `${convInfo.dataFormat}`. Please use 'channelsLast'.`);\n }\n\n const out =
backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmConv2d(\n xId, x.shape[0], x.shape[1], x.shape[2], filterId, filterHeight,\n filterWidth, padTop,
padRight, padBottom, padLeft, isSamePad,\n dilationHeight,
dilationWidth, strideHeight, strideWidth, inputChannels,\n outputChannels, outId);\n return out;\n}\n\nexport
const conv2DConfig: KernelConfig = {\n kernelName: Conv2D,\n backendName: 'wasm',\n setupFunc: setup,\n
kernelFunc: conv2d as { } as KernelFunc\n};\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

```

```

=====\n
*/\n\nimport
{ backend_util, Conv2DBackpropInput, Conv2DBackpropInputAttrs, Conv2DBackpropInputInputs, KernelConfig,
KernelFunc, TensorInfo, util } from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from
'./backend_wasm';\n\nlet wasmConv2DBackpropInput: (\n dyId: number, filterId: number, batchSize: number,
filterHeight: number,\n filterWidth: number, inHeight: number, inWidth: number, inChannels: number,\n
outHeight: number, outWidth: number, outChannels: number,\n strideHeight: number, strideWidth: number,
topPad: number, leftPad: number,\n fltS0: number, fltS1: number, fltS2: number, xBatchStride: number,\n
xRowStride: number, xColStride: number, xChannelStride: number,\n yBatchStride: number, yRowStride:
number, yColStride: number,\n yChannelStride: number, outId: number) => void;\n\nfunction setup(backend:
BackendWasm): void {\n wasmConv2DBackpropInput = backend.wasm.cwrap(Conv2DBackpropInput, null, [\n
'number', // dyId\n 'number', // filterId\n 'number', // batchSize\n 'number', // filterHeight\n
'number', // filterWidth\n 'number', // inHeight\n 'number', // inWidth\n 'number', // inChannels\n
'number', // outHeight\n 'number', // outWidth\n 'number', // outChannels\n 'number', // strideHeight\n
'number', // strideWidth\n 'number', // topPad\n 'number', // leftPad\n 'number', // fltS0\n
'number', // fltS1\n 'number', // fltS2\n 'number', // xBatchStride\n 'number', // xRowStride\n
'number', // xColStride\n 'number', // xChannelStride\n 'number', // yBatchStride\n
'number', // yRowStride\n 'number', // yColStride\n 'number', // yChannelStride\n 'number', // outId\n
]);\n}\n\nfunction conv2DBackpropInput(args: {\n backend: BackendWasm,\n inputs:
Conv2DBackpropInputInputs,\n attrs: Conv2DBackpropInputAttrs\n}): TensorInfo {\n const {backend, inputs,
attrs} = args;\n const {dy, filter} = inputs;\n const {strides, pad, dataFormat,
dimRoundingMode, inputShape} = attrs;\n\n const dilations = 1;\n\n const $dataFormat =
backend_util.convertConv2DDataFormat(dataFormat);\n\n const convInfo = backend_util.computeConv2DInfo(\n
inputShape, filter.shape as [number, number, number, number], strides,\n dilations, pad, dimRoundingMode,
false /* depthwise */, $dataFormat);\n\n const {\n batchSize,\n filterHeight,\n filterWidth,\n inChannels,\n
inHeight,\n inWidth,\n outChannels,\n outHeight,\n outWidth,\n strideHeight,\n strideWidth\n } =
convInfo;\n\n const topPad = filterHeight - 1 - convInfo.padInfo.top;\n const leftPad = filterWidth - 1 -
convInfo.padInfo.left;\n\n const isChannelsLast = convInfo.dataFormat === 'channelsLast';\n const dxStrides =
util.computeStrides(convInfo.inShape);\n const dyStrides = util.computeStrides(dy.shape);\n const [fltS0, fltS1,
fltS2] = util.computeStrides(filter.shape);\n const xBatchStride = dxStrides[0];\n const xRowStride =
isChannelsLast
? dxStrides[1] : dxStrides[2];\n const xColStride = isChannelsLast ? dxStrides[2] : 1;\n const xChannelStride =
isChannelsLast ? 1 : dxStrides[1];\n const yBatchStride = dyStrides[0];\n const yRowStride = isChannelsLast ?

```

```

dyStrides[1] : dyStrides[2];\n const yColStride = isChannelsLast ? dyStrides[2] : 1;\n const yChannelStride =
isChannelsLast ? 1 : dyStrides[1];\n\n const out = backend.makeOutput(convInfo.inShape, 'float32');\n const outId
= backend.dataIdMap.get(out.dataId).id;\n const dyId = backend.dataIdMap.get(dy.dataId).id;\n const filterId =
backend.dataIdMap.get(filter.dataId).id;\n\n wasmConv2DBackpropInput(\n dyId, filterId, batchSize,
filterHeight, filterWidth, inHeight, inWidth,\n inChannels, outHeight, outWidth, outChannels, strideHeight,
strideWidth,\n topPad, leftPad, fltS0, fltS1, fltS2, xBatchStride, xRowStride,\n xColStride, xChannelStride,
yBatchStride, yRowStride, yColStride,\n yChannelStride, outId);\n return out;\n}\n\nexport
const conv2DBackpropInputConfig: KernelConfig = {\n kernelName: Conv2DBackpropInput,\n backendName:
'wasm',\n setupFunc: setup,\n kernelFunc: conv2DBackpropInput as {} as KernelFunc\n};\n", "/*\n * @license\n *
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'License');\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an 'AS IS' BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport { Cos, KernelConfig } from '@tensorflow/tfjs-core';\n\nimport { createUnaryKernelConfig }
from './unary_kernel';\n\nexport const cosConfig: KernelConfig = createUnaryKernelConfig(Cos);\n", "/*\n *
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2.0 (the 'License');\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an 'AS IS' BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport { Cosh, KernelConfig } from '@tensorflow/tfjs-core';\n\nimport { createUnaryKernelConfig } from
 './unary_kernel';\n\nexport const coshConfig: KernelConfig = createUnaryKernelConfig(Cosh);\n", "/*\n *
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2.0 (the 'License');\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an 'AS IS' BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport { CropAndResize, CropAndResizeAttrs, CropAndResizeInputs, KernelConfig, KernelFunc,
TensorInfo } from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from './backend_wasm';\n\nimport { cast }
from './Cast';\n\n// Must match enum in CropAndResize.cc\nenum
InterpolationMethod {\n bilinear = 0,\n nearest = 1\n}\n\nlet wasmCropAndResize: (\n imagesId: number,
boxesId: number, boxIndId: number, numBoxes: number,\n imagesShape: Uint8Array, cropHeight: number,
cropWidth: number,\n method: number, extrapolationValue: number, outId: number) => void;\n\nfunction
setup(backend: BackendWasm): void {\n wasmCropAndResize = backend.wasm.cwrap(CropAndResize, null
/*void*/, [\n 'number', // imagesId\n 'number', // boxesId\n 'number', // boxIndId\n 'number', // numBoxes\n
 'array', // images shape\n 'number', // cropHeight\n 'number', // cropWidth\n 'number', // method\n
 'number', // extrapolation value\n 'number' // out id\n]);\n\nfunction cropAndResize(args: {\n backend:
BackendWasm,\n inputs: CropAndResizeInputs,\n attrs: CropAndResizeAttrs\n}): TensorInfo {\n const {backend,
inputs, attrs} = args;\n const {method, extrapolationValue, cropSize} = attrs;\n const {image,
boxes, boxInd} = inputs;\n\n const numBoxes = boxes.shape[0];\n\n const [cropHeight, cropWidth] = cropSize as
[number, number];\n const outShape = [numBoxes, cropHeight, cropWidth, image.shape[3]];\n\n let imagesData =

```

```

backend.dataIdMap.get(image.dataId);\n let castedData;\n if (image.dtype !== 'float32') {\n castedData =
cast({backend, inputs: {x: image}, attrs: {dtype: 'float32'}});\n imagesData =
backend.dataIdMap.get(castedData.dataId);\n }\n\n const imagesId = imagesData.id;\n const boxesId =
backend.dataIdMap.get(boxes.dataId).id;\n const boxIndId = backend.dataIdMap.get(boxInd.dataId).id;\n\n const
out = backend.makeOutput(outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const
imagesShapeBytes = new Uint8Array(new Int32Array(image.shape).buffer);\n\n wasmCropAndResize(\n
imagesId, boxesId, boxIndId, numBoxes, imagesShapeBytes, cropHeight,\n cropWidth,\n
InterpolationMethod[method as { } as keyof typeof InterpolationMethod],\n
 extrapolationValue, outId);\n\n if (castedData !== null) {\n backend.disposeData(castedData.dataId);\n }\n\n
return out;\n}\n\nexport const cropAndResizeConfig: KernelConfig = {\n kernelName: CropAndResize,\n
backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: cropAndResize as { } as KernelFunc\n};\n\n"/**\n *
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2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {backend_util, KernelConfig, KernelFunc, Cumsum, CumsumAttrs, CumsumInputs, TensorInfo, util}
from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {CppDType} from
'./types';\n\nimport {transpose} from './Transpose';\n\nlet wasmCumsum: (xId: number, exclusive: number, reverse:
number,\n finalDim: number, outId: number, dtype: CppDType) => void;\n\nfunction setup(backend:
BackendWasm) {\n wasmCumsum = backend.wasm.cwrap(Cumsum, null /* void */, [\n 'number', // x_id\n
'number', // exclusive\n 'number', // reverse\n 'number', // final_dim\n 'number', // out_id\n
'number' // dtype\n]);\n}\n\nexport function cumsum(\n args: {inputs: CumsumInputs, backend: BackendWasm, attrs:
CumsumAttrs});\n\nTensorInfo {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {axis,
exclusive, reverse} = attrs;\n const xRank = x.shape.length;\n\n util.assert(x.dtype
=== 'float32' || x.dtype === 'int32',\n () => `cumsum does not support ${x.dtype} tensors in the WASM
backend`);\n // permute required axis to inner most axis\n const permutation =
backend_util.getAxesPermutation([axis], xRank);\n let permutedX = x;\n if (permutation !== null) {\n
permutedX = transpose({inputs: {x}, attrs: {perm: permutation}, backend});\n }\n const permutedAxis =
backend_util.getInnerMostAxes(1, xRank)[0];\n backend_util.assertAxesAreInnerMostDims('cumsum',
[permutedAxis], xRank);\n\n const permutedOut = backend.makeOutput(permutedX.shape, permutedX.dtype);\n
const finalDim = permutedX.shape[permutedAxis];\n const permutedXId =
backend.dataIdMap.get(permutedX.dataId).id;\n const permutedOutId =
backend.dataIdMap.get(permutedOut.dataId).id;\n wasmCumsum(permutedXId, exclusive ? 1 : 0, reverse ? 1 : 0,
finalDim,\n permutedOutId, CppDType[x.dtype]);\n\n // transpose data back if permuted\n let out =
permutedOut;\n if (permutation
!== null) {\n const undoPermutation = backend_util.getUndoAxesPermutation(permutation);\n out =
transpose(\n {inputs: {x: permutedOut}, attrs: {perm: undoPermutation}, backend});\n }\n backend.disposeData(permutedX.dataId);\n backend.disposeData(permutedOut.dataId);\n }\n return
out;\n}\n\nexport const cumsumConfig: KernelConfig = {\n kernelName: Cumsum,\n backendName: 'wasm',\n
setupFunc: setup,\n kernelFunc: cumsum as { } as KernelFunc\n};\n\n"/**\n *
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use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n

```

```

* See the License for the specific language governing permissions and
* limitations under the License.
=====
*\n\nimport {DepthToSpace, DepthToSpaceAttrs, DepthToSpaceInputs, KernelConfig, KernelFunc, TensorInfo,
util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmDepthToSpace:
(n xId: number, blockSize: number, channelsLast: number, xStrides: Uint8Array,\n xStridesLength: number,
outputShape: Uint8Array, outputStrides: Uint8Array,\n outSize: number, outId: number) => void;\n\nfunction
setup(backend: BackendWasm): void {\n wasmDepthToSpace = backend.wasm.cwrap(DepthToSpace, null
/*void*/, [\n 'number', // xId\n 'number', // blockSize\n 'number', // channelsLast\n 'array', // xStrides\n
'number', // xStridesLength\n 'array', // outputShape\n 'array', // outputStrides\n 'number', // outSize\n
'number', // outId\n
]);\n}\n\nexport function depthToSpace(args: {\n backend: BackendWasm,\n inputs: DepthToSpaceInputs,\n
attrs: DepthToSpaceAttrs\n}): TensorInfo {\n const {backend, inputs, attrs} = args;\n const {x} = inputs;\n const
{blockSize, dataFormat} = attrs;\n\n const batchSize = x.shape[0];\n const inputHeight = (dataFormat ===
'NHWC') ? x.shape[1] : x.shape[2];\n const inputWidth = (dataFormat === 'NHWC') ? x.shape[2] : x.shape[3];\n
const inputDepth = (dataFormat === 'NHWC') ? x.shape[3] : x.shape[1];\n\n const outputHeight = inputHeight *
blockSize;\n const outputWidth = inputWidth * blockSize;\n const outputDepth = inputDepth / (blockSize *
blockSize);\n\n const outputShape = (dataFormat === 'NHWC') ?\n [batchSize, outputHeight, outputWidth,
outputDepth] :\n [batchSize, outputDepth, outputHeight, outputWidth];\n\n const out =
backend.makeOutput(outputShape, 'float32');\n\n const xData = backend.dataIdMap.get(x.dataId);\n const xId =
xData.id;\n const xStridesBytes
 =\n new Uint8Array(new Int32Array(util.computeStrides(x.shape)).buffer);\n\n const outputShapeBytes = new
Uint8Array(new Int32Array(outputShape).buffer);\n const outStridesBytes =\n new Uint8Array(new
Int32Array(util.computeStrides(outputShape)).buffer);\n\n const outId = backend.dataIdMap.get(out.dataId).id;\n
const channelsLast = dataFormat === 'NHWC' ? 1 : 0;\n wasmDepthToSpace(\n xId, blockSize, channelsLast,
xStridesBytes, x.shape.length - 1,\n outputShapeBytes, outStridesBytes, outputShape.length, outId);\n\n return
out;\n}\n\nexport const depthToSpaceConfig: KernelConfig = {\n kernelName: DepthToSpace,\n backendName:
'wasm',\n setupFunc: setup,\n kernelFunc: depthToSpace as {} as KernelFunc\n};\n\n"/**\n * @license\n *
Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
'License');\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License
at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in
writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT
WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {backend_util, DepthwiseConv2dNative, DepthwiseConv2dNativeAttrs,
DepthwiseConv2dNativeInputs, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from '../backend_wasm';\n\nlet wasmDepthwiseConv2d: (n xId: number, batchSize: number,
inputHeight: number, inputWidth: number,\n filterId: number, filterHeight: number, filterWidth: number, padTop:
number,\n padRight: number, padBottom: number, padLeft: number, isSamePad: number,\n dilationHeight:
number, dilationWidth:
 number, strideHeight: number,\n strideWidth: number, inputChannels: number, outputChannels: number,\n
outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmDepthwiseConv2d =\n backend.wasm.cwrap(DepthwiseConv2dNative, null /*void*/, [\n 'number', // xId\n 'number', //
batchSize\n 'number', // inputHeight\n 'number', // inputWidth\n 'number', // filterId\n 'number', //
filterHeight\n 'number', // filterWidth\n 'number', // padTop\n 'number', // padRight\n 'number', //
padBottom\n 'number', // padLeft\n 'number', // isSamePad\n 'number', // dilationHeight\n 'number', //
dilationWidth\n 'number', // strideHeight\n 'number', // strideWidth\n 'number', //

```



```

=====
*\nimport {Exp, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'/unary_kernel';\n\nexport const expConfig: KernelConfig = createUnaryKernelConfig(Exp, 'float32');\n", "/**\n *
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License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You
may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required
by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS"
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
=====

```

```

=====
*\nimport {ExpandDims, ExpandDimsAttrs, ExpandDimsInputs, KernelConfig, KernelFunc, util} from
 '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {reshape} from
'/Reshape';\n\nexport function expandDims(args: {\n inputs: ExpandDimsInputs,\n attrs: ExpandDimsAttrs,\n backend: BackendWasm\n}) {\n const {inputs, attrs, backend} = args;\n const
[input] = inputs;\n const {dim} = attrs;\n const inputRank = input.shape.length;\n const newShape =
input.shape.slice();\n let $dim = dim;\n if (dim < 0) {\n // Negative value is counted from the tail of rank.\n
util.assert(\n -(inputRank + 1) <= dim,\n () => `Axis must be in the interval [${-(inputRank + 1)}, ${\n
inputRank}]);\n $dim = inputRank + dim + 1;\n }\n newShape.splice($dim, 0, 1);\n return reshape({inputs:
{x: input}, backend, attrs: {shape: newShape}});\n}\n\nexport const expandDimsConfig: KernelConfig = {\n
kernelName: ExpandDims,\n backendName: 'wasm',\n kernelFunc: expandDims as {} as KernelFunc,\n};\n", "/**\n *
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2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless
required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an
"AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License
for the specific language governing permissions and\n * limitations under the License.\n *
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=====
*\nimport {KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\nimport {Fill, FillAttrs} from
 '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\n\nexport function fill(args: {attrs:
FillAttrs, backend: BackendWasm}) {\n const {attrs: {shape, value, dtype}, backend} = args;\n const out =
backend.makeOutput(shape, dtype);\n const outVals = backend.typedArrayFromHeap(out);\n outVals.fill(value as
number);\n return out;\n}\n\nexport const fillConfig: KernelConfig = {\n kernelName: Fill,\n backendName:
'wasm',\n kernelFunc: fill as {} as KernelFunc,\n};\n", "/**\n *
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2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
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*\nimport {FlipLeftRight, FlipLeftRightInputs, KernelConfig, KernelFunc, TensorInfo} from '@tensorflow/tfjs-
core';\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmFlipLeftRight: (\n xId: number, batch:
number, imageHeight: number, imageWidth: number,\n numChannels:
number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmFlipLeftRight =
backend.wasm.cwrap(FlipLeftRight, null /* void */, [\n 'number', // xId\n 'number', // batch\n 'number', //
imageHeight\n 'number', // imageWidth\n 'number', // numChannels\n 'number', // outId\n]);\n}\n\nexport
function flipLeftRight(\n args: {inputs: FlipLeftRightInputs, backend: BackendWasm}): TensorInfo {\n const
{inputs, backend} = args;\n const {image} = inputs;\n const out = backend.makeOutput(image.shape,
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image.dtype);\n const imageId = backend.dataIdMap.get(image.dataId).id;\n const outId =
backend.dataIdMap.get(out.dataId).id;\n\n const [batch, imageHeight, imageWidth, numChannels] =
image.shape;\n\n wasmFlipLeftRight(\n imageId, batch, imageHeight, imageWidth, numChannels, outId);\n
return out;\n)\n\nexport const flipLeftRightConfig: KernelConfig = {\n kernelName: FlipLeftRight,\n
backendName: 'wasm',\n kernelFunc: flipLeftRight as
 {} as KernelFunc,\n setupFunc: setup\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\nimport {Floor, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'./unary_kernel';\nexport const floorConfig: KernelConfig = createUnaryKernelConfig(Floor);\n", "/*\n *
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may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\nimport {FloorDiv, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
'./binary_kernel';\nconst supportsFullBroadcast = false;\nexport const floorDivConfig: KernelConfig =\ncreateBinaryKernelConfig(FloorDiv, supportsFullBroadcast);\n", "/*\n * @license\n * Copyright 2019
 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\nimport {FusedBatchNorm, FusedBatchNormAttrs, FusedBatchNormInputs, KernelConfig, KernelFunc,
TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nlet
wasmBatchNorm: (\n xId: number, meanId: number, varianceId: number, offsetId: number,\n scaleId: number,
 varianceEpsilon: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n
wasmBatchNorm = backend.wasm.cwrap(\n FusedBatchNorm, null /* void */,\n ['number', 'number',
 'number', 'number', 'number', 'number', 'number']);\n}\n\nfunction fusedBatchNorm(args: {\n backend:
BackendWasm,\n inputs: FusedBatchNormInputs,\n attrs: FusedBatchNormAttrs\n}): TensorInfo {\n const
{backend, inputs, attrs} = args;\n const {varianceEpsilon} = attrs;\n const {x, mean, variance, offset, scale} =
inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const meanId =
backend.dataIdMap.get(mean.dataId).id;\n const varianceId = backend.dataIdMap.get(variance.dataId).id;\n const
offsetId = offset != null ? backend.dataIdMap.get(offset.dataId).id : 0;\n const scaleId = scale != null ?
backend.dataIdMap.get(scale.dataId).id : 0;\n const out = backend.makeOutput(x.shape, x.dtype);\n // Short-
circuit zero-sized tensors.\n if (util.sizeFromShape(x.shape) ===
 0) {\n return out;\n }\n const outId = backend.dataIdMap.get(out.dataId).id;\n const out =
wasmBatchNorm(xId, meanId, varianceId, offsetId, scaleId, varianceEpsilon, outId);\n return out;\n}\n\nexport const

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fusedBatchNormConfig: KernelConfig = {\n kernelName: FusedBatchNorm,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: fusedBatchNorm as {} as KernelFunc\n};\n"/\*\*\n \* @license\n \* Copyright 2019 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the "License");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \* http://www.apache.org/licenses/LICENSE-2.0\n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an "AS IS" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

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=====
\n\nimport {backend_util, FusedConv2D, FusedConv2DAttrs, FusedConv2DInputs, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {FusableActivation} from './types';\n\nlet wasmFusedConv2d:\n (xId: number, batchSize: number, inputHeight: number, inputWidth: number,\n filterId: number, filterHeight: number, filterWidth: number,\n biasId: number, padTop: number, padRight: number, padBottom: number,\n padLeft: number, isSamePad: number, dilationHeight: number,\n dilationWidth: number, strideHeight: number, strideWidth: number,\n inputChannels: number, outputChannels: number, activation: number,\n preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>\n void;\n\nfunction setup(backend: BackendWasm) {\n wasmFusedConv2d = backend.wasm.cwrap(FusedConv2D, null /\n void */, [\n 'number', // xId\n 'number', // batchSize\n 'number', // inputHeight\n 'number', // inputWidth\n 'number', // filterId\n 'number', // filterHeight\n 'number', // filterWidth\n 'number', // biasId\n 'number', // padTop\n 'number', // padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', // isSamePad\n 'number', // dilationHeight\n 'number', // dilationWidth\n 'number', // strideHeight\n 'number', // strideWidth\n 'number', // inputChannels\n 'number', // outputChannels\n 'number', // activation\n 'number', // preluActivationWeightsId\n 'number', // leakyreluAlpha\n 'number', // outId\n]);\n\n function fusedConv2d(args: {\n inputs: FusedConv2DInputs,\n backend: BackendWasm,\n attrs: FusedConv2DAttrs\n }) {\n const {inputs, attrs, backend} = args;\n const {x, filter, bias, preluActivationWeights} = inputs;\n const {\n strides,\n pad,\n dilations,\n dataFormat,\n dimRoundingMode,\n activation,\n leakyreluAlpha\n } = attrs;\n\n const convInfo = backend_util.computeConv2DInfo(\n (x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations,\n pad, dimRoundingMode);\n\n const fusedActivation =\n FusableActivation[activation as {} as keyof typeof FusableActivation];\n if (fusedActivation == null) {\n throw new Error(\n `${activation} activation not yet supported for FusedConv2D` +\n ` in the wasm backend.`);\n }\n\n const xId = backend.dataIdMap.get(x.dataId).id;\n const filterId = backend.dataIdMap.get(filter.dataId).id;\n\n const outputChannels = convInfo.outChannels;\n\n let biasId = 0;\n if (bias != null) {\n const biasData = backend.dataIdMap.get(bias.dataId);\n if (biasData.shape.length !== 1) {\n throw new Error(\n `FusedConv2D only supports rank-1 bias but got` +\n `rank ${biasData.shape.length}.`);\n }\n if (biasData.shape[0] !== outputChannels)\n {\n throw new Error(\n `FusedConv2D bias shape (${biasData.shape}) does not` +\n `match the number of output channels (${outputChannels})`);\n }\n biasId = biasData.id;\n }\n\n const filterHeight = convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const padRight = convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n const padLeft = convInfo.padInfo.left;\n const dilationHeight = convInfo.dilationHeight;\n const dilationWidth = convInfo.dilationWidth;\n const strideHeight = convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n const inputChannels = convInfo.inChannels;\n const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;\n const batchSize = convInfo.batchSize;\n const inHeight = convInfo.inHeight;\n const inWidth = convInfo.inWidth;\n\n if (dataFormat !== 'NHWC') {\n throw new Error(\n `wasm backend FusedConv2D does not`

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support dataFormat:" +\n `${dataFormat}'. Please use 'NHWC.');\n }\n\n const out =
backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n const
preluActivationWeightsId = preluActivationWeights == null ?\n 0 :\nbackend.dataIdMap.get(preluActivationWeights.dataId).id;\n\n wasmFusedConv2d(\n xId, batchSize, inHeight,
inWidth, filterId, filterHeight, filterWidth,\n biasId, padTop, padRight, padBottom, padLeft, isSamePad,
dilationHeight,\n dilationWidth, strideHeight, strideWidth, inputChannels, outputChannels,\n fusedActivation,
preluActivationWeightsId, leakyreluAlpha || 0, outId);\n\n return out;\n}\n\nexport const fusedConv2DConfig:
KernelConfig = {\n kernelName: FusedConv2D,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc:
fusedConv2d as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version
2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {backend_util, FusedDepthwiseConv2D, FusedDepthwiseConv2DAttrs,
FusedDepthwiseConv2DInputs, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from './backend_wasm';\n\nimport {FusableActivation} from './types';\n\nlet
wasmFusedDepthwiseConv2d:\n (xId: number, batchSize: number, inputHeight: number, inputWidth: number,\n filterId: number,
filterHeight: number, filterWidth: number,\n biasId: number, padTop: number, padRight: number, padBottom:
number,\n padLeft: number, isSamePad: number, dilationHeight: number, dilationWidth: number,
strideHeight: number, strideWidth: number,\n inputChannels: number, outputChannels: number, activation:
number,\n preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>\n
void;\n\nfunction setup(backend: BackendWasm) {\n wasmFusedDepthwiseConv2d =\n backend.wasm.cwrap(FusedDepthwiseConv2D, null /* void */, [\n 'number', // xId\n 'number', //
batchSize\n 'number', // inputHeight\n 'number', // inputWidth\n 'number', // filterId\n 'number', //
filterHeight\n 'number', // filterWidth\n 'number', // biasId\n 'number', // padTop\n 'number', //
padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', // isSamePad\n 'number',
// dilationHeight\n 'number', // dilationWidth\n 'number', // strideHeight\n 'number', // strideWidth\n
 'number', // inputChannels\n 'number', // outputChannels\n 'number', // activation\n 'number', //
preluActivationWeightsId\n 'number', // leakyreluAlpha\n 'number', // outId\n]);\n\n\nfunction
fusedDepthwiseConv2d(args: {\n inputs: FusedDepthwiseConv2DInputs,\n backend: BackendWasm,\n attrs:
FusedDepthwiseConv2DAttrs\n}) {\n const {inputs, attrs, backend} = args;\n const {x, filter, bias,
preluActivationWeights} = inputs;\n const {\n strides,\n pad,\n dilations,\n dataFormat,\n
 dimRoundingMode,\n activation,\n leakyreluAlpha\n } = attrs;\n\n const convInfo =
backend_util.computeConv2DInfo(\n (x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations,\n
 pad, dimRoundingMode, true /* depthwise */);\n\n const fusedActivation =\n FusableActivation[activation
as {} as keyof typeof FusableActivation];\n if (fusedActivation == null) {\n throw new Error(\n
`${activation} activation not yet supported for FusedDepthwiseConv2D` +\n `in the wasm backend.`);\n }\n\n const xId = backend.dataIdMap.get(x.dataId).id;\n const filterId = backend.dataIdMap.get(filter.dataId).id;\n\n const outputChannels = convInfo.outChannels;\n\n let biasId = 0;\n if (bias != null) {\n const biasData =
backend.dataIdMap.get(bias.dataId);\n if (biasData.shape.length !== 1) {\n throw new Error(\n
`FusedDepthwiseConv2D only supports rank-1 bias but got ` +\n `rank ${biasData.shape.length}.`);\n }\n }\n if (biasData.shape[0] !== outputChannels) {\n throw new Error(\n
`FusedDepthwiseConv2D bias shape\n (${biasData.shape}) does not ` +\n `match the number of output channels\n (${outputChannels})`);\n }\n\n biasId = biasData.id;\n }\n\n const filterHeight = convInfo.filterHeight;\n const

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filterWidth = convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const padRight =
convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n const padLeft = convInfo.padInfo.left;\n
const dilationHeight = convInfo.dilationHeight;\n const dilationWidth = convInfo.dilationWidth;\n const
strideHeight = convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n const inputChannels =
convInfo.inChannels;\n const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;\n const batchSize =
convInfo.batchSize;\n const inHeight = convInfo.inHeight;\n const inWidth = convInfo.inWidth;\n\n if
(dataFormat !== 'NHWC') {\n throw new Error(\n `wasm backend FusedDepthwiseConv2D does not support
dataFormat:` +\n `${dataFormat}`. Please use 'NHWC'.`);\n }\n\n const out =
backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n const
preluActivationWeightsId = preluActivationWeights ==
null ?\n 0 :\n backend.dataIdMap.get(preluActivationWeights.dataId).id;\n\n
wasmFusedDepthwiseConv2d(\n xId, batchSize, inHeight, inWidth, filterId, filterHeight, filterWidth,\n
biasId, padTop, padRight, padBottom, padLeft, isSamePad, dilationHeight,\n dilationWidth, strideHeight,
strideWidth, inputChannels, outputChannels,\n fusedActivation, preluActivationWeightsId, leakyreluAlpha || 0,
outId);\n\n return out;\n}\n\nexport const fusedDepthwiseConv2DConfig: KernelConfig = {\n kernelName:
FusedDepthwiseConv2D,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: fusedDepthwiseConv2d as
{} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {gather_util, GatherNd, GatherNdInputs, KernelConfig, TensorInfo} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {CppDType} from './types';\n\nlet
wasmGatherNd: (\n xId: number, dtype: CppDType, indicesId: number, numSlices: number,\n sliceRank:
number, sliceSize: number, strides: Uint8Array, outId: number) =>\n void;\n\nfunction setup(backend:
BackendWasm): void {\n wasmGatherNd = backend.wasm.cwrap(GatherNd, null /*void*/, [\n 'number', // xId\n
'number', // dtype\n 'number', // indicesId\n 'number', // numSlices\n 'number', // sliceRank\n
'number', // sliceSize\n 'array', // strides\n 'number' // outId\n]);\n}\n\nfunction gatherNd(args: {backend:
BackendWasm, inputs: GatherNdInputs}): \n TensorInfo {\n const {backend, inputs} = args;\n const {params,
indices} = inputs;\n\n const [resultShape, numSlices, sliceSize, strides] =\n
gather_util.prepareAndValidate(params, indices);\n\n const out = backend.makeOutput(resultShape,
params.dtype);\n\n if (numSlices === 0) {\n return out;\n }\n\n const indicesShape = indices.shape;\n const
sliceRank = indicesShape[indicesShape.length - 1];\n\n const xData = backend.dataIdMap.get(params.dataId);\n
const xId = xData.id;\n const indicesData = backend.dataIdMap.get(indices.dataId);\n const indicesId =
indicesData.id;\n\n const stridesBytes = new Uint8Array(new Int32Array(strides).buffer);\n\n const outId =
backend.dataIdMap.get(out.dataId).id;\n\n wasmGatherNd(\n xId, CppDType[params.dtype], indicesId,
numSlices, sliceRank, sliceSize,\n
stridesBytes, outId);\n\n return out;\n}\n\nexport const gatherNdConfig: KernelConfig = {\n kernelName:
GatherNd,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: gatherNd\n};\n", "/*\n * @license\n *
Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
"License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *

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*\n\nimport {backend_util, GatherV2, GatherV2Attrs, GatherV2Inputs, KernelConfig,
KernelFunc, Tensor, TensorInfo, TypedArray, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from
'./backend_wasm';\n\nimport {reshape} from './Reshape';\n\nimport {CppType} from './types';\n\nlet wasmGather:
(\n xId: number, dtype: CppDType, xStrides: Uint8Array, stridesSize: number,\n indicesId: number, batchSize:
number, outStrides: Uint8Array,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n
wasmGather = backend.wasm.cwrap('Gather', null /*void*/, [\n 'number', // xId\n 'number', // dtype\n 'array',
// xStrides\n 'number', // stridesSize\n 'number', // indicesId\n 'number', // batchSize\n 'array', //
outStrides\n 'number' // outId\n]);\n}\n\nfunction gatherV2(\n args: {backend: BackendWasm, inputs:
GatherV2Inputs, attrs: GatherV2Attrs}): \n TensorInfo {\n const {backend, inputs, attrs} = args;\n const {x,
indices} = inputs;\n const {axis, batchDims} = attrs;\n\n // Throw error when any
index is out of bound.\n const parsedAxis = util.parseAxisParam(axis, x.shape)[0];\n const indicesVals =
backend.readSync(indices.dataId) as TypedArray;\n const axisDim = x.shape[parsedAxis];\n for (let i = 0; i <
indicesVals.length; ++i) {\n const index = indicesVals[i];\n util.assert(\n index <= axisDim - 1 && index >=
0,\n () =>\n `GatherV2: the index value ${index} is not in [0, ${axisDim - 1}]);\n }\n\n const
shapeInfo = backend_util.segment_util.collectGatherOpShapeInfo(\n x as Tensor, indices as Tensor, parsedAxis,
batchDims);\n\n const flattenX = reshape({\n inputs: {x},\n attrs: {\n shape: [\n shapeInfo.batchSize,
shapeInfo.outerSize, shapeInfo.dimSize,\n shapeInfo.sliceSize\n]\n },\n backend\n });\n const
indicesSize = util.sizeFromShape(indices.shape);\n const flattenIndex = reshape({\n inputs: {x: indices},\n attrs:
{shape: [shapeInfo.batchSize, indicesSize / shapeInfo.batchSize]},\n backend\n });\n const flattenOutputShape = [\n shapeInfo.batchSize, shapeInfo.outerSize, indicesSize /
shapeInfo.batchSize,\n shapeInfo.sliceSize\n];\n\n const out = backend.makeOutput(flattenOutputShape,
x.dtype);\n\n if (util.sizeFromShape(x.shape) === 0) {\n return out;\n }\n\n const stridesSize = flattenX.shape.length
- 1;\n\n const xData = backend.dataIdMap.get(flattenX.dataId);\n const xId = xData.id;\n\n const indicesData =
backend.dataIdMap.get(flattenIndex.dataId);\n const indicesId = indicesData.id;\n\n const outId =
backend.dataIdMap.get(out.dataId).id;\n\n const xStridesBytes = new Uint8Array(\n new
Int32Array(util.computeStrides(flattenX.shape)).buffer);\n const outStridesBytes = new Uint8Array(\n new
Int32Array(util.computeStrides(flattenOutputShape)).buffer);\n\n wasmGather(\n xId, CppDType[x.dtype],
xStridesBytes, stridesSize, indicesId,\n shapeInfo.batchSize, outStridesBytes, outId);\n\n backend.disposeData(flattenX.dataId);\n\n backend.disposeData(flattenIndex.dataId);\n\n // reshape\n out.shape = shapeInfo.outputShape;\n\n return
out;\n }\n}\n\nexport const gatherV2Config: KernelConfig = {\n kernelName: GatherV2,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: gatherV2 as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google
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software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n */
=====
*\n\nimport {Greater, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from
'./binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const greaterConfig: KernelConfig =\n createBinaryKernelConfig(Greater, supportsFullBroadcast, 'bool');\n\n"/**\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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```
=====\n\n *^\\nimport { GreaterEqual, KernelConfig } from '@tensorflow/tfjs-core';\\n\\nimport { createBinaryKernelConfig } from './binary_kernel';\\n\\nconst supportsFullBroadcast = false;\\nexport const greaterEqualConfig: KernelConfig =\\n createBinaryKernelConfig(GreaterEqual, supportsFullBroadcast, 'bool');\\n", "/**\n * @license\n * Copyright 2019\n * Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n *
```

```
=====\n\n *^\\n\\nimport { KernelConfig, KernelFunc, LeakyRelu, LeakyReluAttrs, LeakyReluInputs, TensorInfo, util } from '@tensorflow/tfjs-core';\\n\\nimport { BackendWasm } from '../backend_wasm';\\n\\nimport { CppDType } from './types';\\n\\nlet wasmFunc: (\\n xId: number, dtype: number, leakyreluAlpha: number, outId: number) => void;\\n\\nfunction setupFunc(backend: BackendWasm): void {\\n wasmFunc = backend.wasm.cwrap(LeakyRelu, null /* void */, [\\n 'number', // x_id\\n 'number', // dtype\\n 'number', // leakyrelu_alpha\\n 'number', // out_id\\n]);\\n}\\n\\nexport function leakyRelu(\\n args: {\\n inputs: LeakyReluInputs, attrs: LeakyReluAttrs, backend: BackendWasm});\\n TensorInfo {\\n const { inputs: { x }, attrs: { alpha }, backend } = args;\\n\\n const xId = backend.dataIdMap.get(x.dataId).id;\\n // According to TF API, LeakyRelu returns float32 when input is either float32\\n // or int32.\\n const out = backend.makeOutput(x.shape, 'float32');\\n\\n if (util.sizeFromShape(x.shape) !== 0) {\\n const outId = backend.dataIdMap.get(out.dataId).id;\\n wasmFunc(xId, CppDType[x.dtype], alpha, outId);\\n }\\n\\n return out;\\n}\\n}\\n\\nexport const leakyReluConfig: KernelConfig = {\\n kernelName: LeakyRelu,\\n backendName: 'wasm',\\n setupFunc,\\n kernelFunc: leakyRelu as { } as KernelFunc,\\n};\\n", "/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n\n *^\\nimport { KernelConfig, Less } from '@tensorflow/tfjs-core';\\n\\nimport { createBinaryKernelConfig } from './binary_kernel';\\n\\nconst supportsFullBroadcast = false;\\nexport const lessConfig: KernelConfig =\\n createBinaryKernelConfig(Less, supportsFullBroadcast, 'bool');\\n", "/**\n * @license\n * Copyright 2019 Google\n * LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not\n * use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n *
```

```
=====\n\n *^\\n\\nimport { KernelConfig, LessEqual } from '@tensorflow/tfjs-core';\\n\\nimport { createBinaryKernelConfig } from './binary_kernel';\\n\\nconst supportsFullBroadcast = false;\\nexport const lessEqualConfig: KernelConfig =\\n createBinaryKernelConfig(LessEqual, supportsFullBroadcast, 'bool');\\n", "/**\n * @license\n * Copyright 2019\n * Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
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OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n\n *\\nimport {KernelConfig, Log} from '@tensorflow/tfjs-core';\n\\nimport {createUnaryKernelConfig} from\n './unary_kernel';\n\\nexport const logConfig: KernelConfig = createUnaryKernelConfig(Log);\n\\n", /**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * \\n * http://www.apache.org/licenses/LICENSE-2.0\n * \\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n\n *\\nimport {KernelConfig, LogicalAnd}\n from '@tensorflow/tfjs-core';\n\\nimport {createBinaryKernelConfig} from './binary_kernel';\n\\nconst\n supportsFullBroadcast = false;\n\\nexport const logicalAndConfig: KernelConfig =\n createBinaryKernelConfig(LogicalAnd, supportsFullBroadcast, 'bool');\n\\n", /**\n * @license\n * Copyright 2019\n * Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you\n * may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \\n * http://www.apache.org/licenses/LICENSE-2.0\n * \\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n *
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=====\n\n *\\n\\nimport {backend_util,\n KernelConfig, KernelFunc, Max, MaxAttrs, MaxInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\n\\nimport\n {BackendWasm} from './backend_wasm';\n\\nimport {permuteAxesAndTranspose} from './kernel_utils';\n\\nimport\n {CppType} from './types';\n\\nlet wasmMax: (xId: number, dtype: number, reduceSize: number, outId: number)\n => \\n void;\n\\nfunction setup(backend: BackendWasm): void { \\n wasmMax = backend.wasm.cwrap(Max, null\n /*void*/, [\\n 'number', // x_id\n 'number', // dtype\n 'number', // reduce_size\n 'number', // out_id\n]);\n}\\n\\nfunction max(args: {backend: BackendWasm, inputs: MaxInputs, attrs: MaxAttrs}): \\n TensorInfo { \\n\n const {backend, inputs, attrs} = args;\n const {reductionIndices: axis, keepDims} = attrs;\n const {x} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\\n const {transposed, axes,\n originalAxes, inputWasTransposed} = \\n permuteAxesAndTranspose(x, axis, backend);\n\\n if\n (inputWasTransposed)\n { \\n const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n input = transposed;\n inputId =\n transposedId;\n } \\n\\n const inputRank = input.shape.length;\n backend_util.assertAxesAreInnerMostDims('max',\n axes, inputRank);\n const [outShape, reduceShape] = \\n\n backend_util.computeOutAndReduceShapes(input.shape, axes);\n const reduceSize =\n util.sizeFromShape(reduceShape);\n\\n const out = backend.makeOutput(outShape, x.dtype);\n\\n if\n (util.sizeFromShape(input.shape) !== 0) { \\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmMax(inputId, CCppType[x.dtype], reduceSize, outId);\n } \\n\\n if (inputWasTransposed) { \\n // dispose of the\n transposed tensor.\n backend.disposeData(transposed.dataId);\n } \\n\\n if (keepDims) { \\n // reshape\n const\n newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n } \\n\\n\n return out;\n}\\n\\nexport const maxConfig: KernelConfig = { \\n kernelName: Max,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: max as { } as KernelFunc\n};\n\\n", /**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * \\n * http://www.apache.org/licenses/LICENSE-2.0\n * \\n * Unless required by applicable law or
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```
=====\n*\nimport {KernelConfig, Maximum} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const maximumConfig:\n KernelConfig =\n createBinaryKernelConfig(Maximum, supportsFullBroadcast);\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

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=====\n*\nimport {backend_util, KernelConfig, KernelFunc, MaxPool, MaxPoolAttrs, MaxPoolInputs, Tensor4D, util}\nfrom '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nlet wasmMaxPool:\n (\n xId: number, batchSize: number, inputHeight: number, inputWidth: number,\n filterHeight: number, filterWidth: number, padTop: number, padRight: number,\n padBottom: number, padLeft: number, dilationHeight: number,\n dilationWidth: number, strideHeight: number, strideWidth: number,\n inputChannels: number, outputChannels: number, outId: number) => void;\nfunction setup(backend: BackendWasm) {\n wasmMaxPool =\n backend.wasm.cwrap(MaxPool, null /* void */, [\n 'number', // xId\n 'number', // batchSize\n 'number', // inputHeight\n 'number', // inputWidth\n 'number', // filterHeight\n 'number', // filterWidth\n 'number', // padTop\n 'number', // padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', // dilationHeight\n 'number', // dilationWidth\n 'number', // strideHeight\n 'number', // strideWidth\n 'number', // inputChannels\n 'number', // outputChannels\n 'number', // outId\n]);\n}\nfunction maxPool(\n args: {inputs: MaxPoolInputs, backend: BackendWasm, attrs: MaxPoolAttrs}) {\n const {inputs, attrs, backend} = args;\n const x = inputs.x as Tensor4D;\n const xId =\n backend.dataIdMap.get(x.dataId).id;\n // TF API supports int32 input. CPU and WebGL backend also support\n // int32 // input. WASM backend doesn't support it because it uses xnnpack which only\n // supports float32.\n // Add the following assert only for the WASM backend instead of at core op\n // level.\n // TODO: add support for int32 input.\n util.assert(\n x.dtype === 'float32',\n () =>\n `Error in MaxPool: only float32 input is supported. Got ${x.dtype}.`);\n const {filterSize, strides, pad, dimRoundingMode} = attrs;\n const convInfo = backend_util.computePool2DInfo(\n x.shape, filterSize, strides, 1 /* dilations */, pad,\n dimRoundingMode);\n const filterHeight = convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const padRight = convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n const padLeft = convInfo.padInfo.left;\n const dilationHeight = convInfo.dilationHeight;\n const dilationWidth = convInfo.dilationWidth;\n const strideHeight = convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n const inputChannels = convInfo.inChannels;\n const outputChannels = convInfo.outChannels;\n if (convInfo.dataFormat !== 'channelsLast') {\n throw new Error(\n `wasm backend does not support dataFormat: ` +\n `${convInfo.dataFormat}`. Please use 'channelsLast'.`);\n }\n const out =\n backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmMaxPool(\n xId, x.shape[0], x.shape[1], x.shape[2], filterHeight, filterWidth,\n padTop, padRight, padBottom, padLeft, dilationHeight, dilationWidth,\n strideHeight, strideWidth, inputChannels, outputChannels,\n outId);\n return out;\n}\nexport const maxPoolConfig: KernelConfig = {\n kernelName: MaxPool,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: maxPool as {} as KernelFunc\n};\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
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=====
*/\n\nimport { backend_util, KernelConfig, KernelFunc, Mean, MeanAttrs, MeanInputs,
TensorInfo, util } from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from './backend_wasm';\n\nimport { cast }
from './Cast';\n\nimport { permuteAxesAndTranspose } from './kernel_utils';\n\nlet wasmMean: (xId: number,
reduceSize: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmMean =\n backend.wasm.cwrap(Mean, null /*void*/, [number, number, number]);\n}\n\nexport function mean(\n args:
{ backend: BackendWasm, inputs: MeanInputs, attrs: MeanAttrs }):\n TensorInfo {\n const { backend, inputs,
attrs } = args;\n const { axis, keepDims } = attrs;\n const { x } = inputs;\n const xId =
backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const { transposed, axes, originalAxes,
inputWasTransposed } =\n permuteAxesAndTranspose(x, axis, backend);\n\n let reductionAxes = axes;\n if
(inputWasTransposed) {\n const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId
!== xId) {\n
 // transpose was not a no-op. We will need to dispose of this\n // once we are done.\n input = transposed;\n
 inputId = transposedId;\n reductionAxes = backend_util.getInnerMostAxes(\n reductionAxes.length,
input.shape.length);\n }\n }\n\n backend_util.assertAxesAreInnerMostDims(\n 'mean', reductionAxes,
input.shape.length);\n const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n const reduceSize =
util.sizeFromShape(reduceShape);\n let castedInput = input;\n if (input.dtype !== 'float32') {\n castedInput =\n cast({ backend, inputs: { x: input }, attrs: { dtype: 'float32' }});\n inputId =
backend.dataIdMap.get(castedInput.dataId).id;\n }\n\n const out = backend.makeOutput(outShape, 'float32');\n if
(util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmMean(inputId, reduceSize, outId);\n }\n\n if (inputWasTransposed) {\n
 // dispose of the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n //
reshape\n const newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape =
newShape;\n }\n\n if (input.dtype !== 'float32') {\n backend.disposeData(castedInput.dataId);\n }\n\n return
out;\n}\n\nexport const meanConfig: KernelConfig = {\n kernelName: Mean,\n backendName: 'wasm',\n
setupFunc: setup,\n kernelFunc: mean as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF
ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n *
limitations under the License.\n */
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*/\n\nimport { backend_util, KernelConfig, KernelFunc, Min, MinAttrs, MinInputs, TensorInfo, util } from
 '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from './backend_wasm';\n\nimport
{ permuteAxesAndTranspose } from './kernel_utils';\n\nimport { CppDType } from './types';\n\nlet wasmMin: (xId:
number, dtype: number, reduceSize: number, outId: number) =>\n void;\n\nfunction setup(backend:
BackendWasm): void {\n wasmMin = backend.wasm.cwrap(Min, null /*void*/, [\n 'number', // x_id\n
'number', // dtype\n 'number', // reduce_size\n 'number', // out_id\n]);\n}\n\nfunction min(args: { backend:
BackendWasm, inputs: MinInputs, attrs: MinAttrs }):\n TensorInfo {\n const { backend, inputs, attrs } = args;\n
const { axis, keepDims } = attrs;\n const { x }
```





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Int32Array(postPaddingsFlat).buffer);\n\n wasmMirrorPad(\n xId, xShapeBytes, x.shape.length,
CppType[x.dtype], prePaddingsBytes,\n postPaddingsBytes,
 MirrorPaddingMode[mode], outId);\n return out;\n}\n\n\nexport const mirrorPadConfig: KernelConfig = {\n
kernelName: MirrorPad,\n backendName: 'wasm',\n kernelFunc: mirrorPad as {} as KernelFunc,\n setupFunc:
setup\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
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on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

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=====\n
*\n\nimport { KernelConfig, Multiply } from '@tensorflow/tfjs-core';\n\nimport
{ createBinaryKernelConfig } from './binary_kernel';\n\nconst supportsFullBroadcast = true;\n\nexport const
multiplyConfig: KernelConfig =\n createBinaryKernelConfig(Multiply, supportsFullBroadcast);\n", "/*\n *
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2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *

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=====\n
*\n\nimport { KernelConfig, Neg } from '@tensorflow/tfjs-core';\n\nimport
{ createUnaryKernelConfig } from './unary_kernel';\n\nexport const negConfig: KernelConfig =
createUnaryKernelConfig(Neg);\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n *
Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

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=====\n
*\n\nimport { BackendWasm } from './backend_wasm';\n\n// Analogous to `struct Result` in
`non_max_suppression_impl.h`. \n\ninterface Result {\n
 pSelectedIndices: number;\n selectedSize: number;\n pSelectedScores: number;\n pValidOutputs:
number;\n}\n\n/*\n * Parse the result of the c++ method, which has the shape equivalent to\n * `Result`. \n\nexport
function parseResultStruct(\n backend: BackendWasm, resOffset: number): Result {\n const result = new
Int32Array(backend.wasm.HEAPU8.buffer, resOffset, 4);\n const pSelectedIndices = result[0];\n const
selectedSize = result[1];\n const pSelectedScores = result[2];\n const pValidOutputs = result[3];\n // Since the
result was allocated on the heap, we have to delete it.\n backend.wasm._free(resOffset);\n return
{pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs};\n}\n", "/*\n * @license\n * Copyright 2019
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n
*\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is
distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *

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*\n\nimport {KernelConfig, KernelFunc, NonMaxSuppressionV3, NonMaxSuppressionV3Attrs,
NonMaxSuppressionV3Inputs, TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from
'./backend_wasm';\n\nimport {parseResultStruct} from './NonMaxSuppression_util';\n\nlet wasmFunc: (\n
boxesId: number, scoresId: number, maxOutputSize: number,\n iouThreshold: number, scoreThreshold: number)
=> number;\n\nfunction setup(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(\n
NonMaxSuppressionV3,\n 'number', // Result*\n [\n
 'number', // boxesId\n 'number', // scoresId\n 'number', // maxOutputSize\n 'number', //
iouThreshold\n 'number', // scoreThreshold\n]);\n\nfunction kernelFunc(args: {\n backend:
BackendWasm,\n inputs: NonMaxSuppressionV3Inputs,\n attrs: NonMaxSuppressionV3Attrs\n}): TensorInfo {\n
const {backend, inputs, attrs} = args;\n const {iouThreshold, maxOutputSize, scoreThreshold} = attrs;\n const
{boxes, scores} = inputs;\n\n const boxesId = backend.dataIdMap.get(boxes.dataId).id;\n const scoresId =
backend.dataIdMap.get(scores.dataId).id;\n\n const resOffset =\n wasmFunc(boxesId, scoresId, maxOutputSize,
iouThreshold, scoreThreshold);\n\n const {pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs} =\n
parseResultStruct(backend, resOffset);\n\n // Since we are not using scores for V3, we have to delete it from the
heap.\n backend.wasm._free(pSelectedScores);\n backend.wasm._free(pValidOutputs);\n\n const
selectedIndicesTensor
 =\n backend.makeOutput([selectedSize], 'int32', pSelectedIndices);\n\n return
selectedIndicesTensor;\n}\n\nexport const nonMaxSuppressionV3Config: KernelConfig = {\n kernelName:
NonMaxSuppressionV3,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: kernelFunc as {} as
KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
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Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n */
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=====
*\n\nimport {KernelConfig, KernelFunc, NonMaxSuppressionV4, NonMaxSuppressionV4Attrs,
NonMaxSuppressionV4Inputs, TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from
'./backend_wasm';\n\nimport {parseResultStruct} from './NonMaxSuppression_util';\n\nlet wasmFunc: (\n
boxesId: number, scoresId: number, maxOutputSize: number,\n iouThreshold: number, scoreThreshold: number,\n
padToMaxOutputSize: boolean) => number;\n\nfunction setup(backend: BackendWasm): void {\n wasmFunc =
backend.wasm.cwrap(\n NonMaxSuppressionV4,\n 'number', // Result*\n [\n 'number', // boxesId\n
 'number', // scoresId\n 'number', // maxOutputSize\n 'number', // iouThreshold\n 'number', //
scoreThreshold\n 'bool', // padToMaxOutputSize\n]);\n\nfunction nonMaxSuppressionV4(args: {\n
backend: BackendWasm,\n inputs: NonMaxSuppressionV4Inputs,\n attrs: NonMaxSuppressionV4Attrs\n}):
TensorInfo[] {\n const {backend, inputs, attrs} = args;\n const {iouThreshold, maxOutputSize, scoreThreshold,
padToMaxOutputSize} =\n attrs;\n const {boxes, scores} = inputs;\n\n const boxesId =
backend.dataIdMap.get(boxes.dataId).id;\n const scoresId = backend.dataIdMap.get(scores.dataId).id;\n\n const
resOffset = wasmFunc(\n boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold,\n
padToMaxOutputSize);\n\n const {pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs} =\n
parseResultStruct(backend, resOffset);\n\n // Since we are not using scores for V4, we have to delete it from the
heap.\n backend.wasm._free(pSelectedScores);\n\n const selectedIndicesTensor =\n
backend.makeOutput([selectedSize], 'int32', pSelectedIndices);\n\n const validOutputsTensor =
backend.makeOutput([], 'int32', pValidOutputs);\n\n return [selectedIndicesTensor,
validOutputsTensor];\n}\n\nexport const nonMaxSuppressionV4Config: KernelConfig = {\n kernelName:

```

NonMaxSuppressionV4,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: nonMaxSuppressionV4 as  
{ } as KernelFunc,\n);\n", "/\*\*\n \* @license\n \* Copyright 2019 Google LLC. All Rights Reserved.\n \* Licensed  
under the Apache License, Version 2.0 (the \"License\");\n \* you may not use this file except in compliance with the  
License.\n \* You may obtain a copy of the License at\n \* \n \* http://www.apache.org/licenses/LICENSE-2.0\n \* \n \*  
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on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or  
implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the  
License.\n \*  
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```
*\\n\\nimport {KernelConfig, KernelFunc, NonMaxSuppressionV5, NonMaxSuppressionV5Attrs,
NonMaxSuppressionV5Inputs, TensorInfo} from '@tensorflow/tfjs-core';\\n\\nimport
{BackendWasm} from './backend_wasm';\\n\\nimport {parseResultStruct} from './NonMaxSuppression_util';\\n\\nlet
wasmFunc:\\n (boxesId: number, scoresId: number, maxOutputSize: number,\\n iouThreshold: number,
scoreThreshold: number, softNmsSigma: number) =>\\n number;\\n\\nfunction setup(backend: BackendWasm):
void {\\n wasmFunc = backend.wasm.cwrap(\\n NonMaxSuppressionV5,\\n 'number', // Result*\\n [\\n
'number', // boxesId\\n 'number', // scoresId\\n 'number', // maxOutputSize\\n 'number', //
iouThreshold\\n 'number', // scoreThreshold\\n 'number', // softNmsSigma\\n]);\\n}\\n\\nfunction
kernelFunc(args: {\\n backend: BackendWasm,\\n inputs: NonMaxSuppressionV5Inputs,\\n attrs:
NonMaxSuppressionV5Attrs\\n}): TensorInfo[] {\\n const {backend, inputs, attrs} = args;\\n const {iouThreshold,
maxOutputSize, scoreThreshold, softNmsSigma} = attrs;\\n const {boxes, scores} = inputs;\\n const boxesId =
backend.dataIdMap.get(boxes.dataId).id;\\n
 const scoresId = backend.dataIdMap.get(scores.dataId).id;\\n const resOffset = wasmFunc(\\n boxesId,
scoresId, maxOutputSize, iouThreshold, scoreThreshold,\\n softNmsSigma);\\n const {pSelectedIndices,
selectedSize, pSelectedScores, pValidOutputs} =\\n parseResultStruct(backend, resOffset);\\n // Since we are
not using validOutputs for V5, we have to delete it from the\\n // heap.\\n backend.wasm._free(pValidOutputs);\\n const selectedIndicesTensor =\\n backend.makeOutput([selectedSize], 'int32', pSelectedIndices);\\n const
selectedScoresTensor =\\n backend.makeOutput([selectedSize], 'float32', pSelectedScores);\\n return
[selectedIndicesTensor, selectedScoresTensor];\\n}\\n}\\n\\nexport const nonMaxSuppressionV5Config: KernelConfig =
{\\n kernelName: NonMaxSuppressionV5,\\n backendName: 'wasm',\\n setupFunc: setup,\\n kernelFunc: kernelFunc
as { } as KernelFunc,\\n);\\n", "/**\n * @license\n * Copyright 2020 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
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http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
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*\\n\\nimport {KernelConfig, NotEqual} from '@tensorflow/tfjs-core';\\n\\nimport {createBinaryKernelConfig} from
'./binary_kernel';\\nconst supportsFullBroadcast = false;\\nexport const notEqualConfig: KernelConfig =\\n createBinaryKernelConfig(NotEqual, supportsFullBroadcast, 'bool');\\n", "/**\n * @license\n * Copyright 2020
Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this
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http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\\n
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*\n\nimport {KernelConfig, KernelFunc, OneHot, OneHotAttrs, OneHotInputs} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from './backend_wasm';\n\nlet wasmOneHot: (\n indicesId: number, depth:
number, onValue: number, offValue: number,\n outId: number) => void;\n\nfunction setup(backend:
BackendWasm) {\n wasmOneHot
= backend.wasm.cwrap(OneHot, null /* void */, [\n 'number', // indices_id\n 'number', // depth,\n 'number', //
onValue\n 'number', // offValue\n 'number' // out_id\n]);\n\nfunction oneHot(\n args: {inputs:
OneHotInputs, attrs: OneHotAttrs, backend: BackendWasm}) {\n const {inputs, backend, attrs} = args;\n const
{indices} = inputs;\n const {depth, onValue, offValue} = attrs;\n\n const out =
backend.makeOutput([...indices.shape, depth], 'int32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n
const indicesData = backend.dataIdMap.get(indices.dataId);\n const indicesId = indicesData.id;\n\n
wasmOneHot(indicesId, depth, onValue, offValue, outId);\n\n return out;\n}\n\nexport const oneHotConfig:
KernelConfig = {\n kernelName: OneHot,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: oneHot as
{} as KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {KernelConfig, KernelFunc, OnesLike, OnesLikeInputs} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from './backend_wasm';\n\nfunction onesLike(args: {inputs: OnesLikeInputs, backend:
BackendWasm}) {\n const {inputs: {x}, backend} = args;\n const out = backend.makeOutput(x.shape, x.dtype);\n
const outVals = backend.toArrayFromHeap(out);\n outVals.fill(1);\n return
out;\n}\n\nexport const onesLikeConfig: KernelConfig = {\n kernelName: OnesLike,\n backendName: 'wasm',\n
kernelFunc: onesLike as {} as KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights
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software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {KernelConfig, KernelFunc, Pack, PackAttrs, PackInputs, TensorInfo, util} from '@tensorflow/tfjs-
core';\n\nimport
{BackendWasm} from './backend_wasm';\n\nimport {concat} from './Concat';\n\nimport {expandDims} from
'./ExpandDims';\n\nexport function pack(\n args: {inputs: PackInputs, backend: BackendWasm, attrs:
PackAttrs});\n TensorInfo {\n const {inputs, backend, attrs} = args;\n const {axis} = attrs;\n\n if (inputs.length
=== 1) {\n return expandDims(\n {inputs: {input: inputs[0]}, backend, attrs: {dim: axis}});\n }\n\n const
shape = inputs[0].shape;\n const dtype = inputs[0].dtype;\n\n inputs.forEach(t => {\n util.assertShapesMatch(\n
shape, t.shape,\n 'All tensors passed to stack must have matching shapes');\n util.assert(\n dtype ===
t.dtype,\n () => 'All tensors passed to stack must have matching dtypes');\n });\n\n const
intermediateTensorInfos: TensorInfo[] = [];\n const expandedTensors = inputs.map(t => {\n const expandedT =\n
expandDims({inputs: {input: t}, backend, attrs: {dim: axis}});\n intermediateTensorInfos.push(expandedT);\n
return expandedT;\n });\n\n const result = concat({inputs: expandedTensors, backend, attrs: {axis}});\n\n
intermediateTensorInfos.forEach(t => backend.disposeData(t.dataId));\n\n return result;\n}\n\nexport const
packConfig: KernelConfig = {\n kernelName: Pack,\n backendName: 'wasm',\n kernelFunc: pack as {} as
KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the

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* =====\n*\n*\nimport {KernelConfig, KernelFunc, PadV2, PadV2Attrs, PadV2Inputs, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {fill} from './Fill';\nimport {CppType} from './types';\nlet wasmPadV2: (\n xId: number, xShapeBytes: Uint8Array, xShapeLength: number, xDtype: number,\n prePaddingsBytes: Uint8Array, postPaddingsBytes: Uint8Array, \n constantValue: number, outId: number) => void;\nfunction setup(backend: BackendWasm) {\n wasmPadV2 = backend.wasm.cwrap(PadV2, null\n /* void */, [\n 'number', // xId\n 'array', // x.shape\n 'number', // x.shape.length\n 'number', // x.dtype\n 'array', // pre-paddings\n 'array', // post-paddings\n 'number', // constantValue\n 'number', // outId\n]);\n}\nfunction pad(\n args: {inputs: PadV2Inputs, backend: BackendWasm, attrs: PadV2Attrs}) {\n const {inputs: {x}, backend, attrs: {paddings, constantValue}} = args;\n const outShape = paddings.map((p, i) => p[0] /* beforePad */ + x.shape[i] + p[1] /* afterPad */);\n if (util.sizeFromShape(x.shape) === 0) {\n // Short-circuit the computation, since x doesn't have value, only the shape is used to compute output shape to pad.\n return fill({\n backend, \n attrs: {shape: outShape, value: constantValue, dtype: x.dtype}\n });\n }\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out = backend.makeOutput(outShape, x.dtype);\n const outTensorData = backend.dataIdMap.get(out.dataId);\n const outId = outTensorData.id;\n const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n const prePaddingsFlat = paddings.map(padTuple => padTuple[0]);\n const postPaddingsFlat = paddings.map(padTuple => padTuple[1]);\n const prePaddingsBytes = new Uint8Array(new Int32Array(prePaddingsFlat).buffer);\n const postPaddingsBytes = new Uint8Array(new Int32Array(postPaddingsFlat).buffer);\n wasmPadV2(xId, xShapeBytes, x.shape.length, CCppType[x.dtype], prePaddingsBytes, postPaddingsBytes, constantValue, outId);\n return out;\n}\nexport const padV2Config: KernelConfig = {\n kernelName: PadV2, \n backendName: 'wasm', \n kernelFunc: pad as KernelFunc, \n setupFunc: setup\n};\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
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* =====\n*\nimport {KernelConfig, Pow} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const powConfig: KernelConfig =\n createBinaryKernelConfig(Pow, supportsFullBroadcast);\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

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*/\n\nimport {KernelConfig, KernelFunc, Prelu, PreluInputs} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from './backend_wasm';\n\nimport {cast} from './Cast';\n\nlet wasmPrelu: (xId: number,
weightsId: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmPrelu =
backend.wasm.cwrap(Prelu, null /* void */, [\n 'number', // x_id\n 'number', // weights_id\n 'number' //
out_id\n]);\n\n function prelu(args: {inputs: PreluInputs, backend: BackendWasm}) {\n const {inputs, backend}
= args;\n const {x, alpha} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const weightsId =
backend.dataIdMap.get(alpha.dataId).id;\n\n let inputId = xId;\n const input = x;\n let castedInput = input;\n if
(input.dtype !== 'float32') {\n castedInput = cast({backend, inputs: {x}, attrs: {dtype: 'float32'}});\n inputId =
backend.dataIdMap.get(castedInput.dataId).id;\n }\n\n const out = backend.makeOutput(x.shape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmpPrelu(inputId, weightsId, outId);\n\n if (input.dtype !== 'float32') {\n
backend.disposeData(castedInput.dataId);\n }\n return out;\n }\n\n export const preluConfig: KernelConfig = {\n
kernelName: Prelu,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: prelu as {} as
KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
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on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing
permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {backend_util, KernelConfig, KernelFunc, Prod, ProdAttrs, ProdInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport
{permuteAxesAndTranspose} from './kernel_utils';\n\nimport {CppType} from './types';\n\nlet wasmProd: (\n
xId: number, reduceSize: number,\n dtype: number, outId: number) => void;\n\nfunction setup(backend:
BackendWasm): void {\n wasmProd = backend.wasm.cwrap(Prod, null /*void*/, [\n 'number',\n 'number',\n
'number',\n 'number'\n]);\n\n function prod(args: {\n backend: BackendWasm,\n inputs: ProdInputs,\n attrs:
ProdAttrs\n}): TensorInfo {\n const {backend, inputs, attrs} = args;\n const {axis, keepDims} = attrs;\n const {x}
= inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const
{transposed, axes, originalAxes, inputWasTransposed} =\n permuteAxesAndTranspose(x, axis, backend);\n\n let reductionAxes = axes;\n if (inputWasTransposed) {\n const transposedId =
backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId !== xId) {\n // transpose was not a no-op. We
will need to dispose of this\n // once we are done.\n input = transposed;\n inputId = transposedId;\n
reductionAxes = backend_util.getInnerMostAxes(\n reductionAxes.length, input.shape.length);\n }\n }\n\n backend_util.assertAxesAreInnerMostDims(\n 'prod', reductionAxes, input.shape.length);\n const [outShape,
reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n const reduceSize
= util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, input.dtype);\n if
(util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmProd(inputId, reduceSize,
CppType[out.dtype], outId);\n }\n\n if (inputWasTransposed) {\n // dispose of the transposed tensor.\n
backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const newShape =
backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n return
out;\n }\n\n export const prodConfig: KernelConfig = {\n kernelName: Prod,\n backendName: 'wasm',\n setupFunc:
setup,\n kernelFunc: prod as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All
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=====\n*\nimport {KernelConfig, Relu6} from '@tensorflow/tfjs-core';\nimport\n {createUnaryKernelConfig} from './unary_kernel';\nexport const relu6Config: KernelConfig =\n createUnaryKernelConfig(Relu6);\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in\n * compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n *
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=====\n*\nimport {KernelConfig, KernelFunc, ResizeBilinear, ResizeBilinearAttrs, ResizeBilinearInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport\n {BackendWasm} from './backend_wasm';\nimport {cast} from './Cast';\nlet wasmResizeBilinear: (\n xId:\n number, batch: number, oldHeight: number, oldWidth: number,\n numChannels: number, newHeight: number,\n newWidth: number,\n alignCorners: number, halfPixelCenters: number, outId: number) => void;\nfunction\n setup(backend: BackendWasm): void {\n wasmResizeBilinear = backend.wasm.cwrap(ResizeBilinear, null\n /*void*/, [\n 'number', // xId\n 'number', // batch\n 'number', // oldHeight\n 'number', // oldWidth\n 'number', // numChannels\n 'number', // newHeight\n 'number', // newWidth\n 'number', // alignCorners\n 'number', // halfPixelCenters\n 'number' // outId\n]);\n function resizeBilinear(args: {\n backend:\n BackendWasm,\n inputs: ResizeBilinearInputs,\n attrs: ResizeBilinearAttrs\n }): TensorInfo {\n const {backend,\n inputs, attrs} = args;\n const {images} = inputs;\n const {alignCorners, halfPixelCenters,\n size} = attrs;\n const [newHeight, newWidth] = size;\n const [batch, oldHeight, oldWidth, numChannels] =\n images.shape;\n const outShape = [batch, newHeight, newWidth, numChannels];\n let xData =\n backend.dataIdMap.get(images.dataId);\n let castedData;\n if (xData.dtype !== 'float32') {\n castedData =\n cast({backend, inputs: {x: images}, attrs: {dtype: 'float32'}});\n xData =\n backend.dataIdMap.get(castedData.dataId);\n }\n const xId = xData.id;\n const out =\n backend.makeOutput(outShape, 'float32');\n if (util.sizeFromShape(images.shape) === 0) {\n return out;\n }\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmResizeBilinear(\n xId, batch, oldHeight,\n oldWidth, numChannels, newHeight, newWidth,\n alignCorners ? 1 : 0, halfPixelCenters ? 1 : 0, outId);\n if\n (castedData != null) {\n backend.disposeData(castedData.dataId);\n }\n return out;\n }\n export const\n resizeBilinearConfig: KernelConfig = {\n kernelName: ResizeBilinear,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: resizeBilinear as {} as KernelFunc\n };\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a\n copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable\n law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n the specific language governing permissions and\n * limitations under the License.\n *
```

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=====\n*\nimport {KernelConfig, KernelFunc, Reverse, ReverseAttrs, ReverseInputs, TensorInfo, util} from\n '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport\n {identity} from './Identity';\nimport {reshape} from './Reshape';\nlet wasmReverse: (\n xId: number, axes:\n Uint8Array, axesLength: number, outShape: Uint8Array,\n outShapeLength: number, outId: number) =>\n void;\nfunction setup(backend: BackendWasm) {\n wasmReverse = backend.wasm.cwrap(Reverse, null, [\n
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'number', // x_id\n 'array', // axes\n 'number', // axes_length\n 'array', // out_shape\n 'number', //
out_shape_length\n 'number' // out_id\n]);\n\n\nexport function reverse(\n args: {inputs: ReverseInputs,
backend: BackendWasm, attrs: ReverseAttrs});\n TensorInfo {\n const {inputs, backend, attrs} = args;\n const
{x} = inputs;\n const {dims} = attrs;\n\n const axes = util.parseAxisParam(dims, x.shape);\n\n if (x.shape.length
=== 0) {\n return identity({inputs: {x}, backend});\n }\n\n const out = backend.makeOutput(x.shape, x.dtype);\n
const xId = backend.dataIdMap.get(x.dataId).id;\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n
 const axesBytes = new Uint8Array(new Int32Array(axes).buffer);\n const outShapeBytes = new Uint8Array(new
Int32Array(x.shape).buffer);\n\n wasmReverse(\n xId, axesBytes, axes.length, outShapeBytes, x.shape.length,
outId);\n\n const reshaped =\n reshape({inputs: {x: out}, attrs: {shape: x.shape}, backend});\n\n
backend.disposeData(out.dataId);\n return reshaped;\n }\n\n\nexport const reverseConfig: KernelConfig = {\n
kernelName: Reverse,\n backendName: 'wasm',\n kernelFunc: reverse as { } as KernelFunc,\n setupFunc:
setup\n};\n\n\n/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
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on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====
*\n\nimport {KernelConfig, KernelFunc, RotateWithOffset, RotateWithOffsetAttrs, RotateWithOffsetInputs,
TensorInfo} from '@tensorflow/tfjs-core';\nimport {backend_util} from '@tensorflow/tfjs-core';\nimport
{BackendWasm} from '../backend_wasm';\n\nlet wasmRotate: (\n xId: number, batch: number, imageHeight:
number, imageWidth: number,\n numChannels: number, radians: number, centerX: number, centerY: number,\n
fillBytes: Uint8Array, fillLength: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n
wasmRotate = backend.wasm.cwrap(RotateWithOffset, null /* void */, [\n 'number', // xId\n 'number', //
batch\n 'number', // imageHeight\n 'number', //
imageWidth\n 'number', // numChannels\n 'number', // radians\n 'number', // centerX\n 'number', //
centerY\n 'array', // fillBytes\n 'number', // fillLength\n 'number', // outId\n]);\n\n\n\nexport function
rotateWithOffset(args: {\n inputs: RotateWithOffsetInputs,\n backend: BackendWasm,\n attrs:
RotateWithOffsetAttrs\n}): TensorInfo {\n const {inputs, backend, attrs} = args;\n const {image} = inputs;\n
const {radians, fillValue, center} = attrs;\n\n const out = backend.makeOutput(image.shape, image.dtype);\n
const imageId = backend.dataIdMap.get(image.dataId).id;\n const outId = backend.dataIdMap.get(out.dataId).id;\n
const [batch, imageHeight, imageWidth, numChannels] = image.shape;\n\n const [centerX, centerY] =\n
backend_util.getImageCenter(center, imageHeight, imageWidth);\n\n const fillIsBlack = fillValue === 0;\n const
fullOpacityValue = 255;\n\n const fillValues = typeof fillValue === 'number' ?\n [fillValue, fillValue, fillValue,
fillIsBlack ? 0 : fullOpacityValue] :\n [...fillValue, fullOpacityValue];\n\n const fillBytes = new Uint8Array(new
Int32Array(fillValues).buffer);\n\n wasmRotate(\n imageId, batch, imageHeight, imageWidth, numChannels,
radians, centerX,\n centerY, fillBytes, fillValues.length, outId);\n return out;\n}\n\n\nexport const
rotateWithOffsetConfig: KernelConfig = {\n kernelName: RotateWithOffset,\n backendName: 'wasm',\n
kernelFunc: rotateWithOffset as { } as KernelFunc,\n setupFunc: setup\n};\n\n\n/*\n * @license\n * Copyright 2021
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may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
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OR
CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing
permissions and\n * limitations under the License.\n *
=====

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*\nimport {KernelConfig, Round} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from './unary_kernel';\n\nexport const roundConfig: KernelConfig = createUnaryKernelConfig(Round);\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n*\nimport {KernelConfig, Rsqrt} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from './unary_kernel';\n\nexport const rsqrtConfig: KernelConfig = createUnaryKernelConfig(Rsqrt);\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

```
\n=====\n\nimport {KernelConfig, KernelFunc, scatter_util, ScatterNd, ScatterNdAttrs, ScatterNdInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {CppType} from './types';\n\nlet wasmScatterNd: (\n indicesId: number, updatesId: number, dtype: CppDType, sliceRank: number,\n numUpdates: number, sliceSize: number, strides: Uint8Array,\n outputSize: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmScatterNd = backend.wasm.cwrap(ScatterNd, null /*void*/, [\n 'number', // indicesId\n 'number', // updatesId\n 'number', // dtype\n 'number', // sliceRank\n 'number', // numUpdates\n 'number', // sliceSize\n 'array', // strides\n 'number', // outputSize\n 'number' // outId\n]);\n\n function scatterNd(\n args: \n {backend: BackendWasm, inputs: ScatterNdInputs, attrs: ScatterNdAttrs});\n\n TensorInfo {\n const {backend, inputs, attrs} = args;\n const {indices, updates} = inputs;\n const {shape} = attrs;\n\n const out = backend.makeOutput(shape, updates.dtype);\n\n if (util.sizeFromShape(shape) === 0) {\n return out;\n }\n\n const {sliceRank, numUpdates, sliceSize, strides, outputSize} =\n scatter_util.calculateShapes(updates, indices, shape);\n\n const indicesData = backend.dataIdMap.get(indices.dataId);\n const indicesId = indicesData.id;\n\n const updatesData = backend.dataIdMap.get(updates.dataId);\n const updatesId = updatesData.id;\n\n const stridesBytes = new Uint8Array(new Int32Array(strides).buffer);\n\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n wasmScatterNd(\n indicesId, updatesId, CppDType[updates.dtype], sliceRank, numUpdates,\n sliceSize, stridesBytes, outputSize, outId);\n\n return out;\n }\n\n export const scatterNdConfig: KernelConfig = {\n kernelName: ScatterNd,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: scatterNd as { } as KernelFunc\n };"}\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n*\nimport {KernelConfig, KernelFunc, Select, SelectInputs, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmSelect: (\n conditionId: number, tId: number,
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eId: number, offset: number,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n
wasmSelect = backend.wasm.cwrap('SelectV2', null, [\n 'number', // conditionId\n 'number', // tId\n 'number',\n // eId\n 'number', // offset\n 'number', // outId\n]);\n}\n\nfunction select(args: {inputs: SelectInputs, backend:\nBackendWasm}) {\n const {inputs, backend} = args;\n const {condition, t, e} = inputs;\n\n const conditionId =\nbackend.dataIdMap.get(condition.dataId).id;\n const tId = backend.dataIdMap.get(t.dataId).id;\n const eId =\nbackend.dataIdMap.get(e.dataId).id;\n const out = backend.makeOutput(t.shape, t.dtype);\n const outId =\nbackend.dataIdMap.get(out.dataId).id;\n\n const cRank = condition.shape.length;\n const tRank =\nt.shape.length;\n\n const offset = cRank === 0 || cRank > 1 || tRank === 1 ?\n 1 :\n util.sizeFromShape(t.shape.slice(1));\n\n wasmSelect(conditionId, tId, eId, offset, outId);\n return out;\n}\n\nexport\nconst\n\nselectConfig: KernelConfig = {\n kernelName: Select,\n backendName: 'wasm',\n kernelFunc: select as { } as\nKernelFunc,\n setupFunc: setup\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in\n * compliance with the License.\n * You may obtain a copy of the License at\n * \n *\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n *\n * =====\n *\n */\n\nimport {KernelConfig, KernelFunc, Sigmoid, SigmoidInputs, TensorInfo, util} from '@tensorflow/tfjs-\ncore';\nimport {BackendWasm}\n\nfrom './backend_wasm';\n\nlet wasmFunc: (xId: number, outId: number) => void;\n\nfunction setup(backend:\nBackendWasm): void {\n wasmFunc = backend.wasm.cwrap(Sigmoid, null /* void */, ['number',\n'number']);\n}\n\nfunction sigmoid(args: {backend: BackendWasm, inputs: SigmoidInputs}): \nTensorInfo {\n const {backend, inputs: {x}} = args;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out =\nbackend.makeOutput(x.shape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n // Short-circuit\nzero-sized tensors.\n if (util.sizeFromShape(out.shape) === 0) {\n return out;\n }\n\n wasmFunc(xId, outId);\n return out;\n}\n\nexport const sigmoidConfig: KernelConfig = {\n kernelName: 'Sigmoid',\n backendName:\n'wasm',\n setupFunc: setup,\n kernelFunc: sigmoid as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright\n * 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * \n * you may not use this file\n * \n * except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n *\n * =====\n *\n */\n\nimport {KernelConfig, Sin} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from\n'./unary_kernel';\n\nexport const sinConfig: KernelConfig = createUnaryKernelConfig(Sin);\n\n"/**\n * @license\n * Copyright\n * 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * \n *\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n *\n * =====\n *\n */\n\nimport {KernelConfig, KernelFunc, Softmax, SoftmaxAttrs, SoftmaxInputs, TensorInfo, util} from

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'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmFunc: (xId: number, outId: number, channels: number, batch: number) =>\n void;\n\nfunction setup(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(Softmax, null /* void */, [\n 'number', // xId\n 'number', // outId\n 'number', // channels\n 'number' // batch\n]);\n\n function softmax(\n args: {backend: BackendWasm, inputs: SoftmaxInputs, attrs: SoftmaxAttrs}):\n TensorInfo {\n const {backend, inputs: {logits}, attrs: {dim}} = args;\n const xId = backend.dataIdMap.get(logits.dataId).id;\n const out = backend.makeOutput(logits.shape, logits.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n const channels = logits.shape[dim];\n const batch = util.sizeFromShape(logits.shape) / channels;\n\n // Short-circuit zero-sized tensors.\n if (util.sizeFromShape(out.shape) === 0) {\n return out;\n }\n\n wasmFunc(xId, outId, channels, batch);\n return out;\n }\n\n export const softmaxConfig: KernelConfig = {\n kernelName: Softmax,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: softmax as {} as KernelFunc\n };n"/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *\n * =====\n *\nimport {backend_util, KernelConfig, KernelFunc, ReshapeAttrs, ReshapeInputs, SpaceToBatchND, SpaceToBatchNDAttrs, SpaceToBatchNDInputs, TensorInfo, TransposeAttrs, TransposeInputs, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {padV2Config} from './PadV2';\nimport {reshape} from './Reshape';\nimport {transpose} from './Transpose';\n\nfunction spaceToBatchND(args: {\n inputs: SpaceToBatchNDInputs,\n backend: BackendWasm,\n attrs: SpaceToBatchNDAttrs\n}) {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {blockShape, paddings} = attrs;\n\n const prod = util.sizeFromShape(blockShape);\n const completePaddings: Array<[number, number]> = [[0, 0]];\n completePaddings.push(...(paddings as Array<[number, number]>));\n for (let i = 1 + blockShape.length; i < x.shape.length; ++i) {\n completePaddings.push([0, 0]);\n }\n\n const paddedX = padV2Config.kernelFunc({\n inputs: {x},\n backend,\n attrs: {paddings: completePaddings, constantValue: 0}\n }) as TensorInfo;\n\n const reshapedPaddedShape =\n backend_util.getReshaped(paddedX.shape, blockShape, prod, false);\n\n const permutedReshapedPaddedPermutation = backend_util.getPermuted(\n reshapedPaddedShape.length, blockShape.length, false);\n\n const flattenShape =\n backend_util.getReshapedPermuted(paddedX.shape, blockShape, prod, false);\n\n const reshapeInputs: ReshapeInputs = {x: paddedX};\n const reshapeAttrs: ReshapeAttrs = {shape: reshapedPaddedShape};\n\n const paddedXReshaped =\n reshape({inputs: reshapeInputs, backend, attrs: reshapeAttrs});\n\n const transposeInputs: TransposeInputs = {x: paddedXReshaped};\n const transposeAttrs: TransposeAttrs = {perm: permutedReshapedPaddedPermutation};\n const paddedXT =\n transpose({inputs: transposeInputs, backend, attrs: transposeAttrs});\n\n const resultReshapeInputs: ReshapeInputs = {x: paddedXT};\n const resultReshapeAttrs: ReshapeAttrs = {shape: flattenShape};\n const result = reshape(\n {inputs: resultReshapeInputs, backend, attrs: resultReshapeAttrs});\n\n backend.disposeData(paddedX.dataId);\n backend.disposeData(paddedXReshaped.dataId);\n backend.disposeData(paddedXT.dataId);\n\n return result;\n}\n\nexport const spaceToBatchNDConfig: KernelConfig = {\n kernelName: SpaceToBatchND,\n backendName: 'wasm',\n kernelFunc: spaceToBatchND as {} as KernelFunc\n};n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
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express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

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=====\n\n*\n\nimport { KernelConfig, KernelFunc, SplitV, SplitVAttrs, SplitVInputs, util } from '@tensorflow/tfjs-core';\nimport { backend_util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport { slice } from './Slice';\nexport function splitV(\n args: { inputs: SplitVInputs, attrs: SplitVAttrs, backend: BackendWasm }) {\n const { inputs, attrs, backend } = args;\n const { x } = inputs;\n const { numOrSizeSplits, axis } = attrs;\n\n const $axis = util.parseAxisParam(axis, x.shape)[0];\n const splitSizes = backend_util.prepareSplitSize(x, numOrSizeSplits, $axis);\n const begin = new Array(x.shape.length).fill(0);\n const size = x.shape.slice();\n return splitSizes.map((s => {\n const xSliceSize = [...size];\n xSliceSize[$axis] = s;\n const xSlice =\n slice({ inputs: { x }, attrs: { begin, size: xSliceSize }, backend });\n begin[$axis] += s;\n return xSlice;\n }));\n}\n\nexport const splitVConfig: KernelConfig = {\n kernelName: SplitV,\n backendName: 'wasm',\n kernelFunc: splitV as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
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=====\n\n*\n\nimport { KernelConfig, Sqrt } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from './unary_kernel';\nexport const sqrtConfig: KernelConfig = createUnaryKernelConfig(Sqrt);\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
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=====\n\n*\n\nimport { KernelConfig, Square } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from './unary_kernel';\nexport const squareConfig: KernelConfig = createUnaryKernelConfig(Square);\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
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=====\n\n*\n\nimport { KernelConfig, SquaredDifference } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from './binary_kernel';\nconst supportsFullBroadcast = true;\nexport const squaredDifferenceConfig: KernelConfig =\n createBinaryKernelConfig(SquaredDifference, supportsFullBroadcast);\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on
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=====\n
*\n\nimport {KernelConfig, KernelFunc, Step, StepAttrs, StepInputs, TensorInfo} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {CppType} from './types';\n\nlet wasmStep:
(xId: number, alpha: number, dtype: number, outId: number) =>\n void;\n\nfunction setup(backend:
BackendWasm): void {\n wasmStep = backend.wasm.cwrap(Step, null /*void*/, [\n 'number', // x_id\n
'number', // alpha\n 'number', // dtype\n 'number', // out_id\n]);\n\n function step(\n args: {backend:
BackendWasm, inputs: StepInputs, attrs: StepAttrs});\n TensorInfo {\n const {backend, inputs, attrs} = args;\n
const {alpha} = attrs;\n const {x} = inputs;\n const xId
= backend.dataIdMap.get(x.dataId).id;\n\n const out = backend.makeOutput(x.shape, x.dtype);\n const outId =
backend.dataIdMap.get(out.dataId).id;\n wasmStep(xId, alpha, CppDType[x.dtype], outId);\n return
out;\n }\n\n export const stepConfig: KernelConfig = {\n kernelName: Step,\n backendName: 'wasm',\n setupFunc:
setup,\n kernelFunc: step as {} as KernelFunc\n };
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Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
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http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under
the License.\n *
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*\n\nimport {KernelConfig, KernelFunc, slice_util, StridedSlice, StridedSliceAttrs, StridedSliceInputs, TensorInfo,
util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {reshape} from
'/Reshape';\n\nimport {slice} from './Slice';\n\nlet wasmStridedSlice: (\n xId: number, xStridesBytes: Uint8Array,
xRank: number,\n beginBytes: Uint8Array, endBytes: Uint8Array, stridesBytes: Uint8Array,\n outShapeBytes:
Uint8Array, outStridesBytes: Uint8Array,\n outShapeLength: number, outId: number) => void;\n\nfunction
setup(backend: BackendWasm): void {\n wasmStridedSlice = backend.wasm.cwrap(StridedSlice, null /*void*/, [\n
'number', // xId\n 'array', // xStrides\n 'number', // xRank\n 'array', // beginBytes\n 'array', // endBytes\n
'array', // stridesBytes\n 'array', // outShapeBytes\n 'array', // outStridesBytes\n
'number', // outShapeLength\n 'number', // outId\n]);\n\n export function stridedSlice(args: {\n backend:
BackendWasm,\n inputs: StridedSliceInputs,\n attrs: StridedSliceAttrs\n }): TensorInfo {\n const {backend, inputs,
attrs} = args;\n const {x} = inputs;\n\n const {\n begin,\n end,\n strides,\n beginMask,\n endMask,\n ellipsisMask,\n newAxisMask,\n shrinkAxisMask\n } = attrs;\n\n const {\n finalShapeSparse,\n finalShape,\n isIdentity,\n sliceDim0,\n isSimpleSlice,\n begin: $begin,\n end: $end,\n strides: $strides\n } =\n slice_util.sliceInfo(\n x.shape, begin, end, strides, beginMask, endMask, ellipsisMask,\n newAxisMask, shrinkAxisMask);\n\n let result;\n\n if (isIdentity) {\n // Optimization #1, slice is a no-op plus
reshape\n result = reshape({inputs: {x}, backend, attrs: {shape: finalShape}});\n } else if (sliceDim0 ||
isSimpleSlice) {\n // Optimization #2, slice is memory contiguous
(only occurs in dim 0)\n util.assert(\n x.shape.length >= 1,\n () => `Input must have rank at least 1, got:
${x.shape.length}`);\n\n const size = slice_util.computeOutShape($begin, $end, $strides);\n // To tolerate
begin[0] > end[0] (a 0-output slice), we min(begin, end).\n const sliced = slice({inputs: {x}, backend, attrs:
{begin: $begin, size}});\n result =\n reshape({inputs: {x: sliced}, backend, attrs: {shape: finalShape}});\n backend.disposeData(sliced.dataId);\n } else {\n const out = backend.makeOutput(finalShapeSparse,
'float32');\n\n const xId = backend.dataIdMap.get(x.dataId).id;\n const xStridesBytes =\n new
Uint8Array(new Int32Array(util.computeStrides(x.shape)).buffer);\n const beginBytes = new Uint8Array(new
Int32Array($begin).buffer);\n const endBytes = new Uint8Array(new Int32Array($end).buffer);\n const
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stridesBytes = new Uint8Array(new Int32Array($strides).buffer);\n\n const outputShapeBytes =\n
 new Uint8Array(new Int32Array(finalShapeSparse).buffer);\n const outStridesBytes = new Uint8Array(\n
 new Int32Array(util.computeStrides(finalShapeSparse)).buffer);\n const outId =
backend.dataIdMap.get(out.dataId).id;\n\n wasmStridedSlice(\n xId, xStridesBytes, x.shape.length,
beginBytes, endBytes, stridesBytes,\n outputShapeBytes, outStridesBytes, finalShapeSparse.length, outId);\n\n result = reshape({inputs: {x: out}, backend, attrs: {shape: finalShape}});\n\n backend.disposeData(out.dataId);\n
}\n\n return result;\n}\n\nexport const stridedSliceConfig: KernelConfig = {\n kernelName: StridedSlice,\n
backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: stridedSlice as {} as KernelFunc\n};\n", "/*\n *
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WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
=====\n
*/\nimport {KernelConfig, Sub} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
'/binary_kernel';\nconst supportsFullBroadcast = true;\nexport const subConfig: KernelConfig =\ncreateBinaryKernelConfig(Sub, supportsFullBroadcast);\n", "/*\n * @license\n * Copyright 2019 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
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distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *
=====\n
*/\n\nimport {backend_util, KernelConfig, KernelFunc, Sum, SumAttrs, SumInputs, TensorInfo, util} from
 '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\n\nimport
{permuteAxesAndTranspose} from './kernel_utils';\nimport {CppType} from './types';\n\nlet wasmSum: (xId:
number, reduceSize: number, dtype: number, outId: number) =>\n void;\n\nfunction setup(backend:
BackendWasm): void {\n wasmSum = backend.wasm.cwrap(Sum, null /*void*/, [\n 'number', // input_id\n
'number', // reduce_size\n 'number', // dtype\n
 'number', // out_id\n]);\n}\n\nfunction sum(args: {backend: BackendWasm, inputs: SumInputs, attrs:
SumAttrs}): \n TensorInfo {\n const {backend, inputs, attrs} = args;\n const {axis, keepDims} = attrs;\n const
{x} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n const
{transposed, axes, originalAxes, inputWasTransposed} =\n permuteAxesAndTranspose(x, axis, backend);\n\n let
reductionAxes = axes;\n if (inputWasTransposed) {\n const transposedId =
backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId !== xId) {\n // transpose was not a no-op. We
will need to dispose of this\n // once we are done.\n input = transposed;\n inputId = transposedId;\n
reductionAxes = backend_util.getInnerMostAxes(\n reductionAxes.length, input.shape.length);\n }\n }\n\n
backend_util.assertAxesAreInnerMostDims(\n 'sum', reductionAxes, input.shape.length);\n const [outShape,
reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n const reduceSize
= util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, input.dtype);\n if
(util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmSum(inputId, reduceSize, CppType[out.dtype], outId);\n }\n\n if (inputWasTransposed) {\n // dispose of
the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n
const newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n
}

```



return out;\n)\n\nexport const sumConfig: KernelConfig = {\n kernelName: Sum,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: sum as {} as KernelFunc\n};\n", "/\*\n \* @license\n \* Copyright 2021 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the \"License\");\n \* you may not use this file

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=====\n\n\*\n\nimport {KernelConfig, Tan} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from './unary\_kernel';\nexport const tanConfig: KernelConfig = createUnaryKernelConfig(Tan);\n", "/\*\n \* @license\n \* Copyright 2019 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the \"License\");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \*\n \*

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=====\n\n\*\n\nimport {KernelConfig, Tanh} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from './unary\_kernel';\nexport const tanhConfig: KernelConfig = createUnaryKernelConfig(Tanh);\n", "/\*\n \* @license\n \* Copyright 2019 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the \"License\");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \*\n \* <http://www.apache.org/licenses/LICENSE-2.0>\n \*\n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*\n \*

=====\n\n\*\n\nimport {KernelConfig, KernelFunc, Tile, TileAttrs, TileInputs} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend\_wasm';\nimport {CppType} from './types';\n\nlet wasmTile: (\n xId: number, xShape: Uint8Array, xShapeSize: number, newShape: Uint8Array,\n newShapeSize: number, dtype: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmTile = backend.wasm.cwrap(Tile, null /\* void \*/, [\n 'number', // x\_id\n 'array', // x\_shape\n 'number', // x\_shape.length\n 'array', // new\_shape\n 'number', // new\_shape.length\n 'number' // out\_id\n ]);\n\nfunction tile(\n args: {inputs: TileInputs, backend: BackendWasm, attrs: TileAttrs}) {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const {reps} = attrs;\n\n const newShape: number[] = new Array(x.shape.length);\n for (let i = 0; i < newShape.length; i++) {\n newShape[i] = x.shape[i] \* reps[i];\n }\n const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n const newShapeBytes = new Uint8Array(new Int32Array(newShape).buffer);\n\n const out = backend.makeOutput(newShape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n wasmTile(\n xId, xShapeBytes, x.shape.length, newShapeBytes, newShape.length,\n CCppType[out.dtype], outId);\n\n return out;\n}\n\nexport const tileConfig: KernelConfig = {\n kernelName: Tile,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: tile as {} as KernelFunc\n};\n", "/\*\n \* @license\n \* Copyright 2020 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the \"License\");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \*\n \*

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OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\n\nimport {KernelConfig, KernelFunc, TensorInfo, TopK, TopKAttrs, TopKInputs} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {CppType} from './types';\n\nlet wasmTopK: (\n xId: number, xShapeBytes: Uint8Array, xShapeLength: number,\n xDtype: CppDType, k: number, sorted: boolean,\n outValuesId: number,\n outIndicesId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmTopK = backend.wasm.cwrap(TopK, null /* void */, [\n 'number', // xId\n 'array', // x.shape\n 'number', // x.shape.length\n 'number', // x.dtype\n 'number', // k\n 'bool', // sorted\n 'number', // outValuesId\n 'number', // outIndicesId\n]);\n\n export const topk: (\n args: {inputs: TopKInputs, backend: BackendWasm, attrs: TopKAttrs}) =>\n TensorInfo[] | TensorInfo = ({inputs, backend, attrs}) => {\n const {x} = inputs;\n const {k, sorted} = attrs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n const outputShape = x.shape.slice();\n outputShape[outputShape.length - 1] = k;\n const outValues = backend.makeOutput(outputShape, x.dtype);\n const outValuesId = backend.dataIdMap.get(outValues.dataId).id;\n const outIndices = backend.makeOutput(outputShape, 'int32');\n const outIndicesId = backend.dataIdMap.get(outIndices.dataId).id;\n return [outValues, outIndices];\n };\n\n export const topKConfig: KernelConfig = {\n kernelName: TopK,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: topk as { } as KernelFunc,\n };\n\n /**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR
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```
=====\n*\n\nimport {KernelConfig, KernelFunc, TensorInfo, Transform, TransformAttrs, TransformInputs, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\n\nlet wasmTransform: (\n imageId: number, transformsId: number, isBatchTransform: boolean,\n batch: number, outHeight: number, outWidth: number, numChannels: number,\n imageWidth: number, imageHeight: number, strides: Uint8Array,\n stridesLength: number, interpolationModeId: number, fillModeId: number,\n fillValue: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmTransform = backend.wasm.cwrap(Transform, null /* void */, [\n 'number', // imageId\n 'number', // transformsId\n 'bool', // isBatchTransform\n 'number', // batch\n 'number', // outHeight\n 'number', // outWidth\n 'number', // numChannels\n 'number', // imageWidth\n 'number', // imageHeight\n 'array', // strides\n 'number', // stridesLength\n 'number', // interpolationModeId\n 'number', // fillModeId\n 'number', // fillValue\n 'number', // outId\n]);\n\n function transform(\n args: {\n backend: BackendWasm, inputs: TransformInputs, attrs: TransformAttrs\n }): TensorInfo {\n const {backend, inputs, attrs} = args;\n const {image, transforms} = inputs;\n const {interpolation, fillMode, fillValue, outputShape} = attrs;\n const [batch, imageHeight, imageWidth, numChannels] = image.shape;\n const [outHeight, outWidth] =\n outputShape != null ? outputShape : [imageHeight, imageWidth];\n const outShape = [batch, outHeight, outWidth, numChannels] as [number, number, number, number];\n const strides = new Uint8Array(new Int32Array(util.computeStrides(image.shape)).buffer);\n const out = backend.makeOutput(outShape, image.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n const imageData = backend.dataIdMap.get(image.dataId);\n const
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imageId = imageData.id;\n\n const transformsData = backend.dataIdMap.get(transforms.dataId);\n const
transformsId = transformsData.id;\n\n const interpolationModeId = interpolation === 'nearest' ? 1 : 2;\n let
fillModeId;\n switch (fillMode) {\n case 'constant':\n fillModeId = 1;\n break;\n case 'reflect':\n
fillModeId = 2;\n break;\n case 'wrap':\n fillModeId = 3;\n break;\n case 'nearest':\n fillModeId =
4;\n break;\n default:\n fillModeId = 1;\n break;\n }\n\n wasmTransform(\n imageId, transformsId,
(transforms.shape[0] > 1), batch, outHeight,\n outWidth, numChannels, imageWidth, imageHeight, strides,\n
image.shape.length - 1, interpolationModeId, fillModeId, fillValue,\n outId);\n\n
return out;\n}\n\nexport const transformConfig: KernelConfig = {\n kernelName: Transform,\n backendName:
'wasm',\n setupFunc: setup,\n kernelFunc: transform as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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=====\n
*\n\nimport { KernelConfig, KernelFunc, ZerosLike, ZerosLikeInputs } from '@tensorflow/tfjs-core';\nimport
{ BackendWasm } from '../backend_wasm';\n\nfunction zerosLike(args: { inputs: ZerosLikeInputs, backend:
BackendWasm }) {\n const { inputs: { x }, backend } = args;\n const out = backend.makeOutput(x.shape, x.dtype);\n
const outVals = backend.typedArrayFromHeap(out);\n outVals.fill(0);\n return out;\n}\n\nexport const
zerosLikeConfig: KernelConfig = {\n kernelName: ZerosLike,\n backendName: 'wasm',\n kernelFunc: zerosLike
as { } as KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
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on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n
* See the License for the specific language governing permissions and\n * limitations under the License.\n *
=====\n\n *//\n
We explicitly import the modular kernels so they get registered in the\n// global registry when we compile the
library. A modular build would replace\n// the contents of this file and import only the kernels that are
needed.\nimport { KernelConfig, registerKernel } from '@tensorflow/tfjs-core';\n\nimport { fusedMatMulConfig }
from './kernels/_FusedMatMul';\nimport { absConfig } from './kernels/Abs';\nimport { addConfig } from
'./kernels/Add';\nimport { addNConfig } from './kernels/AddN';\nimport { allConfig } from './kernels/All';\nimport
{ anyConfig } from './kernels/Any';\nimport { argMaxConfig } from './kernels/ArgMax';\nimport { avgPoolConfig }
from './kernels/AvgPool';\nimport { batchMatMulConfig } from './kernels/BatchMatMul';\nimport
{ batchToSpaceNConfig } from './kernels/BatchToSpaceND';\nimport
{ castConfig } from './kernels/Cast';\nimport { ceilConfig } from './kernels/Ceil';\nimport { clipByValueConfig }
from './kernels/ClipByValue';\nimport { concatConfig } from './kernels/Concat';\nimport { conv2DConfig } from
'./kernels/Conv2D';\nimport { conv2DBackpropInputConfig } from './kernels/Conv2DBackpropInput';\nimport
{ cosConfig } from './kernels/Cos';\nimport { coshConfig } from './kernels/Cosh';\nimport { cropAndResizeConfig }
from './kernels/CropAndResize';\nimport { cumsumConfig } from './kernels/Cumsum';\nimport
{ depthToSpaceConfig } from './kernels/DepthToSpace';\nimport { depthwiseConv2dNativeConfig } from
'./kernels/DepthwiseConv2dNative';\nimport { eluConfig } from './kernels/Elu';\nimport { equalConfig } from
'./kernels/Equal';\nimport { expConfig } from './kernels/Exp';\nimport { expandDimsConfig } from
'./kernels/ExpandDims';\nimport { fillConfig } from './kernels/Fill';\nimport { flipLeftRightConfig } from
'./kernels/FlipLeftRight';\nimport { floorConfig } from './kernels/Floor';\nimport { floorDivConfig }

```

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from './kernels/FloorDiv';\nimport {fusedBatchNormConfig} from './kernels/FusedBatchNorm';\nimport
{fusedConv2DConfig} from './kernels/FusedConv2D';\nimport {fusedDepthwiseConv2DConfig} from
 './kernels/FusedDepthwiseConv2D';\nimport {gatherNdConfig} from './kernels/GatherNd';\nimport
{gatherV2Config} from './kernels/GatherV2';\nimport {greaterConfig} from './kernels/Greater';\nimport
{greaterEqualConfig} from './kernels/GreaterEqual';\nimport {identityConfig} from './kernels/Identity';\nimport
{leakyReluConfig} from './kernels/LeakyRelu';\nimport {lessConfig} from './kernels/Less';\nimport
{lessEqualConfig} from './kernels/LessEqual';\nimport {logConfig} from './kernels/Log';\nimport
{logicalAndConfig} from './kernels/LogicalAnd';\nimport {maxConfig} from './kernels/Max';\nimport
{maximumConfig} from './kernels/Maximum';\nimport {maxPoolConfig} from './kernels/MaxPool';\nimport
{meanConfig} from './kernels/Mean';\nimport {minConfig} from './kernels/Min';\nimport {minimumConfig} from
 './kernels/Minimum';\nimport {mirrorPadConfig} from './kernels/MirrorPad';\nimport {multiplyConfig} from
 './kernels/Multiply';\nimport {negConfig} from './kernels/Neg';\nimport {nonMaxSuppressionV3Config} from
 './kernels/NonMaxSuppressionV3';\nimport {nonMaxSuppressionV4Config} from
 './kernels/NonMaxSuppressionV4';\nimport {nonMaxSuppressionV5Config} from
 './kernels/NonMaxSuppressionV5';\nimport {notEqualConfig} from './kernels/NotEqual';\nimport {oneHotConfig}
from './kernels/OneHot';\nimport {onesLikeConfig} from './kernels/OnesLike';\nimport {packConfig} from
 './kernels/Pack';\nimport {padV2Config} from './kernels/PadV2';\nimport {powConfig} from
 './kernels/Pow';\nimport {preluConfig} from './kernels/Prelu';\nimport {prodConfig} from './kernels/Prod';\nimport
{rangeConfig} from './kernels/Range';\nimport {realDivConfig} from './kernels/RealDiv';\nimport {reluConfig}
from './kernels/Relu';\nimport {relu6Config} from './kernels/Relu6';\nimport {reshapeConfig} from
 './kernels/Reshape';\nimport
{resizeBilinearConfig} from './kernels/ResizeBilinear';\nimport {reverseConfig} from './kernels/Reverse';\nimport
{rotateWithOffsetConfig} from './kernels/RotateWithOffset';\nimport {roundConfig} from
 './kernels/Round';\nimport {rsqrtConfig} from './kernels/Rsqrt';\nimport {scatterNdConfig} from
 './kernels/ScatterNd';\nimport {selectConfig} from './kernels/Select';\nimport {sigmoidConfig} from
 './kernels/Sigmoid';\nimport {sinConfig} from './kernels/Sin';\nimport {sliceConfig} from './kernels/Slice';\nimport
{softmaxConfig} from './kernels/Softmax';\nimport {spaceToBatchNDConfig} from
 './kernels/SpaceToBatchND';\nimport {splitVConfig} from './kernels/SplitV';\nimport {sqrtConfig} from
 './kernels/Sqrt';\nimport {squareConfig} from './kernels/Square';\nimport {squaredDifferenceConfig} from
 './kernels/SquaredDifference';\nimport {stepConfig} from './kernels/Step';\nimport {stridedSliceConfig} from
 './kernels/StridedSlice';\nimport {subConfig} from './kernels/Sub';\nimport {sumConfig}
from './kernels/Sum';\nimport {tanConfig} from './kernels/Tan';\nimport {tanhConfig} from
 './kernels/Tanh';\nimport {tileConfig} from './kernels/Tile';\nimport {topKConfig} from './kernels/TopK';\nimport
{transformConfig} from './kernels/Transform';\nimport {transposeConfig} from './kernels/Transpose';\nimport
{unpackConfig} from './kernels/Unpack';\nimport {zerosLikeConfig} from './kernels/ZerosLike';\n\n// List all kernel
configs here\nconst kernelConfigs: KernelConfig[] = [\n absConfig,\n addConfig,\n addNConfig,\n allConfig,\n anyConfig,\n argMaxConfig,\n avgPoolConfig,\n batchMatMulConfig,\n batchToSpaceNDConfig,\n castConfig,\n ceilConfig,\n clipByValueConfig,\n concatConfig,\n conv2DConfig,\n conv2DBackpropInputConfig,\n cosConfig,\n coshConfig,\n cropAndResizeConfig,\n cumsumConfig,\n depthToSpaceConfig,\n depthwiseConv2dNativeConfig,\n eluConfig,\n equalConfig,\n expConfig,\n expandDimsConfig,\n fillConfig,\n flipLeftRightConfig,\n floorConfig,\n floorDivConfig,\n fusedMatMulConfig,\n fusedBatchNormConfig,\n fusedConv2DConfig,\n fusedDepthwiseConv2DConfig,\n gatherNdConfig,\n gatherV2Config,\n greaterConfig,\n greaterEqualConfig,\n identityConfig,\n leakyReluConfig,\n lessConfig,\n lessEqualConfig,\n logConfig,\n logicalAndConfig,\n maxConfig,\n maximumConfig,\n maxPoolConfig,\n meanConfig,\n minConfig,\n minimumConfig,\n mirrorPadConfig,\n multiplyConfig,\n negConfig,\n nonMaxSuppressionV3Config,\n nonMaxSuppressionV4Config,\n nonMaxSuppressionV5Config,\n notEqualConfig,\n oneHotConfig,\n onesLikeConfig,\n packConfig,\n padV2Config,\n powConfig,\n preluConfig,\n prodConfig,\n rangeConfig,\n

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realDivConfig,\n reluConfig,\n relu6Config,\n reshapeConfig,\n resizeBilinearConfig,\n reverseConfig,\n
rotateWithOffsetConfig,\n rsqrtConfig,\n roundConfig,\n scatterNdConfig,\n selectConfig,\n sigmoidConfig,\n
sinConfig,\n sliceConfig,\n softmaxConfig,\n spaceToBatchNDConfig,\n splitVConfig,\n
sqrtConfig,\n squareConfig,\n squaredDifferenceConfig,\n stepConfig,\n stridedSliceConfig,\n subConfig,\n
sumConfig,\n tanConfig,\n tanhConfig,\n tileConfig,\n topKConfig,\n transformConfig,\n transposeConfig,\n
unpackConfig,\n zerosLikeConfig\n);\n\nfor (const kernelConfig of kernelConfigs) {\n
registerKernel(kernelConfig);\n}\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n *
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http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n
* =====\n
*\n\nimport { KernelConfig, KernelFunc, TensorInfo, Unpack, UnpackAttrs, UnpackInputs } from
'@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport { slice } from
'./Slice';\n\nfunction unpack(\n args: { inputs: UnpackInputs, backend: BackendWasm, attrs: UnpackAttrs }):\n TensorInfo[] {\n const { inputs, backend, attrs } = args;\n const { value } = inputs;\n let { axis } = attrs;\n if (axis <
0) {\n axis += value.shape.length;\n }\n const numOutputs = value.shape[axis];\n const rank =
value.shape.length;\n const outShape: number[] = new Array(rank - 1);\n let outIndex = 0;\n for (let i = 0; i < rank;\n i++) {\n if (i !== axis) {\n outShape[outIndex++] = value.shape[i];\n }\n }\n const outs: TensorInfo[] = new
Array(numOutputs);\n const begin = new Array(rank).fill(0);\n const size = value.shape.slice();\n size[axis] = 1;\n for (let i = 0; i < outs.length;\n i++) {\n begin[axis] = i;\n outs[i] = slice({ inputs: { x: value }, attrs: { begin, size }, backend});\n }\n return
outs.map(({ dataId, dtype }) => ({ dataId, dtype, shape: outShape }));\n}\n\nexport const unpackConfig: KernelConfig
= {\n kernelName: Unpack,\n backendName: 'wasm',\n kernelFunc: unpack as { } as KernelFunc,\n};\n", "/*\n *
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law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
* =====\n
\n\nimport { env } from '@tensorflow/tfjs-core';\n\nconst ENV = env();\n\n/\n * True if SIMD is supported.\n
*\n * From: https://github.com/GoogleChromeLabs/wasm-feature-detect\nENV.registerFlag(\n // This typed array
passed in to WebAssembly.validate is WebAssembly binary\n // code. In this case it is a small program that
contains SIMD\n // instructions.\n 'WASM_HAS_SIMD_SUPPORT', async () => WebAssembly.validate(new
Uint8Array([\n 0, 97, 115, 109, 1, 0, 0, 0, 1, 4, 1, 96, 0, 0, 3,\n 2, 1, 0, 10, 9, 1, 7, 0, 65, 0, 253, 15, 26,\n 11\n])));\n\n/*\n * True if threads are supported.\n
*\n * From: https://github.com/GoogleChromeLabs/wasm-feature-detect\nENV.registerFlag('WASM_HAS_MULTITHREAD_SUPPORT',
async () => {\n //
TODO(annxingyuan): Enable node support once this is resolved:\n //
https://github.com/tensorflow/tfjs/issues/3830\n if (ENV.get('IS_NODE')) {\n return false;\n }\n try
{\n // Test for transferability of SABs (needed for Firefox)\n //
https://groups.google.com/forum/#!msg/mozilla.dev.platform/IHkBZIHETpA/dwsMNchWEQAJ\n new
MessageChannel().port1.postMessage(new SharedArrayBuffer(1));\n // This typed array is a WebAssembly
program containing threaded\n // instructions.\n return WebAssembly.validate(new Uint8Array([\n 0, 97,\n 115, 109, 1, 0, 0, 0, 1, 4, 1, 96, 0, 0, 3, 2, 1, 0, 5,\n 4, 1, 3, 1, 1, 10, 11, 1, 9, 0, 65, 0, 254, 16, 2, 0, 26,\n 11\n]));\n } catch (e) {\n return false;\n }\n});\n", "\nvar WasmBackendModuleThreadedSimd = (function() {\n

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var _scriptDir = typeof document !== 'undefined' && document.currentScript ? document.currentScript.src :
undefined;\n if (typeof __filename !== 'undefined') _scriptDir = _scriptDir || __filename;\n return
(\nfunction(WasmBackendModuleThreadedSimd) {\n WasmBackendModuleThreadedSimd =
WasmBackendModuleThreadedSimd || {};\n\nfunction
GROWABLE_HEAP_I8(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}
return
HEAP8}function
GROWABLE_HEAP_U8(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)
}return HEAPU8}function
GROWABLE_HEAP_I32(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)
}return HEAP32}function
GROWABLE_HEAP_U32(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer
)}return HEAPU32}function
GROWABLE_HEAP_F64(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer
)}return HEAPF64}var Module=typeof
WasmBackendModuleThreadedSimd!="undefined"?WasmBackendModuleThreadedSimd: {};var
readyPromiseResolve,readyPromiseReject;Module[\"ready\"]=new
Promise(function(resolve,reject){readyPromiseResolve=resolve;readyPromiseReject=reject});var
moduleOverrides={ };var key;for(key in
Module){if(Module.hasOwnProperty(key)){moduleOverrides[key]=Module[key]}}var arguments_=[];var
thisProgram=\. /this.program\";var quit_=function(status,toThrow){throw
toThrow};var ENVIRONMENT_IS_WEB=false;var ENVIRONMENT_IS_WORKER=false;var
ENVIRONMENT_IS_NODE=false;var ENVIRONMENT_IS_SHELL=false;ENVIRONMENT_IS_WEB=typeof
window===\"object\";ENVIRONMENT_IS_WORKER=typeof
importScripts===\"function\";ENVIRONMENT_IS_NODE=typeof process===\"object\"&&typeof
process.versions===\"object\"&&typeof
process.versions.node===\"string\";ENVIRONMENT_IS_SHELL=!ENVIRONMENT_IS_WEB&&!ENVIRONM
ENT_IS_NODE&&!ENVIRONMENT_IS_WORKER;var
ENVIRONMENT_IS_PTHREAD=Module[\"ENVIRONMENT_IS_PTHREAD\"]||false;if(ENVIRONMENT_IS_P
THREAD){buffer=Module[\"buffer\"]}var scriptDirectory=\"\";function
locateFile(path){if(Module[\"locateFile\"]){return Module[\"locateFile\"](path,scriptDirectory)}return
scriptDirectory+path}var read_,readAsync,readBinary,setWindowTitle;var nodeFS;var
nodePath;if(ENVIRONMENT_IS_NODE){if(ENVIRONMENT_IS_WORKER){scriptDirectory=require(\"path\").
dirname(scriptDirectory)+\"/\"}else{scriptDirectory=__dirname+\"/\"}read_=function
shell_read(filename,binary){if(!nodeFS)nodeFS=require(\"fs\");if(!nodePath)nodePath=require(\"path\");filename=no
dePath[\"normalize\"](filename);return
nodeFS[\"readFileSync\"](filename,binary?null:\"utf8\");}readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret};if(process[\"argv\"].length>1){thisProgram=process[\"argv\"][1].replace(/\\\\\\\\g,\"/\")}arguments_=process[\"arg
v\"].slice(2);process[\"on\"](\"uncaughtException\",function(ex){if(!(ex instanceof ExitStatus)){throw
ex}});process[\"on\"](\"unhandledRejection\",abort);quit_=function(status){process[\"exit\"](status)};Module[\"insep
ect\"]=function(){return\"[Emscripten Module object]\"};var
nodeWorkerThreads;try{nodeWorkerThreads=require(\"worker_threads\")}catch(e){console.error(\"The
\\\"worker_threads\\\" module is not supported in this node.js build - perhaps a newer version is needed?\");throw
e}global.Worker=nodeWorkerThreads.Worker}else if(ENVIRONMENT_IS_SHELL){if(typeof
read!="undefined"){read_=function shell_read(f){return read(f)}}readBinary=function readBinary(f){var
data;if(typeof readbuffer===\"function\"){return new
Uint8Array(readbuffer(f))}data=read(f,\"binary\");assert(typeof data===\"object\");return data};if(typeof

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scriptArgs!=="undefined"){arguments_=scriptArgs}else if(typeof
arguments!=="undefined"){arguments_=arguments}if(typeof
quit==="function"){quit_=function(status){quit(status)}}if(typeof print!=="undefined"){if(typeof
console==="undefined")console={};console.log=print;console.warn=console.error=typeof
printErr!=="undefined"?printErr:print}}else
if(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER){if(ENVIRONMENT_IS_WORKER){scriptDire
ctory=self.location.href}else if(typeof
document!=="undefined"&&document.currentScript){scriptDirectory=document.currentScript.src}if(typeof
_scriptDir !=="undefined" &&
_scriptDir){scriptDirectory=_scriptDir}if(scriptDirectory.indexOf("\blob:")!==0){scriptDirectory=scriptDirectory.s
ubstr(0,scriptDirectory.lastIndexOf("\^")+1)}else{scriptDirectory=""}}if(ENVIRONMENT_IS_NODE){read_=fun
ction
shell_read(filename,binary){if(!nodeFS)nodeFS=require("\fs");if(!nodePath)nodePath=require("\path");filename=n
odePath["normalize\"](filename);return
nodeFS["readFileSync\"](filename,binary?null:\utf8\");readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret}}else{read_=function(url){var xhr=new XMLHttpRequest;xhr.open("\GET",url,false);xhr.send(null);return
xhr.responseText};if(ENVIRONMENT_IS_WORKER){readBinary=function(url){var xhr=new
XMLHttpRequest;xhr.open("\GET",url,false);xhr.responseType="arraybuffer";xhr.send(null);return new
Uint8Array(xhr.response)}}readAsync=function(url,onload,onerror){var xhr=new
XMLHttpRequest;xhr.open("\GET",url,true);xhr.responseType="\arraybuffer";xhr.onload=function(){if(xhr.status
==200||xhr.status==0&&xhr.response){onload(xhr.response);return}onerror();}xhr.onerror=onerror;xhr.send(null)}
}setWindowTitle=function(title){document.title=title}}else{}if(ENVIRONMENT_IS_NODE){if(typeof
performance==="undefined"){global.performance=require("\perf_hooks").performance}}var
out=Module["print"]||console.log.bind(console);var err=Module["printErr"]||console.warn.bind(console);for(key
in
moduleOverrides){if(moduleOverrides.hasOwnProperty(key)){Module[key]=moduleOverrides[key]}}moduleOverr
ides=null;if(Module["arguments"])arguments_=Module["arguments"];if(Module["thisProgram"])thisProgram=
Module["thisProgram"];if(Module["quit"])quit_=Module["quit"];function
warnOnce(text){if(!warnOnce.shown)warnOnce.shown={};if(!warnOnce.shown[text]){warnOnce.shown[text]=1;er
r(text)}}var Atomics_load=Atomics.load;var Atomics_store=Atomics.store;var
Atomics_compareExchange=Atomics.compareExchange;var
wasmBinary;if(Module["wasmBinary"])wasmBinary=Module["wasmBinary"];var
noExitRuntime=Module["noExitRuntime"]||true;if(typeof WebAssembly!=="object"){abort("\no
native wasm support detected")}var wasmMemory;var wasmModule;var ABORT=false;var
EXITSTATUS;function assert(condition,text){if(!condition){abort("Assertion failed: \"+text)}}function
getCFunc(ident){var func=Module["_"+ident];assert(func,"\Cannot call unknown function \"+ident+", make sure
it is exported");return func}function ccall(ident,returnType,argTypes,args,opts){var
toC={\string":function(str){var ret=0;if(str===null&&str!=="undefined"&&str===0){var
len=(str.length<<2)+1;ret=stackAlloc(len);stringToUTF8(str,ret,len)}return ret},\array":function(arr){var
ret=stackAlloc(arr.length);writeArrayToMemory(arr,ret);return ret}};function
convertReturnValue(ret){if(returnType==="string")return UTF8ToString(ret);if(returnType==="boolean")return
Boolean(ret);return ret}var func=getCFunc(ident);var cArgs=[];var stack=0;if(args){for(var
i=0;i<args.length;i++){var
converter=toC[argTypes[i]];if(converter){if(stack===0)stack=stackSave();cArgs[i]=converter(args[i])}else{cArgs[i
]=args[i]}}var
ret=func.apply(null,cArgs);ret=convertReturnValue(ret);if(stack!==0)stackRestore(stack);return ret}function
cwrap(ident,returnType,argTypes,opts){argTypes=argTypes||[];var

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numericArgs=argTypes.every(function(type){return type===\"number\"});var
numericRet=returnType!==\"string\";if(numericRet&&numericArgs&&!opts){return getCFunc(ident)}return
function(){return ccall(ident,returnType,argTypes,arguments,opts)}function
UTF8ArrayToString(heap,idx,maxBytesToRead){var endIdx=idx+maxBytesToRead;var
str=\"\";while(!(idx>=endIdx)){var u0=heap[idx++];if(!u0)return
str;if(!(u0&128)){str+=String.fromCharCode(u0);continue}var
u1=heap[idx++]&63;if((u0&224)==192){str+=String.fromCharCode((u0&31)<<6|u1);continue}var
u2=heap[idx++]&63;if((u0&240)==224){u0=(u0&15)<<12|u1<<6|u2}else{u0=(u0&7)<<18|u1<<12|u2<<6|heap[id
x++]&63;if(u0<65536){str+=String.fromCharCode(u0)}else{var ch=u0-
65536;str+=String.fromCharCode(55296|ch>>10,56320|ch&1023)}}return str}function
UTF8ToString(ptr,maxBytesToRead){return
ptr?UTF8ArrayToString(GROWABLE_HEAP_U8(),ptr,maxBytesToRead):\"\"}function
stringToUTF8Array(str,heap,outIdx,maxBytesToWrite){if(!(maxBytesToWrite>0))return 0;var startIdx=outIdx;var
endIdx=outIdx+maxBytesToWrite-1;for(var i=0;i<str.length;++i){var
u=str.charCodeAtAt(i);if(u>=55296&&u<=57343){var
u1=str.charCodeAtAt(++i);u=65536+((u&1023)<<10|u1&1023)}if(u<=127){if(outIdx>=endIdx)break;heap[outIdx++]
=u}else if(u<=2047){if(outIdx+1>=endIdx)break;heap[outIdx++]=192|u>>6;heap[outIdx++]=128|u&63}else
if(u<=65535){if(outIdx+2>=endIdx)break;heap[outIdx++]=224|u>>12;heap[outIdx++]=128|u>>6&63;heap[outIdx
++]=128|u&63}else{if(outIdx+3>=endIdx)break;heap[outIdx++]=240|u>>18;heap[outIdx++]=128|u>>12&63;heap[
outIdx++]=128|u>>6&63;heap[outIdx++]=128|u&63}}heap[outIdx]=0;return outIdx-startIdx}function
stringToUTF8(str,outPtr,maxBytesToWrite){return
stringToUTF8Array(str,GROWABLE_HEAP_U8(),outPtr,maxBytesToWrite)}function lengthBytesUTF8(str){var
len=0;for(var i=0;i<str.length;++i){var
u=str.charCodeAtAt(i);if(u>=55296&&u<=57343)u=65536+((u&1023)<<10|str.charCodeAtAt(++i)&1023);if(u<=127)+
+len;else if(u<=2047)len+=2;else if(u<=65535)len+=3;else len+=4}return len}function
writeArrayToMemory(array,buffer){GROWABLE_HEAP_I8().set(array,buffer)}function
alignUp(x,multiple){if(x%multiple>0){x+=multiple-x%multiple}return x}var
buffer,HEAP8,HEAPU8,HEAP16,HEAPU16,HEAP32,HEAPU32,HEAPF32,HEAPF64;function
updateGlobalBufferAndViews(buf){buffer=buf;Module[\"HEAP8\"]=HEAP8=new
Int8Array(buf);Module[\"HEAP16\"]=HEAP16=new Int16Array(buf);Module[\"HEAP32\"]=HEAP32=new
Int32Array(buf);Module[\"HEAPU8\"]=HEAPU8=new Uint8Array(buf);Module[\"HEAPU16\"]=HEAPU16=new
Uint16Array(buf);Module[\"HEAPU32\"]=HEAPU32=new
Uint32Array(buf);Module[\"HEAPF32\"]=HEAPF32=new
Float32Array(buf);Module[\"HEAPF64\"]=HEAPF64=new Float64Array(buf)}var
INITIAL_MEMORY=Module[\"INITIAL_MEMORY\"]||16777216;if(ENVIRONMENT_IS_PTHREAD){wasmM
emory=Module[\"wasmMemory\"];buffer=Module[\"buffer\"]}else{if(Module[\"wasmMemory\"]){wasmMemory=
Module[\"wasmMemory\"]}else{wasmMemory=new
WebAssembly.Memory({\"initial\":INITIAL_MEMORY/65536,\"maximum\":2147483648/65536,\"shared\":true});
if(!(wasmMemory.buffer instanceof SharedArrayBuffer)){err(\"requested a shared WebAssembly.Memory but the
returned buffer is not a SharedArrayBuffer, indicating that while the browser has SharedArrayBuffer it does not
have WebAssembly threads support - you may need to set a
flag\");if(ENVIRONMENT_IS_NODE){console.log(\"(on node you may need: --experimental-wasm-threads --
experimental-wasm-bulk-memory and also use a recent version)\")}throw Error(\"bad
memory\")}}if(wasmMemory){buffer=wasmMemory.buffer}INITIAL_MEMORY=buffer.byteLength;updateGlob
alBufferAndViews(buffer);var wasmTable;var __ATPRERUN__=[];var __ATINIT__=[];var __ATMAIN__=[];var
__ATEXIT__=[];var __ATPOSTRUN__=[];var runtimeInitialized=false;var
runtimeExited=false;if(!ENVIRONMENT_IS_PTHREAD)__ATINIT__.push({func:function(){__wasm_call_ctor
s()}});function

```



```

preRun(){if(ENVIRONMENT_IS_PTHREAD)return;if(Module["preRun"]){if(typeof
Module["preRun"]!="function")Module["preRun"]=[Module["preRun"]];while(Module["preRun"].length){a
ddOnPreRun(Module["preRun"].shift())}callRuntimeCallbacks(__ATPRERUN__)}function
initRuntime(){runtimeInitialized=true;if(ENVIRONMENT_IS_PTHREAD)return;callRuntimeCallbacks(__ATINIT
__)}function
preMain(){if(ENVIRONMENT_IS_PTHREAD)return;callRuntimeCallbacks(__ATMAIN__)}function
exitRuntime(){if(ENVIRONMENT_IS_PTHREAD)return;runtimeExited=true}function
postRun(){if(ENVIRONMENT_IS_PTHREAD)return;if(Module["postRun"]){if(typeof
Module["postRun"]!="function")Module["postRun"]=[Module["postRun"]];while(Module["postRun"].lengt
h){addOnPostRun(Module["postRun"].shift())}callRuntimeCallbacks(__ATPOSTRUN__)}function
addOnPreRun(cb){__ATPRERUN__.unshift(cb)}function addOnPostRun(cb){__ATPOSTRUN__.unshift(cb)}var
runDependencies=0;var runDependencyWatcher=null;var dependenciesFulfilled=null;function
addRunDependency(id){assert(!ENVIRONMENT_IS_PTHREAD,\'addRunDependency cannot be used in a
pthread
worker\');runDependencies++;if(Module["monitorRunDependencies"]){Module["monitorRunDependencies"](ru
nDependencies)}}function removeRunDependency(id){runDependencies--
;if(Module["monitorRunDependencies"]){Module["monitorRunDependencies"](runDependencies)}if(runDepend
encies==0){if(runDependencyWatcher!=null){clearInterval(runDependencyWatcher);runDependencyWatcher=nu
ll}if(dependenciesFulfilled){var
callback=dependenciesFulfilled;dependenciesFulfilled=null;callback()}}Module["preloadedImages"]={};Module
["preloadedAudios"]={};function
abort(what){if(Module["onAbort"]){Module["onAbort"](what)}if(ENVIRONMENT_IS_PTHREAD)console.err
or(\'Pthread aborting at \'+(new
Error).stack);what+="\";err(what);ABORT=true;EXITSTATUS=1;what=\'abort(\'+what+\'). Build with -s
ASSERTIONS=1 for more info.\';var e=new WebAssembly.RuntimeError(what);readyPromiseReject(e);throw
e}function hasPrefix(str,prefix){return
String.prototype.startsWith?str.startsWith(prefix):str.indexOf(prefix)===0}var
dataURIPrefix=\'data:application/octet-stream;base64,\';function isDataURI(filename){return
hasPrefix(filename,dataURIPrefix)}var fileURIPrefix=\'file://\';function isFileURI(filename){return
hasPrefix(filename,fileURIPrefix)}var wasmBinaryFile=\'tfjs-backend-wasm-threaded-
simd.wasm\';if(!isDataURI(wasmBinaryFile)){wasmBinaryFile=locateFile(wasmBinaryFile)}function
getBinary(file){try{if(file==wasmBinaryFile&&wasmBinary){return new
Uint8Array(wasmBinary)}if(readBinary){return readBinary(file)}else{throw\'both async and sync fetching of the
wasm failed\'}}catch(err){abort(err)}}function
getBinaryPromise(){if(!wasmBinary&&(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER)){if(typeof
fetch=="function"&&!isFileURI(wasmBinaryFile)){return fetch(wasmBinaryFile,{credentials:\'same-
origin\'}).then(function(response){if(!response["ok"]){throw\'failed to load wasm binary file at
\'+wasmBinaryFile+\'}return
response["arrayBuffer"]()).catch(function(){return getBinary(wasmBinaryFile)})}else{if(readAsync){return new
Promise(function(resolve,reject){readAsync(wasmBinaryFile,function(response){resolve(new
Uint8Array(response)),reject}))})}return Promise.resolve().then(function(){return
getBinary(wasmBinaryFile)})}function createWasm(){var info={"a":asmLibraryArg};function
receiveInstance(instance,module){var
exports=instance.exports;Module["asm"]=exports;wasmTable=Module["asm"]["T"];wasmModule=module;if(!E
NVIRONMENT_IS_PTHREAD){var
numWorkersToLoad=PThread.unusedWorkers.length;PThread.unusedWorkers.forEach(function(w){PThread.load
WasmModuleToWorker(w,function(){if(--numWorkersToLoad)removeRunDependency(\'wasm-
instantiate\')})})}if(!ENVIRONMENT_IS_PTHREAD){addRunDependency(\'wasm-instantiate\')}function

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receiveInstantiatedSource(output){receiveInstance(output["instance"],output["module"])}function
instantiateArrayBuffer(receiver){return getBinaryPromise().then(function(binary){return
WebAssembly.instantiate(binary,info)).then(receiver,function(reason){err("failed to asynchronously prepare
wasm: "+reason);abort(reason)})}function instantiateAsync(){if(!wasmBinary&&typeof
WebAssembly.instantiateStreaming===\function\&&!isDataURI(wasmBinaryFile)&&!isFileURI(wasmBinaryFil
e)&&typeof fetch===\function\"){return fetch(wasmBinaryFile,{credentials:"same-
origin"}).then(function(response){var result=WebAssembly.instantiateStreaming(response,info);return
result.then(receiveInstantiatedSource,function(reason){err("wasm streaming compile failed: "+reason);err("falling
back to ArrayBuffer instantiation");return instantiateArrayBuffer(receiveInstantiatedSource)}))}else{return
instantiateArrayBuffer(receiveInstantiatedSource)}if(Module["instantiateWasm"]){try{var
exports=Module["instantiateWasm"](info,receiveInstance);return exports}catch(e){err("Module.instantiateWasm
callback failed with error: "+e);return false}}instantiateAsync().catch(readyPromiseReject);return{}}var
ASM_CONSTS={10520:function(){throw"Canceled!"},10538:function($0,$1){setTimeout(function(){__emscript
en_do_dispatch_to_thread($0,$1),0});function initPthreadsJS(){PThread.initRuntime()}function
callRuntimeCallbacks(callbacks){while(callbacks.length>0){var callback=callbacks.shift();if(typeof
callback===\function\){callback(Module);continue}var func=callback.func;if(typeof
func===\number\){if(callback.arg===undefined){wasmTable.get(func)}else{wasmTable.get(func)(callback.arg
)}else{func(callback.arg===undefined?null:callback.arg)}}}var
ERRNO_CODES={EPERM:63,ENOENT:44,ESRCH:71,EINTR:27,EIO:29,ENXIO:60,E2BIG:1,ENOEXEC:45,E
BADF:8,ECHILD:12,EAGAIN:6,EWOULDBLOCK:6,ENOMEM:48,EACCES:2,EFAULT:21,ENOTBLK:105,EB
USY:10,EEXIST:20,EXDEV:75,ENODEV:43,ENOTDIR:54,EISDIR:31,EINVAL:28,ENFILE:41,EMFILE:33,EN
OTTY:59,ETXTBSY:74,EFBIG:22,ENOSPC:51,ESPIPE:70,EROFS:69,EMLINK:34,EPIPE:64,EDOM:18,ERAN
GE:68,ENOMSG:49,EIDRM:24,ECHRNG:106,EL2NSYNC:156,EL3HLT:107,EL3RST:108,ELNRNG:109,EUNA
TCH:110,ENOSIG:111,EL2HLT:112,EDEADLK:16,ENOLCK:46,EBADE:113,EBADR:114,EXFULL:115,ENOA
NO:104,EBADRQC:103,EBADSLT:102,EDEADLOCK:16,EBFONT:101,ENOSTR:100,ENODATA:116,ETIME:
117,ENOSR:118,ENONET:119,ENOPKG:120,EREMOTE:121,ENOLINK:47,EADV:122,ESRMNT:123,ECOMM
:124,EPROTO:65,EMULTIHOP:36,EDOTDOT:125,EBADMSG:9,ENOTUNIQ:126,EBADFD:127,EREMCHG:1
28,ELIBACC:129,ELIBBAD:130,ELIBSCN:131,ELIBMAX:132,ELIBEXEC:133,ENOSYS:52,ENOTEMPTY:55,
ENAMETOOLONG:37,ELOOP:32,EOPNOTSUPP:138,EPFNOSUPPORT:139,ECONNRESET:15,ENOBUFS:42,
EAFNOSUPPORT:5,EPROTOTYPE:67,ENOTSOCK:57,ENOPROTOOPT:50,ESHUTDOWN:140,ECONNREFU
SED:14,EADDRINUSE:3,ECONNABORTED:13,ENETUNREACH:40,ENETDOWN:38,ETIMEDOUT:73,EHOS
TDOWN:142,EHOSTUNREACH:23,EINPROGRESS:26,EALREADY:7,EDESTADDRREQ:17,EMSGSIZE:35,E
PROTONOSUPPORT:66,ESOCKTNOSUPPORT:137,EADDRNOTAVAIL:4,ENETRESET:39,EISCONN:30,EN
OTCONN:53,ETOOMANYREFS:141,EUSERS:136,EDQUOT:19,ESTALE:72,ENOTSUP:138,ENOMEDIUM:14
8,EILSEQ:25,E_OVERFLOW:61,ECANCELED:11,ENOTRECOVERABLE:56,EOWNERDEAD:62,ESTRPIPE:13
5};function
__emscripten_futex_wake(addr,count){if(addr<=0||addr>GROWABLE_HEAP_I8().length||addr&3!=0||count<0)retu
rn-28;if(count==0)return 0;if(count>=2147483647)count=Infinity;var
mainThreadWaitAddress=Atomics.load(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2);var
mainThreadWoken=0;if(mainThreadWaitAddress==addr){var
loadedAddr=Atomics.compareExchange(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2,mainTh
readWaitAddress,0);if(loadedAddr==mainThreadWaitAddress){--count;mainThreadWoken=1;if(count<=0)return
1}}var ret=Atomics.notify(GROWABLE_HEAP_I32(),addr>>2,count);if(ret>=0)return
ret+mainThreadWoken;throw"Atomics.notify returned an unexpected value
"+ret}Module["_emscripten_futex_wake"]=__emscripten_futex_wake;function
killThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw"Internal Error! killThread() can only ever be
called from main application thread!";if(!pthread_ptr)throw"Internal Error! Null pthread_ptr in
killThread!";GROWABLE_HEAP_I32()[pthread_ptr+12>>2]=0;var

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pthread=PThread.threads[pthread_ptr];pthread.worker.terminate();PThread.freeThreadData(pthread);PThread.runn
ngWorkers.splice(PThread.runningWorkers.indexOf(pthread.worker),1);pthread.worker pthread=undefined }functio
n cancelThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw\`"Internal Error! cancelThread() can only
ever be called from main application thread!\`;if(!pthread_ptr)throw\`"Internal Error! Null pthread_ptr in
cancelThread!\`;var
pthread=PThread.threads[pthread_ptr];pthread.worker.postMessage({"cmd\`:"cancel\`"})}function
cleanupThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw\`"Internal Error! cleanupThread() can only
ever be called from main application thread!\`;if(!pthread_ptr)throw\`"Internal Error! Null pthread_ptr in
cleanupThread!\`;var
pthread=PThread.threads[pthread_ptr];if(pthread){ GROWABLE_HEAP_I32()[pthread_ptr+12>>2]=0;var
worker=pthread.worker;PThread.returnWorkerToPool(worker)} }var
PThread={ unusedWorkers:[],runningWorkers:[],initMainThreadBlock:function(){var
pthreadPoolSize=8;for(var
i=0;i<pthreadPoolSize;++i){PThread.allocateUnusedWorker()}},initRuntime:function(){var
tb=_malloc(228);for(var
i=0;i<228/4;++i)GROWABLE_HEAP_U32()[tb/4+i]=0;GROWABLE_HEAP_I32()[tb+12>>2]=tb;var
headPtr=tb+152;GROWABLE_HEAP_I32()[headPtr>>2]=headPtr;var tlsMemory=_malloc(512);for(var
i=0;i<128;++i)GROWABLE_HEAP_U32()[tlsMemory/4+i]=0;Atomics.store(GROWABLE_HEAP_U32(),tb+100
>>2,tlsMemory);Atomics.store(GROWABLE_HEAP_U32(),tb+40>>2,tb);__emscripten_thread_init(tb,!ENVIRON
MENT_IS_WORKER,1);_emscripten_register_main_browser_thread_id(tb);initWorker:function(){},threads:{},t
hreadExitHandlers:[],setThreadStatus:function(){},runExitHandlers:function(){ while(PThread.threadExitHandlers.l
ength>0){PThread.threadExitHandlers.pop()}if(ENVIRONMENT_IS_PTHREAD&&_pthread_self())__pthread
_tsd_run_dtors(),runExitHandlersAndDeinitThread:function(tb,exitCode){ Atomics.store(GROWABLE_HEAP_U
32(),tb+56>>2,1);Atomics.store(GROWABLE_HEAP_U32(),tb+60>>2,0);PThread.runExitHandlers();Atomics.stor
e(GROWABLE_HEAP_U32(),tb+4>>2,exitCode);Atomics.store(GROWABLE_HEAP_U32(),tb+0>>2,1);_emscri
pten_futex_wake(tb+0,2147483647);__emscripten_thread_init(0,0,0)},threadExit:function(exitCode){var
tb=_pthread_self();if(tb){PThread.runExitHandlersAndDeinitThread(tb,exitCode);if(ENVIRONMENT_IS_PTHRE
AD){postMessage({"cmd\`:"exit\`"})}}},threadCancel:function(){PThread.runExitHandlersAndDeinitThread(_pthr
ead_self(),-1);postMessage({"cmd\`:"cancelDone\`"})},terminateAllThreads:function(){for(var t in
PThread.threads){var
pthread=PThread.threads[t];if(pthread&&pthread.worker){PThread.returnWorkerToPool(pthread.worker)}PThre
ad.threads={};for(var i=0;i<PThread.unusedWorkers.length;++i){var
worker=PThread.unusedWorkers[i];worker.terminate()}PThread.unusedWorkers=[];for(var
i=0;i<PThread.runningWorkers.length;++i){var worker=PThread.runningWorkers[i];var
pthread=worker pthread;PThread.freeThreadData(pthread);worker.terminate()}PThread.runningWorkers=[]},freeTh
readData:function(pthread){if(!pthread)return;if(pthread.threadInfoStruct){var
tlsMemory=GROWABLE_HEAP_I32()[pthread.threadInfoStruct+100>>2];GROWABLE_HEAP_I32()[pthread.thr
eadInfoStruct+100>>2]=0;_free(tlsMemory);_free(pthread.threadInfoStruct)}pthread.threadInfoStruct=0;if(pthread.
allocatedOwnStack&&pthread.stackBase)_free(pthread.stackBase);pthread.stackBase=0;if(pthread.worker)pthread.
worker pthread=null },returnWorkerToPool:function(worker){PThread.runWithoutMainThreadQueuedCalls(funcio
n(){delete
PThread.threads[worker pthread.threadInfoStruct];PThread.unusedWorkers.push(worker);PThread.runningWorker
s.splice(PThread.runningWorkers.indexOf(worker),1);PThread.freeThreadData(worker pthread);worker pthread=un
defined}},runWithoutMainThreadQueuedCalls:function(func){ GROWABLE_HEAP_I32()[__emscripten_allow_ma
in_runtime_queued_calls>>2]=0;try{func()}finally{GROWABLE_HEAP_I32()[__emscripten_allow_ma
in_runtime_queued_calls>>2]=1}},receiveObjectTransfer:function(data){},loadWasmModuleToWorker:function(worker,o
nFinishedLoading){worker.onmessage=function(e){var

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d=e["data"];var
cmd=d["cmd"];if(worker.pthread)PThread.currentProxiedOperationCallerThread=worker.pthread.threadInfoStruct;
if(d["targetThread"]&&d["targetThread"]!="_pthread_self"){var
thread=PThread.pthreads[d.targetThread];if(thread){thread.worker.postMessage(e.data,d["transferList"]);}else{con
sole.error('Internal error! Worker sent a message \''+cmd+'\' to target pthread '+d["targetThread"]+'\', but that
thread no longer
exists!')}PThread.currentProxiedOperationCallerThread=undefined;return}if(cmd===\'processQueuedMainThread
Work\'){_emscripten_main_thread_process_queued_calls()}else
if(cmd===\'spawnThread\'){spawnThread(e.data)}else
if(cmd===\'cleanupThread\'){cleanupThread(d["thread"]);}else
if(cmd===\'killThread\'){killThread(d["thread"]);}else
if(cmd===\'cancelThread\'){cancelThread(d["thread"]);}else
if(cmd===\'loaded\'){worker.loaded=true;if(onFinishedLoading)onFinishedLoading(worker);if(worker.runPthread)
{worker.runPthread();delete
worker.runPthread}}else if(cmd===\'print\'){out("Thread \"+d["threadId"]+"": \"+d["text"]);}else
if(cmd===\'printErr\'){err("Thread \"+d["threadId"]+"": \"+d["text"]);}else if(cmd===\'alert\'){alert("Thread
\"+d["threadId"]+"": \"+d["text"]);}else if(cmd===\'exit\'){var
detached=worker.pthread&&Atomics.load(GROWABLE_HEAP_U32(),worker.pthread.threadInfoStruct+64>>2);if
(detached){PThread.returnWorkerToPool(worker)}else
if(cmd===\'exitProcess\'){try{exit(d["returnCode"]);}catch(e){if(e instanceof ExitStatus)return;throw e}}else
if(cmd===\'cancelDone\'){PThread.returnWorkerToPool(worker)}else
if(cmd===\'objectTransfer\'){PThread.receiveObjectTransfer(e.data)}else
if(e.data.target===\'setimmediate\'){worker.postMessage(e.data)}else{err("worker sent an unknown command
\'"+cmd)}PThread.currentProxiedOperationCallerThread=undefined};worker.onerror=function(e){err("pthread sent
an error! \"+e.filename+"":\"+e.lineno+"":
\"+e.message)};if(ENVIRONMENT_IS_NODE){worker.on("message",function(data){worker.onmessage({data:d
ata}});worker.on("error",function(data){worker.onerror(data)});worker.on("exit",function(data){})}worker.post
Message({"cmd":\'load\',\'urlOrBlob\':Module["mainScriptUrlOrBlob"]|_scriptDir,\'wasmMemory\':wasmMe
mory,\'wasmModule\':wasmModule}),allocateUnusedWorker:function(){var
pthreadMainJs=locateFile(\'tfjs-backend-wasm-threaded-simd.worker.js\');PThread.unusedWorkers.push(new
Worker(pthreadMainJs)),getNewWorker:function(){if(PThread.unusedWorkers.length==0){PThread.allocateUnus
edWorker();PThread.loadWasmModuleToWorker(PThread.unusedWorkers[0])}if(PThread.unusedWorkers.length>
0)return PThread.unusedWorkers.pop();else return null},busySpinWait:function(msecs){var
t=performance.now()+msecs;while(performance.now()<t){}}};function
establishStackSpace(stackTop,stackMax){_emscripten_stack_set_limits(stackTop,stackMax);stackRestore(stackTop
)}Module["establishStackSpace"]=establishStackSpace;function
getNoExitRuntime(){return noExitRuntime}Module["getNoExitRuntime"]=getNoExitRuntime;function
invokeEntryPoint(ptr,arg){return
wasmTable.get(ptr)(arg)}Module["invokeEntryPoint"]=invokeEntryPoint;function
__assert_fail(condition,filename,line,func){abort("Assertion failed: \"+UTF8ToString(condition)+"", at:
\'+[filename?UTF8ToString(filename):\'unknown filename\'],line,func?UTF8ToString(func):\'unknown
function\')}function __call_main(argc,argv){var returnCode=_main(argc,argv)}var
_emscripten_get_now;if(ENVIRONMENT_IS_NODE){_emscripten_get_now=function(){var
t=process["hrtime"]();return t[0]*1e3+t[1]/1e6}}else
if(ENVIRONMENT_IS_PTHREAD){_emscripten_get_now=function(){return performance.now()-
Module["__performance_now_clock_drift"]}}else if(typeof
dateNow!==\'undefined\'){_emscripten_get_now=dateNow}else _emscripten_get_now=function(){return
performance.now()};function setErrNo(value){GROWABLE_HEAP_I32()[__errno_location()>>2]=value;return

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value}function _atexit(func,arg){if(ENVIRONMENT_IS_PTHREAD)return
 _emscripten_proxy_to_main_thread_js(1,1,func,arg)}function
 __emscripten_notify_thread_queue(targetThreadId,mainThreadId){if(targetThreadId==mainThreadId){postMessage
 e({"cmd\":"processQueuedMainThreadWork"})}else
 if(ENVIRONMENT_IS_PTHREAD){postMessage({"targetThread\":targetThreadId,"cmd\":"processThreadQueue
 e"})}else{var pthread=PThread.pthreads[targetThreadId];var
 worker=pthread&&pthread.worker;if(!worker){return}worker.postMessage({"cmd\":"processThreadQueue"})}ret
 urn 1}function _abort(){abort()}function _emscripten_asm_const_int(code,sigPtr,argbuf){var
 args=readAsmConstArgs(sigPtr,argbuf);return ASM_CONSTS[code].apply(null,args)}function
 _emscripten_conditional_set_current_thread_status(expectedStatus,newStatus){}function
 _emscripten_futex_wait(addr,val,timeout){if(addr<=0||addr>GROWABLE_HEAP_I8().length||addr&3!=0)return-
 28;if(!ENVIRONMENT_IS_WEB){var
 ret=Atomics.wait(GROWABLE_HEAP_I32(),addr>>2,val,timeout);if(ret===\"timed-out\")return-
 73;if(ret===\"not-equal\")return-6;if(ret===\"ok\")return
 0;throw\"Atomics.wait returned an unexpected value
 \"+ret}else{if(Atomics.load(GROWABLE_HEAP_I32(),addr>>2)!=val){return-6}var
 tNow=performance.now();var tEnd=tNow+timeout;var
 lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2,addr);while(1){tNo
 w=performance.now();if(tNow>tEnd){lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emscripten_mai
 n_thread_futex>>2,0);return-
 73}lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2,0);if(lastAddr==
 0){break}_emscripten_main_thread_process_queued_calls();if(Atomics.load(GROWABLE_HEAP_I32(),addr>>2)!
 =val){return-
 6}lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2,addr)}return
 0}}function
 _emscripten_memcpy_big(dest,src,num){GROWABLE_HEAP_U8().copyWithin(dest,src,src+num)}function
 _emscripten_num_logical_cores(){if(ENVIRONMENT_IS_NODE)return require(\"os\").cpus().length;return
 navigator[\"hardwareConcurrency\"]}function
 _emscripten_proxy_to_main_thread_js(index,sync){var numCallArgs=arguments.length-2;var
 stack=stackSave();var serializedNumCallArgs=numCallArgs;var args=stackAlloc(serializedNumCallArgs*8);var
 b=args>>3;for(var i=0;i<numCallArgs;i++){var arg=arguments[2+i];GROWABLE_HEAP_F64()[b+i]=arg}var
 ret=_emscripten_run_in_main_runtime_thread_js(index,serializedNumCallArgs,args,sync);stackRestore(stack);retur
 n ret}var _emscripten_receive_on_main_thread_js_callArgs=[];var readAsmConstArgsArray=[];function
 readAsmConstArgs(sigPtr,buf){readAsmConstArgsArray.length=0;var
 ch;buf>>=2;while(ch=GROWABLE_HEAP_U8()[sigPtr++){var
 double=ch<105;if(double&&buf&1)buf++;readAsmConstArgsArray.push(double?GROWABLE_HEAP_F64()[buf
 ++>>1]:GROWABLE_HEAP_I32()[buf]);++buf}return readAsmConstArgsArray}function
 _emscripten_receive_on_main_thread_js(index,numCallArgs,args){_emscripten_receive_on_main_thread_js_callA
 rgs.length=numCallArgs;var b=args>>3;for(var
 i=0;i<numCallArgs;i++){_emscripten_receive_on_main_thread_js_callArgs[i]=GROWABLE_HEAP_F64()[b+i]}v
 ar
 isEmAsmConst=index<0;var func=!isEmAsmConst?proxiedFunctionTable[index]:ASM_CONSTS[-index-
 1];return func.apply(null,_emscripten_receive_on_main_thread_js_callArgs)}function
 _emscripten_get_heap_size(){return GROWABLE_HEAP_U8().length}function
 emscripten_realloc_buffer(size){try{wasmmemory.grow(size-
 buffer.byteLength+65535>>>16);updateGlobalBufferAndViews(wasmmemory.buffer);return
 1}catch(e){}}function _emscripten_resize_heap(requestedSize){var
 oldSize=_emscripten_get_heap_size();if(requestedSize<=oldSize){return false}var

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maxHeapSize=2147483648;if(requestedSize>maxHeapSize){return false}for(var
cutDown=1;cutDown<=4;cutDown*=2){var
overGrownHeapSize=oldSize*(1+.2/cutDown);overGrownHeapSize=Math.min(overGrownHeapSize,requestedSize
+100663296);var
newSize=Math.min(maxHeapSize,alignUp(Math.max(requestedSize,overGrownHeapSize),65536));var
replacement=emscripten_realloc_buffer(newSize);if(replacement){return true}}return false}var
JSEvents={inEventHandler:0,removeAllEventListeners:function(){for(var
i=JSEvents.eventHandlers.length-1;i>=0;--
i){JSEvents._removeHandler(i)}JSEvents.eventHandlers=[];JSEvents.deferredCalls=[],registerRemoveEventListen
ers:function(){if(!JSEvents.removeEventListenersRegistered){__ATEXIT__.push(JSEvents.removeAllEventListene
rs);JSEvents.removeEventListenersRegistered=true}},deferredCalls:[],deferCall:function(targetFunction,precedence
,argsList){function arraysHaveEqualContent(arrA,arrB){if(arrA.length!=arrB.length)return false;for(var i in
arrA){if(arrA[i]!=arrB[i])return false}return true}for(var i in JSEvents.deferredCalls){var
call=JSEvents.deferredCalls[i];if(call.targetFunction==targetFunction&&arraysHaveEqualContent(call.argsList,args
List))return}}JSEvents.deferredCalls.push({targetFunction:targetFunction,precedence:precedence,argsList:argsList
});JSEvents.deferredCalls.sort(function(x,y){return
x.precedence<y.precedence}),removeDeferredCalls:function(targetFunction){for(var
i=0;i<JSEvents.deferredCalls.length;++i){if(JSEvents.deferredCalls[i].targetFunction==targetFunction){JSEvents.d
eferredCalls.splice(i,1);--i}},canPerformEventHandlerRequests:function(){return
JSEvents.inEventHandler&&JSEvents.currentEventHandler.allowsDeferredCalls},runDeferredCalls:function(){if(!J
SEvents.canPerformEventHandlerRequests()){return}for(var i=0;i<JSEvents.deferredCalls.length;++i){var
call=JSEvents.deferredCalls[i];JSEvents.deferredCalls.splice(i,1);--
i;call.targetFunction.apply(null,call.argsList)},eventHandlers:[],removeAllHandlersOnTarget:function(target,event
TypeString){for(var
i=0;i<JSEvents.eventHandlers.length;++i){if(JSEvents.eventHandlers[i].target==target&&(!eventTypeString||event
TypeString==JSEvents.eventHandlers[i].eventTypeString)){JSEvents._removeHandler(i--
)}}},_removeHandler:function(i){var
h=JSEvents.eventHandlers[i];h.target.removeEventListener(h.eventTypeString,h.eventListenerFunc,h.useCapture);J
SEvents.eventHandlers.splice(i,1)},registerOrRemoveHandler:function(eventHandler){var
jsEventHandler=function
jsEventHandler(event){++JSEvents.inEventHandler;JSEvents.currentEventHandler=eventHandler;JSEvents.runDef
erredCalls();eventHandler.handlerFunc(event);JSEvents.runDeferredCalls();--
JSEvents.inEventHandler};if(eventHandler.callbackfunc){eventHandler.eventListenerFunc=jsEventHandler;eventH
andler.target.addEventListener(eventHandler.eventTypeString,jsEventHandler,eventHandler.useCapture);JSEvents.e
ventHandlers.push(eventHandler);JSEvents.registerRemoveEventListeners()}else{for(var
i=0;i<JSEvents.eventHandlers.length;++i){if(JSEvents.eventHandlers[i].target==eventHandler.target&&JSEvents.e
ventHandlers[i].eventTypeString==eventHandler.eventTypeString){JSEvents._removeHandler(i--
)}}},queueEventHandlerOnThread_iiii:function(targetThread,eventHandlerFunc,eventTypeId,eventData,userData)
{var stackTop=stackSave();var
varargs=stackAlloc(12);GROWABLE_HEAP_I32()[varargs>>2]=eventTypeId;GROWABLE_HEAP_I32()[varargs
+4>>2]=eventData;GROWABLE_HEAP_I32()[varargs+8>>2]=userData;__emscripten_call_on_thread(0,targetThr
ead,637534208,eventHandlerFunc,eventData,varargs);stackRestore(stackTop)},getTargetThreadForEventCallback:f
unction(targetThread){switch(targetThread){case
1:return 0;case 2:return PThread.currentProxiedOperationCallerThread;default:return
targetThread}},getNodeNameForTarget:function(target){if(!target)return\"";if(target==window)return\"#window\";
if(target==screen)return\"#screen\";return
target&&target.nodeName?target.nodeName:\"\"},fullscreenEnabled:function(){return
document.fullscreenEnabled||document.webkitFullscreenEnabled}};function stringToNewUTF8(jsString){var

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length=lengthBytesUTF8(jsString)+1;var cString=_malloc(length);stringToUTF8(jsString,cString,length);return
cString}function
_emsripten_set_offscreencanvas_size_on_target_thread_js(targetThread,targetCanvas,width,height){ var
stackTop=stackSave();var varargs=stackAlloc(12);var
targetCanvasPtr=0;if(targetCanvas){targetCanvasPtr=stringToNewUTF8(targetCanvas)}GROWABLE_HEAP_I32(
)[varargs>>2]=targetCanvasPtr;GROWABLE_HEAP_I32()[varargs+4>>2]=width;GROWABLE_HEAP_I32()[var
args+8>>2]=height;__emsripten_call_on_thread(0,targetThread,657457152,0,targetCanvasPtr,varargs);stackRestor
e(stackTop)}function
_emsripten_set_offscreencanvas_size_on_target_thread(targetThread,targetCanvas,width,height){targetCanvas=tar
getCanvas?UTF8ToString(targetCanvas):\"";_emsripten_set_offscreencanvas_size_on_target_thread_js(targetThr
ead,targetCanvas,width,height)}function maybeCStringToJsString(cString){return
cString>2?UTF8ToString(cString):cString}var specialHTMLTargets=[0,typeof
document!=\"undefined\"?document:0,typeof window!=\"undefined\"?window:0];function
findEventTarget(target){target=maybeCStringToJsString(target);var
domElement=specialHTMLTargets[target]||(typeof
document!=\"undefined\"?document.querySelector(target):undefined);return domElement}function
findCanvasEventTarget(target){return findEventTarget(target)}function
_emsripten_set_canvas_element_size_calling_thread(target,width,height){var
canvas=findCanvasEventTarget(target);if(!canvas)return-
4;if(canvas.canvasSharedPtr){GROWABLE_HEAP_I32()[canvas.canvasSharedPtr>>2]=width;GROWABLE_HEA
P_I32()[canvas.canvasSharedPtr+4>>2]=height}if(canvas.offscreenCanvas||!canvas.controlTransferredOffscreen){if
(canvas.offscreenCanvas)canvas=canvas.offscreenCanvas;var
autoResizeViewport=false;if(canvas.GLctxObject&&canvas.GLctxObject.GLctx){var
prevViewport=canvas.GLctxObject.GLctx.getParameter(2978);autoResizeViewport=prevViewport[0]===0&&prev
Viewport[1]===0&&prevViewport[2]===canvas.width&&prevViewport[3]===canvas.height}canvas.width=width;
canvas.height=height;if(autoResizeViewport){canvas.GLctxObject.GLctx.viewport(0,0,width,height)}}else
if(canvas.canvasSharedPtr){var
targetThread=GROWABLE_HEAP_I32()[canvas.canvasSharedPtr+8>>2];_emsripten_set_offscreencanvas_size_o
n_target_thread(targetThread,target,width,height);return 1}else{return-4}return 0}function
_emsripten_set_canvas_element_size_main_thread(target,width,height){if(ENVIRONMENT_IS_PTHREAD)retur
n
_emsripten_proxy_to_main_thread_js(2,1,target,width,height);return
_emsripten_set_canvas_element_size_calling_thread(target,width,height)}function
_emsripten_set_canvas_element_size(target,width,height){var
canvas=findCanvasEventTarget(target);if(canvas){return
_emsripten_set_canvas_element_size_calling_thread(target,width,height)}else{return
_emsripten_set_canvas_element_size_main_thread(target,width,height)}}function
_emsripten_set_current_thread_status(newStatus){}function
_emsripten_set_thread_name(threadId,name){}function __webgl_enable_ANGLE_instanced_arrays(ctx){var
ext=ctx.getExtension(\"ANGLE_instanced_arrays\");if(ext){ctx[\"vertexAttribDivisor\"]=function(index,divisor){ex
t[\"vertexAttribDivisorANGLE\"](index,divisor)};ctx[\"drawArraysInstanced\"]=function(mode,first,count,primcou
nt){ext[\"drawArraysInstancedANGLE\"](mode,first,count,primcount)};ctx[\"drawElementsInstanced\"]=function(
mode,count,type,indices,primcount){ext[\"drawElementsInstancedANGLE\"](mode,count,type,indices,primcount)};
return
1}}function __webgl_enable_OES_vertex_array_object(ctx){var
ext=ctx.getExtension(\"OES_vertex_array_object\");if(ext){ctx[\"createVertexArray\"]=function(){return
ext[\"createVertexArrayOES\"](0)};ctx[\"deleteVertexArray\"]=function(vao){ext[\"deleteVertexArrayOES\"](vao)};
ctx[\"bindVertexArray\"]=function(vao){ext[\"bindVertexArrayOES\"](vao)};ctx[\"isVertexArray\"]=function(vao)

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{return ext["isVertexArrayOES"](vao);return 1}}function __webgl_enable_WEBGL_draw_buffers(ctx){var
ext=ctx.getExtension("WEBGL_draw_buffers");if(ext){ctx["drawBuffers"]=function(n,bufs){ext["drawBuffers
WEBGL"](n,bufs)};return 1}}function
__webgl_enable_WEBGL_multi_draw(ctx){return!(ctx.multiDrawWebgl=ctx.getExtension("WEBGL_multi_dra
w"))}var
GL={counter:1,buffers:[],programs:[],framebuffers:[],renderbuffers:[],textures:[],uniforms:[],shaders:[],vaos:[],cont
exts:{},offscreenCanvases:{},timerQueriesEXT:[],programInfos:{},stringCache:{},unpackAlignment:4,recordError:
function
recordError(errorCode){if(!GL.lastError){GL.lastError=errorCode}},getNewId:function(table){var
ret=GL.counter++;for(var i=table.length;i<ret;i++){table[i]=null}return
ret},getSource:function(shader,count,string,length){var source="";for(var i=0;i<count;++i){var
len=length?GROWABLE_HEAP_I32()[length+i*4>>2]:-
1;source+=UTF8ToString(GROWABLE_HEAP_I32()[string+i*4>>2],len<0?undefined:len)}return
source},createContext:function(canvas,webGLContextAttributes){var
ctx=canvas.getContext("webgl",webGLContextAttributes);if(!ctx)return 0;var
handle=GL.registerContext(ctx,webGLContextAttributes);return
handle},registerContext:function(ctx,webGLContextAttributes){var
handle=_malloc(8);GROWABLE_HEAP_I32()[handle+4>>2]=_pthread_self();var
context={handle:handle,attributes:webGLContextAttributes,version:webGLContextAttributes.majorVersion,GLctx:
ctx};if(ctx.canvas)ctx.canvas.GLctxObject=context;GL.contexts[handle]=context;if(typeof
webGLContextAttributes.enableExtensionsByDefault===undefined||webGLContextAttributes.enableExtensions
ByDefault){GL.initExtensions(context)}return
handle},makeContextCurrent:function(contextHandle){GL.currentContext=GL.contexts[contextHandle];Module.ctx
=GLctx=GL.currentContext&&GL.currentContext.GLctx;return!(contextHandle&&!GLctx)},getContext:function(c
ontextHandle){return
GL.contexts[contextHandle]},deleteContext:function(contextHandle){if(GL.currentContext===GL.contexts[context
Handle])GL.currentContext=null;if(typeof
JSEvents===undefined||JSEvents.removeAllHandlersOnTarget(GL.contexts[contextHandle].GLctx.canvas);if(GL.co
ntexts[contextHandle]&&GL.contexts[contextHandle].GLctx.canvas)GL.contexts[contextHandle].GLctx.canvas.GL
ctxObject=undefined;_free(GL.contexts[contextHandle].handle);GL.contexts[contextHandle]=null},initExtensions:f
unction(context){if(!context)context=GL.currentContext;if(context.initExtensionsDone)return;context.initExtension
sDone=true;var
GLctx=context.GLctx;__webgl_enable_ANGLE_instanced_arrays(GLctx);__webgl_enable_OES_vertex_array_obj
ect(GLctx);__webgl_enable_WEBGL_draw_buffers(GLctx);GLctx.disjointTimerQueryExt=GLctx.getExtension("
EXT_disjoint_timer_query");__webgl_enable_WEBGL_multi_draw(GLctx);var
exts=GLctx.getSupportedExtensions()||[];exts.forEach(function(ext){if(ext.indexOf("lose_context")<0&&ext.inde
xOf("debug")<0){GLctx.getExtension(ext)}}),populateUniformTable:function(program){var
p=GL.programs[program];var
ptable=GL.programInfos[program]={uniforms:{},maxUniformLength:0,maxAttributeLength:-
1,maxUniformBlockNameLength:-1};var utable=ptable.uniforms;var
numUniforms=GLctx.getProgramParameter(p,35718);for(var i=0;i<numUniforms;++i){var
u=GLctx.getActiveUniform(p,i);var
name=u.name;ptable.maxUniformLength=Math.max(ptable.maxUniformLength,name.length+1);if(name.slice(-
1)!="\"){name=name.slice(0,name.lastIndexOf("\\"))}var loc=GLctx.getUniformLocation(p,name);if(loc){var
id=GL.getNewId(GL.uniforms);utable[name]=[u.size,id];GL.uniforms[id]=loc;for(var
j=1;j<u.size;++j){var
n=name+"\\"+j+"\\";loc=GLctx.getUniformLocation(p,n);id=GL.getNewId(GL.uniforms);GL.uniforms[id]=loc}}
}};var __emscripten_webgl_power_preferences=["default","low-power","high-performance"];function

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_emsripten_webgl_do_create_context(target,attributes){var a=attributes>>2;var
powerPreference=GROWABLE_HEAP_I32()[a+(24>>2)];var
contextAttributes={"alpha":!!GROWABLE_HEAP_I32()[a+(0>>2)],"depth":!!GROWABLE_HEAP_I32()[a+(4
>>2)],"stencil":!!GROWABLE_HEAP_I32()[a+(8>>2)],"antialias":!!GROWABLE_HEAP_I32()[a+(12>>2)],"p
remultipliedAlpha":!!GROWABLE_HEAP_I32()[a+(16>>2)],"preserveDrawingBuffer":!!GROWABLE_HEAP_
I32()[a+(20>>2)],"powerPreference":_emsripten_webgl_power_preferences[powerPreference],"failIfMajorPerf
ormanceCaveat":!!GROWABLE_HEAP_I32()[a+(28>>2)],majorVersion:GROWABLE_HEAP_I32()[a+(32>>2)],
minorVersion:GROWABLE_HEAP_I32()[a+(36>>2)],enableExtensionsByDefault:GROWABLE_HEAP_I32()[a+(
40>>2)],explicitSwapControl:GROWABLE_HEAP_I32()[a+(44>>2)],proxyContextToMainThread:GROWABLE_
HEAP_I32()[a+(48>>2)],renderViaOffscreenBackBuffer:GROWABLE_HEAP_I32()[a+(52>>2)]};var
canvas=findCanvasEventTarget(target);if(!canvas){return 0}if(contextAttributes.explicitSwapControl){return
0}var contextHandle=GL.createContext(canvas,contextAttributes);return contextHandle}function
_emsripten_webgl_create_context(a0,a1){return _emsripten_webgl_do_create_context(a0,a1)}var
SYSCALLS={mappings:{},buffers:[null,[],[]],printChar:function(stream,curr){var
buffer=SYSCALLS.buffers[stream];if(curr===0||curr===10){stream===1?out:err}(UTF8ArrayToString(buffer,0));
buffer.length=0}else{buffer.push(curr)},varargs:undefined,get:function(){SYSCALLS.varargs+=4;var
ret=GROWABLE_HEAP_I32()[SYSCALLS.varargs-4>>2];return ret},getStr:function(ptr){var
ret=UTF8ToString(ptr);return ret},get64:function(low,high){return low}};function
_fd_close(fd){if(ENVIRONMENT_IS_PTHREAD)return _emsripten_proxy_to_main_thread_js(3,1,fd);return
0}function _fd_seek(fd,offset_low,offset_high,whence,newOffset){if(ENVIRONMENT_IS_PTHREAD)return
_emsripten_proxy_to_main_thread_js(4,1,fd,offset_low,offset_high,whence,newOffset)}function
_fd_write(fd,iow,iowcnt,pnum){if(ENVIRONMENT_IS_PTHREAD)return
_emsripten_proxy_to_main_thread_js(5,1,fd,iow,iowcnt,pnum);var num=0;for(var i=0;i<iowcnt;i++){var
ptr=GROWABLE_HEAP_I32()[iow+i*8>>2];var len=GROWABLE_HEAP_I32()[iow+(i*8+4)>>2];for(var
j=0;j<len;j++){SYSCALLS.printChar(fd,GROWABLE_HEAP_U8)[ptr+j]}num+=len}GROWABLE_HEAP_I32
()[pnum>>2]=num;return 0}function _pthread_cleanup_pop(execute){var
routine=PThread.threadExitHandlers.pop();if(execute)routine()}function
_pthread_cleanup_push(routine,arg){PThread.threadExitHandlers.push(function(){wasmTable.get(routine)(arg)})}f
unction spawnThread(threadParams){if(ENVIRONMENT_IS_PTHREAD)throw"Internal Error! spawnThread()
can only ever be called from main application thread!";var
worker=PThread.getNewWorker();if(worker.pthread!==undefined)throw"Internal
error!";if(!threadParams.pthread_ptr)throw"Internal
error, no pthread ptr!";PThread.runningWorkers.push(worker);var tlsMemory=_malloc(128*4);for(var
i=0;i<128;++i){GROWABLE_HEAP_I32()[tlsMemory+i*4>>2]=0}var
stackHigh=threadParams.stackBase+threadParams.stackSize;var
pthread=PThread.pthreads[threadParams.pthread_ptr]={worker:worker,stackBase:threadParams.stackBase,stackSize
:threadParams.stackSize,allocatedOwnStack:threadParams.allocatedOwnStack,threadInfoStruct:threadParams.pthrea
d_ptr};var
tis=pthread.threadInfoStruct>>2;Atomics.store(GROWABLE_HEAP_U32(),tis+(64>>2),threadParams.detached);A
tomics.store(GROWABLE_HEAP_U32(),tis+(100>>2),tlsMemory);Atomics.store(GROWABLE_HEAP_U32(),tis
+(40>>2),pthread.threadInfoStruct);Atomics.store(GROWABLE_HEAP_U32(),tis+(80>>2),threadParams.stackSiz
e);Atomics.store(GROWABLE_HEAP_U32(),tis+(76>>2),stackHigh);Atomics.store(GROWABLE_HEAP_U32(),t
is+(104>>2),threadParams.stackSize);Atomics.store(GROWABLE_HEAP_U32(),tis+(104+8>>2),stackHigh);Atom
ics.store(GROWABLE_HEAP_U32(),tis+(104+12>>2),threadParams.detached);var
global_libc=_emsripten_get_global_libc();var
global_locale=global_libc+40;Atomics.store(GROWABLE_HEAP_U32(),tis+(172>>2),global_locale);worker.pthr
ead=pthread;var
msg={"cmd":"run","start_routine":threadParams.startRoutine,"arg":threadParams.arg,"threadInfoStruct":thre

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adParams.pthread_ptr,\'stackBase\':threadParams.stackBase,\'stackSize\':threadParams.stackSize};worker.runPthre
ad=function(){msg.time=performance.now();worker.postMessage(msg,threadParams.transferList)};if(worker.loaded
){worker.runPthread();delete worker.runPthread}}function
__pthread_create(pthread_ptr,attr,start_routine,arg){if(typeof SharedArrayBuffer===\'undefined\'){err(\'Current
environment does not support SharedArrayBuffer, pthreads are not available!\');return
6}if(!pthread_ptr){err(\'pthread_create called with a null thread pointer!\');return 28}var transferList=[];var
error=0;if(ENVIRONMENT_IS_PTHREAD&&(transferList.length===0||error)){return
__emscripten_sync_run_in_main_thread_4(687865856,pthread_ptr,attr,start_routine,arg)}if(error)return
error;var stackSize=0;var stackBase=0;var detached=0;if(attr&&attr!=-
1){stackSize=GROWABLE_HEAP_I32()[attr>>2];stackSize+=81920;stackBase=GROWABLE_HEAP_I32()[attr+
8>>2];detached=GROWABLE_HEAP_I32()[attr+12>>2]!==0}else{stackSize=2097152}var
allocatedOwnStack=stackBase==0;if(allocatedOwnStack){stackBase=_memalign(16,stackSize)}else{stackBase=
stackSize;assert(stackBase>0)}var threadInfoStruct=_malloc(228);for(var
i=0;i<228>>2;+i)GROWABLE_HEAP_U32()[threadInfoStruct>>2+i]=0;GROWABLE_HEAP_I32()[pthread_p
tr>>2]=threadInfoStruct;GROWABLE_HEAP_I32()[threadInfoStruct+12>>2]=threadInfoStruct;var
headPtr=threadInfoStruct+152;GROWABLE_HEAP_I32()[headPtr>>2]=headPtr;var
threadParams={stackBase:stackBase,stackSize:stackSize,allocatedOwnStack:allocatedOwnStack,detached:detached
,startRoutine:start_routine,pthread_ptr:threadInfoStruct,arg:arg,transferList:transferList};if(ENVIRONMENT_IS_P
THREAD){threadParams.cmd=\'spawnThread\';postMessage(threadParams,transferList)}else{spawnThread(thread
Params)}return
0}function __pthread_testcancel_js(){if(!ENVIRONMENT_IS_PTHREAD)return;var
tb=__pthread_self();if(!tb)return;var
cancelDisabled=Atomics.load(GROWABLE_HEAP_U32(),tb+56>>2);if(cancelDisabled)return;var
canceled=Atomics.load(GROWABLE_HEAP_U32(),tb+0>>2);if(canceled===2)throw\'Canceled!\'}function
__emscripten_check_blocking_allowed(){if(ENVIRONMENT_IS_NODE)return;if(ENVIRONMENT_IS_WORKE
R)return;warnOnce(\'Blocking on the main thread is very dangerous, see
https://emscripten.org/docs/porting/pthreads.html#blocking-on-the-main-browser-thread\')}function
__emscripten_do_pthread_join(thread,status,block){if(!thread){err(\'pthread_join attempted on a null thread
pointer!\');return
ERRNO_CODES.ESRCH}if(ENVIRONMENT_IS_PTHREAD&&__pthread_self()===thread){err(\'PThread
\'"+thread+\' is attempting to join to itself!\');return ERRNO_CODES.EDEADLK}else
if(!ENVIRONMENT_IS_PTHREAD&&__emscripten_main_browser_thread_id()===thread){err(\'Main
thread \'"+thread+\' is attempting to join to itself!\');return ERRNO_CODES.EDEADLK}var
self=GROWABLE_HEAP_I32()[thread+12>>2];if(self!==thread){err(\'pthread_join attempted on thread
\'"+thread+\' , which does not point to a valid thread, or does not exist anymore!\');return
ERRNO_CODES.ESRCH}var
detached=Atomics.load(GROWABLE_HEAP_U32(),thread+64>>2);if(detached){err(\'Attempted to join thread
\'"+thread+\' , which was already detached!\');return
ERRNO_CODES.EINVAL}if(block){__emscripten_check_blocking_allowed()}for(;;){var
threadStatus=Atomics.load(GROWABLE_HEAP_U32(),thread+0>>2);if(threadStatus===1){var
threadExitCode=Atomics.load(GROWABLE_HEAP_U32(),thread+4>>2);if(status)GROWABLE_HEAP_I32()[sta
tus>>2]=threadExitCode;Atomics.store(GROWABLE_HEAP_U32(),thread+64>>2,1);if(!ENVIRONMENT_IS_PT
HREAD)cleanupThread(thread);else postMessage({\'cmd\':\'cleanupThread\',\'thread\':thread});return
0}if(!block){return
ERRNO_CODES.EBUSY}__pthread_testcancel_js();if(!ENVIRONMENT_IS_PTHREAD)__emscripten_main_thre
ad_process_queued_calls();__emscripten_futex_wait(thread+0,threadStatus,ENVIRONMENT_IS_PTHREAD?100:1
)}}function

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pthread_join(thread,status){return __emscripten_do_pthread_join(thread,status,true)}function
_sysconf(name){if(ENVIRONMENT_IS_PTHREAD)return
__emscripten_proxy_to_main_thread_js(6,1,name);switch(name){case 30:return 16384;case 85:var
maxHeapSize=2147483648;return maxHeapSize/16384;case 132:case 133:case 12:case 137:case 138:case 15:case
235:case 16:case 17:case 18:case 19:case 20:case 149:case 13:case 10:case 236:case 153:case 9:case 21:case 22:case
159:case 154:case 14:case 77:case 78:case 139:case 82:case 68:case 67:case 164:case 11:case 29:case 47:case
48:case 95:case 52:case 51:case 46:return 200809;case 27:case 246:case 127:case 128:case 23:case 24:case 160:case
161:case 181:case 182:case 242:case 183:case 184:case 243:case 244:case 245:case 165:case 178:case 179:case
49:case 50:case 168:case 169:case 175:case 170:case 171:case 172:case
97:case 76:case 32:case 173:case 35:case 80:case 81:case 79:return-1;case 176:case 177:case 7:case 155:case 8:case
157:case 125:case 126:case 92:case 93:case 129:case 130:case 131:case 94:case 91:return 1;case 74:case 60:case
69:case 70:case 4:return 1024;case 31:case 42:case 72:return 32;case 87:case 26:case 33:return 2147483647;case
34:case 1:return 47839;case 38:case 36:return 99;case 43:case 37:return 2048;case 0:return 2097152;case 3:return
65536;case 28:return 32768;case 44:return 32767;case 75:return 16384;case 39:return 1e3;case 89:return 700;case
71:return 256;case 40:return 255;case 2:return 100;case 180:return 64;case 25:return 20;case 5:return 16;case
6:return 6;case 73:return 4;case 84:{if(typeof navigator===\"object\")return
navigator[\"hardwareConcurrency\"]||1;return 1}}setErrNo(28);return-
1}if(!ENVIRONMENT_IS_PTHREAD)PThread.initMainThreadBlock();var GLctx;var
proxiedFunctionTable=[null,_atexit,__emscripten_set_canvas_element_size_main_thread,_fd_close,_fd_seek,_fd_wr
ite,_sysconf];var
asmLibraryArg={\"e\":__assert_fail,\"r\":__call_main,\"x\":__emscripten_notify_thread_queue,\"b\":_abort,\"y\":
__emscripten_asm_const_int,\"j\":__emscripten_conditional_set_current_thread_status,\"d\":__emscripten_futex_wait,\"
c\":__emscripten_futex_wake,\"f\":__emscripten_get_now,\"p\":__emscripten_memcpy_big,\"A\":__emscripten_num_l
ogical_cores,\"u\":__emscripten_receive_on_main_thread_js,\"q\":__emscripten_resize_heap,\"v\":__emscripten_set_ca
nvas_element_size,\"i\":__emscripten_set_current_thread_status,\"s\":__emscripten_set_thread_name,\"w\":__emscript
en_webgl_create_context,\"l\":_fd_close,\"n\":_fd_seek,\"g\":_fd_write,\"o\":initPthreadsJS,\"a\":wasmMemory||Mo
dule[\"wasmMemory\"],\"z\":_pthread_cleanup_pop,\"k\":_pthread_cleanup_push,\"h\":_pthread_create,\"m\":_pthr
ead_join,\"t\":_sysconf};var asm=createWasm();var
__wasm_call_ctors=Module[\"__wasm_call_ctors\"]=function(){return(__wasm_call_ctors=Module[\"__wasm
_call_ctors\"])=Module[\"asm\"][\"B\"]).apply(null,arguments)};var
_init=Module[\"_init\"]=function(){return(_init=Module[\"_init\"])=Module[\"asm\"][\"C\"]).apply(null,arguments)};
var
_init_with_threads_count=Module[\"_init_with_threads_count\"]=function(){return(_init_with_threads_count=Mod
ule[\"_init_with_threads_count\"])=Module[\"asm\"][\"D\"]).apply(null,arguments)};var
_get_threads_count=Module[\"_get_threads_count\"]=function(){return(_get_threads_count=Module[\"_get_threads
_count\"])=Module[\"asm\"][\"E\"]).apply(null,arguments)};var
_register_tensor=Module[\"_register_tensor\"]=function(){return(_register_tensor=Module[\"_register_tensor\"])=M
odule[\"asm\"][\"F\"]).apply(null,arguments)};var
_dispose_data=Module[\"_dispose_data\"]=function(){return(_dispose_data=Module[\"_dispose_data\"])=Module[\"
asm\"][\"G\"]).apply(null,arguments)};var
_dispose=Module[\"_dispose\"]=function(){return(_dispose=Module[\"_dispose\"])=Module[\"asm\"][\"H\"]).apply(
null,arguments)};var
_Abs=Module[\"_Abs\"]=function(){return(_Abs=Module[\"_Abs\"])=Module[\"asm\"][\"J\"]).apply(null,arguments
)};var
_Add=Module[\"_Add\"]=function(){return(_Add=Module[\"_Add\"])=Module[\"asm\"][\"K\"]).apply(null,argumen
ts)};var
_AddN=Module[\"_AddN\"]=function(){return(_AddN=Module[\"_AddN\"])=Module[\"asm\"][\"L\"]).apply(null,ar
guments)};var

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_All=Module["_All"]=function(){return(_All=Module["_All"]=Module["asm"][["M"]]).apply(null,arguments)};
var
_Any=Module["_Any"]=function(){return(_Any=Module["_Any"]=Module["asm"][["N"]]).apply(null,arguments)};var
_ArgMax=Module["_ArgMax"]=function(){return(_ArgMax=Module["_ArgMax"]=Module["asm"][["O"]]).apply(null,arguments)};var
_AvgPool=Module["_AvgPool"]=function(){return(_AvgPool=Module["_AvgPool"]=Module["asm"][["P"]]).apply(null,arguments)};var
_BatchMatMul=Module["_BatchMatMul"]=function(){return(_BatchMatMul=Module["_BatchMatMul"]=Module["asm"][["Q"]]).apply(null,arguments)};var
_Ceil=Module["_Ceil"]=function(){return(_Ceil=Module["_Ceil"]=Module["asm"][["R"]]).apply(null,arguments)};var
_ClipByValue=Module["_ClipByValue"]=function(){return(_ClipByValue=Module["_ClipByValue"]=Module["asm"][["S"]]).apply(null,arguments)};var
_Conv2D=Module["_Conv2D"]=function(){return(_Conv2D=Module["_Conv2D"]=Module["asm"][["T"]]).apply(null,arguments)};var
_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=function(){return(_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=Module["asm"][["U"]]).apply(null,arguments)};var
_Cos=Module["_Cos"]=function(){return(_Cos=Module["_Cos"]=Module["asm"][["V"]]).apply(null,arguments)};var
_Cosh=Module["_Cosh"]=function(){return(_Cosh=Module["_Cosh"]=Module["asm"][["W"]]).apply(null,arguments)};var
_CropAndResize=Module["_CropAndResize"]=function(){return(_CropAndResize=Module["_CropAndResize"]=Module["asm"][["X"]]).apply(null,arguments)};var
_Cumsum=Module["_Cumsum"]=function(){return(_Cumsum=Module["_Cumsum"]=Module["asm"][["Y"]]).apply(null,arguments)};var
_DepthToSpace=Module["_DepthToSpace"]=function(){return(_DepthToSpace=Module["_DepthToSpace"]=Module["asm"][["Z"]]).apply(null,arguments)};var
_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=function(){return(_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=Module["asm"][["_"]]).apply(null,arguments)};var
_Elu=Module["_Elu"]=function(){return(_Elu=Module["_Elu"]=Module["asm"][["$"]]).apply(null,arguments)};var
_Equal=Module["_Equal"]=function(){return(_Equal=Module["_Equal"]=Module["asm"][["aa"]]).apply(null,arguments)};var
_Exp=Module["_Exp"]=function(){return(_Exp=Module["_Exp"]=Module["asm"][["ba"]]).apply(null,arguments)};var
_FlipLeftRight=Module["_FlipLeftRight"]=function(){return(_FlipLeftRight=Module["_FlipLeftRight"]=Module["asm"][["ca"]]).apply(null,arguments)};var
_Floor=Module["_Floor"]=function(){return(_Floor=Module["_Floor"]=Module["asm"][["da"]]).apply(null,arguments)};var
_FloorDiv=Module["_FloorDiv"]=function(){return(_FloorDiv=Module["_FloorDiv"]=Module["asm"][["ea"]]).apply(null,arguments)};var
_FusedBatchNorm=Module["_FusedBatchNorm"]=function(){return(_FusedBatchNorm=Module["_FusedBatchNorm"]=Module["asm"][["fa"]]).apply(null,arguments)};var
_FusedConv2D=Module["_FusedConv2D"]=function(){return(_FusedConv2D=Module["_FusedConv2D"]=Module["asm"][["ga"]]).apply(null,arguments)};var
_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=function(){return(_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=Module["asm"][["ha"]]).apply(null,arguments)};var

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_Gather=Module["_Gather"]=function(){return(_Gather=Module["_Gather"]=Module["asm"][["ia"]]).apply(null,arguments)};var
_GatherNd=Module["_GatherNd"]=function(){return(_GatherNd=Module["_GatherNd"]=Module["asm"][["ja"]]).apply(null,arguments)};var
_Greater=Module["_Greater"]=function(){return(_Greater=Module["_Greater"]=Module["asm"][["ka"]]).apply(null,arguments)};var
_GreaterEqual=Module["_GreaterEqual"]=function(){return(_GreaterEqual=Module["_GreaterEqual"]=Module["asm"][["la"]]).apply(null,arguments)};var
_LeakyRelu=Module["_LeakyRelu"]=function(){return(_LeakyRelu=Module["_LeakyRelu"]=Module["asm"][["ma"]]).apply(null,arguments)};var
_Less=Module["_Less"]=function(){return(_Less=Module["_Less"]=Module["asm"][["na"]]).apply(null,arguments)};var
_LessEqual=Module["_LessEqual"]=function(){return(_LessEqual=Module["_LessEqual"]=Module["asm"][["oa"]]).apply(null,arguments)};var
_Log=Module["_Log"]=function(){return(_Log=Module["_Log"]=Module["asm"][["pa"]]).apply(null,arguments)};var
_LogicalAnd=Module["_LogicalAnd"]=function(){return(_LogicalAnd=Module["_LogicalAnd"]=Module["asm"][["qa"]]).apply(null,arguments)};var
_Max=Module["_Max"]=function(){return(_Max=Module["_Max"]=Module["asm"][["ra"]]).apply(null,arguments)};var
_MaxPool=Module["_MaxPool"]=function(){return(_MaxPool=Module["_MaxPool"]=Module["asm"][["sa"]]).apply(null,arguments)};var
_Maximum=Module["_Maximum"]=function(){return(_Maximum=Module["_Maximum"]=Module["asm"][["ta"]]).apply(null,arguments)};var
_Mean=Module["_Mean"]=function(){return(_Mean=Module["_Mean"]=Module["asm"][["ua"]]).apply(null,arguments)};var
_Min=Module["_Min"]=function(){return(_Min=Module["_Min"]=Module["asm"][["va"]]).apply(null,arguments)};var
_Minimum=Module["_Minimum"]=function(){return(_Minimum=Module["_Minimum"]=Module["asm"][["wa"]]).apply(null,arguments)};var
_MirrorPad=Module["_MirrorPad"]=function(){return(_MirrorPad=Module["_MirrorPad"]=Module["asm"][["xa"]]).apply(null,arguments)};var
_Multiply=Module["_Multiply"]=function(){return(_Multiply=Module["_Multiply"]=Module["asm"][["ya"]]).apply(null,arguments)};var
_Neg=Module["_Neg"]=function(){return(_Neg=Module["_Neg"]=Module["asm"][["za"]]).apply(null,arguments)};var
_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=function(){return(_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=Module["asm"][["Aa"]]).apply(null,arguments)};var
_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=function(){return(_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=Module["asm"][["Ba"]]).apply(null,arguments)};var
_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=function(){return(_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=Module["asm"][["Ca"]]).apply(null,arguments)};var
_NotEqual=Module["_NotEqual"]=function(){return(_NotEqual=Module["_NotEqual"]=Module["asm"][["Da"]]).apply(null,arguments)};var
_OneHot=Module["_OneHot"]=function(){return(_OneHot=Module["_OneHot"]=Module["asm"][["Ea"]]).apply(null,arguments)};var
_PadV2=Module["_PadV2"]=function(){return(_PadV2=Module["_PadV2"]=Module["asm"][["Fa"]]).apply(null,arguments)};var

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_Pow=Module["_Pow"]=function(){return(_Pow=Module["_Pow"]=Module["asm"][_"Ga"]).apply(null,arguments);var
_Prelu=Module["_Prelu"]=function(){return(_Prelu=Module["_Prelu"]=Module["asm"][_"Ha"]).apply(null,arguments);var
_Prod=Module["_Prod"]=function(){return(_Prod=Module["_Prod"]=Module["asm"][_"Ia"]).apply(null,arguments);var
_RealDiv=Module["_RealDiv"]=function(){return(_RealDiv=Module["_RealDiv"]=Module["asm"][_"Ja"]).apply(null,arguments);var
_RelU=Module["_Relu"]=function(){return(_Relu=Module["_Relu"]=Module["asm"][_"Ka"]).apply(null,arguments);var
_RelU6=Module["_Relu6"]=function(){return(_Relu6=Module["_Relu6"]=Module["asm"][_"La"]).apply(null,arguments);var
_ResizeBilinear=Module["_ResizeBilinear"]=function(){return(_ResizeBilinear=Module["_ResizeBilinear"]=Module["asm"][_"Ma"]).apply(null,arguments);var
_Reverse=Module["_Reverse"]=function(){return(_Reverse=Module["_Reverse"]=Module["asm"][_"Na"]).apply(null,arguments);var
_RotateWithOffset=Module["_RotateWithOffset"]=function(){return(_RotateWithOffset=Module["_RotateWithOffset"]=Module["asm"][_"Oa"]).apply(null,arguments);var
_Round=Module["_Round"]=function(){return(_Round=Module["_Round"]=Module["asm"][_"Pa"]).apply(null,arguments);var
_Rsqrt=Module["_Rsqrt"]=function(){return(_Rsqrt=Module["_Rsqrt"]=Module["asm"][_"Qa"]).apply(null,arguments);var
_ScatterNd=Module["_ScatterNd"]=function(){return(_ScatterNd=Module["_ScatterNd"]=Module["asm"][_"Ra"]).apply(null,arguments);var
_SelectV2=Module["_SelectV2"]=function(){return(_SelectV2=Module["_SelectV2"]=Module["asm"][_"Sa"]).apply(null,arguments);var
_Sigmoid=Module["_Sigmoid"]=function(){return(_Sigmoid=Module["_Sigmoid"]=Module["asm"][_"Ta"]).apply(null,arguments);var
_Sin=Module["_Sin"]=function(){return(_Sin=Module["_Sin"]=Module["asm"][_"Ua"]).apply(null,arguments);var
_Softmax=Module["_Softmax"]=function(){return(_Softmax=Module["_Softmax"]=Module["asm"][_"Va"]).apply(null,arguments);var
_Sqrt=Module["_Sqrt"]=function(){return(_Sqrt=Module["_Sqrt"]=Module["asm"][_"Wa"]).apply(null,arguments);var
_Square=Module["_Square"]=function(){return(_Square=Module["_Square"]=Module["asm"][_"Xa"]).apply(null,arguments);var
_SquaredDifference=Module["_SquaredDifference"]=function(){return(_SquaredDifference=Module["_SquaredDifference"]=Module["asm"][_"Ya"]).apply(null,arguments);var
_Step=Module["_Step"]=function(){return(_Step=Module["_Step"]=Module["asm"][_"Za"]).apply(null,arguments);var
_StridedSlice=Module["_StridedSlice"]=function(){return(_StridedSlice=Module["_StridedSlice"]=Module["asm"][_"a"]).apply(null,arguments);var
_Sub=Module["_Sub"]=function(){return(_Sub=Module["_Sub"]=Module["asm"][_"Sa"]).apply(null,arguments);var
_Sum=Module["_Sum"]=function(){return(_Sum=Module["_Sum"]=Module["asm"][_"ab"]).apply(null,arguments);var
_Tan=Module["_Tan"]=function(){return(_Tan=Module["_Tan"]=Module["asm"][_"bb"]).apply(null,arguments);var

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_Tanh=Module["_Tanh"]=function(){return(_Tanh=Module["_Tanh"]=Module["asm"][["cb"]]).apply(null,arguments)};var
_Tile=Module["_Tile"]=function(){return(_Tile=Module["_Tile"]=Module["asm"][["db"]]).apply(null,arguments)};var
_TopK=Module["_TopK"]=function(){return(_TopK=Module["_TopK"]=Module["asm"][["eb"]]).apply(null,arguments)};var
_Transform=Module["_Transform"]=function(){return(_Transform=Module["_Transform"]=Module["asm"][["fb"]]).apply(null,arguments)};var
_Transpose=Module["_Transpose"]=function(){return(_Transpose=Module["_Transpose"]=Module["asm"][["gb"]]).apply(null,arguments)};var
__FusedMatMul=Module["__FusedMatMul"]=function(){return(__FusedMatMul=Module["__FusedMatMul"]=Module["asm"][["hb"]]).apply(null,arguments)};var
_malloc=Module["_malloc"]=function(){return(_malloc=Module["_malloc"]=Module["asm"][["ib"]]).apply(null,arguments)};var
_free=Module["_free"]=function(){return(_free=Module["_free"]=Module["asm"][["jb"]]).apply(null,arguments)};var
__errno_location=Module["__errno_location"]=function(){return(__errno_location=Module["__errno_location"]=Module["asm"][["kb"]]).apply(null,arguments)};var
_emscripten_get_global_libc=Module["_emscripten_get_global_libc"]=function(){return(_emscripten_get_global_libc=Module["_emscripten_get_global_libc"]=Module["asm"][["lb"]]).apply(null,arguments)};var
_thread_self=Module["_thread_self"]=function(){return(_thread_self=Module["_thread_self"]=Module["asm"][["mb"]]).apply(null,arguments)};var
__pthread_tsd_run_dtors=Module["__pthread_tsd_run_dtors"]=function(){return(__pthread_tsd_run_dtors=Module["__pthread_tsd_run_dtors"]=Module["asm"][["nb"]]).apply(null,arguments)};var
_emscripten_main_thread_process_queued_calls=Module["_emscripten_main_thread_process_queued_calls"]=function(){return(_emscripten_main_thread_process_queued_calls=Module["_emscripten_main_thread_process_queued_calls"]=Module["asm"][["ob"]]).apply(null,arguments)};var
_emscripten_current_thread_process_queued_calls=Module["_emscripten_current_thread_process_queued_calls"]=function(){return(_emscripten_current_thread_process_queued_calls=Module["_emscripten_current_thread_process_queued_calls"]=Module["asm"][["pb"]]).apply(null,arguments)};var
_emscripten_register_main_browser_thread_id=Module["_emscripten_register_main_browser_thread_id"]=function(){return(_emscripten_register_main_browser_thread_id=Module["_emscripten_register_main_browser_thread_id"]=Module["asm"][["qb"]]).apply(null,arguments)};var
_emscripten_main_browser_thread_id=Module["_emscripten_main_browser_thread_id"]=function(){return(_emscripten_main_browser_thread_id=Module["_emscripten_main_browser_thread_id"]=Module["asm"][["rb"]]).apply(null,arguments)};var
__emscripten_do_dispatch_to_thread=Module["__emscripten_do_dispatch_to_thread"]=function(){return(__emscripten_do_dispatch_to_thread=Module["__emscripten_do_dispatch_to_thread"]=Module["asm"][["sb"]]).apply(null,arguments)};var
_emscripten_sync_run_in_main_thread_4=Module["_emscripten_sync_run_in_main_thread_4"]=function(){return(_emscripten_sync_run_in_main_thread_4=Module["_emscripten_sync_run_in_main_thread_4"]=Module["asm"][["tb"]]).apply(null,arguments)};var
_emscripten_run_in_main_runtime_thread_js=Module["_emscripten_run_in_main_runtime_thread_js"]=function(){return(_emscripten_run_in_main_runtime_thread_js=Module["_emscripten_run_in_main_runtime_thread_js"]=Module["asm"][["ub"]]).apply(null,arguments)};var
__emscripten_call_on_thread=Module["__emscripten_call_on_thread"]=function(){return(__emscripten_call_on_thread=Module["__emscripten_call_on_thread"]=Module["asm"][["vb"]]).apply(null,arguments)};var
_emscripten_tls_init=Module["_emscripten_tls_init"]=function(){return(_emscripten_tls_init=Module["_emscript

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Module){if(Module.hasOwnProperty(key)){moduleOverrides[key]=Module[key]}}var arguments_=[];var
thisProgram=\.\/this.program";var quit_=function(status,toThrow){throw toThrow};var
ENVIRONMENT_IS_WEB=false;var ENVIRONMENT_IS_WORKER=false;var
ENVIRONMENT_IS_NODE=false;var ENVIRONMENT_IS_SHELL=false;ENVIRONMENT_IS_WEB=typeof
window===\object";ENVIRONMENT_IS_WORKER=typeof
importScripts===\function";ENVIRONMENT_IS_NODE=typeof process===\object"&&typeof
process.versions===\object"&&typeof
process.versions.node===\string";ENVIRONMENT_IS_SHELL=!ENVIRONMENT_IS_WEB&&!ENVIRONM
ENT_IS_NODE&&!ENVIRONMENT_IS_WORKER;var scriptDirectory=\.\/";function
locateFile(path){if(Module["locateFile"]){return Module["locateFile"](path,scriptDirectory)}return
scriptDirectory+path}var read_,readAsync,readBinary,setWindowTitle;var nodeFS;var
nodePath;if(ENVIRONMENT_IS_NODE){if(ENVIRONMENT_IS_WORKER){scriptDirectory=require(\path\").
dirname(scriptDirectory)+\^"}else{scriptDirectory=__dirname+\^"}read_=function
shell_read(filename,binary){if(!nodeFS)nodeFS=require(\fs");if(!nodePath)nodePath=require(\path");filename=n
odePath[\normalize\](filename);return
nodeFS[\readFileSync\](filename,binary?null:\utf8");readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret};if(process[\argv\].length>1){thisProgram=process[\argv\"][1].replace(/\\/g,\^)}arguments_=process[\arg
v\].slice(2);process[\on\](\uncaughtException",function(ex){if(!(ex instanceof ExitStatus)){throw
ex}});process[\on\](\unhandledRejection",abort);quit_=function(status){process[\exit\](status)};Module["insp
ect"]=function(){return\["Emscripten Module object"]}}else if(ENVIRONMENT_IS_SHELL){if(typeof
read!=\undefined"){read_=function shell_read(f){return read(f)}readBinary=function readBinary(f){var
data;if(typeof readbuffer===\function"){return new
Uint8Array(readbuffer(f))}data=read(f,\binary");assert(typeof data===\object");return data};if(typeof
scriptArgs!=\undefined){arguments_=scriptArgs}else if(typeof
arguments!=\undefined){arguments_=arguments}if(typeof
quit===\function"){quit_=function(status){quit(status)}if(typeof print!=\undefined){if(typeof
console===\undefined)console={};console.log=print;console.warn=console.error=typeof
printErr!=\undefined"?printErr:print}}else
if(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER){if(ENVIRONMENT_IS_WORKER){scriptDire
ctory=self.location.href}else if(typeof
document!=\undefined"&&document.currentScript){scriptDirectory=document.currentScript.src}if(_scriptDir){s
criptDirectory=_scriptDir}if(scriptDirectory.indexOf(\blob:\")!==(0){scriptDirectory=scriptDirectory.substr(0,script
Directory.lastIndexOf(\^")+1)}else{scriptDirectory=\.\/"}read_=function(url){var xhr=new
XMLHttpRequest;xhr.open(\GET",url,false);xhr.send(null);return
xhr.responseText};if(ENVIRONMENT_IS_WORKER){readBinary=function(url){var xhr=new
XMLHttpRequest;xhr.open(\GET",url,false);xhr.responseType=\arraybuffer";xhr.send(null);return new
Uint8Array(xhr.response)}}readAsync=function(url,onload,onerror){var xhr=new
XMLHttpRequest;xhr.open(\GET",url,true);xhr.responseType=\arraybuffer";xhr.onload=function(){if(xhr.status
==200||xhr.status==0&&xhr.response){onload(xhr.response);return}onerror();}xhr.onerror=onerror;xhr.send(null)}
}setWindowTitle=function(title){document.title=title}}else{var
out=Module["print"]||console.log.bind(console);var err=Module["printErr"]||console.warn.bind(console);for(key
in
moduleOverrides){if(moduleOverrides.hasOwnProperty(key)){Module[key]=moduleOverrides[key]}}moduleOverr
ides=null;if(Module["arguments"]arguments_=Module["arguments"];if(Module["thisProgram"]thisProgram=
Module["thisProgram"];if(Module["quit"]quit_=Module["quit"];var
wasmBinary;if(Module["wasmBinary"]wasmBinary=Module["wasmBinary"];var
noExitRuntime=Module["noExitRuntime"]||true;if(typeof WebAssembly!=\object"){abort(\no native wasm

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support detected\")}var wasmMemory;var ABORT=false;var EXITSTATUS;function
assert(condition,text){if(!condition){abort("\Assertion failed: "+text)}}function getCFunc(ident){var
func=Module["_"+ident];assert(func,"\Cannot call unknown function "+ident+", make sure it is exported");return
func}function
ccall(ident,returnType,argTypes,args,opts){var toC={"string":function(str){var
ret=0;if(str!=null&&str!=undefined&&str!=0){var
len=(str.length<<2)+1;ret=stackAlloc(len);stringToUTF8(str,ret,len)}return ret},\array":function(arr){var
ret=stackAlloc(arr.length);writeArrayToMemory(arr,ret);return ret}};function
convertReturnValue(ret){if(returnType===\string\)return UTF8ToString(ret);if(returnType===\boolean\)return
Boolean(ret);return ret}var func=getCFunc(ident);var cArgs=[];var stack=0;if(args){for(var
i=0;i<args.length;i++){var
converter=toC[argTypes[i]];if(converter){if(stack===0)stack=stackSave();cArgs[i]=converter(args[i])}else{cArgs[i]
]=args[i]}}var ret=func.apply(null,cArgs);ret=convertReturnValue(ret);if(stack!=0)stackRestore(stack);return
ret}function cwrap(ident,returnType,argTypes,opts){argTypes=argTypes||[];var
numericArgs=argTypes.every(function(type){return type===\number\});var
numericRet=returnType!==\string\;if(numericRet&&numericArgs&&!opts){return getCFunc(ident)}return
function(){return ccall(ident,returnType,argTypes,arguments,opts)}}var UTF8Decoder=typeof
TextDecoder!=="undefined"?new TextDecoder(\utf8\"):undefined;function
UTF8ArrayToString(heap,idx,maxBytesToRead){var endIdx=idx+maxBytesToRead;var
endPtr=idx;while(heap[endPtr]&&!(endPtr>=endIdx))++endPtr;if(endPtr-
idx>16&&heap.subarray&&UTF8Decoder){return UTF8Decoder.decode(heap.subarray(idx,endPtr))}else{var
str="";while(idx<endPtr){var u0=heap[idx++];if(!(u0&128)){str+=String.fromCharCode(u0);continue}var
u1=heap[idx++]&63;if((u0&224)==192){str+=String.fromCharCode((u0&31)<<6|u1);continue}var
u2=heap[idx++]&63;if((u0&240)==224){u0=(u0&15)<<12|u1<<6|u2}else{u0=(u0&7)<<18|u1<<12|u2<<6|heap[id
x++]&63}if(u0<65536){str+=String.fromCharCode(u0)}else{var ch=u0-
65536;str+=String.fromCharCode(55296|ch>>10,56320|ch&1023)}}}return str}function
UTF8ToString(ptr,maxBytesToRead){return
ptr?UTF8ArrayToString(HEAPU8,ptr,maxBytesToRead):\"}function
stringToUTF8Array(str,heap,outIdx,maxBytesToWrite){if(!(maxBytesToWrite>0))return
0;var startIdx=outIdx;var endIdx=outIdx+maxBytesToWrite-1;for(var i=0;i<str.length;++){var
u=str.charCodeAt(i);if(u>=55296&&u<=57343){var
u1=str.charCodeAt(++i);u=65536+((u&1023)<<10|u1&1023)}if(u<=127){if(outIdx>=endIdx)break;heap[outIdx++]
=u}else if(u<=2047){if(outIdx+1>=endIdx)break;heap[outIdx++]=192|u>>6;heap[outIdx++]=128|u&63}else
if(u<=65535){if(outIdx+2>=endIdx)break;heap[outIdx++]=224|u>>12;heap[outIdx++]=128|u>>6&63;heap[outIdx
++]=128|u&63}else{if(outIdx+3>=endIdx)break;heap[outIdx++]=240|u>>18;heap[outIdx++]=128|u>>12&63;heap[
outIdx++]=128|u>>6&63;heap[outIdx++]=128|u&63}}heap[outIdx]=0;return outIdx-startIdx}function
stringToUTF8(str,outPtr,maxBytesToWrite){return
stringToUTF8Array(str,HEAPU8,outPtr,maxBytesToWrite)}function
writeArrayToMemory(array,buffer){HEAP8.set(array,buffer)}function
alignUp(x,multiple){if(x%multiple>0){x+=multiple-x%multiple}return x}var
buffer,HEAP8,HEAPU8,HEAP16,HEAPU16,HEAP32,HEAPU32,HEAPF32,HEAPF64;function
updateGlobalBufferAndViews(buf){buffer=buf;Module[\HEAP8\"]=HEAP8=new
Int8Array(buf);Module[\HEAP16\"]=HEAP16=new Int16Array(buf);Module[\HEAP32\"]=HEAP32=new
Int32Array(buf);Module[\HEAPU8\"]=HEAPU8=new Uint8Array(buf);Module[\HEAPU16\"]=HEAPU16=new
Uint16Array(buf);Module[\HEAPU32\"]=HEAPU32=new
Uint32Array(buf);Module[\HEAPF32\"]=HEAPF32=new
Float32Array(buf);Module[\HEAPF64\"]=HEAPF64=new Float64Array(buf)}var
INITIAL_MEMORY=Module[\INITIAL_MEMORY\"]||16777216;var wasmTable;var __ATPRERUN__=[];var

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__ATINIT__=[];var __ATMAIN__=[];var __ATPOSTRUN__=[];var
runtimeInitialized=false;__ATINIT__.push({func:function(){__wasm_call_ctors()}});function
preRun(){if(Module["preRun"]){if(typeof
Module["preRun"]!="function")Module["preRun"]=[Module["preRun"]];while(Module["preRun"].length){a
ddOnPreRun(Module["preRun"].shift())}callRuntimeCallbacks(__ATPRERUN__)}function
initRuntime(){runtimeInitialized=true;callRuntimeCallbacks(__ATINIT__)}function
preMain(){callRuntimeCallbacks(__ATMAIN__)}function
postRun(){if(Module["postRun"]){if(typeof
Module["postRun"]!="function")Module["postRun"]=[Module["postRun"]];while(Module["postRun"].lengt
h){addOnPostRun(Module["postRun"].shift())}callRuntimeCallbacks(__ATPOSTRUN__)}function
addOnPreRun(cb){__ATPRERUN__.unshift(cb)}function addOnPostRun(cb){__ATPOSTRUN__.unshift(cb)}var
runDependencies=0;var runDependencyWatcher=null;var dependenciesFulfilled=null;function
addRunDependency(id){runDependencies++;if(Module["monitorRunDependencies"]){Module["monitorRunDep
endencies"](runDependencies)}function removeRunDependency(id){runDependencies--
;if(Module["monitorRunDependencies"]){Module["monitorRunDependencies"](runDependencies)}if(runDepend
encies==0){if(runDependencyWatcher!=null){clearInterval(runDependencyWatcher);runDependencyWatcher=nu
ll}if(dependenciesFulfilled){var
callback=dependenciesFulfilled;dependenciesFulfilled=null;callback()}}Module["preloadedImages"]={};Module
["preloadedAudios"]={};function
abort(what){if(Module["onAbort"]){Module["onAbort"](what)}what+="\n";err(what);ABORT=true;EXITSTAT
US=1;what+="abort("+what+"). Build with -s ASSERTIONS=1 for more info.";var e=new
WebAssembly.RuntimeError(what);readyPromiseReject(e);throw e}function hasPrefix(str,prefix){return
String.prototype.startsWith?str.startsWith(prefix):str.indexOf(prefix)===0}var
dataURIPrefix="data:application/octet-stream;base64,";function isDataURI(filename){return
hasPrefix(filename,dataURIPrefix)}var fileURIPrefix="file://^";function isFileURI(filename){return
hasPrefix(filename,fileURIPrefix)}var wasmBinaryFile="tfjs-backend-
wasm.wasm";if(!isDataURI(wasmBinaryFile)){wasmBinaryFile=locateFile(wasmBinaryFile)}function
getBinary(file){try{if(file==wasmBinaryFile&&wasmBinary){return new
Uint8Array(wasmBinary)}if(readBinary){return readBinary(file)}else{throw"both async and sync fetching of the
wasm failed"}}catch(err){abort(err)}}function
getBinaryPromise(){if(!wasmBinary&&(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER)){if(typeof
fetch==="function"&&!isFileURI(wasmBinaryFile)){return fetch(wasmBinaryFile,{credentials:"same-
origin"}).then(function(response){if(!response["ok"]){throw"failed to load wasm binary file at
"+wasmBinaryFile+"\""}return response["arrayBuffer"]()).catch(function(){return
getBinary(wasmBinaryFile)})}else{if(readAsync){return new
Promise(function(resolve,reject){readAsync(wasmBinaryFile,function(response){resolve(new
Uint8Array(response)),reject}))})}return Promise.resolve().then(function(){return
getBinary(wasmBinaryFile)})}function createWasm(){var info={"a":asmLibraryArg};function
receiveInstance(instance,module){var
exports=instance.exports;Module["asm"]=exports;wasmMemory=Module["asm"]["j"];updateGlobalBufferAnd
Views(wasmMemory.buffer);wasmTable=Module["asm"]["r"];removeRunDependency("wasm-
instantiate")}addRunDependency("wasm-instantiate");function
receiveInstantiatedSource(output){receiveInstance(output["instance"])function
instantiateArrayBuffer(receiver){return getBinaryPromise().then(function(binary){return
WebAssembly.instantiate(binary,info)}).then(receiver,function(reason){err("failed to asynchronously prepare
wasm: "+reason);abort(reason)})}function instantiateAsync(){if(!wasmBinary&&typeof
WebAssembly.instantiateStreaming==="function"&&!isDataURI(wasmBinaryFile)&&!isFileURI(wasmBinaryFil
e)&&typeof fetch==="function"){return fetch(wasmBinaryFile,{credentials:"same-

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origin\").then(function(response){ var result=WebAssembly.instantiateStreaming(response,info);return
result.then(receiveInstantiatedSource,function(reason){err(\"wasm streaming compile failed: \"+reason);err(\"falling
back to ArrayBuffer instantiation\");return instantiateArrayBuffer(receiveInstantiatedSource)}))})else{return
instantiateArrayBuffer(receiveInstantiatedSource)}if(Module[\"instantiateWasm\"]){try{var
exports=Module[\"instantiateWasm\"](info,receiveInstance);return exports}catch(e){err(\"Module.instantiateWasm
callback failed with error: \"+e);return false}}instantiateAsync().catch(readyPromiseReject);return{}}function
callRuntimeCallbacks(callbacks){while(callbacks.length>0){var callback=callbacks.shift();if(typeof
callback===\"function\"){callback(Module);continue}var func=callback.func;if(typeof
func===\"number\"){if(callback.arg===undefined){wasmTable.get(func)()}else{wasmTable.get(func)(callback.arg)
}}else{func(callback.arg===undefined?null:callback.arg)}}function _abort(){abort()}function
_emscipten_memcpy_big(dest,src,num){HEAPU8.copyWithin(dest,src,src+num)}function
_emscipten_get_heap_size(){return HEAPU8.length}function
emscipten_realloc_buffer(size){try{wasmMemory.grow(size-
buffer.byteLength+65535>>>16);updateGlobalBufferAndViews(wasmMemory.buffer);return
1}catch(e){}}function _emscipten_resize_heap(requestedSize){var oldSize=_emscipten_get_heap_size();var
maxHeapSize=2147483648;if(requestedSize>maxHeapSize){return false}for(var
cutDown=1;cutDown<=4;cutDown*=2){var
overGrownHeapSize=oldSize*(1+.2/cutDown);overGrownHeapSize=Math.min(overGrownHeapSize,requestedSize
+100663296);var
newSize=Math.min(maxHeapSize,alignUp(Math.max(requestedSize,overGrownHeapSize),65536));var
replacement=emscipten_realloc_buffer(newSize);if(replacement){return true}}return false}var
SYSCALLS={mappings:{},buffers:[null,[],[]],printChar:function(stream,curr){var
buffer=SYSCALLS.buffers[stream];if(curr===0||curr===10){stream===1?out:err}(UTF8ArrayToString(buffer,0));
buffer.length=0}else{buffer.push(curr)}},varargs:undefined,get:function(ptr){SYSCALLS.varargs+=4;var
ret=HEAP32[SYSCALLS.varargs-4>>2];return ret},getStr:function(ptr){var ret=UTF8ToString(ptr);return
ret},get64:function(low,high){return low}};function _fd_close(fd){return 0}function
_fd_seek(fd,offset_low,offset_high,whence,newOffset){}function _fd_write(fd,iov,iocnt,pnum){var num=0;for(var
i=0;i<iocnt;i++){var ptr=HEAP32[iov+i*8>>2];var len=HEAP32[iov+(i*8+4)>>2];for(var
j=0;j<len;j++){SYSCALLS.printChar(fd,HEAPU8[ptr+j])}num+=len}HEAP32[pnum>>2]=num;return
0}function _pthread_create(){return 6}function _pthread_join(){return 28}function
setErrNo(value){HEAP32[___errno_location()>>2]=value;return value}function
_sysconf(name){switch(name){case 30:return 16384;case 85:var maxHeapSize=2147483648;return
maxHeapSize/16384;case 132:case 133:case 12:case 137:case 138:case 15:case 235:case 16:case 17:case 18:case
19:case 20:case 149:case 13:case 10:case 236:case 153:case 9:case 21:case 22:case 159:case 154:case 14:case
77:case 78:case 139:case 82:case 68:case 67:case 164:case 11:case 29:case 47:case 48:case 95:case 52:case 51:case
46:return 200809;case 27:case 246:case 127:case 128:case 23:case 24:case 160:case 161:case 181:case 182:case
242:case 183:case 184:case 243:case 244:case 245:case 165:case 178:case 179:case 49:case 50:case 168:case
169:case 175:case 170:case 171:case 172:case 97:case 76:case 32:case 173:case 35:case 80:case 81:case 79:return-
1;case 176:case 177:case 7:case
155:case 8:case 157:case 125:case 126:case 92:case 93:case 129:case 130:case 131:case 94:case 91:return 1;case
74:case 60:case 69:case 70:case 4:return 1024;case 31:case 42:case 72:return 32;case 87:case 26:case 33:return
2147483647;case 34:case 1:return 47839;case 38:case 36:return 99;case 43:case 37:return 2048;case 0:return
2097152;case 3:return 65536;case 28:return 32768;case 44:return 32767;case 75:return 16384;case 39:return
1e3;case 89:return 700;case 71:return 256;case 40:return 255;case 2:return 100;case 180:return 64;case 25:return
20;case 5:return 16;case 6:return 6;case 73:return 4;case 84:{if(typeof navigator===\"object\")return
navigator[\"hardwareConcurrency\"]||1;return 1}}setErrNo(28);return-1}var
asmLibraryArg={\"a\":_abort,\"d\":_emscipten_memcpy_big,\"e\":_emscipten_resize_heap,\"f\":_fd_close,\"c\":_f
d_seek,\"b\":_fd_write,\"h\":_pthread_create,\"g\":_pthread_join,\"i\":_sysconf};var asm=createWasm();var

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__wasm_call_ctors=Module["__wasm_call_ctors"]=function(){return(__wasm_call_ctors=Module["__wasm
_call_ctors"]=Module["asm"][["k"]]).apply(null,arguments)};var
_init=Module["_init"]=function(){return(_init=Module["asm"][["l"]]).apply(null,arguments)};
var
_init_with_threads_count=Module["_init_with_threads_count"]=function(){return(_init_with_threads_count=Mod
ule["_init_with_threads_count"]=Module["asm"][["m"]]).apply(null,arguments)};var
_get_threads_count=Module["_get_threads_count"]=function(){return(_get_threads_count=Module["_get_threads
_count"]=Module["asm"][["n"]]).apply(null,arguments)};var
_register_tensor=Module["_register_tensor"]=function(){return(_register_tensor=Module["_register_tensor"]=M
odule["asm"][["o"]]).apply(null,arguments)};var
_dispose_data=Module["_dispose_data"]=function(){return(_dispose_data=Module["_dispose_data"]=Module["asm"
][["p"]]).apply(null,arguments)};var
_dispose=Module["_dispose"]=function(){return(_dispose=Module["_dispose"]=Module["asm"][["q"]]).apply(n
ull,arguments)};var
_Abs=Module["_Abs"]=function(){return(_Abs=Module["_Abs"]=Module["asm"][["s"]]).apply(null,arguments
)};var
_Add=Module["_Add"]=function(){return(_Add=Module["_Add"]=Module["asm"][["t"]]).apply(null,argument
s)};var
_AddN=Module["_AddN"]=function(){return(_AddN=Module["_AddN"]=Module["asm"][["u"]]).apply(null,ar
guments)};var
_All=Module["_All"]=function(){return(_All=Module["_All"]=Module["asm"][["v"]]).apply(null,arguments)};
var
_Any=Module["_Any"]=function(){return(_Any=Module["_Any"]=Module["asm"][["w"]]).apply(null,argumen
ts)};var
_ArgMax=Module["_ArgMax"]=function(){return(_ArgMax=Module["_ArgMax"]=Module["asm"][["x"]]).app
ly(null,arguments)};var
_AvgPool=Module["_AvgPool"]=function(){return(_AvgPool=Module["_AvgPool"]=Module["asm"][["y"]]).a
pply(null,arguments)};var
_BatchMatMul=Module["_BatchMatMul"]=function(){return(_BatchMatMul=Module["_BatchMatMul"]=Modu
le["asm"][["z"]]).apply(null,arguments)};var
_Ceil=Module["_Ceil"]=function(){return(_Ceil=Module["_Ceil"]=Module["asm"][["A"]]).apply(null,argument
s)};var
_ClipByValue=Module["_ClipByValue"]=function(){return(_ClipByValue=Module["_ClipByValue"]=Module[
"asm"][["B"]]).apply(null,arguments)};var
_Conv2D=Module["_Conv2D"]=function(){return(_Conv2D=Module["_Conv2D"]=Module["asm"][["C"]]).ap
ply(null,arguments)};var
_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=function(){return(_Conv2DBackpropInput=Modul
e["_Conv2DBackpropInput"]=Module["asm"][["D"]]).apply(null,arguments)};var
_Cos=Module["_Cos"]=function(){return(_Cos=Module["_Cos"]=Module["asm"][["E"]]).apply(null,arguments
)};var
_Cosh=Module["_Cosh"]=function(){return(_Cosh=Module["_Cosh"]=Module["asm"][["F"]]).apply(null,argu
ments)};var
_CropAndResize=Module["_CropAndResize"]=function(){return(_CropAndResize=Module["_CropAndResize\"]=
Module["asm"][["G"]]).apply(null,arguments)};var
_Cumsum=Module["_Cumsum"]=function(){return(_Cumsum=Module["_Cumsum"]=Module["asm"][["H"]]).a
pply(null,arguments)};var
_DepthToSpace=Module["_DepthToSpace"]=function(){return(_DepthToSpace=Module["_DepthToSpace\"]=M
odule["asm"][["I"]]).apply(null,arguments)};var

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_DeepwiseConv2dNative=Module["_DeepwiseConv2dNative"]=function(){return(_DeepwiseConv2dNative=Module["_DeepwiseConv2dNative"]=Module["asm"]["J"]).apply(null,arguments)};var
_Elu=Module["_Elu"]=function(){return(_Elu=Module["_Elu"]=Module["asm"]["K"]).apply(null,arguments)};var
_Equal=Module["_Equal"]=function(){return(_Equal=Module["_Equal"]=Module["asm"]["L"]).apply(null,arguments)};var
_Exp=Module["_Exp"]=function(){return(_Exp=Module["_Exp"]=Module["asm"]["M"]).apply(null,arguments)};var
_FlipLeftRight=Module["_FlipLeftRight"]=function(){return(_FlipLeftRight=Module["_FlipLeftRight"]=Module["asm"]["N"]).apply(null,arguments)};var
_Floor=Module["_Floor"]=function(){return(_Floor=Module["_Floor"]=Module["asm"]["O"]).apply(null,arguments)};var
_FloorDiv=Module["_FloorDiv"]=function(){return(_FloorDiv=Module["_FloorDiv"]=Module["asm"]["P"]).apply(null,arguments)};var
_FusedBatchNorm=Module["_FusedBatchNorm"]=function(){return(_FusedBatchNorm=Module["_FusedBatchNorm"]=Module["asm"]["Q"]).apply(null,arguments)};var
_FusedConv2D=Module["_FusedConv2D"]=function(){return(_FusedConv2D=Module["_FusedConv2D"]=Module["asm"]["R"]).apply(null,arguments)};var
_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=function(){return(_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=Module["asm"]["S"]).apply(null,arguments)};var
_Gather=Module["_Gather"]=function(){return(_Gather=Module["_Gather"]=Module["asm"]["T"]).apply(null,arguments)};var
_GatherNd=Module["_GatherNd"]=function(){return(_GatherNd=Module["_GatherNd"]=Module["asm"]["U"]).apply(null,arguments)};var
_Greater=Module["_Greater"]=function(){return(_Greater=Module["_Greater"]=Module["asm"]["V"]).apply(null,arguments)};var
_GreaterEqual=Module["_GreaterEqual"]=function(){return(_GreaterEqual=Module["_GreaterEqual"]=Module["asm"]["W"]).apply(null,arguments)};var
_LeakyRelu=Module["_LeakyRelu"]=function(){return(_LeakyRelu=Module["_LeakyRelu"]=Module["asm"]["X"]).apply(null,arguments)};var
_Less=Module["_Less"]=function(){return(_Less=Module["_Less"]=Module["asm"]["Y"]).apply(null,arguments)};var
_LessEqual=Module["_LessEqual"]=function(){return(_LessEqual=Module["_LessEqual"]=Module["asm"]["Z"]).apply(null,arguments)};var
_Log=Module["_Log"]=function(){return(_Log=Module["_Log"]=Module["asm"]["_"]).apply(null,arguments)};var
_LogicalAnd=Module["_LogicalAnd"]=function(){return(_LogicalAnd=Module["_LogicalAnd"]=Module["asm"]["$"]).apply(null,arguments)};var
_Max=Module["_Max"]=function(){return(_Max=Module["_Max"]=Module["asm"]["aa"]).apply(null,arguments)};var
_MaxPool=Module["_MaxPool"]=function(){return(_MaxPool=Module["_MaxPool"]=Module["asm"]["ba"]).apply(null,arguments)};var
_Maximum=Module["_Maximum"]=function(){return(_Maximum=Module["_Maximum"]=Module["asm"]["ca"]).apply(null,arguments)};var
_Mean=Module["_Mean"]=function(){return(_Mean=Module["_Mean"]=Module["asm"]["da"]).apply(null,arguments)};var
_Min=Module["_Min"]=function(){return(_Min=Module["_Min"]=Module["asm"]["ea"]).apply(null,arguments)};var

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_Minimum=Module["_Minimum"]=function(){return(_Minimum=Module["_Minimum"]=Module["asm"][["fa"]]).apply(null,arguments)};var
_MirrorPad=Module["_MirrorPad"]=function(){return(_MirrorPad=Module["_MirrorPad"]=Module["asm"][["ga"]]).apply(null,arguments)};var
_Multiply=Module["_Multiply"]=function(){return(_Multiply=Module["_Multiply"]=Module["asm"][["ha"]]).apply(null,arguments)};var
_Neg=Module["_Neg"]=function(){return(_Neg=Module["_Neg"]=Module["asm"][["ia"]]).apply(null,arguments)};var
_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=function(){return(_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=Module["asm"][["ja"]]).apply(null,arguments)};var
_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=function(){return(_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=Module["asm"][["ka"]]).apply(null,arguments)};var
_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=function(){return(_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=Module["asm"][["la"]]).apply(null,arguments)};var
_NotEqual=Module["_NotEqual"]=function(){return(_NotEqual=Module["_NotEqual"]=Module["asm"][["ma"]]).apply(null,arguments)};var
_OneHot=Module["_OneHot"]=function(){return(_OneHot=Module["_OneHot"]=Module["asm"][["na"]]).apply(null,arguments)};var
_PadV2=Module["_PadV2"]=function(){return(_PadV2=Module["_PadV2"]=Module["asm"][["oa"]]).apply(null,arguments)};var
_Pow=Module["_Pow"]=function(){return(_Pow=Module["_Pow"]=Module["asm"][["pa"]]).apply(null,arguments)};var
_Prelu=Module["_Prelu"]=function(){return(_Prelu=Module["_Prelu"]=Module["asm"][["qa"]]).apply(null,arguments)};var
_Prod=Module["_Prod"]=function(){return(_Prod=Module["_Prod"]=Module["asm"][["ra"]]).apply(null,arguments)};var
_RealDiv=Module["_RealDiv"]=function(){return(_RealDiv=Module["_RealDiv"]=Module["asm"][["sa"]]).apply(null,arguments)};var
_Relu=Module["_Relu"]=function(){return(_Relu=Module["_Relu"]=Module["asm"][["ta"]]).apply(null,arguments)};var
_Relu6=Module["_Relu6"]=function(){return(_Relu6=Module["_Relu6"]=Module["asm"][["ua"]]).apply(null,arguments)};var
_ResizeBilinear=Module["_ResizeBilinear"]=function(){return(_ResizeBilinear=Module["_ResizeBilinear"]=Module["asm"][["va"]]).apply(null,arguments)};var
_Reverse=Module["_Reverse"]=function(){return(_Reverse=Module["_Reverse"]=Module["asm"][["wa"]]).apply(null,arguments)};var
_RotateWithOffset=Module["_RotateWithOffset"]=function(){return(_RotateWithOffset=Module["_RotateWithOffset"]=Module["asm"][["xa"]]).apply(null,arguments)};var
_Round=Module["_Round"]=function(){return(_Round=Module["_Round"]=Module["asm"][["ya"]]).apply(null,arguments)};var
_Rsqrt=Module["_Rsqrt"]=function(){return(_Rsqrt=Module["_Rsqrt"]=Module["asm"][["za"]]).apply(null,arguments)};var
_ScatterNd=Module["_ScatterNd"]=function(){return(_ScatterNd=Module["_ScatterNd"]=Module["asm"][["Aa"]]).apply(null,arguments)};var
_SelectV2=Module["_SelectV2"]=function(){return(_SelectV2=Module["_SelectV2"]=Module["asm"][["Ba"]]).apply(null,arguments)};var
_Sigmoid=Module["_Sigmoid"]=function(){return(_Sigmoid=Module["_Sigmoid"]=Module["asm"][["Ca"]]).apply(null,arguments)};var

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_Sin=Module["_Sin"]=function(){return(_Sin=Module["_Sin"]=Module["asm"][["Da"]]).apply(null,arguments)
};var
_Softmax=Module["_Softmax"]=function(){return(_Softmax=Module["_Softmax"]=Module["asm"][["Ea"]]).ap
ply(null,arguments)};var
_Sqrt=Module["_Sqrt"]=function(){return(_Sqrt=Module["_Sqrt"]=Module["asm"][["Fa"]]).apply(null,argumen
ts)};var
_Square=Module["_Square"]=function(){return(_Square=Module["_Square"]=Module["asm"][["Ga"]]).apply(nu
ll,arguments)};var
_SquaredDifference=Module["_SquaredDifference"]=function(){return(_SquaredDifference=Module["_Squared
Difference"]=Module["asm"][["Ha"]]).apply(null,arguments)};var
_Step=Module["_Step"]=function(){return(_Step=Module["_Step"]=Module["asm"][["Ia"]]).apply(null,argume
nts)};var
_StridedSlice=Module["_StridedSlice"]=function(){return(_StridedSlice=Module["_StridedSlice"]=Module["as
m"][["Ja"]]).apply(null,arguments)};var
_Sub=Module["_Sub"]=function(){return(_Sub=Module["_Sub"]=Module["asm"][["Ka"]]).apply(null,argument
s)};var
_Sum=Module["_Sum"]=function(){return(_Sum=Module["_Sum"]=Module["asm"][["La"]]).apply(null,argum
ents)};var
_Tan=Module["_Tan"]=function(){return(_Tan=Module["_Tan"]=Module["asm"][["Ma"]]).apply(null,argumen
ts)};var
_Tanh=Module["_Tanh"]=function(){return(_Tanh=Module["_Tanh"]=Module["asm"][["Na"]]).apply(null,argu
ments)};var
_Tile=Module["_Tile"]=function(){return(_Tile=Module["_Tile"]=Module["asm"][["Oa"]]).apply(null,argumen
ts)};var
_TopK=Module["_TopK"]=function(){return(_TopK=Module["_TopK"]=Module["asm"][["Pa"]]).apply(null,ar
guments)};var
_Transform=Module["_Transform"]=function(){return(_Transform=Module["_Transform"]=Module["asm"][["
Qa"]]).apply(null,arguments)};var
_Transpose=Module["_Transpose"]=function(){return(_Transpose=Module["_Transpose"]=Module["asm"][["R
a"]]).apply(null,arguments)};var
__FusedMatMul=Module["__FusedMatMul"]=function(){return(__FusedMatMul=Module["__FusedMatMul"]=
Module["asm"][["Sa"]]).apply(null,arguments)};var
_malloc=Module["_malloc"]=function(){return(_malloc=Module["_malloc"]=Module["asm"][["Ta"]]).apply(nu
ll,arguments)};var
_free=Module["_free"]=function(){return(_free=Module["_free"]=Module["asm"][["Ua"]]).apply(null,argument
s)};var
__errno_location=Module["__errno_location"]=function(){return(__errno_location=Module["__errno_locati
on"]=Module["asm"][["Va"]]).apply(null,arguments)};var
stackSave=Module["stackSave"]=function(){return(stackSave=Module["stackSave"]=Module["asm"][["Wa"]]).
apply(null,arguments)};var
stackRestore=Module["stackRestore"]=function(){return(stackRestore=Module["stackRestore"]=Module["asm"
][["Xa"]]).apply(null,arguments)};var
stackAlloc=Module["stackAlloc"]=function(){return(stackAlloc=Module["stackAlloc"]=Module["asm"][["Ya"
]).apply(null,arguments)};Module["cwrap"]=cwrap;var calledRun;function
ExitStatus(status){this.name="ExitStatus";this.message="Program terminated with
exit("+status+")";this.status=status}dependenciesFulfilled=function
runCaller(){if(!calledRun)run();if(!calledRun)dependenciesFulfilled=runCaller};function
run(args){args=args||arguments_;if(runDependencies>0){return}preRun();if(runDependencies>0){return}function

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doRun(){if(calledRun)return;calledRun=true;Module["calledRun"]=true;if(ABORT)return;initRuntime();preMain(
);readyPromiseResolve(Module);if(Module["onRuntimeInitialized"])Module["onRuntimeInitialized"]();postRun(
)}if(Module["setStatus\"]) {Module["setStatus\"]("Running...");setTimeout(function(){setTimeout(function(){Mo
dule["setStatus\"]("\n"),1);doRun(),1)}else{doRun()})Module["run"]=run;if(Module["preInit\"]) {if(typeof
Module["preInit"]==="function")Module["preInit"]=[Module["preInit"]];while(Module["preInit"].length>0){
Module["preInit"].pop()}run();\n\n\n return WasmBackendModule.ready\n\n);\n\n};\n\nif (typeof exports ===
'object' && typeof module === 'object')\n module.exports = WasmBackendModule;\nelse if (typeof define ===
'function' && define['amd'])\n define([], function() { return WasmBackendModule; });\nelse if (typeof exports ===
'object')\n exports["WasmBackendModule"] = WasmBackendModule;\n"/**\n * @license\n * Copyright 2019
Google LLC. All Rights Reserved.\n * Licensed under the

```

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=====
*\nimport './flags_wasm';\nimport {backend_util, BackendTimingInfo, DataStorage, DataType, deprecationWarn,
engine, env, KernelBackend, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasmModule,
WasmFactoryConfig} from './wasm-out/tfjs-backend-wasm';\nimport {BackendWasmThreadedSimdModule} from
'./wasm-out/tfjs-backend-wasm-threaded-simd';\nimport
wasmFactoryThreadedSimd from './wasm-out/tfjs-backend-wasm-threaded-simd.js';\n// @ts-ignore\nimport
{wasmWorkerContents} from './wasm-out/tfjs-backend-wasm-threaded-simd.worker.js';\nimport wasmFactory
from './wasm-out/tfjs-backend-wasm.js';\n\ninterface TensorData {\n id: number;\n memoryOffset: number;\n
shape: number[];\n dtype: DataType;\n refCount: number;\n /** Only used for string tensors, storing encoded
bytes. */\n stringBytes?: Uint8Array[];\n}\n\nexport type DataId = object; // object instead of {} to force non-
primitive.\n\nexport class BackendWasm extends KernelBackend {\n // 0 is reserved for null data ids.\n private
dataIdNextNumber = 1;\n dataIdMap: DataStorage<TensorData>;\n\n constructor(public wasm:
BackendWasmModule|BackendWasmThreadedSimdModule) {\n super();\n
this.wasm.tfjs.initWithThreadsCount(threadsCount);\n actualThreadsCount = this.wasm.tfjs.getThreadsCount();\n
this.dataIdMap = new DataStorage(this, engine());\n }\n\n write(values:
backend_util.BackendValues, shape: number[], dtype: DataType):\n DataId {\n const dataId = {id:
this.dataIdNextNumber++};\n this.move(dataId, values, shape, dtype, 1);\n return dataId;\n }\n\n
numDataIds(): number {\n return this.dataIdMap.numDataIds();\n }\n\n async time(f: () => void):
Promise<BackendTimingInfo> {\n const start = util.now();\n f();\n const kernelMs = util.now() - start;\n
return {kernelMs};\n }\n\n move(\n dataId: DataId, values: backend_util.BackendValues, shape: number[],\n
dtype: DataType, refCount: number): void {\n const id = this.dataIdNextNumber++;\n if (dtype === 'string') {\n
const stringBytes = values as Uint8Array[];\n this.dataIdMap.set(\n dataId,\n {id, stringBytes,
shape, dtype, memoryOffset: null, refCount});\n return;\n }\n\n const size = util.sizeFromShape(shape);\n
const numBytes = size * util.bytesPerElement(dtype);\n const memoryOffset = this.wasm._malloc(numBytes);\n
this.dataIdMap.set(dataId, {id, memoryOffset, shape, dtype, refCount});\n this.wasm.tfjs.registerTensor(id,
size, memoryOffset);\n if (values != null) {\n this.wasm.HEAPU8.set(\n new Uint8Array(\n
(values as backend_util.TypedArray).buffer,\n (values as backend_util.TypedArray).byteOffset,
numBytes),\n memoryOffset);\n }\n }\n\n async read(dataId: DataId):
Promise<backend_util.BackendValues> {\n return this.readSync(dataId);\n }\n\n readSync(dataId: DataId):
backend_util.BackendValues {\n const {memoryOffset, dtype, shape, stringBytes} =\n
this.dataIdMap.get(dataId);\n if (dtype === 'string') {\n return stringBytes;\n }\n const bytes =
this.wasm.HEAPU8.slice(\n memoryOffset,\n memoryOffset + util.sizeFromShape(shape) *

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util.bytesPerElement(dtype));\n return typedArrayFromBuffer(bytes.buffer, dtype);\n }\n\n /**\n * Dispose the
memory if the dataId
 has 0 refCount. Return true if the memory\n * is released, false otherwise.\n * @param dataId\n * @param force
Optional, remove the data regardless of refCount\n */\n disposeData(dataId: DataId, force = false): boolean {\n if
(this.dataIdMap.has(dataId)) {\n const data = this.dataIdMap.get(dataId);\n data.refCount--;\n if (!force
&& data.refCount > 0) {\n return false;\n }\n this.wasm._free(data.memoryOffset);\n this.wasm.tfjs.disposeData(data.id);\n this.dataIdMap.delete(dataId);\n }\n return true;\n }\n\n /** Return
refCount of a `TensorData`. */\n refCount(dataId: DataId): number {\n if (this.dataIdMap.has(dataId)) {\n
const tensorData = this.dataIdMap.get(dataId);\n return tensorData.refCount;\n }\n return 0;\n }\n\n
incRef(dataId: DataId) {\n const data = this.dataIdMap.get(dataId);\n if (data != null) {\n data.refCount++;\n
}\n }\n\n floatPrecision(): 32 {\n return 32;\n }\n\n
// Returns the memory offset of a tensor. Useful for debugging and unit\n // testing.\n getMemoryOffset(dataId:
DataId): number {\n return this.dataIdMap.get(dataId).memoryOffset;\n }\n\n dispose() {\n
this.wasm.tfjs.dispose();\n if ('PThread' in this.wasm) {\n this.wasm.PThread.terminateAllThreads();\n }\n
this.wasm = null;\n }\n\n memory() {\n return {unreliable: false};\n }\n\n /**\n * Make a tensor info for the
output of an op. If `memoryOffset` is not\n * present, this method allocates memory on the WASM heap. If
`memoryOffset`\n * is present, the memory was allocated elsewhere (in c++) and we just record\n * the pointer
where that memory lives.\n */\n makeOutput(shape: number[], dtype: DataType, memoryOffset?: number):\n
TensorInfo {\n let dataId: {};\n if (memoryOffset == null) {\n dataId = this.write(null /* values */, shape,
dtype);\n } else {\n const id = this.dataIdNextNumber++;\n dataId = {id};\n
this.dataIdMap.set(dataId, {id, memoryOffset, shape, dtype, refCount: 1});\n const size =
util.sizeFromShape(shape);\n this.wasm.tfjs.registerTensor(id, size, memoryOffset);\n }\n return {dataId,
shape, dtype};\n }\n\n typedArrayFromHeap({shape, dtype, dataId}: TensorInfo):\n backend_util.TypedArray
{\n const buffer = this.wasm.HEAPU8.buffer;\n const {memoryOffset} = this.dataIdMap.get(dataId);\n const
size = util.sizeFromShape(shape);\n switch (dtype) {\n case 'float32':\n return new Float32Array(buffer,
memoryOffset, size);\n case 'int32':\n return new Int32Array(buffer, memoryOffset, size);\n case 'bool':\n
return new Uint8Array(buffer, memoryOffset, size);\n default:\n throw new Error(`Unknown dtype
${dtype}`);\n }\n }\n\n\nfunction createInstantiateWasmFunc(path: string) {\n // this will be replace by rollout
plugin patchWechatWebAssembly in\n // miniprogram's output.\n // tslint:disable-next-line:no-any\n
return (imports: any, callback: any) => {\n util.fetch(path, {credentials: 'same-origin'}).then((response) => {\n
if (!response['ok']) {\n imports.env.a(`failed to load wasm binary file at '${path}'`);\n }\n
response.arrayBuffer().then(binary => {\n WebAssembly.instantiate(binary, imports).then(output => {\n
callback(output.instance, output.module);\n });\n });\n });\n return {};;\n }\n\n\n /**\n * Returns the
path of the WASM binary.\n * @param simdSupported whether SIMD is supported\n * @param threadsSupported
whether multithreading is supported\n * @param wasmModuleFolder the directory containing the WASM
binaries.\n */\n function getPathToWasmBinary(\n simdSupported: boolean, threadsSupported: boolean,\n wasmModuleFolder: string) {\n if (wasmPath != null) {\n // If wasmPath is defined, the user has supplied a full
path to\n // the vanilla .wasm binary.\n return wasmPath;\n }\n\n let path:
WasmBinaryName = 'tfjs-backend-wasm.wasm';\n if (simdSupported && threadsSupported) {\n path = 'tfjs-
backend-wasm-threaded-simd.wasm';\n } else if (simdSupported) {\n path = 'tfjs-backend-wasm-simd.wasm';\n
}\n\n if (wasmFileMap != null) {\n if (wasmFileMap[path] != null) {\n return wasmFileMap[path];\n }\n
}\n\n return wasmModuleFolder + path;\n }\n\n\n /**\n * Initializes the wasm module and creates the js <-> wasm
bridge.\n * NOTE: We wrap the wasm module in a object with property 'wasm' instead of\n * returning
Promise<BackendWasmModule> to avoid freezing Chrome (last tested\n * in Chrome 76).\n */\n export async
function init(): Promise<{wasm: BackendWasmModule}> {\n const [simdSupported, threadsSupported] = await
Promise.all([\n env().getAsync('WASM_HAS_SIMD_SUPPORT'),\n
env().getAsync('WASM_HAS_MULTITHREAD_SUPPORT')\n]);\n\n return new Promise((resolve, reject) =>
{\n const factoryConfig: WasmFactoryConfig = {};\n\n /**\n * This function

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overrides the Emscripten module locateFile utility.\n * @param path The relative path to the file that needs to be
loaded.\n * @param prefix The path to the main JavaScript file's directory.\n */\n factoryConfig.locateFile =
(path, prefix) => {\n if (path.endsWith('.worker.js')) {\n const response = wasmWorkerContents;\n const
blob = new Blob([response], {type: 'application/javascript'});\n return URL.createObjectURL(blob);\n }\n if (path.endsWith('.wasm')) {\n return getPathToWasmBinary(\n simdSupported as boolean,
threadsSupported as boolean,\n wasmPathPrefix != null ? wasmPathPrefix : prefix);\n }\n return prefix
+ path;\n };
\n // Use the instantiateWasm override when system fetch is not available.\n // Reference:\n //
https://github.com/emscripten-core/emscripten/blob/2bca083cbbd5a4133db61fbd74d04f7feecfa907/tests/manual_wasm_instantiate.html#L170\n
if (customFetch) {\n
 factoryConfig.instantiateWasm =\n createInstantiateWasmFunc(getPathToWasmBinary(\n
simdSupported as boolean, threadsSupported as boolean,\n wasmPathPrefix != null ? wasmPathPrefix :
));\n }\n\n let initialized = false;\n factoryConfig.onAbort = () => {\n if (initialized) {\n // Emscripten
already called console.warn so no need to double log.\n return;\n }\n if (initAborted) {\n //
Emscripten calls `onAbort` twice, resulting in double error\n // messages.\n return;\n }\n initAborted
= true;\n const rejectMsg =\n 'Make sure the server can serve the `.wasm` file relative to the '+\n
'bundled js file. For more details see https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-wasm/README.md#using-bundlers';\n
 reject({message: rejectMsg});\n };\n\n let wasm:
Promise<BackendWasmModule>;\n // If `wasmPath` has been defined we must initialize
the vanilla module.\n if (threadsSupported && simdSupported && wasmPath == null) {\n
 factoryConfig.mainScriptUrlOrBlob = new Blob(\n [var WasmBackendModuleThreadedSimd = `+\n
wasmFactoryThreadedSimd.toString(),\n {type: 'text/javascript'});\n wasm =
wasmFactoryThreadedSimd(factoryConfig);\n } else {\n // The wasmFactory works for both vanilla and SIMD
binaries.\n wasm = wasmFactory(factoryConfig);\n }\n\n // The WASM module has been successfully
created by the factory.\n // Any error will be caught by the onAbort callback defined above.\n
wasm.then((module) => {\n initialized = true;\n initAborted = false;\n\n const voidReturnType: string =
null;\n // Using the tfjs namespace to avoid conflict with emscripten's API.\n module.tfjs = {\n init:
module.cwrap('init', null, []),\n initWithThreadCount:\n module.cwrap('init_with_threads_count', null,
['number']),\n getThreadCount:
module.cwrap('get_threads_count', 'number', []),\n registerTensor: module.cwrap(\n 'register_tensor',
null,\n [\n 'number', // id\n 'number', // size\n 'number', // memoryOffset\n
]),\n disposeData: module.cwrap('dispose_data', voidReturnType, ['number']),\n dispose:
module.cwrap('dispose', voidReturnType, []),\n resolve({wasm: module});\n });\n });\n\n function
typedArrayFromBuffer(\n buffer: ArrayBuffer, dtype: DataType): backend_util.TypedArray {\n switch (dtype)
{\n case 'float32':\n return new Float32Array(buffer);\n case 'int32':\n return new Int32Array(buffer);\n
 case 'bool':\n return new Uint8Array(buffer);\n default:\n throw new Error(`Unknown dtype ${dtype}`);\n
 }\n }\n\n const wasmBinaryNames = [\n 'tfjs-backend-wasm.wasm', 'tfjs-backend-wasm-simd.wasm',\n 'tfjs-backend-wasm-threaded-simd.wasm'\n] as const
;\n\n type WasmBinaryName = typeof wasmBinaryNames[number];\n\n let wasmPath: string = null;\n\n let
wasmPathPrefix: string = null;\n\n let wasmFileMap: {[key in WasmBinaryName]?: string} = {};\n\n let initAborted =
false;\n\n let customFetch = false;\n\n /**\n * @deprecated Use `setWasmPaths` instead.\n * Sets the path to the
`.wasm` file which will be fetched when the wasm\n * backend is initialized. See\n *
https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-wasm/README.md#using-bundlers\n * for more
details.\n * @param path wasm file path or url\n * @param usePlatformFetch optional boolean to use platform fetch
to download\n * the wasm file, default to false.\n */\n * @doc {heading: 'Environment', namespace: 'wasm'}\n
*/\n\n export function setWasmPath(path: string, usePlatformFetch = false): void {\n deprecationWarn(\n
'setWasmPath has been deprecated in favor of setWasmPaths and' +\n ' ' will be removed in a future release.);\n if
(initAborted) {\n throw new Error(\n

```

The WASM backend was already initialized. Make sure you call `tf.setWasmPath()` before you call `tf.setBackend()` or `tf.ready()`;

```

wasmPath = path;
customFetch = usePlatformFetch;

```

Configures the locations of the WASM binaries.

```

js
setWasmPaths({
 'tfjs-backend-wasm.wasm': 'renamed.wasm',
 'tfjs-backend-wasm-simd.wasm': 'renamed-simd.wasm',
 'tfjs-backend-wasm-threaded-simd.wasm': 'renamed-threaded-simd.wasm'
});
tf.setBackend('wasm');

```

`prefixOrFileMap` This can be either a string or object:

- (string) The path to the directory where the WASM binaries are located. Note that this prefix will be used to load each binary (vanilla, SIMD-enabled, threading-enabled, etc.).
- (object) Mapping from names of WASM binaries to custom full paths specifying the locations of those binaries. This is useful if your WASM binaries are not all located in the same directory,

or if your WASM binaries have been renamed.

```

@param usePlatformFetch optional boolean to use platform fetch to download the wasm file, default to false.

```

`@doc` {heading: 'Environment', namespace: 'wasm'}

```

export function setWasmPaths(
 prefixOrFileMap: string | {[key in WasmBinaryName]?: string},
 usePlatformFetch = false): void {
 if (initAborted) {
 throw new Error('The WASM backend was already initialized. Make sure you call `setWasmPaths()` before you call `tf.setBackend()` or `tf.ready()`');
 }
 if (typeof prefixOrFileMap === 'string') {
 wasmPathPrefix = prefixOrFileMap;
 } else {
 wasmFileMap = prefixOrFileMap;
 const missingPaths = wasmBinaryNames.filter(name =>
 wasmFileMap[name] == null);
 if (missingPaths.length > 0) {
 throw new Error('There were no entries found for the following binaries: `'+
 missingPaths.join(','). Please either call setWasmPaths with a `map providing a path for each binary, or with a string indicating the directory where all the binaries can be found.`');
 }
 }
 customFetch = usePlatformFetch;
}

```

```

Used in unit tests.
export function resetWasmPath(): void {
 wasmPath = null;
 wasmPathPrefix = null;
 wasmFileMap = {};
 customFetch = false;
 initAborted = false;
 let threadsCount = -1;
 let actualThreadsCount = -1;
}

```

`sets the number of threads that will be used by XNNPACK to create threadpool (default to the number of logical CPU cores). This must be called before calling tf.setBackend('wasm').`

```

export function setThreadsCount(numThreads: number) {
 threadsCount = numThreads;
}

```

`Gets the actual threads count that is used by XNNPACK. It is set after the backend is intialized.`

```

export function getThreadsCount(): number {
 if (actualThreadsCount === -1) {
 throw new Error('WASM backend not initialized.');
```

```

 }
 return actualThreadsCount;
}
export const wasmWorkerContents = 'var Module={};function threadPrintErr(){var text=Array.prototype.slice.call(arguments).join('\n');console.error(text)}function threadAlert(){var text=Array.prototype.slice.call(arguments).join('\n');postMessage({cmd:"alert",text:text,threadId:Module["_pthread_self"]()})}var err=threadPrintErr;this.alert=threadAlert;Module["instantiateWasm"]=function(info,receiveInstance){var instance=new WebAssembly.Instance(Module["wasmModule"],info);Module["wasmModule"]=null;receiveInstance(instance);return instance.exports};function moduleLoaded(){this.onmessage=function(e){try{if(e.data.cmd==="load"){Module["wasmModule"]=e.data.wasmModule;Module["wasmMemory"]=e.data.wasmMemory;Module["buffer"]=Module["wasmMemory"].buffer;Module["ENVIRONMENT_IS_PTHREAD"]=true;if(typeof e.data.urlOrBlob==="string"){importScripts(e.data.urlOrBlob)}else{var objectUrl=URL.createObjectURL(e.data.urlOrBlob);importScripts(objectUrl);URL.revokeObjectURL(objectUrl)}WasmBackendModuleThreadedSimd(Module).then(function(instance){Module=instance;moduleLoaded()})}else if(e.data.cmd==="objectTransfer"){Module["PThread"].receiveObjectTransfer(e.data)}else if(e.data.cmd==="run"){Module["__performance_now_clock_drift"]=performance.now()-e.data.time;Module["__emscripten_thread_init"](e.data.threadInfoStruct,0,0);var max=e.data.stackBase;var top=e.data.stackBase+e.data.stackSize;Module["establishStackSpace"](top,max);Module["__emscripten_tls_init"]();Module["PThread"].receiveObjectTransfer(e.data);Module["PThread"].setThreadStatus(Module["_pthread_self"]

```

```

};function threadPrintErr(){var text=Array.prototype.slice.call(arguments).join('\n');console.error(text)}function threadAlert(){var text=Array.prototype.slice.call(arguments).join('\n');postMessage({cmd:"alert",text:text,threadId:Module["_pthread_self"]()})}var err=threadPrintErr;this.alert=threadAlert;Module["instantiateWasm"]=function(info,receiveInstance){var instance=new

```

```

WebAssembly.Instance(Module["wasmModule"],info);Module["wasmModule"]=null;receiveInstance(instance);return instance.exports};function

```

```

moduleLoaded(){this.onmessage=function(e){try{if(e.data.cmd==="load"){Module["wasmModule"]=e.data.wasmModule;Module["wasmMemory"]=e.data.wasmMemory;Module["buffer"]=Module["wasmMemory"].buffer;Module["ENVIRONMENT_IS_PTHREAD"]=true;if(typeof

```

```

e.data.urlOrBlob==="string"){importScripts(e.data.urlOrBlob)}else{var objectUrl=URL.createObjectURL(e.data.urlOrBlob);importScripts(objectUrl);URL.revokeObjectURL(objectUrl)}WasmBackendModuleThreadedSimd(Module).then(function(instance){Module=instance;moduleLoaded()})}else

```

```

if(e.data.cmd==="objectTransfer"){Module["PThread"].receiveObjectTransfer(e.data)}else if(e.data.cmd==="run"){Module["__performance_now_clock_drift"]=performance.now()-

```

```

e.data.time;Module["__emscripten_thread_init"](e.data.threadInfoStruct,0,0);var max=e.data.stackBase;var top=e.data.stackBase+e.data.stackSize;Module["establishStackSpace"](top,max);Module["__emscripten_tls_init"]();Module["PThread"].receiveObjectTransfer(e.data);Module["PThread"].setThreadStatus(Module["_pthread_self"]

```

```

\"])},1);try{var
result=Module["invokeEntryPoint"](e.data.start_routine,e.data.arg);if(!Module["getNoExitRuntime"]())Module["PThread"].threadExit(result)}catch(ex){if(ex===\Canceled!"){Module["PThread"].threadCancel()}else
if(ex!==\unwind"){if(ex instanceof
Module["ExitStatus"]){if(Module["getNoExitRuntime"]()){}}else{Module["PThread"].threadExit(ex.status)}}else
se{Module["PThread"].threadExit(-2);throw
ex}}}}else
if(e.data.cmd===\cancel){if(Module["_pthread_self"]()){Module["PThread"].threadCancel()}else
if(e.data.target===\setimmediate){}else
if(e.data.cmd===\processThreadQueue){if(Module["_pthread_self"]()){Module["_emscripten_current_thread_
process_queued_calls"]())}else{err(\worker.js received unknown command
\+e.data.cmd);err(e.data)}}catch(ex){err(\worker.js onmessage() captured an uncaught exception:
\+ex);if(ex&&ex.stack)err(ex.stack);throw ex}};if(typeof process===\object"&&typeof
process.versions===\object"&&typeof process.versions.node===\string"){self={location:{href:__filename}}};var
onmessage=this.onmessage;var
nodeWorkerThreads=require(\worker_threads");global.Worker=nodeWorkerThreads.Worker;var
parentPort=nodeWorkerThreads.parentPort;parentPort.on(\message",function(data){onmessage({data:data})});var
nodeFS=require(\fs");var nodeRead=function(filename){return
nodeFS.readFileSync(filename,\utf8");function
globalEval(x){global.require=require;global.Module=Module;eval.call(null,x)}importScripts=function(f){globalEval(
nodeRead(f));postMessage=function(msg){parentPort.postMessage(msg)};if(typeof
performance===\undefined"){performance={now:function(){return Date.now()}}};",\/** @license See the
LICENSE file. *\n\n// This code is auto-generated, do not modify this file!\nconst version = '3.11.0';\nexport
{version};\n",\/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \AS IS\ BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND,
either express or implied.\n * See the License for the specific language governing permissions and\n * limitations
under the License.\n *
=====\n
*\n\nimport './flags_wasm';\n\nimport {registerBackend} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm,
init} from './backend_wasm';\n\nexport {BackendWasm, getThreadsCount, setThreadsCount, setWasmPath,
setWasmPaths} from './backend_wasm';\n\nexport {version as version_wasm} from './version';\n\nconst
WASM_PRIORITY = 2;\nregisterBackend('wasm', async () => {\n const {wasm} = await init();\n return new
BackendWasm(wasm);\n},
WASM_PRIORITY);\n"],"names":["CppType","FusableActivation","wasmFusedMatMul","fusedMatMulConfig",
"kernelName","_FusedMatMul","backendName","setupFunc","backend","wasm","cwrap","kernelFunc","args","inpu
ts","attrs","a","b","bias","preluActivationWeights","dtype","Error","transposeA","transposeB","activation","leaky
eluAlpha","aId","dataIdMap","get","dataId","id","bId","biasId","biasData","shape","length","preluActivationWeigh
tSId","fusedActivation","leftDim","rightDim","batchDim","out","makeOutput","outId","aShapeBytes","Uint8Array",
"Int32Array","buffer","bShapeBytes","createUnaryKernelConfig","outType","wasmFunc","x","xId","util","sizeFrom
Shape","absConfig","Abs","createBinaryKernelConfig","supportsFullBroadcast","outputType","newShape","back
end_util","assertAndGetBroadcastShape","aBroadcastDims","getBroadcastDims","bBroadcastDims","loopsOverAll
OfA","every","v","i","loopsOverAllOfB","addConfig","Add","addNConfig","AddN","inputIds","map","inputIdsByt
es","identity","inVals","typedArrayFromHeap","set","identityConfig","Identity","wasmTranspose","transpose","red
ucedShape","perm","newPerm","push","minValIdx","j","removeOneSizeDims","permIsNoOp","outShape","inShap
e","Array","computeOutShape","cloned","permBytes","xShapeBytes","transposeConfig","Transpose","permuteAxe

```

sAndTranspose", "axis", "xShape", "xRank", "originalAxes", "parseAxisParam", "axes", "permutedAxes", "getAxesPermutation", "xTransposed", "inputWasTransposed", "getInnerMostAxes", "transposed", "wasmAll", "allConfig", "All", "keepDims", "inputId", "input", "inputRank", "assertAxesAreInnerMostDims", "reduceShape", "computeOutAndReduceShapes", "reduceSize", "disposeData", "expandShapeToKeepDim", "wasmAny", "anyConfig", "Any", "argMaxConfig", "ArgMax", "transposedId", "slice", "outerSize", "innerSize", "wasmAvgPool", "avgPoolConfig", "AvgPool", "filterSize", "strides", "pad", "dimRoundingMode", "convInfo", "computePool2DInfo", "filterHeight", "filterWidth", "padTop", "padInfo", "top", "padRight", "right", "padBottom", "bottom", "padLeft", "left", "strideHeight", "strideWidth", "channels", "inChannels", "dataFormat", "dilationWidth", "dilationHeight", "reshape", "xSize", "\$shape", "inferFromImplicitShape", "assert", "incRef", "reshapeConfig", "Reshape", "wasmBatchMatMul", "batchMatMulConfig", "BatchMatMul", "aRank", "bRank", "innerShapeA", "innerShapeB", "outerShapeA", "outerShapeB", "outerDimsA", "outerDimsB", "batchDimA", "batchDimB", "batchDimsCompatible", "concat", "b3dShape", "a3d", "b3d", "a3dId", "b3dId", "Math", "max", "sliceImpl", "vals", "begin", "size", "isContinous", "slice\_util", "isSliceContinous", "xStrides", "computeStrides", "flatOffset", "computeFlatOffset", "subarray", "decodedData", "fromUint8ToStringArray", "inBuf", "outBuf", "outLoc", "indexToLoc", "inLoc", "idx", "fromStringArrayToUint8", "values", "begin\_", "size\_", "parseSliceParams", "xVals", "readSync", "outData", "stringBytes", "res", "sliceImplCPU", "outVals", "rank", "xStride", "outOffset", "beginI", "beginJ", "endI", "xOffset", "slice2d", "xStride1", "xStride2", "beginK", "endJ", "slice3d", "xStride3", "endK", "beginL", "k", "slice4d", "sliceConfig", "Slice", "batchToSpaceNDConfig", "BatchToSpaceND", "blockShape", "crops", "prod", "reduce", "reshaped", "getReshaped", "permuted", "getPermuted", "reshapedPermuted", "getReshapedPermuted", "sliceBeginCoords", "getSliceBeginCoords", "sliceSize", "getSliceSize", "xReshaped", "result", "cast", "castConfig", "Cast", "ceilConfig", "Ceil", "wasmClip", "clipByValueConfig", "ClipByValue", "clipValueMin", "clipValueMax", "t", "\$inputs", "filter", "shapes", "assertParamsConsistent", "inputs2D", "inputsValShapes", "simplyConcat", "getArrayFromDType", "offset", "forEach", "colOffset", "tIdx", "row", "resIdx", "col", "concatImplCPU", "finalOutShape", "sumInnerDims", "innerDims", "innerDim", "inOffset", "concatConfig", "Concat", "wasmConv2d", "conv2DConfig", "Conv2D", "filterId", "dilations", "\$dataFormat", "convertConv2DDataFormat", "computeConv2DInfo", "inputChannels", "outputChannels", "outChannels", "isSamePad", "type", "wasmConv2DBackpropInput", "conv2DBackpropInputConfig", "Conv2DBackpropInput", "dy", "inputShape", "batchSize", "inHeight", "inWidth", "outHeight", "outWidth", "topPad", "leftPad", "isChannelsLast", "dxStrides", "dyStrides", "fltS0", "fltS1", "fltS2", "xBatchStride", "xRowStride", "xColStride", "xChannelStride", "yBatchStride", "yRowStride", "yColStride", "yChannelStride", "dyId", "cosConfig", "Cos", "coshConfig", "Cosh", "InterpolationMethod", "wasmCropAndResize", "cropAndResizeConfig", "CropAndResize", "method", "extrapolationValue", "cropSize", "image", "boxes", "boxInd", "numBoxes", "cropHeight", "cropWidth", "castedData", "imagesData", "imagesId", "boxesId", "boxIndId", "imagesShapeBytes", "wasmCumsum", "cumsumConfig", "Cumsum", "exclusive", "reverse", "permutation", "permutedX", "permutedAxis", "permutedOut", "finalDim", "permutedXId", "permutedOutId", "getUndoAxesPermutation", "wasmDepthToSpace", "depthToSpaceConfig", "DepthToSpace", "blockSize", "outputHeight", "outputWidth", "outputDepth", "outputShape", "xStridesBytes", "outputShapeBytes", "outStridesBytes", "wasmDepthwiseConv2d", "depthwiseConv2dNativeConfig", "DepthwiseConv2dNative", "\$dilations", 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orPaddingMode", "wasmMirrorPad", "mirrorPadConfig", "MirrorPad", "paddings", "mode", "p", "prePaddingsFlat", "pad Tuple", "postPaddingsFlat", "prePaddingsBytes", "postPaddingsBytes", "multiplyConfig", "Multiply", "negConfig", "Neg", "parseResultStruct", "resOffset", "HEAPU8", "pSelectedIndices", "selectedSize", "pSelectedScores", "pValidOutputs", "\_free", "nonMaxSuppressionV3Config", "NonMaxSuppressionV3", "iouThreshold", "maxOutputSize", "scoreThreshold", "scores", "scoresId", "nonMaxSuppressionV4Config", "NonMaxSuppressionV4", "padToMaxOutputSize", "nonMaxSuppressionV5Config", "NonMaxSuppressionV5", "softNmsSigma", "notEqualConfig", "NotEqual", "wasmOneHot", "oneHotConfig", "OneHot", "depth", "onValue", "offValue", "onesLikeConfig", "OnesLike", "packConfig", "Pack", "assertShapesMatch", "intermediateTensorInfos", "expandedT", "wasmPadV2", "padV2Config", "PadV2", "constantValue", "powConfig", "Pow", "wasmPrelu", "preluConfig", "Prelu", "weightsId", "wasmProd", "prodConfig", "Prod", 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"spaceToBatchNDConfig", "SpaceToBatchND", "completePaddings", "paddedX", "reshapedPaddedShape", "permutedReshapedPaddedPermutation", "flattenShape", "paddedXReshaped", "paddedXT", "splitVConfig", "SplitV", "numOrSizeSplits", "\$axis", "splitSizes", "prepareSplitSize", "s", "xSliceSize", "xSlice", "sqrtConfig", "Sqrt", "squareConfig", "Square", "squaredDifferenceConfig", "SquaredDifference", "wasmStep", "stepConfig", "Step", "wasmStridedSlice", "stridedSliceConfig", "StridedSlice", "end", "beginMask", "endMask", "ellipsisMask", "newAxisMask", "shrinkAxisMask", "finalShapeSparse", "finalShape", "isIdentity", "sliceDim0", "isSimpleSlice", "\$begin", "\$end", "\$strides", "sliceInfo", "sliced", "beginBytes", "endBytes", "subConfig", "Sub", "wasmSum", "sumConfig", "Sum", "tanConfig", "Tan", "tanhConfig", "Tanh", "wasmTile", "wasmTopK", "wasmTransform", "kernelConfigs", "Tile", "reps", "newShapeBytes", "TopK", "sorted", "outValues", "outValuesId", "outIndices", "outIndicesId", "Transform", 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"readBinary", "nodeFS", "nodePath", "scriptDirectory", "locateFile", "path", "nodeWorkerThreads", "require\$\$0", "dirname", "\_\_dirname", "filename", "binary", "require\$\$1", "ret", "replace", "ex", "ExitStatus", "abort", "require\$\$2", "console", "error", "global", "Worker", "read", "f", "data", "readbuffer", "scriptArgs", "quit", "print", "log", "warn", "printErr", "self", "location", "href", "indexOf", "substr", "lastIndexOf", "url", "xhr", "XMLHttpRequest", "open", "send", "responseText", "responseType", "response", "onload", "onerror", "performance", "require\$\$3", "wasmBinary", "bind", "err", "warnOnce", "text", "shown", "wasmModule", "noExitRuntime", "ABORT", "getCFunc", "ident", "func", "ccall", "returnType", "argTypes", "opts", "toC", "string", "str", "len", "stringToUTF8", "stackAlloc", "array", "arr", "writeArrayToMemory", "cArgs", "stack", "converter", "stackSave", "apply", "UTF8ToString", "Boolean", "convertReturnValue", "stackRestore", "numericArgs", "arguments", "UTF8ArrayToString", "heap", "maxBytesToRead", "endIdx", "u0", "u1", "u2", "String", "fromCharCode", "ch", "ptr", "stringToUTF8Array", "outIdx", "maxBytesToWrite", "startIdx", "u", "charCodeAt", "outPtr", "lengthBytesUTF8", "alignUp", "multiple", "buf", "Int8Array", "Int16Array", "Uint16Array", "Uint32Array", "Float32Array", "Float64Array", "wasmTable", "INITIAL\_MEMORY", "Memory", "initial", "maximum", "shared", "byteLength", "\_\_ATPRERUN\_\_", "\_\_ATINIT\_\_", "\_\_ATMAIN\_\_", "\_\_ATPOSTRUN\_\_", "preRun", "addOnPreRun", "shift", "callRuntimeCallb

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```
=====\n*\n\nimport {backend_util, GatherV2, GatherV2Attrs, GatherV2Inputs,
KernelConfig, KernelFunc, Tensor, TensorInfo, TypedArray, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {reshape} from './Reshape';\n\nimport {CppType} from './types';\n\nlet wasmGather: (\n xId: number, dtype: CppDType, xStrides: Uint8Array, stridesSize: number,\n indicesId: number, batchSize: number, outStrides: Uint8Array,\n outId: number) => void;\n\nfunction
setup(backend: BackendWasm): void {\n wasmGather = backend.wasm.cwrap('Gather', null /*void*/, [\n 'number', // xId\n 'number', // dtype\n 'array', // xStrides\n 'number', // stridesSize\n 'number', //
indicesId\n 'number', // batchSize\n 'array', // outStrides\n 'number' // outId\n]);\n\n function gatherV2(\n args: {backend: BackendWasm, inputs: GatherV2Inputs, attrs: GatherV2Attrs}):
TensorInfo {\n const {backend, inputs, attrs} = args;\n const {x, indices} = inputs;\n const {axis, batchDims} = attrs;\n\n //
Throw error when any index is out of bound.\n const parsedAxis = util.parseAxisParam(axis, x.shape)[0];\n const indicesVals = backend.readSync(indices.dataId) as TypedArray;\n const axisDim = x.shape[parsedAxis];\n for (let i = 0; i < indicesVals.length; ++i) {\n const index = indicesVals[i];\n util.assert(\n index <= axisDim - 1 &&
index >= 0,\n () =>`\n `GatherV2: the index value ${index} is not in [0, ${axisDim - 1}]);\n }\n\n const shapeInfo = backend_util.segment_util.collectGatherOpShapeInfo(\n x as Tensor, indices as Tensor, parsedAxis,
batchDims);\n\n const flattenX = reshape({\n inputs: {x},\n attrs: {\n shape: [\n shapeInfo.batchSize,
shapeInfo.outerSize, shapeInfo.dimSize,\n shapeInfo.sliceSize\n]\n },\n backend\n });\n const indicesSize = util.sizeFromShape(indices.shape);\n const flattenIndex = reshape({\n inputs: {x: indices},\n attrs: {
shape: [shapeInfo.batchSize, indicesSize / shapeInfo.batchSize]},\n backend\n });\n const flattenOutputShape = [\n shapeInfo.batchSize, shapeInfo.outerSize, indicesSize /
shapeInfo.batchSize,\n shapeInfo.sliceSize\n];\n const out = backend.makeOutput(flattenOutputShape,
```

```
x.dtype);\n if (util.sizeFromShape(x.shape) === 0) {\n return out;\n }\n const stridesSize = flattenX.shape.length\n - 1;\n const xData = backend.dataIdMap.get(flattenX.dataId);\n const xId = xData.id;\n const indicesData =\n backend.dataIdMap.get(flattenIndex.dataId);\n const indicesId = indicesData.id;\n const outId =\n backend.dataIdMap.get(out.dataId).id;\n const xStridesBytes = new Uint8Array(\n new\n Int32Array(util.computeStrides(flattenX.shape)).buffer);\n const outStridesBytes = new Uint8Array(\n new\n Int32Array(util.computeStrides(flattenOutputShape)).buffer);\n const wasmGather(\n xId, CppDType[x.dtype],\n xStridesBytes, stridesSize, indicesId,\n shapeInfo.batchSize, outStridesBytes, outId);\n backend.disposeData(flattenX.dataId);\n\n backend.disposeData(flattenIndex.dataId);\n // reshape\n out.shape = shapeInfo.outputShape;\n return\n out;\n}\n\nexport const gatherV2Config: KernelConfig = {\n kernelName: GatherV2,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: gatherV2 as {} as KernelFunc\n};\n\n}}}
```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/GatherV2.js.map

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=====\n
```

```
\n\nimport {KernelConfig, KernelFunc, LeakyRelu, LeakyReluAttrs,\n LeakyReluInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from\n './backend_wasm';\nimport {CppType} from './types';\n\nlet wasmFunc: (\n xId: number, dtype: number,\n leakyreluAlpha: number, outId: number) => void;\n\nfunction setupFunc(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(LeakyRelu, null / void */, [\n 'number', // x_id\n 'number', // dtype\n 'number', // leakyrelu_alpha\n 'number', // out_id\n]);\n\nexport function leakyRelu(\n args: {\n inputs:\n LeakyReluInputs, attrs: LeakyReluAttrs, backend: BackendWasm\n }):\n TensorInfo {\n const {inputs: {x}, attrs:\n {alpha}, backend} = args;\n\n const xId = backend.dataIdMap.get(x.dataId).id;\n // According to TF API,\n LeakyRelu returns float32 when input is either float32\n // or int32.\n const out = backend.makeOutput(x.shape,
```



No license file was found, but licenses were detected in source scan.

```
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 *
```

```
=====\n
*\n
\nimport {KernelConfig, KernelFunc, TensorInfo, TopK, TopKAttrs, TopKInputs} from '@tensorflow/tfjs-
core';\n
\nimport {BackendWasm} from './backend_wasm';\n
\nimport {CppType} from './types';\n
\nlet wasmTopK:
(\n xId: number, xShapeBytes: Uint8Array, xShapeLength: number,\n xDtype: CppDType, k: number, sorted:
boolean, outValuesId: number,\n outIndicesId: number) => void;\n
\nfunction setup(backend: BackendWasm) {\n
 wasmTopK = backend.wasm.cwrap(TopK, null /* void */, [\n 'number', // xId\n 'array', // x.shape\n 'number',
// x.shape.length\n 'number', // x.dtype\n 'number', // k\n 'bool',
// sorted\n 'number', // outValuesId\n 'number', // outIndicesId\n]);\n
\n \nextport const topk:\n (\n args:
{inputs: TopKInputs, backend: BackendWasm, attrs: TopKAttrs}) =>\n TensorInfo[] | TensorInfo = ({inputs,
backend, attrs}) => {\n const {x} = inputs;\n const {k, sorted} = attrs;\n const xId =
backend.dataIdMap.get(x.dataId).id;\n const xShapeBytes = new Uint8Array(new
Int32Array(x.shape).buffer);\n const outputShape = x.shape.slice();\n outputShape[outputShape.length -
1] = k;\n const outValues = backend.makeOutput(outputShape, x.dtype);\n const outValuesId =
backend.dataIdMap.get(outValues.dataId).id;\n const outIndices = backend.makeOutput(outputShape,
'int32');\n const outIndicesId = backend.dataIdMap.get(outIndices.dataId).id;\n wasmTopK(\n xId, xShapeBytes, x.shape.length, CppDType[x.dtype], k, sorted,\n outValuesId, outIndicesId);\n return [outValues, outIndices];\n });\n
\n \nextport const topKConfig: KernelConfig = {\n kernelName:
TopK,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: topk as { } as KernelFunc,\n };
\n}
```



Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/TopK.js.map

No license file was found, but licenses were detected in source scan.

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```

```
=====\n*\n\nimport { KernelConfig, KernelFunc, OneHot, OneHotAttrs, OneHotInputs } from
 '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nlet wasmOneHot: (\n indicesId:
number, depth: number, onValue: number, offValue: number,\n outId: number) => void;\n\nfunction
setup(backend: BackendWasm) {\n wasmOneHot = backend.wasm.cwrap(OneHot, null /* void */, [\n 'number',
// indices_id\n 'number', // depth,\n 'number', // onValue\n 'number', // offValue\n 'number' // out_id\n
]);\n}\n\nfunction oneHot(\n args: { inputs: OneHotInputs, attrs: OneHotAttrs, backend: BackendWasm }) {\n
const { inputs, backend, attrs } = args;\n const { indices } = inputs;\n const { depth, onValue, offValue } =
attrs;\n const out = backend.makeOutput([...indices.shape, depth], 'int32');\n const outId =
backend.dataIdMap.get(out.dataId).id;\n const indicesData = backend.dataIdMap.get(indices.dataId);\n const
indicesId = indicesData.id;\n wasmOneHot(indicesId, depth, onValue, offValue, outId);\n return
out;\n}\n\nexport const oneHotConfig:
 KernelConfig = {\n kernelName: OneHot,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: oneHot as
 {} as KernelFunc,\n};\n}
```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/OneHot.js.map

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governing permissions and\n * limitations under the License.\n *
```

```
=====\n
*\nimport {KernelConfig, NotEqual} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from
'./binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const notEqualConfig: KernelConfig =\ncreateBinaryKernelConfig(NotEqual, supportsFullBroadcast, 'bool');\n\n"]}
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Found in path(s):

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* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
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* limitations under the License.
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```
=====\n*\n\nimport { backend_util, KernelConfig, KernelFunc, MaxPool, MaxPoolAttrs, MaxPoolInputs, Tensor4D, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nlet wasmMaxPool: (\n xId: number, batchSize: number, inputHeight: number, inputWidth: number, filterHeight: number, filterWidth: number, padTop: number, padRight: number, padBottom: number, padLeft: number, dilationHeight: number, dilationWidth: number, strideHeight: number, strideWidth: number, inputChannels: number, outputChannels: number, outId: number) => void;\nfunction setup(backend: BackendWasm) {\n wasmMaxPool = backend.wasm.cwrap(MaxPool, null /* void */, [\n 'number', // xId\n 'number', // batchSize\n 'number', // inputHeight\n 'number', // inputWidth\n 'number', // filterHeight\n 'number', // filterWidth\n 'number', // padTop\n 'number', // padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', // dilationHeight\n 'number', // dilationWidth\n 'number', // strideHeight\n 'number', // strideWidth\n 'number', // inputChannels\n 'number', // outputChannels\n 'number', // outId\n]);\n function maxPool(\n args: { inputs: MaxPoolInputs, backend: BackendWasm, attrs: MaxPoolAttrs }) {\n const { inputs, attrs, backend } = args;\n const x = inputs.x as Tensor4D;\n const xId =
```

```

backend.dataIdMap.get(x.dataId).id;\n\n // TF API supports int32 input. CPU and WebGL backend also support
int32\n // input. WASM backend doesn't support it because it uses xnnpack which only\n // supports float32.\n\n // Add the following assert only for the WASM backend instead of at core op\n // level.\n\n // TODO: add
support for int32 input.\n util.assert(\n x.dtype === 'float32',\n () =>\n `Error in MaxPool: only float32 input is supported. Got ${x.dtype}.`);\n\n const {filterSize,
strides, pad, dimRoundingMode} = attrs;\n const convInfo = backend_util.computePool2DInfo(\n x.shape,
filterSize, strides, 1 /* dilations */, pad, dimRoundingMode);\n\n const filterHeight = convInfo.filterHeight;\n const
filterWidth = convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const padRight =
convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n const padLeft = convInfo.padInfo.left;\n
const dilationHeight = convInfo.dilationHeight;\n const dilationWidth = convInfo.dilationWidth;\n const
strideHeight = convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n const inputChannels =
convInfo.inChannels;\n const outputChannels = convInfo.outChannels;\n\n if (convInfo.dataFormat !==
'channelsLast') {\n throw new Error(\n `wasm backend does not support dataFormat: ` +\n
`${convInfo.dataFormat}`);\n }\n\n Please use 'channelsLast'.);\n }\n\n const out = backend.makeOutput(convInfo.outShape, 'float32');\n const outId
= backend.dataIdMap.get(out.dataId).id;\n\n wasmMaxPool(\n xId, x.shape[0], x.shape[1], x.shape[2],
filterHeight, filterWidth,\n padTop, padRight, padBottom, padLeft, dilationHeight, dilationWidth,\n
strideHeight, strideWidth, inputChannels, outputChannels, outId);\n return out;\n}\n\nexport const maxPoolConfig:
KernelConfig = {\n kernelName: MaxPool,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: maxPool
as { } as KernelFunc\n};\n"}

```

Found in path(s):

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* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
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```
=====\n*\n\nimport { KernelConfig, KernelFunc, RotateWithOffset, RotateWithOffsetAttrs, RotateWithOffsetInputs, TensorInfo } from '@tensorflow/tfjs-core';\nimport { backend_util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nlet wasmRotate: (\n xId: number, batch: number, imageHeight: number, imageWidth: number,\n numChannels: number, radians: number, centerX: number, centerY: number,\n fillBytes: Uint8Array, fillLength: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmRotate = backend.wasm.cwrap(RotateWithOffset, null /* void */, [\n 'number', // xId\n 'number', // batch\n 'number', // imageHeight\n 'number', // imageWidth\n 'number', // numChannels\n 'number', // radians\n 'number', // centerX\n 'number', // centerY\n 'array', // fillBytes\n 'number', // fillLength\n 'number', // outId\n]);\n\n export function rotateWithOffset(args: {\n inputs: RotateWithOffsetInputs,\n backend: BackendWasm,\n attrs: RotateWithOffsetAttrs\n }): TensorInfo {\n const { inputs, backend, attrs } = args;\n const { image } = inputs;\n const { radians, fillValue, center } = attrs;\n\n const out = backend.makeOutput(image.shape, image.dtype);\n const imageId = backend.dataIdMap.get(image.dataId).id;\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const [batch, imageHeight, imageWidth, numChannels] = image.shape;\n const [centerX, centerY] =\n backend_util.getImageCenter(center, imageHeight, imageWidth);\n\n const fillIsBlack = fillValue === 0;\n const fullOpacityValue = 255;\n\n const fillValues = typeof fillValue === 'number' ?\n [fillValue, fillValue, fillValue, fillIsBlack ? 0 : fullOpacityValue] :\n [...fillValue, fullOpacityValue];\n\n const fillBytes = new Uint8Array(new Int32Array(fillValues).buffer);\n\n wasmRotate(\n imageId, batch, imageHeight, imageWidth, numChannels,\n radians, centerX, centerY, fillBytes, fillValues.length, outId);\n\n return out;\n }\n\n export const rotateWithOffsetConfig: KernelConfig = {\n kernelName: RotateWithOffset,\n backendName: 'wasm',\n kernelFunc: rotateWithOffset as {} as KernelFunc,\n setupFunc: setup\n };
}
```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/RotateWithOffset.js.map

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```
=====\n*\n\nimport {backend_util, KernelConfig, KernelFunc, Mean, MeanAttrs, MeanInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {cast} from './Cast';\nimport
{permuteAxesAndTranspose} from './kernel_utils';\nlet wasmMean: (xId: number, reduceSize: number, outId:
number) => void;\nfunction setup(backend: BackendWasm): void {\n wasmMean =\n backend.wasm.cwrap(Mean, null /*void*/, ['number, number, number']);\n}\n\nexport function mean(\n args:
{backend: BackendWasm, inputs: MeanInputs, attrs: MeanAttrs}):
TensorInfo {\n const {backend, inputs,
 attrs} = args;\n const
 {axis, keepDims} = attrs;\n const {x} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId =
 xId;\n let input = x;\n const {transposed, axes, originalAxes, inputWasTransposed} =\n permuteAxesAndTranspose(x, axis, backend);\n let reductionAxes = axes;\n if (inputWasTransposed) {\n const
 transposedId = backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId !== xId) {\n // transpose was
 not a no-op. We will need to dispose of this\n // once we are done.\n input = transposed;\n inputId =
 transposedId;\n reductionAxes = backend_util.getInnerMostAxes(\n reductionAxes.length,
 input.shape.length);\n }\n }\n backend_util.assertAxesAreInnerMostDims(\n 'mean', reductionAxes,
 input.shape.length);\n const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n const reduceSize =
 util.sizeFromShape(reduceShape);\n let castedInput = input;\n if (input.dtype
 !== 'float32') {\n castedInput =\n cast({backend, inputs: {x: input}, attrs: {dtype: 'float32'}});\n inputId =
 backend.dataIdMap.get(castedInput.dataId).id;\n }\n const out = backend.makeOutput(outShape, 'float32');\n if
 (util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n }\n}
```

```
wasmMean(inputId, reduceSize, outId);\n }\n\n if (inputWasTransposed) {\n // dispose of the transposed\n tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const newShape =\n backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n if (input.dtype\n !== 'float32') {\n backend.disposeData(castedInput.dataId);\n }\n\n return out;\n}\n\nexport const meanConfig:\n KernelConfig = {\n kernelName: Mean,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: mean as }
as KernelFunc\n};\n"}\n}}
```

Found in path(s):

```
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Mean.js.map
```

No license file was found, but licenses were detected in source scan.

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```
=====\n*\n\nimport * as tf from '@tensorflow/tfjs-core';\nimport {registerBackend, removeBackend, test_util, util} from\n '@tensorflow/tfjs-core';\n// tslint:disable-next-line:no-imports-from-dist\nimport {ALL_ENVS, BROWSER_ENVS,\n describeWithFlags} from '@tensorflow/tfjs-core/dist/jasmine_util';\nimport {init, resetWasmPath} from\n './backend_wasm';\nimport\n {BackendWasm, setWasmPath, setWasmPaths} from './index';\n\n/**\n * Tests specific to the wasm backend. The\n name of these tests must start with\n * 'wasm' so that they are always included in the test runner. See\n *\n `env.specFilter` in `setup_test.ts` for details.\n *\n\ndescribeWithFlags('wasm read/write', ALL_ENVS, () => {\n it('write and read values', async () => {\n const x = tf.tensor1d([1, 2, 3]);\n test_util.expectArraysClose([1, 2, 3],\n await x.data());\n });\n it('allocate repetitively and confirm reuse of heap space', () => {\n const backend =\n tf.backend() as BackendWasm;\n const size = 100;\n // Allocate for the first time, record the memory offset and\n dispose.\n const t1 = tf.zeros([size]);\n const memOffset1 = backend.getMemoryOffset(t1.dataId);\n t1.dispose();\n // Allocate again and make sure the offset is the same (memory was reused).\n const t2 =\n tf.zeros([size]);\n const memOffset2 = backend.getMemoryOffset(t2.dataId);\n\n // This should fail in case of a memory leak.\n expect(memOffset1).toBe(memOffset2);\n });\n it('allocates\n buffers with byteOffsets', async () => {\n const data = [-0.5, 0.5, 3.14];\n const buffer = new ArrayBuffer(32);\n const view = new Float32Array(buffer, 8, data.length);\n\n // Write values to buffer.\n for (let i = 0; i <\n data.length; ++i) {\n view[i] = data[i];\n }\n const t = tf.tensor(view);\n // Tensor values should match.\n test_util.expectArraysClose(await t.data(), view);\n });\n\ndescribeWithFlags('wasm init', BROWSER_ENVS,\n () => {\n beforeEach(() => {\n registerBackend('wasm-test', async () => {\n const {wasm} = await init();\n return new BackendWasm(wasm);\n }, 100);\n\n // Silences backend registration warnings.\n spyOn(console,\n 'warn');\n spyOn(console, 'log');\n });\n\n afterEach(() => {\n resetWasmPath();\n removeBackend('wasm-\n test');\n });\n\n it('backend init fails when the\n path is invalid', async () => {\n setWasmPath('invalid/path');\n let wasmPath: string;\n const realFetch =\n fetch;\n spyOn(self, 'fetch').and.callFake((path: string) => {\n wasmPath = path;\n return realFetch(path);\n });\n expect(await tf.setBackend('wasm-test')).toBe(false);\n expect(wasmPath).toBe('invalid/path');\n });\n\n it('backend init fails when setWasmPaths is called with '\n +\n 'an invalid prefix',\n async () => {\n setWasmPaths('invalid/prefix/');\n let wasmPath: string;\n const realFetch = fetch;\n spyOn(self,\n 'fetch').and.callFake((path: string) => {\n wasmPath = path;\n return realFetch(path);\n });\n expect(await tf.setBackend('wasm-test')).toBe(false);\n expect(wasmPath).toContain('invalid/prefix');\n });\n\n it('backend init fails when setWasmPaths is called with '\n +\n 'an invalid fileMap',\n async () => {\n setWasmPaths({\n 'tfjs-backend-wasm.wasm':\n 'invalid/path',\n 'tfjs-backend-wasm-simd.wasm': 'invalid/path',\n 'tfjs-backend-wasm-threaded-\n simd.wasm': 'invalid/path'\n });\n let wasmPathPrefix: string;\n const realFetch = fetch;\n spyOn(self,\n 'fetch').and.callFake((path: string) => {\n wasmPathPrefix = path;\n return realFetch(path);\n });\n expect(await tf.setBackend('wasm-test')).toBe(false);\n expect(wasmPathPrefix).toBe('invalid/path');\n });\n\n it('setWasmPaths throws error when called without specifying a path for '\n +\n 'each binary',\n async () => {\n
```

```

 expect(() => {\n setWasmPaths({\n 'tfjs-backend-wasm.wasm': '/base/wasm-out/tfjs-backend-
wasm.wasm'\n });\n }).toThrow();\n });\n it('backend init works when the path is valid and use
platform fetch',\n async () => {\n const usePlatformFetch = true;\n const validPrefix = '/base/wasm-out';\n setWasmPaths(validPrefix,\n usePlatformFetch);\n let wasmPath: string;\n const realFetch = util.fetch;\n spyOn(util,\n 'fetch').and.callFake((path: string) => {\n wasmPath = path;\n return realFetch(path);\n });\n expect(await tf.setBackend('wasm-test')).toBe(true);\n const validPaths = new Set([\n validPrefix + 'tfjs-backend-
wasm.wasm',\n validPrefix + 'tfjs-backend-wasm-simd.wasm',\n validPrefix + 'tfjs-backend-
wasm-threaded-simd.wasm',\n]);\n expect(validPaths).toContain(wasmPath);\n });\n it('backend init
works when the wasm paths overrides map is valid and ' +\n 'using platform fetch',\n async () => {\n const usePlatformFetch = true;\n const validPrefix = '/base/wasm-out';\n setWasmPaths(\n {\n 'tfjs-backend-wasm.wasm': '/base/wasm-out/tfjs-backend-wasm.wasm',\n 'tfjs-backend-wasm-simd.wasm':\n '/base/wasm-out/tfjs-backend-wasm-simd.wasm',\n 'tfjs-backend-wasm-threaded-simd.wasm':\n '/base/wasm-out/tfjs-backend-wasm-threaded-
simd.wasm'\n },\n usePlatformFetch);\n let wasmPath: string;\n const realFetch = util.fetch;\n spyOn(util, 'fetch').and.callFake((path: string) => {\n wasmPath = path;\n return realFetch(path);\n });\n expect(await tf.setBackend('wasm-test')).toBe(true);\n const validPaths = new Set([\n validPrefix +
'tfjs-backend-wasm.wasm',\n validPrefix + 'tfjs-backend-wasm-simd.wasm',\n validPrefix + 'tfjs-backend-
wasm-threaded-simd.wasm',\n]);\n expect(validPaths).toContain(wasmPath);\n });\n it('backend init
works when the path is valid and use platform fetch',\n async () => {\n const usePlatformFetch = true;\n const validPath = '/base/wasm-out/tfjs-backend-wasm.wasm';\n setWasmPath(validPath, usePlatformFetch);\n let wasmPath:
string;\n const realFetch = util.fetch;\n spyOn(util, 'fetch').and.callFake((path: string) => {\n wasmPath
= path;\n return realFetch(path);\n });\n expect(await tf.setBackend('wasm-test')).toBe(true);\n expect(wasmPath).toBe(validPath);\n });\n // Disabling this test because it intermittently times out on CI.\n //
tslint:disable-next-line: ban\n it('backend init fails when the path is invalid and use platform fetch',\n async ()
=> {\n const usePlatformFetch = true;\n setWasmPath('invalid/path', usePlatformFetch);\n let
wasmPath: string;\n const realFetch = util.fetch;\n spyOn(util, 'fetch').and.callFake((path: string) => {\n
wasmPath = path;\n return realFetch(path);\n });\n expect(await tf.setBackend('wasm-
test')).toBe(false);\n expect(wasmPath).toBe('invalid/path');\n });\n it('backend init succeeds with default
path', async () => {\n expect(await
tf.setBackend('wasm-test')).toBe(true);\n });\n it('setWasmPath called too late', async () => {\n // Set an invalid
path.\n setWasmPath('invalid/path');\n await tf.setBackend('wasm-test');\n // Setting the path too late.\n expect(() => setWasmPath('too/late'))\n .toThrowError(/The WASM backend was already initialized. Make
sure/);\n });\n}]]}

```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/index\_test.js.map  
No license file was found, but licenses were detected in source scan.

```

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```

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```
=====\n
*\n\nimport { KernelConfig, KernelFunc } from '@tensorflow/tfjs-core';\nimport { Fill, FillAttrs } from\n '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\n\nexport function fill(args: { attrs:\n FillAttrs, backend: BackendWasm }) {\n const { attrs: { shape, value, dtype }, backend } = args;\n const out =\n backend.makeOutput(shape, dtype);\n const outVals = backend.typedArrayFromHeap(out);\n outVals.fill(value as\n number);\n return out;\n}\n\nexport const fillConfig: KernelConfig = {\n kernelName: Fill,\n backendName:\n 'wasm',\n kernelFunc: fill as { } as KernelFunc,\n};\n}
```

Found

in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Fill.js.map

No license file was found, but licenses were detected in source scan.

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```
=====\n*/\n\nimport {backend_util, KernelConfig, KernelFunc, Sum, SumAttrs, SumInputs, TensorInfo, util} from
 '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport
{permuteAxesAndTranspose} from './kernel_utils';\nimport {CppType} from './types';\n\nlet wasmSum: (xId:
number, reduceSize: number, dtype: number, outId: number) =>\n void;\n\nfunction setup(backend:
BackendWasm): void {\n wasmSum = backend.wasm.cwrap(Sum, null /*void*/, [\n 'number', // input_id\n 'number', // reduce_size\n 'number', // dtype\n 'number', // out_id\n]);\n\n function sum(args: {backend:
BackendWasm, inputs: SumInputs, attrs: SumAttrs}):
TensorInfo {\n const {backend, inputs, attrs} = args;\n const {axis, keepDims} = attrs;\n const {x} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let
inputId = xId;\n let input = x;\n const {transposed, axes, originalAxes, inputWasTransposed} =\npermuteAxesAndTranspose(x,
axis, backend);\n\n let reductionAxes = axes;\n if (inputWasTransposed) {\n const transposedId =
backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId !== xId) {\n // transpose was not a no-op. We
will need to dispose of this\n // once we are done.\n input = transposed;\n inputId = transposedId;\n reductionAxes = backend_util.getInnerMostAxes(\n reductionAxes.length, input.shape.length);\n }\n\n backend_util.assertAxesAreInnerMostDims(\n 'sum', reductionAxes, input.shape.length);\n const [outShape,
reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n const reduceSize
= util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, input.dtype);\n if
(util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmSum(inputId, reduceSize, CCppType[out.dtype], outId);\n }\n\n if (inputWasTransposed) {\n // dispose of
the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n return out;\n }\n\n export const sumConfig: KernelConfig = {\n kernelName: Sum,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: sum as {} as KernelFunc\n };\n }\n}
```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-  
wasm/dist/kernels/Sum.js.map

No license file was found, but licenses were detected in source scan.

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s/Identity.ts","../src/kernels/Transpose.ts","../src/kernels/kernel_utils.ts","../src/kernels/All.ts","../src/kernels/Any.ts",
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```

```

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2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a
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law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT
WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\n// This enum must align with the enum defined in cc/backend.h.\nexport enum CppDType {\n float32 = 0,\n
int32 = 1,\n bool = 2,\n string = 3,\n complex64 = 4\n}\n\n// Must match enum in cc/fusable_activations.h.\nexport
enum FusableActivation {\n linear = 0,\n relu = 1,\n relu6 = 2,\n prelu = 3,\n leakyrelu = 4,\n sigmoid = 5,\n elu
= 6\n}\n", "/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache
License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You
may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required
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 * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR
CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing
permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport { _FusedMatMul, _FusedMatMulAttrs, _FusedMatMulInputs, KernelConfig, KernelFunc } from
'@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport { FusableActivation } from
'./types';\n\nlet wasmFusedMatMul: (\n aId: number, aShape: Uint8Array, aShapeSize: number, bId: number,\n
bShape: Uint8Array, bShapeSize: number, transposeA: boolean,\n transposeB: boolean, activation: number,
biasId: number,\n preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>\n
void;\n\nfunction setup(backend: BackendWasm) {\n wasmFusedMatMul = backend.wasm.cwrap(_FusedMatMul,
null /* void */, [\n

```

```

'number', // a_id\n 'array', // a_shape\n 'number', // a_shape.length\n 'number', // b_id\n 'array', //
b_shape\n 'number', // b_shape.length\n 'number', // transpose_a\n 'number', // transpose_b\n 'number', //
activation\n 'number', // biasId\n 'number', // preluActivationWeightsId\n 'number', // leakyreluAlpha\n
'number' // out_id\n]);\n}\n\nfunction fusedBatchMatMul(args: {\n inputs: _FusedMatMulInputs,\n backend:
BackendWasm,\n attrs: _FusedMatMulAttrs\n}) {\n const {inputs, backend, attrs} = args;\n const {a, b, bias,
preluActivationWeights} = inputs;\n\n if (a.dtype !== 'float32' || b.dtype !== 'float32') {\n throw new Error(\n
`_FusedMatMul for non non-float32 tensors not yet supported.`);\n }\n\n const {transposeA, transposeB,
activation, leakyreluAlpha} = attrs;\n const aId = backend.dataIdMap.get(a.dataId).id;\n const bId =
backend.dataIdMap.get(b.dataId).id;\n\n let biasId = 0;\n if (bias != null) {\n
const biasData = backend.dataIdMap.get(bias.dataId);\n if (biasData.shape.length !== 1) {\n throw new
Error(\n `_FusedMatMul only supports rank-1 bias but got ` +\n `rank ${biasData.shape.length}.`);\n
}\n biasId = biasData.id;\n }\n\n const preluActivationWeightsId = preluActivationWeights == null ?\n 0 :
backend.dataIdMap.get(preluActivationWeights.dataId).id;\n\n const fusedActivation =\n
FusableActivation[activation as {}] as keyof typeof FusableActivation);\n\n if (fusedActivation == null) {\n throw
new Error(\n `_${activation} activation not yet supported for FusedConv2D ` +\n `in the wasm backend.`);\n
}\n\n const leftDim = transposeA ? a.shape[2] : a.shape[1];\n const rightDim = transposeB ? b.shape[1] :
b.shape[2];\n const batchDim = a.shape[0];\n\n const out = backend.makeOutput([batchDim, leftDim, rightDim],
a.dtype);\n\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const aShapeBytes = new Uint8Array(new
Int32Array(a.shape).buffer);\n const bShapeBytes = new Uint8Array(new Int32Array(b.shape).buffer);\n\n
wasmFusedMatMul(\n aId, aShapeBytes, a.shape.length, bId, bShapeBytes, b.shape.length,\n transposeA,
transposeB, fusedActivation, biasId, preluActivationWeightsId,\n leakyreluAlpha || 0, outId);\n\n return
out;\n}\n\nexport const fusedMatMulConfig: KernelConfig = {\n kernelName: _FusedMatMul,\n backendName:
'wasm',\n setupFunc: setup,\n kernelFunc: fusedBatchMatMul as {} as KernelFunc\n};\n\n"/**\n * @license\n *
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WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {DataType, KernelConfig, TensorInfo, UnaryInputs, util} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from '../backend_wasm';\n\nimport {CppType} from './types';\n\nexport function
createUnaryKernelConfig(\n kernelName: string, outType?: DataType): KernelConfig {\n let wasmFunc: (xId:
number, dtype: number, outId: number) => void;\n\n function setupFunc(backend: BackendWasm): void {\n
wasmFunc = backend.wasm.cwrap(kernelName, null /* void */, [\n 'number', // x_id\n 'number', // dtype\n
'number', // out_id\n]);\n }\n\n function kernelFunc(args: {backend: BackendWasm, inputs: UnaryInputs}):\n
TensorInfo {\n const {backend, inputs: {x}} = args;\n const xId = backend.dataIdMap.get(x.dataId).id;\n
const out = backend.makeOutput(x.shape, outType || x.dtype);\n const outId =
backend.dataIdMap.get(out.dataId).id;\n\n // Short-circuit zero-sized tensors.\n if (util.sizeFromShape(out.shape)
=== 0) {\n return out;\n }\n\n wasmFunc(xId, CppDType[x.dtype], outId);\n return out;\n }\n\n return
{kernelName, backendName: 'wasm', setupFunc, kernelFunc};\n}\n\n"/**\n * @license\n *
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LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the `License`);\n * you may not
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```

and\n \* limitations under the License.\n \*

```
=====\n\n*/\nimport { Abs, KernelConfig } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from\n './unary_kernel';\nexport const absConfig: KernelConfig = createUnaryKernelConfig(Abs);\n"/**\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an\n * "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n\n*/\nimport { backend_util, BinaryInputs, DataType, KernelConfig, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport { CppDType } from './types';\nexport\nfunction createBinaryKernelConfig(\n kernelName: string, supportsFullBroadcast: boolean,\n dtype?:\n DataType): KernelConfig {\n let wasmFunc:\n (aId: number, aShape: Uint8Array, aShapeLen: number, bId:\n number,\n bShape: Uint8Array, bShapeLen: number, dtype: number, outId: number) =>\n void;\n function setupFunc(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(kernelName, null /*\n void */, [\n 'number', // a_id,\n 'array', // a_shape\n 'number', // a_shape.length\n 'number', // b_id\n 'array', // b_shape\n 'number', // b_shape.length\n 'number', // dtype\n 'number' // out_id\n]);\n }\n function kernelFunc(args: { backend: BackendWasm, inputs:\n BinaryInputs }):\n TensorInfo {\n const { backend, inputs } = args;\n const { a, b } = inputs;\n const aId =\n backend.dataIdMap.get(a.dataId).id;\n const bId = backend.dataIdMap.get(b.dataId).id;\n const outputType =\n dtype != null ? dtype : a.dtype;\n const newShape = backend_util.assertAndGetBroadcastShape(a.shape,\n b.shape);\n const out = backend.makeOutput(newShape, outputType);\n // Short-circuit zero-sized tensors.\n if (util.sizeFromShape(newShape) === 0) {\n return out;\n }\n const aShapeBytes = new Uint8Array(new\n Int32Array(a.shape).buffer);\n const bShapeBytes = new Uint8Array(new\n Int32Array(b.shape).buffer);\n const\n outId = backend.dataIdMap.get(out.dataId).id;\n const kernelFunc = () => wasmFunc(\n aId, aShapeBytes,\n a.shape.length, bId, bShapeBytes, b.shape.length,\n CppDType[a.dtype], outId);\n // Currently only some\n float operations support full broadcast.\n if (supportsFullBroadcast && a.dtype === 'float32')\n {\n kernelFunc();\n return out;\n }\n const aBroadcastDims = backend_util.getBroadcastDims(a.shape,\n newShape);\n const bBroadcastDims = backend_util.getBroadcastDims(b.shape, newShape);\n const\n loopsOverAllOfA = aBroadcastDims.every((v, i) => v === i);\n const loopsOverAllOfB =\n bBroadcastDims.every((v, i) => v === i);\n if (loopsOverAllOfA && loopsOverAllOfB) {\n kernelFunc();\n return out;\n } else {\n throw new Error(\n `Broadcasting along outer dims is not yet\n ` +\n `supported for ${a.dtype} ${kernelName}.`);\n }\n }\n return { kernelName, backendName: 'wasm', setupFunc,\n kernelFunc };\n}\n"/**\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the\n * Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the\n * License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless
```

```
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```

```
=====\n\n*/\nimport { Add, KernelConfig } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from\n './binary_kernel';\nconst supportsFullBroadcast = true;\nexport const addConfig: KernelConfig =\n createBinaryKernelConfig(Add, supportsFullBroadcast);\n"/**\n * Copyright 2019 Google LLC. All\n * Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this\n * file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless
```



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```
=====
*
* \n\nimport {AddN, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';
* \n\nimport {BackendWasm} from '../backend_wasm';
* \n\nimport {CppType} from './types';
* \n\nlet wasmFunc: (inputIds: Uint8Array, inputIdsLen: number, dtype: number, outId: number) => void;
* \n\nfunction setupFunc(backend: BackendWasm): void {
* \n\n wasmFunc = backend.wasm.cwrap(AddN, null /* void */, ['array', // input_ids
* \n\n 'number', // input_ids.length
* \n\n 'number', // dtype
* \n\n 'number', // out_id
* \n\n]);
* \n\n function addn(args: {inputs: TensorInfo[], backend: BackendWasm}) {
* \n\n const {inputs, backend} = args;
* \n\n const out = backend.makeOutput(inputs[0].shape, inputs[0].dtype);
* \n\n // Short-circuit zero-sized tensors.
* \n\n if (util.sizeFromShape(out.shape) === 0) {
* \n\n return out;
* \n\n }
* \n\n const inputIds = inputs.map(x => backend.dataIdMap.get(x.dataId).id);
* \n\n const inputIdsBytes = new Uint8Array(new Int32Array(inputIds).buffer);
* \n\n const outId = backend.dataIdMap.get(out.dataId).id;
* \n\n wasmFunc(inputIdsBytes, inputIds.length, CppDType[out.dtype], outId);
* \n\n return out;
* \n\n }
* \n\n export const addNConfig: KernelConfig = {
* \n\n kernelName: AddN,
* \n\n backendName: 'wasm',
* \n\n setupFunc,
* \n\n kernelFunc: addn as { } as KernelFunc,
* \n\n };
* \n\n /**
* \n\n * @license
* \n\n * Copyright 2020 Google LLC. All Rights Reserved.
* \n\n * Licensed under the Apache License, Version 2.0 (the "License");
* \n\n * you may not use this file except in compliance with the License.
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* \n\n * Unless required by applicable law or
```

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```
=====
*
* \n\nimport {Identity, IdentityInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';
* \n\nimport {TensorInfo} from '@tensorflow/tfjs-core';
* \n\nimport {BackendWasm} from '../backend_wasm';
* \n\nexport function identity(args: {inputs: IdentityInputs, backend: BackendWasm}): TensorInfo {
* \n\n const {inputs, backend} = args;
* \n\n const out = backend.makeOutput(x.shape, x.dtype);
* \n\n const inVals = backend.toArrayFromHeap(x);
* \n\n const outVals = backend.toArrayFromHeap(out);
* \n\n outVals.set(inVals);
* \n\n return out;
* \n\n}
* \n\nexport const identityConfig: KernelConfig = {
* \n\n kernelName: Identity,
* \n\n backendName: 'wasm',
* \n\n kernelFunc: identity as { } as KernelFunc,
* \n\n};
* \n\n/**
* \n\n * @license
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* \n\n * you may not use this file except in compliance with the License.
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```

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```
=====
*
* \n\nimport {KernelConfig, KernelFunc, TensorInfo, Transpose, TransposeAttrs, TransposeInputs} from '@tensorflow/tfjs-core';
* \n\nimport {BackendWasm} from '../backend_wasm';
* \n\nimport {identity} from './Identity';
* \n\nimport {CppType} from './types';
* \n\nlet wasmTranspose: (xId: number, xShape: Uint8Array, xShapeLength: number, dtype: CppDType, outId: number, perm: Uint8Array, permLength: number) => void;
* \n\nfunction setup(backend: BackendWasm) {
* \n\n wasmTranspose = backend.wasm.cwrap(Transpose, null /* void */, ['number', // xId
* \n\n 'array', // x.shape
* \n\n 'number', // x.shape.length
* \n\n 'number', // dtype
* \n\n 'number', // outId
* \n\n 'array', // perm
* \n\n 'number', // perm.length
* \n\n]);
* \n\n export function transpose(\n * \n\n args: {inputs: TransposeInputs, backend: BackendWasm, attrs: TransposeAttrs}):
* \n\n TensorInfo {
* \n\n const {inputs, backend, attrs} = args;
* \n\n // Reduce any
```

```

dimensions with size one. Lower-rank transpose kernel performs
 // better due to simpler memory access pattern.
const [reducedShape, perm] = removeOneSizeDims(inputs.x.shape, attrs.perm);
let permIsNoOp = true;
for (let i = 0; i < perm.length; i++) {
 if (perm[i] !== i) {
 permIsNoOp = false;
 }
}
const outShape = computeOutShape(inputs.x.shape, attrs.perm);
const x = {
 dataId: inputs.x.dataId,
 shape: reducedShape,
 dtype: inputs.x.dtype
};
if (permIsNoOp) {
 const cloned = identity({inputs, backend});
 cloned.shape = outShape;
 return cloned;
}
const out = backend.makeOutput(outShape, x.dtype);
const xId = backend.dataIdMap.get(x.dataId).id;
const outId = backend.dataIdMap.get(out.dataId).id;
const permBytes = new Uint8Array(new Int32Array(perm).buffer);
const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);
wasmTranspose(xId, xShapeBytes, x.shape.length, CppDType[x.dtype], outId, permBytes, perm.length);
return out;
}

function computeOutShape(inShape: number[], perm: number[]): number[] {
 const outShape = new Array(inShape.length);
 for (let i = 0; i < outShape.length; i++) {
 outShape[i] = inShape[perm[i]];
 }
 return outShape;
}

function removeOneSizeDims(shape: number[], perm: number[]): [number[], number[]] {
 const newShape: number[] = [];
 const newPerm: number[] = [];
 for (let i = 0; i < shape.length; ++i) {
 if (shape[i] !== 1) {
 newShape.push(shape[i]);
 }
 if (shape[perm[i]] !== 1) {
 newPerm.push(perm[i]);
 }
 }
 for (let i = 0; i < newPerm.length; ++i) {
 let minValIdx = -1;
 for (let j = 0; j < newPerm.length; ++j) {
 if (newPerm[j] >= i && (minValIdx === -1 || newPerm[minValIdx] > newPerm[j])) {
 minValIdx = j;
 }
 }
 newPerm[minValIdx] = i;
 }
 return [newShape, newPerm];
}

export const transposeConfig:
KernelConfig = {
 kernelName: Transpose,
 backendName: 'wasm',
 kernelFunc: transpose as {} as
KernelFunc,
 setupFunc: setup,
};
/**
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 * you may not use this
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 * distributed under the License is distributed on an "AS IS" BASIS,
 * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.
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 * limitations under the License.
 */
=====
import {backend_util, TensorInfo, util} from '@tensorflow/tfjs-core';
import {BackendWasm} from './backend_wasm';
import {transpose} from './Transpose';
/**
 * Compute permutation axes and do a transpose
if necessary.
 * Used by reduction ops.
 * @param x input TensorInfo
 * @param axis reduction axes
 * @param backend wasm backend instance
 */
export function permuteAxesAndTranspose(x: TensorInfo,
axis: number|number[],
backend: BackendWasm): {
 transposed: TensorInfo|null,
 axes: number[],
 originalAxes: number[],
 inputWasTransposed: boolean
} {
 const xShape = x.shape;
 const xRank = x.shape.length;
 const originalAxes = util.parseAxisParam(axis, xShape);
 let axes = originalAxes;
 const permutedAxes = backend_util.getAxesPermutation(axes, xRank);
 let xTransposed = null;
 let inputWasTransposed = false;
 if (permutedAxes !== null) {
 const newShape: number[] = new Array(xRank);
 for (let i = 0; i < newShape.length; i++) {
 newShape[i] = xShape[permutedAxes[i]];
 }
 axes = backend_util.getInnerMostAxes(axes.length, xRank);
 xTransposed = transpose({inputs: {x}, attrs: {perm: permutedAxes}, backend});
 const xId = backend.dataIdMap.get(x.dataId).id;
 const transposedId = backend.dataIdMap.get(xTransposed.dataId).id;
 if (transposedId !== xId) {
 inputWasTransposed = true;
 }
 }
 return {transposed: xTransposed, originalAxes, axes, inputWasTransposed};
}
/**
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file except in compliance with the License.
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 * WITHOUT WARRANTIES

```

OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\n\nimport {All, AllAttrs, AllInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util} from\n '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport\n {permuteAxesAndTranspose} from\n './kernel_utils';\nlet wasmAll: (xId: number, reduceSize: number, outId: number) => void;\nfunction\n setup(backend: BackendWasm): void {\n wasmAll = backend.wasm.cwrap(All, null /*void*/, ['number, number,\n number']);\n}\nfunction all(args: {backend: BackendWasm, inputs: AllInputs, attrs: AllAttrs}):\n TensorInfo {\n const {backend, inputs, attrs} = args;\n const {axis, keepDims} = attrs;\n const {x} = inputs;\n const xId =\n backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n const {transposed, axes, originalAxes,\n inputWasTransposed} =\n permuteAxesAndTranspose(x, axis, backend);\n if (inputWasTransposed) {\n const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n input = transposed;\n inputId =\n transposedId;\n }\n const inputRank = input.shape.length;\n backend_util.assertAxesAreInnerMostDims('all',\n axes, inputRank);\n const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, axes);\n const reduceSize = util.sizeFromShape(reduceShape);\n const out = backend.makeOutput(outShape, x.dtype);\n if (util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmAll(inputId, reduceSize, outId);\n }\n if (inputWasTransposed) {\n // dispose of the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n if (keepDims) {\n // reshape\n const newShape =\n backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n return\n out;\n}\nexport const allConfig: KernelConfig = {\n kernelName: All,\n backendName: 'wasm',\n setupFunc:\n setup,\n kernelFunc: all as { } as KernelFunc\n};\n"/**\n * @license\n * Copyright 2021 Google LLC. All Rights\n Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file\n except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * \n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is\n distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either\n express or implied.\n * See the License for the specific language governing permissions and\n * limitations under\n the License.\n *
```

```
=====\n*\n\nimport {Any, AnyAttrs, AnyInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util} from\n '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport\n {permuteAxesAndTranspose} from './kernel_utils';\nlet wasmAny: (xId: number, reduceSize: number, outId:\n number) => void;\nfunction\n setup(backend: BackendWasm): void {\n wasmAny = backend.wasm.cwrap(Any,\n null /*void*/, ['number, number, number']);\n}\nfunction any(args: {backend: BackendWasm, inputs: AnyInputs,\n attrs: AnyAttrs}):\n TensorInfo {\n const {backend, inputs,\n attrs} = args;\n const {axis, keepDims} = attrs;\n const {x} = inputs;\n const xId =\n backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n const {transposed, axes, originalAxes,\n inputWasTransposed} =\n permuteAxesAndTranspose(x, axis, backend);\n if (inputWasTransposed) {\n const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n input = transposed;\n inputId =\n transposedId;\n }\n const inputRank = input.shape.length;\n backend_util.assertAxesAreInnerMostDims('any',\n axes, inputRank);\n const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, axes);\n const reduceSize =\n util.sizeFromShape(reduceShape);\n const out = backend.makeOutput(outShape, x.dtype);\n if\n (util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmAny(inputId, reduceSize, outId);\n }\n if (inputWasTransposed) {\n // dispose of the transposed tensor.\n
```

```

 backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const newShape =
backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n return
out;\n}\n\nexport const anyConfig: KernelConfig = {\n kernelName: Any,\n backendName: 'wasm',\n setupFunc:
setup,\n kernelFunc: any as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n
*\n
* =====\n
*\n\nimport { ArgMax, ArgMaxAttrs, ArgMaxInputs, KernelConfig, KernelFunc, util } from '@tensorflow/tfjs-
core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport { permuteAxesAndTranspose } from
'/kernel_utils';\n\nimport { CppDType } from './types';\n\nlet wasmFunc: (\n xId: number, dtype: number, outerSize:
number, innerSize: number,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n
wasmFunc = backend.wasm.cwrap(ArgMax, null /* void */, [\n 'number', // x_id\n 'number', // dtype\n
'number', // outer_size\n 'number', // inner_size\n 'number' // out_id\n]);\n\nfunction argmax(\n args:
{inputs: ArgMaxInputs, backend: BackendWasm, attrs: ArgMaxAttrs}) {\n const {backend, inputs, attrs} = args;\n
const {axis} = attrs as {} as ArgMaxAttrs;\n const {x} = inputs as {} as ArgMaxInputs;\n const xId =
backend.dataIdMap.get(x.dataId).id;\n let
inputId = xId;\n let input = x;\n\n const {transposed, axes, inputWasTransposed} =\n
permuteAxesAndTranspose(x, axis, backend);\n\n if (inputWasTransposed) {\n const transposedId =
backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId !== xId) {\n // transpose was not a no-op. We
will need to dispose of this\n // once we are done.\n input = transposed;\n inputId = transposedId;\n }\n
}\n\n const outShape = input.shape.slice(0, -1);\n const out = backend.makeOutput(outShape, 'int32');\n const
outId = backend.dataIdMap.get(out.dataId).id;\n const outerSize = util.sizeFromShape(out.shape);\n const
innerSize = input.shape[axes[0]];\n wasmFunc(inputId, CppDType[input.dtype], outerSize, innerSize, outId);\n\n if
(inputWasTransposed) {\n // dispose of the transposed tensor.\n backend.disposeData(transposed.dataId);\n
}\n\n return out;\n}\n\nexport const argMaxConfig: KernelConfig = {\n kernelName: ArgMax,\n backendName:
'wasm',\n
kernelFunc: argmax as {} as KernelFunc,\n setupFunc: setup\n};\n", "/*\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n
*\n
* =====\n
*\n\nimport { AvgPool, AvgPoolAttrs, AvgPoolInputs, backend_util, KernelConfig, KernelFunc, Tensor4D } from
 '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nlet wasmAvgPool: (\n xId:
number, batchSize: number, inputHeight: number, inputWidth: number,\n filterHeight: number, filterWidth:
number, padTop: number, padRight: number,\n padBottom: number, padLeft: number, strideHeight: number,\n
strideWidth: number, channels: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n
wasmAvgPool = backend.wasm.cwrap(AvgPool, null /* void */, [\n 'number', // xId\n 'number', // batchSize\n
'number', // inputHeight\n 'number', // inputWidth\n 'number', // filterHeight\n 'number', // filterWidth\n
'number', // padTop\n 'number', // padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', //
strideHeight\n 'number', // strideWidth\n 'number', // channels\n 'number', // outId\n]);\n\nfunction
avgPool(\n args: {inputs: AvgPoolInputs, backend: BackendWasm, attrs: AvgPoolAttrs}) {\n const {inputs, attrs,

```

```

backend} = args;\n\n const x = inputs.x as Tensor4D);\n const xId = backend.dataIdMap.get(x.dataId).id;\n\n
const {filterSize, strides, pad, dimRoundingMode} = attrs;\n const convInfo =
backend_util.computePool2DInfo(\n x.shape, filterSize, strides, 1 /* dilations */, pad, dimRoundingMode);\n\n
const filterHeight = convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const padTop =
convInfo.padInfo.top;\n const padRight = convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n
const padLeft = convInfo.padInfo.left;\n const strideHeight = convInfo.strideHeight;\n const strideWidth =
convInfo.strideWidth;\n const channels = convInfo.inChannels;\n\n if (convInfo.dataFormat !== 'channelsLast') {\n
throw new Error(\n `wasm backend does not support dataFormat:` +\n `${convInfo.dataFormat}`. Please
use 'channelsLast'.`);\n }\n\n if (convInfo.dilationWidth !== 1 || convInfo.dilationHeight !== 1) {\n throw new
Error(\n `was backend only supports average pooling with dilation = [1, 1], `
+\n `got [${convInfo.dilationHeight}, ${convInfo.dilationWidth}].`);\n }\n\n const out =
backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n
wasmAvgPool(\n xId, x.shape[0], x.shape[1], x.shape[2], filterHeight, filterWidth,\n padTop, padRight,
padBottom, padLeft, strideHeight, strideWidth, channels,\n outId);\n return out;\n}\n\nexport const
avgPoolConfig: KernelConfig = {\n kernelName: AvgPool,\n backendName: 'wasm',\n setupFunc: setup,\n
kernelFunc: avgPool as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights
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on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====\n
*/\n\nimport {KernelConfig, KernelFunc, Reshape, ReshapeAttrs, ReshapeInputs, util} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from './backend_wasm';\n\nexport function reshape(\n args: {inputs:
ReshapeInputs, attrs: ReshapeAttrs, backend: BackendWasm}) {\n const {inputs, attrs} = args;\n const {x} =
inputs;\n const {shape} = attrs;\n\n const xSize = util.sizeFromShape(x.shape);\n const $shape =
util.inferFromImplicitShape(shape, xSize);\n\n util.assert(\n xSize === util.sizeFromShape($shape),\n () =>
`new shape: ${$shape}, old shape: ${x.shape}. New shape and old ` +\n `shape must have the same number of
elements.`);\n\n // Backend needs to track refCount
for the dataId for reshape op\n args.backend.incRef(x.dataId);\n return {dataId: x.dataId, shape: $shape, dtype:
x.dtype};\n}\n\nexport const reshapeConfig: KernelConfig = {\n kernelName: Reshape,\n backendName: 'wasm',\n
kernelFunc: reshape as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport
{BatchMatMul, BatchMatMulAttrs, BatchMatMulInputs, KernelConfig, KernelFunc, util} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {reshape} from './Reshape';\n\nlet
wasmBatchMatMul: (\n aId: number, aShape: Uint8Array, aShapeSize: number, bId: number,\n bShape:
Uint8Array, bShapeSize: number, transposeA: boolean,\n transposeB: boolean, outId: number) =>
void;\n\nfunction setup(backend: BackendWasm) {\n wasmBatchMatMul = backend.wasm.cwrap(BatchMatMul,
null /* void */, [\n 'number', // a_id\n 'array', // a_shape\n 'number', // a_shape.length\n 'number', // b_id\n

```





ZhbHMgPSB1dGlsLmdldEFycmF5RnJvbURUeXBIKGR0eXBILCB1dGlsLnNpemVGcm9tU2hhcGUob3V0U2hhcGUoPktTcblxulCBpZiAoc2ltcGx5Q29uY2F0ICYmIGR0eXBIIICE9PSAnc3RyaW5nJyke1xuICAgIC8vIFVzZSBI dWlsdC1pbiBUeXBIZEFycmF5LnNldCgplG1ldGhvZCBmb3Igc3BIZWQuXG4gICAgbGV0IG9mZnNldCA9IDA 7XG4gICAgW5wdXRzLmZvckVhY2goaW5wdXQgPT4ge1xuICAgICAgY29uc3Qgc2l6ZSA9IHV0aWwuc2l6Z UZyb21TaGFwZShpbnB1dC5zaGFwZSk7XG5cbiAgICAgIChdXRWYXZzIGFzIFR5cGVkQXJyYXkpLnNldCh pbnB1dC52YWxzIGFzIFR5cGVkQXJyYXksIG9mZnNldCk7XG4gICAgICBvZmZzZXQgKz0gc2l6ZTtcbiAgICB 9KTtcbiAgfSB1bHNIIHtcbiAgICBsZXQgY29sT2Zmc2V0ID0gMDtcbxulCBvZmZzZXQgKz0gc2l6ZTtcbiAgICB HV0ID0+IHtcbiAgICAgIGNvbnN0IGRIY29kZWREYXRhID0gZHR5cGUgPT09ICdZdHJpbmcnID9cbiAgICAgI CAgICBiYWNrZW5kX3V0aWwuc2l6ZS5zaGFwZSwxTsgKytyb3cp IHtcbiAgICAgICAgY29uc3QgcmlvZmZzSWR4ID0gcm93ICogb3V0U2hhcGVbMV0gKyBjb2xPZmZzZXQ7XG4gICA gICAgIGZvciAobGV0IGNvbCA9IDA7IGNvbCA8IGlucHV0LnNoYXBIWzFdOyArk2NvbCkge1xuICAgICAgIC AgIG91dFZhbHNbcmVzSWR4ICsgY29sXSA9IGRIY29kZWREYXRhW3RjZHR5cGVkQXJyYXksIG9mZnNldCk7XG4gICAgICAgIH1cbiA gICAgIH1cbxulCBvZmZzZXQgY29sT2Zmc2V0ICs9IGlucHV0LnNoYXBIWzFdO1xuICAgIH0pO1xuICB9XG5cbiAgc mV0dXJuIG91dFZhbHM7XG59XG4iXX0=", /\*\*\n

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```
=====\n*\nimport { util } from '@tensorflow/tfjs-core';\nexport function rangeImpl(start, stop, step, dtype) {\n const\n sameStartStop = start === stop;\n const increasingRangeNegativeStep = start < stop && step < 0;\n const\n decreasingRangePositiveStep = stop < start && step > 1;\n if (sameStartStop || increasingRangeNegativeStep ||\n decreasingRangePositiveStep) {\n return util.makeZerosTypedArray(0, dtype);\n }\n const numElements\n = Math.abs(Math.ceil((stop - start) / step));\n const values = util.makeZerosTypedArray(numElements, dtype);\n if (stop < start && step === 1) {\n // Auto\n adjust the step's sign if it hasn't been set\n // (or was set to 1)\n step = -1;\n }\n values[0] = start;\n for\n (let i = 1; i < values.length; i++) {\n values[i] = values[i - 1] + step;\n }\n return values;\n}\n/>\n\nsourceMappingURL=data:application/json;base64,eyJ2ZXJzaW9uIjozLCJmaWxlIjoiaU9mZmZzZXQgY29uc3QgcmlvZmZzSWR4ID0gcm93ICogb3V0U2hhcGVbMV0gKyBjb2xPZmZzZXQ7XG4gICAgICAgIH1cbiAgICAgIH1cbxulCBvZmZzZXQgY29sT2Zmc2V0ICs9IGlucHV0LnNoYXBIWzFdOyArk2NvbCkge1xuICAgICAgIC AgIG91dFZhbHNbcmVzSWR4ICsgY29sXSA9IGRIY29kZWREYXRhW3RjZHR5cGVkQXJyYXksIG9mZnNldCk7XG4gICAgICAgIH1cbiA gICAgIH1cbxulCBvZmZzZXQgY29sT2Zmc2V0ICs9IGlucHV0LnNoYXBIWzFdO1xuICAgIH0pO1xuICB9XG5cbiAgc mV0dXJuIG91dFZhbHM7XG59XG4iXX0="
```









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```
=====\n*\n\nimport { backend_util, KernelConfig, KernelFunc, Slice, slice_util, SliceAttrs, SliceInputs, TypedArray, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { sliceImplCPU } from '../kernel_utils/shared';\nexport function slice(\n args: { inputs: SliceInputs, attrs: SliceAttrs, backend: BackendWasm }) {\n const { inputs: { x }, attrs: { begin, size }, backend } = args;\n\n const [begin_, size_] = slice_util.parseSliceParams(x, begin, size);\n\n const isContinuous = slice_util.isSliceContinuous(x.shape, begin_, size_);\n const xVals = backend.readSync(x.dataId);\n const out = backend.makeOutput(size_, x.dtype);\n const xStrides = util.computeStrides(x.shape);\n const outData = backend.dataIdMap.get(out.dataId);\n\n if (isContinuous) {\n const flatOffset = slice_util.computeFlatOffset(begin_, xStrides);\n\n if (x.dtype === 'string') {\n outData.stringBytes =\n (xVals as Uint8Array[]).slice(flatOffset, flatOffset +\n util.sizeFromShape(size_));\n } else {\n const outVals = backend.typedArrayFromHeap(out);\n outVals.set(\n (xVals as TypedArray).subarray(flatOffset, flatOffset +\n util.sizeFromShape(size_)));\n }\n\n return out;\n }\n\n if (x.dtype === 'string') {\n const res = sliceImplCPU(xVals, begin_, size_, x.shape, x.dtype);\n outData.stringBytes = res as Uint8Array[];\n return out;\n }\n\n const outVals = backend.typedArrayFromHeap(out);\n const rank = x.shape.length;\n if (rank === 2) {\n slice2d(\n xVals as TypedArray, xStrides[0], outVals, begin_ as [number, number],\n size_ as [number, number]);\n } else if (rank === 3) {\n slice3d(\n xVals as TypedArray, xStrides[0], xStrides[1], outVals,\n begin_ as [number, number, number], size_ as [number, number, number]);\n } else if (rank === 4) {\n slice4d(\n xVals as TypedArray, xStrides[0], xStrides[1], xStrides[2], outVals,\n begin_ as [number, number, number, number], size_ as [number, number, number, number]);\n } else {\n const res =\n sliceImplCPU(xVals, begin_, size_, x.shape, x.dtype) as TypedArray;\n outVals.set(res);\n }\n\n return out;\n}\n\nfunction slice2d(\n xVals: backend_util.TypedArray, xStride: number,\n outVals: backend_util.TypedArray, begin: [number, number],\n size: [number, number]): void {\n let outOffset = 0;\n const beginI = begin[0];\n const beginJ = begin[1];\n const endI = beginI + size[0];\n for (let i = beginI; i < endI; i++) {\n const xOffset = i * xStride + beginJ;\n outVals.set(xVals.subarray(xOffset, xOffset + size[1]), outOffset);\n outOffset += size[1];\n }\n}\n\nfunction slice3d(\n xVals: backend_util.TypedArray, xStride1: number, xStride2: number,\n outVals: backend_util.TypedArray, begin: [number, number, number],\n size: [number, number, number]): void {\n let outOffset = 0;\n const beginI = begin[0];\n const beginJ = begin[1];\n const beginK = begin[2];\n const endI = beginI + size[0];\n const endJ = beginJ + size[1];\n for (let i = beginI; i < endI; i++) {\n for (let j = beginJ; j < endJ; j++) {\n const xOffset = i * xStride1 + j * xStride2 + beginK;\n outVals.set(xVals.subarray(xOffset, xOffset + size[2]), outOffset);\n outOffset += size[2];\n }\n }\n}\n\nfunction slice4d(\n xVals: backend_util.TypedArray, xStride1: number, xStride2: number,\n xStride3: number, outVals: backend_util.TypedArray,\n begin: [number, number, number, number],\n size: [number, number, number, number]): void {\n let outOffset = 0;\n const beginI = begin[0];\n const beginJ = begin[1];\n const beginK = begin[2];\n\n const endI = beginI + size[0];\n const endJ = beginJ + size[1];\n const endK = beginK + size[2];\n const beginL = begin[3];\n for (let i = beginI; i < endI; i++) {\n for (let j = beginJ; j < endJ; j++) {\n for (let k = beginK; k < endK; k++) {\n const xOffset = i * xStride1 + j * xStride2 + k * xStride3 + beginL;\n outVals.set(xVals.subarray(xOffset, xOffset + size[3]), outOffset);\n outOffset += size[3];\n }\n }\n }\n}\n\nexport const sliceConfig: KernelConfig = {\n kernelName: Slice,\n backendName: 'wasm',\n kernelFunc: slice as {} as KernelFunc,\n};\n\n/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n *
```

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```
=====
*
import { backend_util, BatchToSpaceND, BatchToSpaceNDAttrs, BatchToSpaceNDInputs, KernelConfig,
KernelFunc } from '@tensorflow/tfjs-core';
import { BackendWasm } from '../backend_wasm';
import { reshape } from './Reshape';
import { slice } from './Slice';
import { transpose } from './Transpose';
function
batchToSpaceND(args: {
 inputs: BatchToSpaceNDInputs,
 backend: BackendWasm,
 attrs: BatchToSpaceNDAttrs
) {
 const { inputs, backend, attrs } = args;
 const { x } = inputs;
 const { blockShape, crops } = attrs;

 const prod = blockShape.reduce((a, b) => a * b);
 const reshaped =
 backend_util.getReshaped(x.shape, blockShape, prod);
 const
 permuted = backend_util.getPermuted(reshaped.length, blockShape.length);
 const reshapedPermuted =
 backend_util.getReshapedPermuted(x.shape, blockShape, prod);
 const sliceBeginCoords =
 backend_util.getSliceBeginCoords(crops, blockShape.length);
 const sliceSize =
 backend_util.getSliceSize(reshapedPermuted, crops, blockShape.length);
 const xReshaped = reshape({ inputs:
 { x }, backend, attrs: { shape: reshaped } });
 const xTransposed =
 transpose({ inputs: { x: xReshaped }, backend,
 attrs: { perm: permuted } });
 const xTransposedReshaped = reshape({ inputs: { x: xTransposed }, backend,
 attrs: { shape: reshapedPermuted } });
 const result = slice({
 inputs: { x: xTransposedReshaped },
 backend,
 attrs: { begin: sliceBeginCoords, size: sliceSize }
 });
 backend.disposeData(xReshaped.dataId);
 backend.disposeData(xTransposed.dataId);
 backend.disposeData(xReshaped.dataId);
 return
 result;
}
export const batchToSpaceNDConfig:
 KernelConfig = {
 kernelName: 'BatchToSpaceND',
 backendName: 'wasm',
 kernelFunc: batchToSpaceND as
 { } as KernelFunc
 };
 /**
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 * implied.
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 * limitations under the
 * License.
 */
 }
=====
*
import { Cast, CastAttrs, CastInputs, KernelConfig, KernelFunc } from '@tensorflow/tfjs-core';
import {
 TensorInfo } from '@tensorflow/tfjs-core';
import {
 BackendWasm } from '../backend_wasm';
export function cast({
 inputs: CastInputs, attrs: CastAttrs,
 backend: BackendWasm
):
 TensorInfo {
 const { inputs: { x }, attrs: { dtype }, backend } = args;
 const out =
 backend.makeOutput(x.shape, dtype);
 const inVals = backend.typedArrayFromHeap(x);
 const outVals =
 backend.typedArrayFromHeap(out);
 outVals.set(inVals);
 return out;
}
export const castConfig:
 KernelConfig = {
 kernelName: 'Cast',
 backendName: 'wasm',
 kernelFunc: cast as { } as
 KernelFunc
 };
 /**
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 *
 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
 * See the License
 * for the specific language governing permissions and
 * limitations under the License.
 */
 }
```

```

=====
*\nimport {KernelConfig, Ceil} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'./unary_kernel';\n\nexport const ceilConfig: KernelConfig = createUnaryKernelConfig(Ceil);\n", "/*\n *
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* See the License for the specific language governing permissions and\n * limitations under the License.\n *
=====
*\nimport {ClipByValue, ClipByValueAttrs, ClipByValueInputs, KernelConfig, KernelFunc} from
'@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmClip: (xId: number, min:
number, max: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmClip =
backend.wasm.cwrap(ClipByValue, null /* void */, [\n 'number', // x_id\n 'number', // min\n 'number', //
max\n 'number' // out_id\n]);\n\n function clip(args: {\n inputs: ClipByValueInputs,\n backend:
BackendWasm,\n attrs: ClipByValueAttrs\n }) {\n const {inputs, backend, attrs} = args;\n const {x} =
inputs;\n const {clipValueMin, clipValueMax} = attrs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out =
backend.makeOutput(x.shape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n
 wasmClip(xId, clipValueMin, clipValueMax, outId);\n return out;\n }\n\n export const clipByValueConfig:
KernelConfig = {\n kernelName: ClipByValue,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: clip
as {} as KernelFunc\n };
", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed
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on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====
*\nimport {backend_util, Concat, ConcatAttrs, ConcatInputs, KernelConfig, KernelFunc, util} from
'@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {concatImplCPU} from
'./kernel_utils/shared';\nimport {identity} from './Identity';\nimport {reshape} from './Reshape';\n\nexport function
concat(\n args: {\n inputs: ConcatInputs, backend: BackendWasm, attrs: ConcatAttrs\n }) {\n const {inputs, backend}
= args;\n\n const axis = util.parseAxisParam(args.attrs.axis, inputs[0].shape)[0];\n\n let outShape =
backend_util.computeOutShape(inputs.map(t => t.shape), axis);\n\n // Keep only non-empty tensors (ignore tensors
with 0 in their shape).\n const $inputs = inputs.filter(t => util.sizeFromShape(t.shape) > 0);\n\n if ($inputs.length ====
1) {\n return identity({inputs: {x: $inputs[0]}, backend});\n }\n\n const out = backend.makeOutput(outShape,
inputs[0].dtype);\n\n if (util.sizeFromShape(outShape) ==== 0) {\n return out;\n }\n\n const shapes =
$inputts.map(t
=> t.shape);\n backend_util.assertParamsConsistent(shapes, axis);\n\n if ($inputs[0].dtype ==== 'string') {\n
// Any concat of n-dimensional tensors across any axis can be reduced to\n // a concatenation of two-dimensional
tensors across the axis 1 by first\n // partitioning the axes of the original tensors into those less than the\n // axis
to be concatenated and the rest. Then reshape the tensors\n // into a two-dimensional tensor by collapsing these
two sets of axes and\n // concatenate the resulting matrices across the axis 1, finally reshaping\n // the result to
have the proper shape.\n const inputs2D = $inputs.map(t => {\n const innerSize =
util.sizeFromShape(t.shape.slice(axis));\n const shape = [-1, innerSize];\n return reshape({inputs: {x: t},
backend, attrs: {shape}});\n });\n\n const inputsValShapes = inputs2D.map(t => {\n return {vals:
backend.readSync(t.dataId), shape: t.shape};\n });\n\n // Concat 2d tensors

```



```

(convInfo.dataFormat !== 'channelsLast') {\n throw new Error(\n `wasm backend Conv2D does not support
dataFormat:` +\n `${convInfo.dataFormat}`. Please
 use 'channelsLast'.`);\n }\n\n const out = backend.makeOutput(convInfo.outShape, 'float32');\n const outId =
backend.dataIdMap.get(out.dataId).id;\n wasmConv2d(\n xId, x.shape[0], x.shape[1], x.shape[2], filterId,
filterHeight,\n filterWidth, padTop, padRight, padBottom, padLeft, isSamePad,\n dilationHeight,
dilationWidth, strideHeight, strideWidth, inputChannels,\n outputChannels, outId);\n return out;\n }\n\nexport
const conv2DConfig: KernelConfig = {\n kernelName: Conv2D,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: conv2d as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights
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ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n *
limitations under the License.\n *
===== \n
*/\n\nimport { backend_util, Conv2DBackpropInput, Conv2DBackpropInputAttrs, Conv2DBackpropInputInputs,
KernelConfig, KernelFunc, TensorInfo, util } from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from
'./backend_wasm';\n\nlet wasmConv2DBackpropInput: (\n dyId: number, filterId: number, batchSize: number,
filterHeight: number,\n filterWidth: number, inHeight: number, inWidth: number, inChannels: number,\n outHeight: number, outWidth: number, outChannels: number,\n strideHeight: number, strideWidth: number,
topPad: number, leftPad: number,\n fltS0: number, fltS1: number, fltS2: number, xBatchStride: number,\n xRowStride: number, xColStride: number,
 xChannelStride: number,\n yBatchStride: number, yRowStride: number, yColStride: number,\n yChannelStride:
number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n
 wasmConv2DBackpropInput = backend.wasm.cwrap(Conv2DBackpropInput, null, [\n 'number', // dyId\n
 'number', // filterId\n 'number', // batchSize\n 'number', // filterHeight\n 'number', // filterWidth\n
 'number', // inHeight\n 'number', // inWidth\n 'number', // inChannels\n 'number', // outHeight\n
 'number', // outWidth\n 'number', // outChannels\n 'number', // strideHeight\n 'number', // strideWidth\n
 'number', // topPad\n 'number', // leftPad\n 'number', // fltS0\n 'number', // fltS1\n 'number', // fltS2\n
 'number', // xBatchStride\n 'number', // xRowStride\n 'number', // xColStride\n 'number', // xChannelStride\n
 'number', // yBatchStride\n 'number', // yRowStride\n 'number', // yColStride\n
 'number', // yChannelStride\n 'number', // outId\n]);\n\n function conv2DBackpropInput(args: {\n backend:
BackendWasm,\n inputs: Conv2DBackpropInputInputs,\n attrs: Conv2DBackpropInputAttrs\n}): TensorInfo {\n
 const { backend, inputs, attrs } = args;\n const { dy, filter } = inputs;\n const { strides, pad, dataFormat,
dimRoundingMode, inputShape } = attrs;\n\n const dilations = 1;\n const $dataFormat =
backend_util.convertConv2DDataFormat(dataFormat);\n const convInfo = backend_util.computeConv2DInfo(\n
inputShape, filter.shape as [number, number, number, number], strides,\n dilations, pad, dimRoundingMode,
false /* depthwise */, $dataFormat);\n const {\n batchSize,\n filterHeight,\n filterWidth,\n inChannels,\n
inHeight,\n inWidth,\n outChannels,\n outHeight,\n outWidth,\n strideHeight,\n strideWidth\n } =
convInfo;\n\n const topPad = filterHeight - 1 - convInfo.padInfo.top;\n const leftPad = filterWidth - 1 -
convInfo.padInfo.left;\n\n const isChannelsLast = convInfo.dataFormat === 'channelsLast';\n const dxStrides =
util.computeStrides(convInfo.inShape);\n const dyStrides = util.computeStrides(dy.shape);\n const [fltS0, fltS1,
fltS2] = util.computeStrides(filter.shape);\n const xBatchStride = dxStrides[0];\n const xRowStride =
isChannelsLast ? dxStrides[1] : dxStrides[2];\n const xColStride = isChannelsLast ? dxStrides[2] : 1;\n const
xChannelStride = isChannelsLast ? 1 : dxStrides[1];\n const yBatchStride = dyStrides[0];\n const yRowStride =
isChannelsLast ? dyStrides[1] : dyStrides[2];\n const yColStride = isChannelsLast ? dyStrides[2] : 1;\n const

```



```

yChannelStride = isChannelsLast ? 1 : dyStrides[1];\n\n const out = backend.makeOutput(convInfo.inShape,
'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n const dyId =
backend.dataIdMap.get(dy.dataId).id;\n const filterId = backend.dataIdMap.get(filter.dataId).id;\n\n
wasmConv2DBackpropInput(\n dyId, filterId, batchSize,
 filterHeight, filterWidth, inHeight, inWidth,\n inChannels, outHeight, outWidth, outChannels, strideHeight,
strideWidth,\n topPad, leftPad, fltS0, fltS1, fltS2, xBatchStride, xRowStride,\n xColStride, xChannelStride,
yBatchStride, yRowStride, yColStride,\n yChannelStride, outId);\n return out;\n}\n\nexport const
conv2DBackpropInputConfig: KernelConfig = {\n kernelName: Conv2DBackpropInput,\n backendName:
'wasm',\n setupFunc: setup,\n kernelFunc: conv2DBackpropInput as {} as KernelFunc\n};\n", "/*\n * @license\n *
Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
'License');\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an 'AS IS' BASIS,\n *
WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport { Cos, KernelConfig } from '@tensorflow/tfjs-core';\n\nimport { createUnaryKernelConfig } from
'./unary_kernel';\n\nexport const cosConfig: KernelConfig = createUnaryKernelConfig(Cos);\n", "/*\n * @license\n
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the
specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport { Cosh, KernelConfig } from '@tensorflow/tfjs-core';\n\nimport { createUnaryKernelConfig } from
'./unary_kernel';\n\nexport const coshConfig: KernelConfig = createUnaryKernelConfig(Cosh);\n", "/*\n *
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n
*
=====\n
*\n\nimport { CropAndResize, CropAndResizeAttrs, CropAndResizeInputs, KernelConfig, KernelFunc,
TensorInfo } from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from './backend_wasm';\n\nimport { cast }
from './Cast';\n\n// Must match enum in CropAndResize.cc\nenum InterpolationMethod {\n bilinear = 0,\n nearest
= 1\n}\n\nlet wasmCropAndResize: (\n imagesId: number, boxesId: number, boxIndId: number, numBoxes:
number,\n imagesShape: Uint8Array, cropHeight: number, cropWidth: number,\n method: number,
extrapolationValue: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n
wasmCropAndResize = backend.wasm.cwrap(CropAndResize, null /*void*/, [\n 'number', // imagesId\n
'number', // boxesId\n 'number', // boxIndId\n 'number', // numBoxes\n 'array', // images shape\n
'number', // cropHeight\n 'number', // cropWidth\n 'number', // method\n
'number', // extrapolation value\n 'number' // out id\n]);\n\nfunction cropAndResize(args: {\n backend:
BackendWasm,\n inputs: CropAndResizeInputs,\n attrs: CropAndResizeAttrs\n}): TensorInfo {\n const {backend,
inputs, attrs} = args;\n const {method, extrapolationValue, cropSize} = attrs;\n const {image, boxes, boxInd} =

```

```

inputs;\n\n const numBoxes = boxes.shape[0];\n\n const [cropHeight, cropWidth] = cropSize as [number,
number];\n const outShape = [numBoxes, cropHeight, cropWidth, image.shape[3]];\n\n let imagesData =
backend.dataIdMap.get(image.dataId);\n let castedData;\n if (image.dtype !== 'float32') {\n castedData =
cast({backend, inputs: {x: image}, attrs: {dtype: 'float32'}});\n imagesData =
backend.dataIdMap.get(castedData.dataId);\n }\n\n const imagesId = imagesData.id;\n const boxesId =
backend.dataIdMap.get(boxes.dataId).id;\n const boxIndId = backend.dataIdMap.get(boxInd.dataId).id;\n\n const
out = backend.makeOutput(outShape, 'float32');\n\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const imagesShapeBytes = new Uint8Array(new
Int32Array(image.shape).buffer);\n\n wasmCropAndResize(\n imagesId, boxesId, boxIndId, numBoxes,
imagesShapeBytes, cropHeight,\n cropWidth,\n InterpolationMethod[method as {}] as keyof typeof
InterpolationMethod],\n extrapolationValue, outId);\n\n if (castedData !== null) {\n
backend.disposeData(castedData.dataId);\n }\n\n return out;\n}\n\nexport const cropAndResizeConfig:
KernelConfig = {\n kernelName: CropAndResize,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc:
cropAndResize as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights
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http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====*\n\nimport {backend_util, KernelConfig, KernelFunc, Cumsum, CumsumAttrs, CumsumInputs, TensorInfo, util}
from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {CppType} from
 './types';\nimport {transpose} from './Transpose';\n\nlet wasmCumsum: (xId: number, exclusive: number, reverse:
number,\n finalDim: number, outId: number, dtype: CppDType) => void;\n\nfunction setup(backend:
BackendWasm) {\n wasmCumsum = backend.wasm.cwrap(Cumsum, null /* void */, [\n 'number', // x_id\n
'number', // exclusive\n 'number', // reverse\n 'number', // final_dim\n
'number', // out_id\n 'number' // dtype\n]);\n}\n\nexport function cumsum(\n args: {inputs: CumsumInputs,
backend: BackendWasm, attrs: CumsumAttrs}): TensorInfo {\n const {inputs, backend, attrs} = args;\n const {x}
= inputs;\n const {axis, exclusive, reverse} = attrs;\n const xRank = x.shape.length;\n\n util.assert(x.dtype ===
'float32' || x.dtype === 'int32',\n () => `cumsum does not support ${x.dtype} tensors in the WASM backend`);\n //
permute required axis to inner most axis\n const permutation = backend_util.getAxesPermutation([axis], xRank);\n\n
let permutedX = x;\n if (permutation !== null) {\n permutedX = transpose({inputs: {x}, attrs: {perm:
permutation}, backend});\n }\n const permutedAxis = backend_util.getInnerMostAxes(1, xRank)[0];\n\n
backend_util.assertAxesAreInnerMostDims('cumsum', [permutedAxis], xRank);\n const permutedOut =
backend.makeOutput(permutedX.shape, permutedX.dtype);\n const finalDim = permutedX.shape[permutedAxis];\n\n
const\n permutedXId = backend.dataIdMap.get(permutedX.dataId).id;\n const permutedOutId =
backend.dataIdMap.get(permutedOut.dataId).id;\n wasmCumsum(permutedXId, exclusive ? 1 : 0, reverse ? 1 : 0,
finalDim,\n permutedOutId, CppDType[x.dtype]);\n\n // transpose data back if permuted\n let out =
permutedOut;\n if (permutation !== null) {\n const undoPermutation =
backend_util.getUndoAxesPermutation(permutation);\n out = transpose(\n {inputs: {x: permutedOut}, attrs:
{perm: undoPermutation}, backend});\n backend.disposeData(permutedX.dataId);\n }\n backend.disposeData(permutedOut.dataId);\n }\n return out;\n}\n\nexport const cumsumConfig: KernelConfig =
{\n kernelName: Cumsum,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: cumsum as {} as
KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with

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filterHeight\n 'number', // filterWidth\n 'number', // padTop\n 'number', // padRight\n 'number', //
padBottom\n 'number', // padLeft\n 'number', // isSamePad\n
 'number', // dilationHeight\n 'number', // dilationWidth\n 'number', // strideHeight\n 'number', //
strideWidth\n 'number', // inputChannels\n 'number', // outputChannels\n 'number', // outId\n
]);\n}\n\nfunction depthwiseConv2d(args: {\n inputs: DepthwiseConv2dNativeInputs,\n backend:
BackendWasm,\n attrs: DepthwiseConv2dNativeAttrs\n}) {\n const {inputs, attrs, backend} = args;\n const {x,
filter} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const filterId =
backend.dataIdMap.get(filter.dataId).id;\n const {strides, dilations, pad, dimRoundingMode} = attrs;\n const
$dilations = dilations === null ? [1, 1] : dilations;\n const convInfo = backend_util.computeConv2DInfo(\n (x as
Tensor4D).shape, (filter as Tensor4D).shape, strides,\n ($dilations as number | [number, number]), pad,
dimRoundingMode,\n true /* depthwise */);\n const filterHeight = convInfo.filterHeight;\n const filterWidth
= convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const padRight = convInfo.padInfo.right;\n
const padBottom = convInfo.padInfo.bottom;\n const padLeft = convInfo.padInfo.left;\n const dilationHeight =
convInfo.dilationHeight;\n const dilationWidth = convInfo.dilationWidth;\n const strideHeight =
convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n const inputChannels =
convInfo.inChannels;\n const outputChannels = convInfo.outChannels;\n const isSamePad = convInfo.padInfo.type
=== 'SAME' ? 1 : 0;\n if (convInfo.dataFormat !== 'channelsLast') {\n throw new Error(\n `wasm backend
DepthwiseConv2dNative does not support dataFormat:` +\n `${convInfo.dataFormat}`. Please use
'channelsLast'.`);\n }\n const out = backend.makeOutput(convInfo.outShape, 'float32');\n const outId =
backend.dataIdMap.get(out.dataId).id;\n wasmDepthwiseConv2d(\n xId, x.shape[0], x.shape[1], x.shape[2],
filterId, filterHeight,\n filterWidth,
 padTop, padRight, padBottom, padLeft, isSamePad,\n dilationHeight, dilationWidth, strideHeight, strideWidth,
inputChannels,\n outputChannels, outId);\n return out;\n}\n\nexport const depthwiseConv2dNativeConfig:
KernelConfig = {\n kernelName: DepthwiseConv2dNative,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: depthwiseConv2d as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2021 Google LLC. All
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http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations
under the License.\n *
=====
\n
*/\nimport {Elu, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'/unary_kernel';\n\nexport const eluConfig: KernelConfig = createUnaryKernelConfig(Elu);\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
"License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
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agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
\n
*/\nimport {Equal, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
'/binary_kernel';\n\nconst supportsFullBroadcast = false;\nexport const equalConfig: KernelConfig =\ncreateBinaryKernelConfig(Equal, supportsFullBroadcast, 'bool');\n\n"/**\n * @license\n * Copyright 2019 Google
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use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,

```

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```
=====\n\n*\nimport {Exp, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from './unary_kernel';\nexport const expConfig: KernelConfig = createUnaryKernelConfig(Exp, 'float32');\n","/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *\n
```

```
=====\n\n*\nimport {ExpandDims, ExpandDimsAttrs, ExpandDimsInputs, KernelConfig, KernelFunc, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {reshape} from './Reshape';\nexport function expandDims(args: {\n inputs: ExpandDimsInputs,\n attrs: ExpandDimsAttrs,\n backend: BackendWasm\n}) {\n const {inputs, attrs, backend} = args;\n const {input} = inputs;\n const {dim} = attrs;\n const inputRank = input.shape.length;\n const newShape = input.shape.slice();\n let $dim = dim;\n if (dim < 0) {\n // Negative value is counted from the tail of rank.\n util.assert(\n -(inputRank + 1) <= dim,\n () => `Axis must be in the interval [${-(inputRank + 1)}, ${inputRank}]`);\n $dim = inputRank + dim + 1;\n }\n newShape.splice($dim, 0, 1);\n return reshape({inputs: {x: input}, backend, attrs: {shape: newShape}});\n}\n\nexport const expandDimsConfig: KernelConfig = {\n kernelName: ExpandDims,\n backendName: 'wasm',\n kernelFunc: expandDims as {} as KernelFunc,\n};\n","/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *\n
```

```
=====\n\n*\nimport {KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\nimport {Fill, FillAttrs} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nexport function fill(args: {attrs: FillAttrs, backend: BackendWasm}) {\n const {attrs: {shape, value, dtype}, backend} = args;\n const out = backend.makeOutput(shape, dtype);\n const outVals = backend.typedArrayFromHeap(out);\n outVals.fill(value as number);\n return out;\n}\n\nexport const fillConfig: KernelConfig = {\n kernelName: Fill,\n backendName: 'wasm',\n kernelFunc: fill as {} as KernelFunc,\n};\n","/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *\n
```

```
=====\n\n*\nimport {FlipLeftRight, FlipLeftRightInputs, KernelConfig, KernelFunc, TensorInfo} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nlet wasmFlipLeftRight: (\n xId: number, batch: number, imageHeight: number, imageWidth: number,\n numChannels: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmFlipLeftRight = backend.wasm.cwrap(FlipLeftRight,\n
```

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null /* void */, [n 'number', // xId\n 'number', // batch\n 'number', // imageHeight\n 'number', //
imageWidth\n 'number', // numChannels\n 'number', // outId\n]);\n}\n\nexport function flipLeftRight(\n
args: {inputs: FlipLeftRightInputs, backend: BackendWasm}): TensorInfo {\n const {inputs, backend} = args;\n
const {image} = inputs;\n\n const out = backend.makeOutput(image.shape, image.dtype);\n const imageId =
backend.dataIdMap.get(image.dataId).id;\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n
const [batch, imageHeight, imageWidth, numChannels] = image.shape;\n\n wasmFlipLeftRight(\n imageId,
batch, imageHeight, imageWidth, numChannels, outId);\n return out;\n}\n\nexport const flipLeftRightConfig:
KernelConfig = {\n kernelName: FlipLeftRight,\n backendName: 'wasm',\n kernelFunc: flipLeftRight as {} as
KernelFunc,\n setupFunc: setup\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n
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software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under
the License.\n *
=====
\n
*/\nimport {Floor, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'/unary_kernel';\nexport const floorConfig: KernelConfig = createUnaryKernelConfig(Floor);\n", "/*\n *
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2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n
* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
\n
*/\n\nimport {FloorDiv, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
'/binary_kernel';\n\nconst supportsFullBroadcast = false;\nexport const floorDivConfig: KernelConfig =\ncreateBinaryKernelConfig(FloorDiv, supportsFullBroadcast);\n", "/*\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
\n
*/\n\nimport {FusedBatchNorm, FusedBatchNormAttrs, FusedBatchNormInputs, KernelConfig, KernelFunc,
TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\n\nlet
wasmBatchNorm: (\n xId: number, meanId: number, varianceId: number, offsetId: number,\n scaleId: number,
varianceEpsilon: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n
wasmBatchNorm = backend.wasm.cwrap(\n FusedBatchNorm, null /* void */,\n ['number', 'number',
'number', 'number', 'number', 'number', 'number']);\n}\n\nfunction fusedBatchNorm(args: {\n backend:
BackendWasm,\n inputs: FusedBatchNormInputs,\n attrs: FusedBatchNormAttrs\n}): TensorInfo {\n const
{backend, inputs, attrs} = args;\n const {varianceEpsilon} = attrs;\n const {x, mean, variance, offset, scale} =
inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const meanId =
backend.dataIdMap.get(mean.dataId).id;\n const varianceId = backend.dataIdMap.get(variance.dataId).id;\n
const offsetId = offset != null ? backend.dataIdMap.get(offset.dataId).id : 0;\n const scaleId = scale != null ?
backend.dataIdMap.get(scale.dataId).id : 0;\n\n const out = backend.makeOutput(x.shape, x.dtype);\n // Short-

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circuit zero-sized tensors.\n if (util.sizeFromShape(x.shape) === 0) {\n return out;\n }\n\n const outId =
backend.dataIdMap.get(out.dataId).id;\n\n wasmBatchNorm(\n xId, meanId, varianceId, offsetId, scaleId,
varianceEpsilon, outId);\n return out;\n}\n\nexport const fusedBatchNormConfig: KernelConfig = {\n kernelName:
FusedBatchNorm,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: fusedBatchNorm as { } as
KernelFunc\n};\n", "/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
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*\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is
distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *

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=====\n
*\n\nimport { backend_util, FusedConv2D, FusedConv2DAttrs, FusedConv2DInputs, KernelConfig, KernelFunc,
Tensor4D } from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport
{ FusibleActivation } from './types';\n\nlet wasmFusedConv2d:\n (xId: number, batchSize: number, inputHeight:
number, inputWidth: number,\n filterId: number, filterHeight: number, filterWidth: number,\n biasId: number,
padTop: number, padRight: number, padBottom: number,\n padLeft: number, isSamePad: number,
dilationHeight: number,\n dilationWidth:
number, strideHeight: number, strideWidth: number,\n inputChannels: number, outputChannels: number,
activation: number,\n preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>\n
void;\n\nfunction setup(backend: BackendWasm) {\n wasmFusedConv2d = backend.wasm.cwrap(FusedConv2D,
null /* void */, [\n 'number', // xId\n 'number', // batchSize\n 'number', // inputHeight\n 'number', //
inputWidth\n 'number', // filterId\n 'number', // filterHeight\n 'number', // filterWidth\n 'number', // biasId\n
'number', // padTop\n 'number', // padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', //
isSamePad\n 'number', // dilationHeight\n 'number', // dilationWidth\n 'number', // strideHeight\n 'number',
// strideWidth\n 'number', // inputChannels\n 'number', // outputChannels\n 'number', // activation\n
'number', // preluActivationWeightsId\n 'number', //
leakyreluAlpha\n 'number', // outId\n]);\n}\n\nfunction fusedConv2d(args: {\n inputs: FusedConv2DInputs,\n
backend: BackendWasm,\n attrs: FusedConv2DAttrs\n}) {\n const { inputs, attrs, backend } = args;\n const { x,
filter, bias, preluActivationWeights } = inputs;\n const {\n strides,\n pad,\n dilations,\n dataFormat,\n dimRoundingMode,\n activation,\n leakyreluAlpha\n } = attrs;\n\n const convInfo =
backend_util.computeConv2DInfo(\n (x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations,\n pad, dimRoundingMode);\n\n const fusedActivation =\n FusibleActivation[activation as { } as keyof typeof
FusibleActivation];\n if (fusedActivation == null) {\n throw new Error(\n `${activation} activation not yet
supported for FusedConv2D` +\n `in the wasm backend.`);\n }\n\n const xId =
backend.dataIdMap.get(x.dataId).id;\n const filterId = backend.dataIdMap.get(filter.dataId).id;\n\n const
outputChannels = convInfo.outChannels;\n\n let biasId = 0;\n if (bias != null) {\n const biasData = backend.dataIdMap.get(bias.dataId);\n if
(biasData.shape.length !== 1) {\n throw new Error(\n `FusedConv2D only supports rank-1 bias but got `
+\n `rank ${biasData.shape.length}.`);\n }\n if (biasData.shape[0] !== outputChannels) {\n throw new
Error(\n `FusedConv2D bias shape (${biasData.shape}) does not ` +\n `match the number of output
channels (${outputChannels})`);\n }\n biasId = biasData.id;\n }\n\n const filterHeight =
convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const
padRight = convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n const padLeft =
convInfo.padInfo.left;\n const dilationHeight = convInfo.dilationHeight;\n const dilationWidth =
convInfo.dilationWidth;\n const strideHeight = convInfo.strideHeight;\n const strideWidth =
convInfo.strideWidth;\n

```

```

const inputChannels = convInfo.inChannels;\n const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;\n
const batchSize = convInfo.batchSize;\n const inHeight = convInfo.inHeight;\n const inWidth =
convInfo.inWidth;\n\n if (dataFormat !== 'NHWC') {\n throw new Error(\n `wasm backend FusedConv2D
does not support dataFormat:` +\n ` ${dataFormat}'. Please use 'NHWC'.`);\n }\n\n const out =
backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n const
preluActivationWeightsId = preluActivationWeights == null ?\n 0 :\n
backend.dataIdMap.get(preluActivationWeights.dataId).id;\n\n wasmFusedConv2d(\n xId, batchSize, inHeight,
inWidth, filterId, filterHeight, filterWidth,\n biasId, padTop, padRight, padBottom, padLeft, isSamePad,
dilationHeight,\n dilationWidth, strideHeight, strideWidth, inputChannels, outputChannels,\n fusedActivation,
preluActivationWeightsId, leakyreluAlpha
|| 0, outId);\n\n return out;\n}\n\nexport const fusedConv2DConfig: KernelConfig = {\n kernelName:
FusedConv2D,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: fusedConv2d as {} as
KernelFunc\n};\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n */
=====\n
*/\n\nimport {backend_util, FusedDepthwiseConv2D, FusedDepthwiseConv2DAttrs,
FusedDepthwiseConv2DInputs, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from './backend_wasm';\n\nimport {FusableActivation} from './types';\n\nlet
wasmFusedDepthwiseConv2d:\n (xId: number, batchSize: number, inputHeight: number, inputWidth: number,\n
filterId: number, filterHeight: number, filterWidth: number,\n biasId: number, padTop: number, padRight:
number, padBottom: number,\n padLeft: number, isSamePad: number, dilationHeight: number,\n
dilationWidth: number, strideHeight: number, strideWidth: number,\n inputChannels: number, outputChannels:
number, activation: number,\n preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>\n
void;\n\nfunction setup(backend: BackendWasm) {\n wasmFusedDepthwiseConv2d =\n
backend.wasm.cwrap(FusedDepthwiseConv2D, null /* void */, [\n 'number', // xId\n 'number', //
batchSize\n 'number', // inputHeight\n
'number', // inputWidth\n 'number', // filterId\n 'number', // filterHeight\n 'number', // filterWidth\n
'number', // biasId\n 'number', // padTop\n 'number', // padRight\n 'number', // padBottom\n
'number', // padLeft\n 'number', // isSamePad\n 'number', // dilationHeight\n 'number', //
dilationWidth\n 'number', // strideHeight\n 'number', // strideWidth\n 'number', // inputChannels\n
'number', // outputChannels\n 'number', // activation\n 'number', // preluActivationWeightsId\n
'number', // leakyreluAlpha\n 'number', // outId\n]);\n\nfunction fusedDepthwiseConv2d(args: {\n
inputs: FusedDepthwiseConv2DInputs,\n backend: BackendWasm,\n attrs: FusedDepthwiseConv2DAttrs\n}) {\n
const {inputs, attrs, backend} = args;\n const {x, filter, bias, preluActivationWeights} = inputs;\n const {\n
strides,\n pad,\n dilations,\n
dataFormat,\n dimRoundingMode,\n activation,\n leakyreluAlpha\n } = attrs;\n\n const convInfo =
backend_util.computeConv2DInfo(\n (x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations,\n
pad, dimRoundingMode, true /* depthwise */);\n\n const fusedActivation =\n FusableActivation[activation as {}
as keyof typeof FusableActivation];\n if (fusedActivation == null) {\n throw new Error(\n ` ${activation}
activation not yet supported for FusedDepthwiseConv2D` +\n ` in the wasm backend.`);\n }\n\n const xId =
backend.dataIdMap.get(x.dataId).id;\n const filterId = backend.dataIdMap.get(filter.dataId).id;\n const
outputChannels = convInfo.outChannels;\n\n let biasId = 0;\n if (bias != null) {\n const biasData =
backend.dataIdMap.get(bias.dataId);\n if (biasData.shape.length !== 1) {\n throw new Error(\n

```



```

`FusedDepthwiseConv2D only supports rank-1 bias but got ` +\n `rank ${biasData.shape.length}.`);\n
 }\n if (biasData.shape[0] !== outputChannels) {\n throw new Error(\n `FusedDepthwiseConv2D bias\n shape (${biasData.shape}) does not ` +\n `match the number of output channels (${outputChannels})`);\n }\n biasId = biasData.id;\n}\n\nconst filterHeight = convInfo.filterHeight;\nconst filterWidth =\nconvInfo.filterWidth;\nconst padTop = convInfo.padInfo.top;\nconst padRight = convInfo.padInfo.right;\nconst\npadBottom = convInfo.padInfo.bottom;\nconst padLeft = convInfo.padInfo.left;\nconst dilationHeight =\nconvInfo.dilationHeight;\nconst dilationWidth = convInfo.dilationWidth;\nconst strideHeight =\nconvInfo.strideHeight;\nconst strideWidth = convInfo.strideWidth;\nconst inputChannels =\nconvInfo.inChannels;\nconst isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;\nconst batchSize =\nconvInfo.batchSize;\nconst inHeight = convInfo.inHeight;\nconst inWidth = convInfo.inWidth;\n\nif\n(dataFormat !== 'NHWC') {\n\n throw new Error(\n `wasm backend FusedDepthwiseConv2D does not support dataFormat: ` +\n `${dataFormat}`. Please use 'NHWC'.`);\n}\n\nconst out = backend.makeOutput(convInfo.outShape, 'float32');\nconst outId = backend.dataIdMap.get(out.dataId).id;\nconst preluActivationWeightsId = preluActivationWeights\n== null ?\n 0 :\n backend.dataIdMap.get(preluActivationWeights.dataId).id;\n\nwasmFusedDepthwiseConv2d(\n xId, batchSize, inHeight, inWidth, filterId, filterHeight, filterWidth,\n biasId, padTop, padRight, padBottom, padLeft, isSamePad, dilationHeight,\n dilationWidth, strideHeight,\n strideWidth, inputChannels, outputChannels,\n fusedActivation, preluActivationWeightsId, leakyreluAlpha || 0,\n outId);\n\nreturn out;\n}\n\nexport const fusedDepthwiseConv2DConfig: KernelConfig = {\n kernelName:\n FusedDepthwiseConv2D,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: fusedDepthwiseConv2d as\n {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {gather_util, GatherNd, GatherNdInputs, KernelConfig, TensorInfo} from '@tensorflow/tfjs-\ncore';\nimport {BackendWasm} from '../backend_wasm';\nimport {CppDType} from './types';\n\nlet\nwasmGatherNd: (\n xId: number, dtype: CppDType, indicesId: number, numSlices: number,\n sliceRank: number, sliceSize: number, strides: Uint8Array, outId: number) =>\n void;\n\nfunction\nsetup(backend: BackendWasm): void {\n wasmGatherNd = backend.wasm.cwrap(GatherNd, null /*void*/, [\n 'number', // xId\n 'number', // dtype\n 'number', // indicesId\n 'number', // numSlices\n 'number', //\n sliceRank\n 'number', // sliceSize\n 'array', // strides\n 'number' // outId\n]);\n}\n\nfunction gatherNd(args:\n {backend: BackendWasm, inputs: GatherNdInputs}):\n TensorInfo {\n const {backend, inputs} = args;\n const\n {params, indices} = inputs;\n\n const [resultShape, numSlices, sliceSize, strides] =\n gather_util.prepareAndValidate(params, indices);\n\n const out = backend.makeOutput(resultShape,\n params.dtype);\n if (numSlices === 0) {\n return out;\n }\n\n const indicesShape = indices.shape;\n const\n sliceRank = indicesShape[indicesShape.length - 1];\n\n const xData = backend.dataIdMap.get(params.dataId);\n const\n xId = xData.id;\n\n const indicesData = backend.dataIdMap.get(indices.dataId);\n const\n indicesId = indicesData.id;\n\n const\n stridesBytes = new Uint8Array(new Int32Array(strides).buffer);\n\n const outId =\n backend.dataIdMap.get(out.dataId).id;\n\n wasmGatherNd(\n xId, CppDType[params.dtype], indicesId,\n numSlices, sliceRank, sliceSize,\n stridesBytes, outId);\n\n return out;\n}\n\nexport const gatherNdConfig:\n KernelConfig = {\n kernelName: GatherNd,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc:\n gatherNd\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the\n * Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the

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License.\n \* You may obtain a copy of the License at\n \* http://www.apache.org/licenses/LICENSE-2.0\n \*\n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\n\nimport {backend_util, GatherV2, GatherV2Attrs, GatherV2Inputs, KernelConfig, KernelFunc, Tensor, TensorInfo, TypedArray, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {reshape} from './Reshape';\nimport {CppType} from './types';\n\nlet wasmGather:\n (xId: number, dtype: CppDType, xStrides: Uint8Array, stridesSize: number,\n indicesId: number, batchSize: number, outStrides: Uint8Array,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmGather = backend.wasm.cwrap('Gather', null /*void*/, [\n 'number', // xId\n 'number', // dtype\n 'array', // xStrides\n 'number', // stridesSize\n 'number', // indicesId\n 'number', // batchSize\n 'array', // outStrides\n 'number', // outId\n]);\n\n function gatherV2(\n args: {backend: BackendWasm, inputs: GatherV2Inputs, attrs: GatherV2Attrs}): TensorInfo {\n const {backend, inputs, attrs} = args;\n const {x, indices} = inputs;\n const {axis, batchDims} = attrs;\n\n // Throw error when any index is out of bound.\n const parsedAxis = util.parseAxisParam(axis, x.shape)[0];\n const indicesVals = backend.readSync(indices.dataId) as TypedArray;\n const axisDim = x.shape[parsedAxis];\n for (let i = 0; i < indicesVals.length; ++i) {\n const index = indicesVals[i];\n util.assert(\n index <= axisDim - 1 && index >= 0,\n () =>`\n `GatherV2: the index value ${index} is not in [0, ${axisDim - 1}]);\n }\n\n const shapeInfo = backend_util.segment_util.collectGatherOpShapeInfo(\n x as Tensor, indices as Tensor, parsedAxis, batchDims);\n\n const flattenX = reshape({\n inputs: {x},\n attrs: {\n shape: [\n shapeInfo.batchSize, shapeInfo.outerSize, shapeInfo.dimSize,\n shapeInfo.sliceSize\n]\n },\n backend\n });\n const indicesSize = util.sizeFromShape(indices.shape);\n const flattenIndex = reshape({\n inputs: {x: indices},\n attrs: {\n shape: [shapeInfo.batchSize, indicesSize / shapeInfo.batchSize],\n backend\n }\n });\n const flattenOutputShape = [\n shapeInfo.batchSize, shapeInfo.outerSize, indicesSize / shapeInfo.batchSize,\n shapeInfo.sliceSize\n];\n\n const out = backend.makeOutput(flattenOutputShape, x.dtype);\n if (util.sizeFromShape(x.shape) === 0) {\n return out;\n }\n\n const stridesSize = flattenX.shape.length - 1;\n const xData = backend.dataIdMap.get(flattenX.dataId);\n const xId = xData.id;\n\n const indicesData = backend.dataIdMap.get(flattenIndex.dataId);\n const indicesId = indicesData.id;\n\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const xStridesBytes = new Uint8Array(\n new Int32Array(util.computeStrides(flattenX.shape)).buffer);\n\n const outStridesBytes = new Uint8Array(\n new Int32Array(util.computeStrides(flattenOutputShape)).buffer);\n\n wasmGather(\n xId, CppDType[x.dtype], xStridesBytes, stridesSize, indicesId,\n shapeInfo.batchSize, outStridesBytes, outId);\n\n backend.disposeData(flattenX.dataId);\n backend.disposeData(flattenIndex.dataId);\n\n // reshape\n out.shape = shapeInfo.outputShape;\n return out;\n }\n\n export const gatherV2Config: KernelConfig = {\n kernelName: GatherV2,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: gatherV2 as {} as KernelFunc\n };*\n\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport {Greater, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from './binary_kernel';\n\nconst supportsFullBroadcast = false;\nexport const greaterConfig: KernelConfig =\n
```

createBinaryKernelConfig(Greater, supportsFullBroadcast, 'bool');\n", "/\*\n \* @license\n \* Copyright 2019 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the \"License\");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \* http://www.apache.org/licenses/LICENSE-2.0\n \* Unless required by applicable law or agreed to in writing, software\n

\* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\nimport { GreaterEqual, KernelConfig } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from './binary_kernel';\n\nconst supportsFullBroadcast = false;\nexport const greaterEqualConfig: KernelConfig =\n createBinaryKernelConfig(GreaterEqual, supportsFullBroadcast, 'bool');\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\nimport { KernelConfig, KernelFunc, LeakyRelu, LeakyReluAttrs, LeakyReluInputs, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport { CppDType } from './types';\n\nlet wasmFunc: (\n xId: number, dtype: number, leakyreluAlpha: number, outId: number) =>\n void;\n\nfunction setupFunc(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(LeakyRelu, null /* void */, [\n 'number', // x_id\n 'number', // dtype\n 'number', // leakyrelu_alpha\n 'number', // out_id\n]);\n\n export function leakyRelu(\n args: {\n inputs: LeakyReluInputs, attrs: LeakyReluAttrs, backend: BackendWasm\n }):\n TensorInfo {\n const { inputs: [x], attrs: { alpha }, backend } = args;\n\n const xId = backend.dataIdMap.get(x.dataId).id;\n // According to TF API, LeakyRelu returns float32 when input is either float32\n // or int32.\n const out = backend.makeOutput(x.shape, 'float32');\n\n if (util.sizeFromShape(x.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmFunc(xId, CppDType[x.dtype], alpha, outId);\n }\n\n return out;\n }\n\n export const leakyReluConfig: KernelConfig = {\n kernelName: LeakyRelu,\n backendName: 'wasm',\n setupFunc,\n kernelFunc: leakyRelu as {} as KernelFunc,\n };\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\nimport { KernelConfig, Less } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from './binary_kernel';\n\nconst supportsFullBroadcast = false;\nexport const lessConfig: KernelConfig =\n createBinaryKernelConfig(Less, supportsFullBroadcast, 'bool');\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

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=====\n
```

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*\n\nimport {KernelConfig, LessEqual} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from
'./binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const lessEqualConfig: KernelConfig =\ncreateBinaryKernelConfig(LessEqual, supportsFullBroadcast, 'bool');\n\n"/**\n * @license\n * Copyright 2019
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *

```

```

=====\n
*\n\nimport {KernelConfig, Log} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'./unary_kernel';\n\nexport const logConfig: KernelConfig = createUnaryKernelConfig(Log);\n\n"/**\n * @license\n *
Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
"License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

```

```

=====\n
*\n\nimport {KernelConfig, LogicalAnd} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from
'./binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const logicalAndConfig: KernelConfig =\ncreateBinaryKernelConfig(LogicalAnd, supportsFullBroadcast, 'bool');\n\n"/**\n * @license\n * Copyright 2019
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License
is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *

```

```

=====\n
*\n\nimport {backend_util, KernelConfig, KernelFunc, Max, MaxAttrs, MaxInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport
{permuteAxesAndTranspose} from './kernel_utils';\n\nimport {CppType} from './types';\n\nlet wasmMax: (xId:
number, dtype: number, reduceSize: number, outId: number) =>\n void;\n\nfunction setup(backend:
BackendWasm): void {\n\n wasmMax = backend.wasm.cwrap(Max, null /*void*/, [\n 'number', // x_id\n
'number', // dtype\n 'number', // reduce_size\n 'number', // out_id\n]);\n\n\nfunction max(args: {backend:
BackendWasm, inputs: MaxInputs, attrs: MaxAttrs}):\n TensorInfo {\n\n const
{backend, inputs, attrs} = args;\n\n const {reductionIndices: axis, keepDims} = attrs;\n\n const {x} = inputs;\n\n const
xId = backend.dataIdMap.get(x.dataId).id;\n\n let inputId = xId;\n\n let input = x;\n\n\n const {transposed, axes,
originalAxes, inputWasTransposed} =\n permuteAxesAndTranspose(x, axis, backend);\n\n\n if
(inputWasTransposed) {\n\n const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n\n input =
transposed;\n\n inputId = transposedId;\n\n }\n\n\n const inputRank = input.shape.length;\n\n
backend_util.assertAxesAreInnerMostDims('max', axes, inputRank);\n\n const [outShape, reduceShape] =\n
backend_util.computeOutAndReduceShapes(input.shape, axes);\n\n const reduceSize =
util.sizeFromShape(reduceShape);\n\n\n const out = backend.makeOutput(outShape, x.dtype);\n\n if
(util.sizeFromShape(input.shape) !== 0) {\n\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n
wasmMax(inputId, CCppType[x.dtype], reduceSize, outId);\n\n }\n\n\n if (inputWasTransposed)

```

```
{\n // dispose of the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n return out;\n}\n\nexport const maxConfig: KernelConfig = {\n kernelName: Max,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: max as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing\n * permissions and\n * limitations under the License.\n */
```

```
=====\n\n*/\nimport {KernelConfig, Maximum} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from\n './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const maximumConfig: KernelConfig =\n createBinaryKernelConfig(Maximum, supportsFullBroadcast);\n\n"/**\n * @license\n * Copyright 2019 Google\n * LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not\n * use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing\n * permissions and\n * limitations under the License.\n */
```

```
=====\n\n*/\nimport {backend_util, KernelConfig, KernelFunc, MaxPool, MaxPoolAttrs, MaxPoolInputs, Tensor4D, util}\n from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\n\nlet wasmMaxPool: (\n xId:\n number, batchSize: number, inputHeight: number, inputWidth: number,\n filterHeight: number, filterWidth:\n number, padTop: number, padRight: number,\n padBottom: number, padLeft: number, dilationHeight: number,\n dilationWidth: number, strideHeight: number, strideWidth: number,\n inputChannels: number, outputChannels:\n number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmMaxPool =\n backend.wasm.cwrap(MaxPool, null /* void */, [\n 'number', // xId\n 'number', // batchSize\n 'number', //\n inputHeight\n 'number', // inputWidth\n 'number', // filterHeight\n 'number', // filterWidth\n 'number', // padTop\n 'number', // padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number',\n // dilationHeight\n 'number', // dilationWidth\n 'number', // strideHeight\n 'number', // strideWidth\n 'number', // inputChannels\n 'number', // outputChannels\n 'number', // outId\n]);\n\nfunction maxPool(\n args: {inputs: MaxPoolInputs, backend: BackendWasm, attrs: MaxPoolAttrs}) {\n const {inputs, attrs, backend} =\n args;\n const x = inputs.x as Tensor4D;\n const xId = backend.dataIdMap.get(x.dataId).id;\n // TF API\n supports int32 input. CPU and WebGL backend also support int32\n // input. WASM backend doesn't support it\n because it uses xnnpack which only\n // supports float32.\n // Add the following assert only for the WASM\n backend instead of at core op\n // level.\n // TODO: add support for int32 input.\n util.assert(\n x.dtype\n === 'float32',\n () =>\n `Error in MaxPool: only float32\n input is supported. Got ${x.dtype}.`);\n const {filterSize, strides, pad, dimRoundingMode} = attrs;\n const\n convInfo = backend_util.computePool2DInfo(\n x.shape, filterSize, strides, 1 /* dilations */, pad,\n dimRoundingMode);\n const filterHeight = convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const padRight = convInfo.padInfo.right;\n const padBottom =\n convInfo.padInfo.bottom;\n const padLeft = convInfo.padInfo.left;\n const dilationHeight =\n convInfo.dilationHeight;\n const dilationWidth = convInfo.dilationWidth;\n const strideHeight =\n convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n const inputChannels =\n convInfo.inChannels;\n const outputChannels = convInfo.outChannels;\n if (convInfo.dataFormat !==
```

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'channelsLast') {\n throw new Error(\n `wasm backend does not support dataFormat:` +\n `${convInfo.dataFormat}`. Please use 'channelsLast'.`);\n }\n\n const out
= backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n\nwasmMaxPool(\n xId, x.shape[0], x.shape[1], x.shape[2], filterHeight, filterWidth,\n padTop, padRight, padBottom, padLeft, dilationHeight, dilationWidth,\n strideHeight, strideWidth, inputChannels, outputChannels,
outId);\n return out;\n}\n\nexport const maxPoolConfig: KernelConfig = {\n kernelName: MaxPool,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: maxPool as { } as KernelFunc\n};\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*/\n\nimport { backend_util, KernelConfig, KernelFunc, Mean, MeanAttrs, MeanInputs, TensorInfo, util } from
'@tensorflow/tfjs-core';\n\nimport { BackendWasm } from './backend_wasm';\nimport { cast } from './Cast';\n\nimport
{ permuteAxesAndTranspose } from './kernel_utils';\n\nlet wasmMean: (xId: number, reduceSize: number, outId:
number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmMean =\n backend.wasm.cwrap(Mean, null /*void*/, ['number, number, number']);\n}\n\nexport function mean(\n args:
{ backend: BackendWasm, inputs: MeanInputs, attrs: MeanAttrs }):\n TensorInfo {\n const { backend, inputs,
attrs } = args;\n const { axis, keepDims } = attrs;\n const { x } = inputs;\n const xId =
backend.dataIdMap.get(x.dataId).id;\n
 let inputId = xId;\n let input = x;\n const { transposed, axes, originalAxes, inputWasTransposed } =\n permuteAxesAndTranspose(x, axis, backend);\n let reductionAxes = axes;\n if (inputWasTransposed) {\n const
transposedId = backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId !== xId) {\n // transpose was
not a no-op. We will need to dispose of this\n // once we are done.\n input = transposed;\n inputId =
transposedId;\n reductionAxes = backend_util.getInnerMostAxes(\n reductionAxes.length,
input.shape.length);\n }\n }\n backend_util.assertAxesAreInnerMostDims(\n 'mean', reductionAxes,
input.shape.length);\n const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n const reduceSize =
util.sizeFromShape(reduceShape);\n let castedInput = input;\n if (input.dtype !== 'float32') {\n castedInput =\n cast({ backend, inputs: { x: input }, attrs: { dtype:
'float32' }});\n inputId = backend.dataIdMap.get(castedInput.dataId).id;\n }\n const out =
backend.makeOutput(outShape, 'float32');\n if (util.sizeFromShape(input.shape) !== 0) {\n const outId =
backend.dataIdMap.get(out.dataId).id;\n wasmMean(inputId, reduceSize, outId);\n }\n if
(inputWasTransposed) {\n // dispose of the transposed tensor.\n backend.disposeData(transposed.dataId);\n
}\n if (keepDims) {\n // reshape\n const newShape = backend_util.expandShapeToKeepDim(out.shape,
originalAxes);\n out.shape = newShape;\n }\n if (input.dtype !== 'float32') {\n backend.disposeData(castedInput.dataId);\n
}\n return out;\n}\n\nexport const meanConfig: KernelConfig = {\n
kernelName: Mean,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: mean as { } as
KernelFunc\n};\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

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=====
*/\n\nimport { backend_util, KernelConfig, KernelFunc, Min, MinAttrs, MinInputs, TensorInfo, util } from
'@tensorflow/tfjs-core';\n\nimport { BackendWasm } from './backend_wasm';\n\nimport
{ permuteAxesAndTranspose } from './kernel_utils';\n\nimport { CppDType } from './types';\n\nlet wasmMin: (xId:
number, dtype: number, reduceSize: number, outId: number) =>\n void;\n\nfunction setup(backend:
BackendWasm): void {\n wasmMin = backend.wasm.cwrap(Min,
 null /*void*/, [\n 'number', // x_id\n 'number', // dtype\n 'number', // reduce_size\n 'number', // out_id\n
]);\n\n function min(args: { backend: BackendWasm, inputs: MinInputs, attrs: MinAttrs }):\n TensorInfo {\n const { backend, inputs, attrs } = args;\n const { axis, keepDims } = attrs;\n const { x } = inputs;\n const xId =
backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const { transposed, axes, originalAxes,
inputWasTransposed } =\n permuteAxesAndTranspose(x, axis, backend);\n\n if (inputWasTransposed) {\n
const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId !== xId) {\n // transpose
was not a no-op. We will need to dispose of this\n // once we are done.\n input = transposed;\n inputId =
transposedId;\n }\n }\n\n const inputRank = input.shape.length;\n\n backend_util.assertAxesAreInnerMostDims('min', axes, inputRank);\n const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, axes);\n const reduceSize =
util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, input.dtype);\n if
(util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmMin(inputId, CppDType[x.dtype], reduceSize, outId);\n }\n\n if (inputWasTransposed) {\n // dispose of the
transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const
newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n return out;\n}\n\nexport const minConfig: KernelConfig = {\n kernelName: Min,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: min as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not
use this file except in compliance with the License.\n
* You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless
required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an
"AS IS"\n * BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n
* See the License for the specific language governing permissions and\n * limitations under the License.\n
*/\n\nimport { KernelConfig, Minimum } from '@tensorflow/tfjs-core';\n\nimport { createBinaryKernelConfig } from
'/binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const minimumConfig: KernelConfig =\n createBinaryKernelConfig(Minimum, supportsFullBroadcast);\n\n"/**\n * @license\n * Copyright 2021 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not
use this file except in compliance with the License.\n
* You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless
required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an
"AS IS"\n * BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n
* See the License for the specific language governing permissions and\n * limitations under the License.\n
*/\n\nimport { KernelConfig, KernelFunc, MirrorPad, MirrorPadAttrs, MirrorPadInputs } from '@tensorflow/tfjs-
core';\n\nimport { BackendWasm } from './backend_wasm';\n\nimport { CppDType } from './types';\n\n// Must match
enum in MirrorPad.cc\nenum MirrorPaddingMode {\n reflect = 0,\n symmetric = 1\n}\n\nlet wasmMirrorPad: (\n
xId: number, xShapeBytes: Uint8Array, xShapeLength: number, xDtype: number,\n prePaddingsBytes:
Uint8Array, postPaddingsBytes: Uint8Array, mode: number,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmMirrorPad =
backend.wasm.cwrap(MirrorPad, null /* void */, [\n 'number', // xId\n 'array', // x.shape\n 'number', //
x.shape.length\n 'number', // x.dtype\n 'array', // pre-paddings\n 'array', // post-paddings\n 'number', //

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mode\n 'number', // outId\n]);\n\nfunction mirrorPad(args: {\n inputs: MirrorPadInputs,\n backend: BackendWasm,\n attrs: MirrorPadAttrs\n}) {\n const {inputs: {x}, backend, attrs: {paddings, mode}} = args;\n const outShape = paddings.map(\n (p, i) => p[0] /* beforePad */ + x.shape[i] + p[1] /* afterPad */);\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out = backend.makeOutput(outShape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n const prePaddingsFlat = paddings.map(padTuple => padTuple[0]);\n const postPaddingsFlat = paddings.map(padTuple => padTuple[1]);\n const prePaddingsBytes =\n new Uint8Array(new Int32Array(prePaddingsFlat).buffer);\n const postPaddingsBytes =\n new Uint8Array(new Int32Array(postPaddingsFlat).buffer);\n wasmMirrorPad(\n xId, xShapeBytes, x.shape.length, CppDType[x.dtype], prePaddingsBytes,\n postPaddingsBytes, MirrorPaddingMode[mode], outId);\n return out;\n}\n\nexport const mirrorPadConfig: KernelConfig = {\n kernelName: MirrorPad,\n backendName: 'wasm',\n kernelFunc: mirrorPad as {\n KernelFunc,\n setupFunc: setup\n };
}
\n\n/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
\n\nimport {KernelConfig, Multiply} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from './binary_kernel';\nconst supportsFullBroadcast = true;\nexport const multiplyConfig: KernelConfig =\n createBinaryKernelConfig(Multiply, supportsFullBroadcast);\n\n/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
\n\nimport {KernelConfig, Neg} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from './unary_kernel';\nexport const negConfig: KernelConfig = createUnaryKernelConfig(Neg);\n\n/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
\n\nimport {BackendWasm} from '../backend_wasm';\n// Analogous to `struct Result` in `non_max_suppression_impl.h`\ninterface Result {\n pSelectedIndices: number;\n selectedSize: number;\n pSelectedScores: number;\n pValidOutputs: number;\n}\n\n/*\n * Parse the result of the c++ method, which has the shape equivalent to\n * `Result`.\n */\nexport function parseResultStruct(\n backend: BackendWasm, resOffset: number): Result {\n const result = new Int32Array(backend.wasm.HEAPU8.buffer, resOffset, 4);\n const pSelectedIndices = result[0];\n const selectedSize = result[1];\n const pSelectedScores = result[2];\n const pValidOutputs = result[3];\n // Since the result was allocated on the heap, we have to delete it.\n backend.wasm._free(resOffset);\n return {pSelectedIndices, selectedSize,

```



pSelectedScores, pValidOutputs};\n}\n", "/\*\n \* @license\n \* Copyright 2019 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the \"License\");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \* \n \* http://www.apache.org/licenses/LICENSE-2.0\n \* \n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\n\nimport { KernelConfig, KernelFunc, NonMaxSuppressionV3, NonMaxSuppressionV3Attrs, NonMaxSuppressionV3Inputs, TensorInfo } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport { parseResultStruct } from './NonMaxSuppression_util';\n\nlet wasmFunc: (\n boxesId: number, scoresId: number, maxOutputSize: number,\n iouThreshold: number, scoreThreshold: number) => number;\n\nfunction setup(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(\n NonMaxSuppressionV3,\n 'number', // Result*\n [\n 'number', // boxesId\n 'number', // scoresId\n 'number', // maxOutputSize\n 'number', // iouThreshold\n 'number', // scoreThreshold\n]);\n\n function kernelFunc(args: {\n backend: BackendWasm,\n inputs: NonMaxSuppressionV3Inputs,\n attrs: NonMaxSuppressionV3Attrs\n }): TensorInfo {\n const { backend, inputs, attrs } = args;\n const { iouThreshold, maxOutputSize, scoreThreshold } = attrs;\n const { boxes, scores } = inputs;\n\n const boxesId = backend.dataIdMap.get(boxes.dataId).id;\n const scoresId = backend.dataIdMap.get(scores.dataId).id;\n\n const resOffset =\n wasmFunc(boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold);\n\n const { pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs } =\n parseResultStruct(backend, resOffset);\n\n // Since we are not using scores for V3, we have to delete it from the heap.\n backend.wasm._free(pSelectedScores);\n backend.wasm._free(pValidOutputs);\n\n const selectedIndicesTensor =\n backend.makeOutput([selectedSize, 'int32', pSelectedIndices]);\n\n return selectedIndicesTensor;\n }\n\n export const nonMaxSuppressionV3Config: KernelConfig = {\n kernelName: NonMaxSuppressionV3,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: kernelFunc as {\n KernelFunc,\n };\n };\n}\n\n/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport { KernelConfig, KernelFunc, NonMaxSuppressionV4, NonMaxSuppressionV4Attrs, NonMaxSuppressionV4Inputs, TensorInfo } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport { parseResultStruct } from './NonMaxSuppression_util';\n\nlet wasmFunc: (\n boxesId: number, scoresId: number, maxOutputSize: number,\n iouThreshold: number, scoreThreshold: number,\n padToMaxOutputSize: boolean) => number;\n\nfunction setup(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(\n NonMaxSuppressionV4,\n 'number', // Result*\n [\n 'number', // boxesId\n 'number', // scoresId\n 'number', // maxOutputSize\n 'number', // iouThreshold\n 'number', // scoreThreshold\n 'bool', // padToMaxOutputSize\n]);\n\n function nonMaxSuppressionV4(args: {\n backend: BackendWasm,\n inputs: NonMaxSuppressionV4Inputs,\n attrs: NonMaxSuppressionV4Attrs\n }): TensorInfo[] {\n const { backend, inputs, attrs } = args;\n const { iouThreshold, maxOutputSize, scoreThreshold, padToMaxOutputSize } =\n attrs;\n const { boxes, scores } = inputs;\n\n const boxesId =\n backend.dataIdMap.get(boxes.dataId).id;\n const scoresId = backend.dataIdMap.get(scores.dataId).id;\n\n const
```

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resOffset = wasmFunc(\n boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold,\n
padToMaxOutputSize);\n\n const {pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs} =\n
parseResultStruct(backend, resOffset);\n\n // Since we are not using scores for V4, we have to delete it from the\n
heap.\n backend.wasm._free(pSelectedScores);\n\n
const selectedIndicesTensor =\n backend.makeOutput([selectedSize], 'int32', pSelectedIndices);\n\n const\n
validOutputsTensor = backend.makeOutput([], 'int32', pValidOutputs);\n\n return [selectedIndicesTensor,\n
validOutputsTensor];\n\n\nexport const nonMaxSuppressionV4Config: KernelConfig = {\n kernelName:\n
NonMaxSuppressionV4,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: nonMaxSuppressionV4 as { }\n
as KernelFunc,\n};\n\n",/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under\n
the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the\n
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n
implied.\n * See\n
the License for the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {KernelConfig, KernelFunc, NonMaxSuppressionV5, NonMaxSuppressionV5Attrs,\n
NonMaxSuppressionV5Inputs, TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from\n
'./backend_wasm';\n\nimport {parseResultStruct} from './NonMaxSuppression_util';\n\nlet wasmFunc:\n
(boxesId: number, scoresId: number, maxOutputSize: number,\n iouThreshold: number, scoreThreshold: number,\n
softNmsSigma: number) =>\n number;\n\nfunction setup(backend: BackendWasm): void {\n wasmFunc =\n
backend.wasm.cwrap(\n NonMaxSuppressionV5,\n 'number', // Result*\n [\n 'number', // boxesId\n
 'number', // scoresId\n 'number', // maxOutputSize\n 'number', // iouThreshold\n
 'number', //\n
scoreThreshold\n 'number', // softNmsSigma\n]);\n\n\nfunction\n
kernelFunc(args: {\n backend: BackendWasm,\n inputs: NonMaxSuppressionV5Inputs,\n attrs:\n
NonMaxSuppressionV5Attrs\n}): TensorInfo[] {\n const {backend, inputs, attrs} = args;\n const {iouThreshold,\n
maxOutputSize, scoreThreshold, softNmsSigma} = attrs;\n const {boxes, scores} = inputs;\n\n const boxesId =\n
backend.dataIdMap.get(boxes.dataId).id;\n const scoresId = backend.dataIdMap.get(scores.dataId).id;\n\n const\n
resOffset = wasmFunc(\n boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold,\n
softNmsSigma);\n\n const {pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs} =\n
parseResultStruct(backend, resOffset);\n\n // Since we are not using validOutputs for V5, we have to delete it from\n
the\n // heap.\n backend.wasm._free(pValidOutputs);\n\n const selectedIndicesTensor =\n
backend.makeOutput([selectedSize], 'int32', pSelectedIndices);\n const selectedScoresTensor =\n
backend.makeOutput([selectedSize], 'float32', pSelectedScores);\n\n
return [selectedIndicesTensor, selectedScoresTensor];\n\n\nexport const nonMaxSuppressionV5Config:\n
KernelConfig = {\n kernelName: NonMaxSuppressionV5,\n backendName: 'wasm',\n setupFunc: setup,\n
kernelFunc: kernelFunc as { } as KernelFunc,\n};\n\n",/**\n * @license\n * Copyright 2020 Google LLC. All Rights\n
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file\n
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *

http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,

software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES

OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language

governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport\n
{KernelConfig, NotEqual} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from\n
'./binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const notEqualConfig: KernelConfig =\n
createBinaryKernelConfig(NotEqual, supportsFullBroadcast, 'bool');\n\n",/**\n * @license\n * Copyright 2020

```

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```
=====\n*\n\nimport\n {KernelConfig, KernelFunc, OneHot, OneHotAttrs, OneHotInputs} from '@tensorflow/tfjs-core';\n import {BackendWasm} from '../backend_wasm';\n let wasmOneHot: (\n indicesId: number, depth: number, onValue: number, offValue: number,\n outId: number) => void;\n function setup(backend: BackendWasm) {\n wasmOneHot = backend.wasm.cwrap(OneHot, null /* void */, [\n 'number', // indices_id\n 'number', // depth,\n 'number', // onValue\n 'number', // offValue\n 'number' // out_id\n]);\n }\n function oneHot(\n args: {inputs: OneHotInputs, attrs: OneHotAttrs, backend: BackendWasm}) {\n const {inputs, backend, attrs} = args;\n const {indices} = inputs;\n const {depth, onValue, offValue} = attrs;\n const out = backend.makeOutput([...indices.shape, depth], 'int32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n const indicesData = backend.dataIdMap.get(indices.dataId);\n const indicesId = indicesData.id;\n wasmOneHot(indicesId, depth, onValue, offValue, outId);\n return out;\n }\n export const oneHotConfig: KernelConfig = {\n kernelName: OneHot,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: oneHot as {} as KernelFunc,\n };,\n /**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport {KernelConfig, KernelFunc, OnesLike, OnesLikeInputs}\n from '@tensorflow/tfjs-core';\n import {BackendWasm} from '../backend_wasm';\n function onesLike(\n args: {inputs: OnesLikeInputs, backend: BackendWasm}) {\n const {inputs: {x}, backend} = args;\n const out = backend.makeOutput(x.shape, x.dtype);\n const outVals = backend.typedArrayFromHeap(out);\n outVals.fill(1);\n return out;\n }\n export const onesLikeConfig: KernelConfig = {\n kernelName: OnesLike,\n backendName: 'wasm',\n kernelFunc: onesLike as {} as KernelFunc,\n };,\n /**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express\n * or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport {KernelConfig, KernelFunc, Pack, PackAttrs, PackInputs, TensorInfo, util}\n from '@tensorflow/tfjs-core';\n import {BackendWasm} from '../backend_wasm';\n import {concat} from './Concat';\n import {expandDims} from './ExpandDims';\n export function pack(\n args: {inputs: PackInputs, backend: BackendWasm, attrs: PackAttrs}) {\n TensorInfo {\n const {inputs, backend, attrs} = args;\n const {axis} = attrs;\n if (inputs.length === 1) {\n return expandDims(\n {inputs: {input: inputs[0]}, backend, attrs: {dim: axis}});\n }\n const shape = inputs[0].shape;\n const dtype = inputs[0].dtype;\n inputs.forEach(t => {\n util.assertShapesMatch(\n shape, t.shape,\n 'All tensors passed to stack must have matching shapes');\n });\n }\n }\n}
```

```

util.assert(\n
 dtype === t.dtype,\n
 () => 'All tensors passed to stack must have matching dtypes');\n
});\n\n const
intermediateTensorInfos: TensorInfo[] = [];\n const expandedTensors = inputs.map(t => {\n const expandedT =\n
 expandDims({inputs: {input: t}, backend, attrs: {dim: axis}});\n intermediateTensorInfos.push(expandedT);\n
return expandedT;\n });\n\n const result = concat({inputs: expandedTensors, backend, attrs: {axis}});\n\n
intermediateTensorInfos.forEach(t => backend.disposeData(t.dataId));\n\n return result;\n}\n\nexport const
packConfig: KernelConfig = {\n kernelName: Pack,\n backendName: 'wasm',\n kernelFunc: pack as {} as
KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
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* Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====
*/\n\nimport {KernelConfig, KernelFunc, PadV2, PadV2Attrs, PadV2Inputs, util} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {fill} from './Fill';\n\nimport {CppType}
from './types';\n\nlet wasmPadV2: (\n xId: number, xShapeBytes: Uint8Array, xShapeLength: number, xDtype:
number,\n prePaddingsBytes: Uint8Array, postPaddingsBytes: Uint8Array,\n constantValue: number, outId:
number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmPadV2 = backend.wasm.cwrap(PadV2, null
/* void */, [\n 'number', // xId\n 'array', //
x.shape\n 'number', // x.shape.length\n 'number', // x.dtype\n 'array', // pre-paddings\n 'array', // post-
paddings\n 'number', // constantValue\n 'number', // outId\n]);\n\nfunction pad(\n args: {inputs:
PadV2Inputs, backend: BackendWasm, attrs: PadV2Attrs}) {\n const {inputs: {x}, backend, attrs: {paddings,
constantValue}} = args;\n\n const outShape = paddings.map(\n (p, i) => p[0] /* beforePad */ + x.shape[i] + p[1]
/* afterPad */);\n\n if (util.sizeFromShape(x.shape) === 0) {\n // Short-circuit the computation, since x doesn't
have value, only\n // the shape is used to compute output shape to pad.\n return fill({\n backend,\n attrs:
{shape: outShape, value: constantValue, dtype: x.dtype}\n });\n }\n\n const xId =
backend.dataIdMap.get(x.dataId).id;\n const out = backend.makeOutput(outShape, x.dtype);\n const
outTensorData = backend.dataIdMap.get(out.dataId);\n const outId = outTensorData.id;\n\n const xShapeBytes
= new Uint8Array(new Int32Array(x.shape).buffer);\n\n const prePaddingsFlat = paddings.map(padTuple =>
padTuple[0]);\n const postPaddingsFlat = paddings.map(padTuple => padTuple[1]);\n const prePaddingsBytes =\n
new Uint8Array(new Int32Array(prePaddingsFlat).buffer);\n const postPaddingsBytes =\n
new Uint8Array(new Int32Array(postPaddingsFlat).buffer);\n\n wasmPadV2(\n xId, xShapeBytes, x.shape.length,
CppType[x.dtype], prePaddingsBytes,\n postPaddingsBytes, constantValue, outId);\n return out;\n}\n\nexport
const padV2Config: KernelConfig = {\n kernelName: PadV2,\n backendName: 'wasm',\n kernelFunc: pad as {} as
KernelFunc,\n setupFunc: setup\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n
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http://www.apache.org/licenses/LICENSE-2.0\n *\n
* Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====
*/\n\nimport {KernelConfig, Pow} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from
'/binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const powConfig: KernelConfig =\n
createBinaryKernelConfig(Pow, supportsFullBroadcast);\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All

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```
=====\n*\n\nimport { KernelConfig, KernelFunc, Prelu, PreluInputs } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { cast } from './Cast';\nlet wasmPrelu: (xId: number, weightsId: number, outId: number) => void;\nfunction setup(backend: BackendWasm) {\n wasmPrelu = backend.wasm.cwrap(Prelu, null /* void */, [\n 'number', // x_id\n 'number', // weights_id\n 'number' // out_id\n]);\n function prelu(args: { inputs: PreluInputs, backend: BackendWasm }) {\n const { inputs, backend } = args;\n const { x, alpha } = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const weightsId = backend.dataIdMap.get(alpha.dataId).id;\n let inputId = xId;\n const input = x;\n let castedInput = input;\n if (input.dtype !== 'float32') {\n castedInput = cast({ backend, inputs: { x }, attrs: { dtype: 'float32' });\n inputId = backend.dataIdMap.get(castedInput.dataId).id;\n }\n const out = backend.makeOutput(x.shape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmPrelu(inputId, weightsId, outId);\n if (input.dtype !== 'float32') {\n backend.disposeData(castedInput.dataId);\n }\n return out;\n }\n export const preluConfig: KernelConfig = {\n kernelName: Prelu,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: prelu as KernelFunc\n };}\n\n/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n
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```
=====\n*\n\nimport { backend_util, KernelConfig, KernelFunc, Prod, ProdAttrs, ProdInputs, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { permuteAxesAndTranspose } from './kernel_utils';\nimport { CppDType } from './types';\nlet wasmProd: (\n xId: number, reduceSize: number, dtype: number, outId: number) => void;\nfunction setup(backend: BackendWasm): void {\n wasmProd = backend.wasm.cwrap(Prod, null /* void */, [\n 'number',\n 'number',\n 'number',\n 'number'\n]);\n function prod(args: {\n backend: BackendWasm,\n inputs: ProdInputs,\n attrs: ProdAttrs\n }): TensorInfo {\n const { backend, inputs, attrs } = args;\n const { axis, keepDims } = attrs;\n const { x } = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n const { transposed, axes, originalAxes, inputWasTransposed } = permuteAxesAndTranspose(x, axis, backend);\n let reductionAxes = axes;\n if (inputWasTransposed) {\n const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId !== xId) {\n // transpose was not a no-op. We will need to dispose of this\n // once we are done.\n input = transposed;\n inputId = transposedId;\n reductionAxes = backend_util.getInnerMostAxes(\n reductionAxes.length, input.shape.length);\n }\n backend_util.assertAxesAreInnerMostDims(\n 'prod', reductionAxes, input.shape.length);\n const [outShape, reduceShape] = backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n const reduceSize = util.sizeFromShape(reduceShape);\n const out = backend.makeOutput(outShape, input.dtype);\n if (util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmProd(inputId, reduceSize, CppDType[out.dtype], outId);\n }\n if (inputWasTransposed) {\n // dispose of\n
```

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the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const\n newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n return out;\n}\n\nexport const prodConfig: KernelConfig = {\n kernelName: Prod,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: prod as { } as KernelFunc\n};\n"/**\n * @license\n * Copyright 2020 Google\n LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not\n use this file except in
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*/\n\nimport { KernelConfig, KernelFunc, Range, RangeAttrs, TensorInfo } from '@tensorflow/tfjs-core';\nimport\n { BackendWasm } from '../backend_wasm';\nimport { rangeImplCPU } from '../kernel_utils/shared';\n\nexport const\n range =\n (args: { backend: BackendWasm, attrs: RangeAttrs }): TensorInfo => {\n const { backend, attrs } =\n args;\n const { start, stop, step, dtype } = attrs;\n const values = rangeImplCPU(start, stop, step, dtype);\n\n const\n out = backend.makeOutput([values.length], dtype);\n const outVals = backend.typedArrayFromHeap(out);\n outVals.set(values);\n return out;\n};\n\nexport const rangeConfig: KernelConfig = {\n kernelName: Range,\n backendName: 'wasm',\n kernelFunc: range as { } as KernelFunc\n};\n"/**\n * @license\n * Copyright 2019\n Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you\n may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n governing permissions and\n * limitations under the License.\n *\n=====\n
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*/\n\nimport { KernelConfig, RealDiv } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from\n './binary_kernel';\n\nconst supportsFullBroadcast = true;\n\nexport const realDivConfig: KernelConfig =\n createBinaryKernelConfig(RealDiv, supportsFullBroadcast);\n"/**\n * @license\n * Copyright 2019 Google LLC.\n All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this\n file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n governing permissions and\n * limitations under the License.\n *\n=====\n
```

```
*/\n\nimport { KernelConfig, Relu } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from\n './unary_kernel';\n\nexport const reluConfig: KernelConfig = createUnaryKernelConfig(Relu);\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or\n agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n the specific language governing permissions and\n * limitations under the License.\n *\n=====\n
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```
*/\n\nimport { KernelConfig, Relu6 } from '@tensorflow/tfjs-core';\nimport
```

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{createUnaryKernelConfig} from './unary_kernel';\nexport const relu6Config: KernelConfig =\ncreateUnaryKernelConfig(Relu6);\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in\n * compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n */
```

```
=====\n*\nimport {KernelConfig, KernelFunc, ResizeBilinear, ResizeBilinearAttrs, ResizeBilinearInputs, TensorInfo,\nutil} from '@tensorflow/tfjs-core';\nimport\n{BackendWasm} from '../backend_wasm';\nimport {cast} from './Cast';\nlet wasmResizeBilinear: (\n xId:\n number, batch: number, oldHeight: number, oldWidth: number,\n numChannels: number, newHeight: number,\n newWidth: number,\n alignCorners: number, halfPixelCenters: number, outId: number) => void;\nfunction\nsetup(backend: BackendWasm): void {\n wasmResizeBilinear = backend.wasm.cwrap(ResizeBilinear, null\n/*void*/, [\n 'number', // xId\n 'number', // batch\n 'number', // oldHeight\n 'number', // oldWidth\n 'number', // numChannels\n 'number', // newHeight\n 'number', // newWidth\n 'number', // alignCorners\n 'number', // halfPixelCenters\n 'number' // outId\n]);\nfunction resizeBilinear(args: {\n backend:\n BackendWasm,\n inputs: ResizeBilinearInputs,\n attrs: ResizeBilinearAttrs\n}): TensorInfo {\n const {backend,\ninputs, attrs} = args;\n const {images} = inputs;\n const {alignCorners, halfPixelCenters, size}\n= attrs;\n const [newHeight, newWidth] = size;\n const [batch, oldHeight, oldWidth, numChannels] =\nimages.shape;\n const outShape = [batch, newHeight, newWidth, numChannels];\n let xData =\nbackend.dataIdMap.get(images.dataId);\n let castedData;\n if (xData.dtype !== 'float32') {\n castedData =\n cast({backend, inputs: {x: images}, attrs: {dtype: 'float32'}});\n xData =\n backend.dataIdMap.get(castedData.dataId);\n }\n const xId = xData.id;\n const out =\nbackend.makeOutput(outShape, 'float32');\n if (util.sizeFromShape(images.shape) === 0) {\n return out;\n }\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmResizeBilinear(\n xId, batch, oldHeight,\n oldWidth, numChannels, newHeight, newWidth,\n alignCorners ? 1 : 0, halfPixelCenters ? 1 : 0, outId);\n if\n(castedData !== null) {\n backend.disposeData(castedData.dataId);\n }\n return out;\n}\nexport const\nresizeBilinearConfig: KernelConfig = {\n kernelName: ResizeBilinear,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: resizeBilinear as {} as KernelFunc\n};\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a\n * copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable\n * law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n*\nimport {KernelConfig, KernelFunc, Reverse, ReverseAttrs, ReverseInputs, TensorInfo, util} from\n '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport\n{identity} from './Identity';\nimport {reshape} from './Reshape';\nlet wasmReverse: (\n xId: number, axes:\n Uint8Array, axesLength: number, outShape: Uint8Array,\n outShapeLength: number, outId: number) =>\nvoid;\nfunction setup(backend: BackendWasm) {\n wasmReverse = backend.wasm.cwrap(Reverse, null, [\n 'number', // x_id\n 'array', // axes\n 'number', // axes_length\n 'array', // out_shape\n 'number', //\n out_shape_length\n 'number' // out_id\n]);\nexport function reverse(\n args: {inputs: ReverseInputs,\nbackend: BackendWasm, attrs: ReverseAttrs\n}): TensorInfo {\n const {inputs, backend, attrs} = args;\n const\n{x} = inputs;\n const {dims} = attrs;\n const axes = util.parseAxisParam(dims, x.shape);\n if (x.shape.length\n=== 0) {\n return identity({inputs: {x}, backend});\n }\n const out = backend.makeOutput(x.shape, x.dtype);\n}
```

```

const xId = backend.dataIdMap.get(x.dataId).id;\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n
const axesBytes = new Uint8Array(new Int32Array(axes).buffer);\n const outShapeBytes = new Uint8Array(new
Int32Array(x.shape).buffer);\n\n wasmReverse(\n xId, axesBytes, axes.length, outShapeBytes, x.shape.length,
outId);\n\n const reshaped =\n reshape({inputs: {x: out}, attrs: {shape: x.shape}, backend});\n\n
backend.disposeData(out.dataId);\n return reshaped;\n}\n\nexport const reverseConfig: KernelConfig = {\n
kernelName: Reverse,\n backendName: 'wasm',\n kernelFunc: reverse as { } as KernelFunc,\n setupFunc:
setup\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====\n
*/\n\nimport { KernelConfig, KernelFunc, RotateWithOffset, RotateWithOffsetAttrs, RotateWithOffsetInputs,
TensorInfo } from '@tensorflow/tfjs-core';\nimport { backend_util } from '@tensorflow/tfjs-core';\n\nimport
{ BackendWasm } from '../backend_wasm';\n\nlet wasmRotate: (\n xId: number, batch: number, imageHeight:
number, imageWidth: number,\n numChannels: number, radians: number, centerX: number, centerY: number,\n
fillBytes: Uint8Array, fillLength: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n
wasmRotate = backend.wasm.cwrap(RotateWithOffset, null /* void */, [\n 'number', // xId\n 'number', //
batch\n 'number', // imageHeight\n 'number', // imageWidth\n
'number', // numChannels\n 'number', // radians\n 'number', // centerX\n 'number', // centerY\n 'array', //
fillBytes\n 'number', // fillLength\n 'number', // outId\n]);\n}\n\nexport function rotateWithOffset(args: {\n
inputs: RotateWithOffsetInputs,\n backend: BackendWasm,\n attrs: RotateWithOffsetAttrs\n}): TensorInfo {\n
const {inputs, backend, attrs} = args;\n const {image} = inputs;\n const {radians, fillValue, center} = attrs;\n\n
const out = backend.makeOutput(image.shape, image.dtype);\n const imageId =
backend.dataIdMap.get(image.dataId).id;\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const [batch,
imageHeight, imageWidth, numChannels] = image.shape;\n\n const [centerX, centerY] =\n
backend_util.getImageCenter(center, imageHeight, imageWidth);\n\n const fillIsBlack = fillValue === 0;\n const
fullOpacityValue = 255;\n\n const fillValues = typeof fillValue === 'number' ?\n [fillValue, fillValue, fillValue,
fillIsBlack ? 0 : fullOpacityValue] :\n [...fillValue, fullOpacityValue];\n const fillBytes = new Uint8Array(new
Int32Array(fillValues).buffer);\n\n wasmRotate(\n imageId, batch, imageHeight, imageWidth, numChannels,
radians, centerX,\n centerY, fillBytes, fillValues.length, outId);\n return out;\n}\n\nexport const
rotateWithOffsetConfig: KernelConfig = {\n kernelName: RotateWithOffset,\n backendName: 'wasm',\n
kernelFunc: rotateWithOffset as { } as KernelFunc,\n setupFunc: setup\n};\n", "/*\n * @license\n * Copyright 2021
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OR CONDITIONS
OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions
and\n * limitations under the License.\n *
=====\n
*/\n\nimport { KernelConfig, Round } from '@tensorflow/tfjs-core';\n\nimport { createUnaryKernelConfig } from
'/unary_kernel';\n\nexport const roundConfig: KernelConfig = createUnaryKernelConfig(Round);\n", "/*\n *
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```



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language governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\nimport {KernelConfig, Rsqrt} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from './unary_kernel';\nexport const rsqrtConfig: KernelConfig = createUnaryKernelConfig(Rsqrt);\n", "/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\nimport {KernelConfig, KernelFunc, scatter_util, ScatterNd, ScatterNdAttrs, ScatterNdInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {CppType} from './types';\nlet wasmScatterNd: (\n indicesId: number, updatesId: number, dtype: CppDType, sliceRank: number,\n numUpdates: number, sliceSize: number, strides: Uint8Array,\n outputSize: number, outId: number) => void;\nfunction setup(backend: BackendWasm): void {\n wasmScatterNd = backend.wasm.cwrap(ScatterNd, null /*void*/, [\n 'number', // indicesId\n 'number', // updatesId\n 'number', // dtype\n 'number', // sliceRank\n 'number', // numUpdates\n 'number', // sliceSize\n 'array', // strides\n 'number', // outputSize\n 'number' // outId\n]);\n}\nfunction scatterNd(\n args: \n {backend: BackendWasm, inputs: ScatterNdInputs, attrs:
```

```
ScatterNdAttrs});\n TensorInfo {\n const {backend, inputs, attrs} = args;\n const {indices, updates} = inputs;\n const {shape} = attrs;\n const out = backend.makeOutput(shape, updates.dtype);\n if (util.sizeFromShape(shape) === 0) {\n return out;\n }\n const {sliceRank, numUpdates, sliceSize, strides, outputSize} =\n scatter_util.calculateShapes(updates, indices, shape);\n const indicesData = backend.dataIdMap.get(indices.dataId);\n const indicesId = indicesData.id;\n const updatesData = backend.dataIdMap.get(updates.dataId);\n const updatesId = updatesData.id;\n const stridesBytes = new Uint8Array(new Int32Array(strides).buffer);\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmScatterNd(\n indicesId, updatesId, CppDType[updates.dtype], sliceRank, numUpdates,\n sliceSize, stridesBytes, outputSize, outId);\n return out;\n }\n}\nexport const scatterNdConfig: KernelConfig = {\n kernelName: ScatterNd,\n backendName: 'wasm',\n
```

```
 setupFunc: setup,\n kernelFunc: scatterNd as { } as KernelFunc\n};\n", "/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\nimport {KernelConfig, KernelFunc, Select, SelectInputs, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nlet wasmSelect: (\n conditionId: number, tId: number, eId: number, offset: number,\n outId: number) => void;\nfunction setup(backend: BackendWasm) {\n wasmSelect = backend.wasm.cwrap('SelectV2', null, [\n 'number', // conditionId\n 'number', // tId\n 'number', // eId\n 'number', // offset\n 'number', // outId\n]);\n}\nfunction select(args: {inputs: SelectInputs, backend: BackendWasm}) {\n const {inputs, backend} = args;\n const {condition, t, e} = inputs;\n const conditionId = backend.dataIdMap.get(condition.dataId).id;\n const tId = backend.dataIdMap.get(t.dataId).id;\n const eId =
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backend.dataIdMap.get(e.dataId).id;\n const out = backend.makeOutput(t.shape, t.dtype);\n const outId =
backend.dataIdMap.get(out.dataId).id;\n\n const cRank = condition.shape.length;\n const tRank =
t.shape.length;\n\n const offset = cRank === 0 || cRank > 1 || tRank === 1 ?\n 1 :\n util.sizeFromShape(t.shape.slice(1));\n\n wasmSelect(conditionId, tId, eId, offset, outId);\n return out;\n}\n\nexport
const selectConfig:
 KernelConfig = {\n kernelName: Select,\n backendName: 'wasm',\n kernelFunc: select as {} as KernelFunc,\n
setupFunc: setup\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed
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on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====
*\n\nimport {KernelConfig, KernelFunc, Sigmoid, SigmoidInputs, TensorInfo, util} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm}
from './backend_wasm';\n\nlet wasmFunc: (xId: number, outId: number) => void;\n\nfunction setup(backend:
BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(Sigmoid, null /* void */, ['number',
'number']);\n}\n\nfunction sigmoid(args: {backend: BackendWasm, inputs: SigmoidInputs}):\n TensorInfo {\n
const {backend, inputs: {x}} = args;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out =
backend.makeOutput(x.shape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n // Short-circuit
zero-sized tensors.\n if (util.sizeFromShape(out.shape) === 0) {\n return out;\n }\n\n wasmFunc(xId, outId);\n
return out;\n}\n\nexport const sigmoidConfig: KernelConfig = {\n kernelName: 'Sigmoid',\n backendName:
'wasm',\n setupFunc: setup,\n kernelFunc: sigmoid as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {KernelConfig, Sin} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'/unary_kernel';\n\nexport const sinConfig: KernelConfig = createUnaryKernelConfig(Sin);\n", "/*\n * @license\n *
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {KernelConfig, KernelFunc, Softmax, SoftmaxAttrs, SoftmaxInputs, TensorInfo, util} from
 '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nlet wasmFunc: (xId: number, outId:
number, channels: number, batch: number) =>\n void;\n\nfunction setup(backend: BackendWasm): void {\n
waswFunc = backend.wasm.cwrap(Softmax, null /* void */, [\n 'number', // xId\n 'number', // outId\n
'number', // channels\n 'number' // batch\n]);\n}\n\nfunction softmax(\n args: {backend: BackendWasm,

```

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inputs: SoftmaxInputs, attrs: SoftmaxAttrs));\n TensorInfo {\n const {backend, inputs: {logits}, attrs: {dim}} =
args;\n const xId = backend.dataIdMap.get(logits.dataId).id;\n const out = backend.makeOutput(logits.shape,
logits.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n const channels = logits.shape[dim];\n const batch = util.sizeFromShape(logits.shape) / channels;\n // Short-circuit zero-sized tensors.\n if
(util.sizeFromShape(out.shape) === 0) {\n return out;\n }\n wasmFunc(xId, outId, channels, batch);\n return
out;\n}\n\nexport const softmaxConfig: KernelConfig = {\n kernelName: Softmax,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: softmax as {} as KernelFunc\n};\n"/**\n * @license\n * Copyright 2021 Google
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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=====\n
*/\n\nimport {backend_util, KernelConfig, KernelFunc, ReshapeAttrs, ReshapeInputs, SpaceToBatchND,
SpaceToBatchNDAttrs, SpaceToBatchNDInputs, TensorInfo, TransposeAttrs, TransposeInputs, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {padV2Config} from
'./PadV2';\n\nimport {reshape} from './Reshape';\n\nimport {transpose} from './Transpose';\n\nfunction
spaceToBatchND(args: {\n inputs: SpaceToBatchNDInputs,\n backend: BackendWasm,\n attrs:
SpaceToBatchNDAttrs\n}) {\n const {inputs, backend,
attrs} = args;\n const {x} = inputs;\n const {blockShape, paddings} = attrs;\n const prod =
util.sizeFromShape(blockShape);\n const completePaddings: Array<number, number> = [[0, 0]];\n
completePaddings.push(...(paddings as Array<number, number>));\n for (let i = 1 + blockShape.length; i <
x.shape.length; ++i) {\n completePaddings.push([0, 0]);\n }\n const paddedX = padV2Config.kernelFunc({\n
inputs: {x},\n backend,\n attrs: {paddings: completePaddings, constantValue: 0}\n}) as TensorInfo;\n const
reshapedPaddedShape =\n backend_util.getReshaped(paddedX.shape, blockShape, prod, false);\n const
permutedReshapedPaddedPermutation = backend_util.getPermuted(\n reshapedPaddedShape.length,
blockShape.length, false);\n const flattenShape =\n backend_util.getReshapedPermuted(paddedX.shape,
blockShape, prod, false);\n const reshapeInputs: ReshapeInputs = {x: paddedX};\n const reshapeAttrs:
ReshapeAttrs = {shape: reshapedPaddedShape};\n
 const paddedXReshaped =\n reshape({inputs: reshapeInputs, backend, attrs: reshapeAttrs});\n const
transposeInputs: TransposeInputs = {x: paddedXReshaped};\n const transposeAttrs:\n TransposeAttrs = {perm:
permutedReshapedPaddedPermutation};\n const paddedXT =\n transpose({inputs: transposeInputs, backend,
attrs: transposeAttrs});\n const resultReshapeInputs: ReshapeInputs = {x: paddedXT};\n const
resultReshapeAttrs: ReshapeAttrs = {shape: flattenShape};\n const result = reshape(\n {inputs:
resultReshapeInputs, backend, attrs: resultReshapeAttrs});\n backend.disposeData(paddedX.dataId);\n
backend.disposeData(paddedXReshaped.dataId);\n backend.disposeData(paddedXT.dataId);\n return
result;\n}\n\nexport const spaceToBatchNDConfig: KernelConfig = {\n kernelName: SpaceToBatchND,\n backendName: 'wasm',\n kernelFunc: spaceToBatchND as {} as KernelFunc\n};\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the
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```

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=====\n
*/\n\nimport {KernelConfig, KernelFunc, SplitV, SplitVAttrs, SplitVInputs, util} from '@tensorflow/tfjs-

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core';\nimport {backend_util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from
'./backend_wasm';\n\nimport {slice} from './Slice';\n\nexport function splitV(\n args: {inputs: SplitVInputs, attrs:
SplitVAttrs, backend: BackendWasm}) {\n const {inputs,
 attrs, backend} = args;\n const {x} = inputs;\n const {numOrSizeSplits, axis} = attrs;\n\n const $axis =
util.parseAxisParam(axis, x.shape)[0];\n\n const splitSizes = backend_util.prepareSplitSize(x, numOrSizeSplits,
$axis);\n const begin = new Array(x.shape.length).fill(0);\n const size = x.shape.slice();\n return splitSizes.map(s
=> {\n const xSliceSize = [...size];\n xSliceSize[$axis] = s;\n const xSlice =\n slice({inputs: {x}, attrs:
{begin, size: xSliceSize}, backend});\n begin[$axis] += s;\n return xSlice;\n });\n}\n\nexport const
splitVConfig: KernelConfig = {\n kernelName: SplitV,\n backendName: 'wasm',\n kernelFunc: splitV as {} as
KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
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express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *
```

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=====\n
*\nimport {KernelConfig, Sqrt} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'./unary_kernel';\nexport const sqrtConfig: KernelConfig = createUnaryKernelConfig(Sqrt);\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
"License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
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CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing
permissions and\n * limitations under the License.\n *
```

```
=====\n
*\nimport {KernelConfig, Square} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'./unary_kernel';\nexport const squareConfig: KernelConfig = createUnaryKernelConfig(Square);\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n
*\nimport {KernelConfig, SquaredDifference} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig}
from './binary_kernel';\nconst supportsFullBroadcast = true;\nexport const squaredDifferenceConfig: KernelConfig
=\n createBinaryKernelConfig(SquaredDifference, supportsFullBroadcast);\n\n"/**\n * @license\n * Copyright
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"AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License
for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n
*\nimport {KernelConfig, KernelFunc, Step, StepAttrs, StepInputs, TensorInfo} from '@tensorflow/tfjs-
core';\nimport {BackendWasm} from './backend_wasm';\nimport {CppType} from './types';\n\nlet wasmStep:
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(xId: number, alpha: number, dtype: number, outId: number) => void;
function setup(backend: BackendWasm): void {
 wasmStep = backend.wasm.cwrap(Step, null /*void*/, [
 'number', // x_id
 'number', // alpha
 'number', // dtype
 'number', // out_id
]);
 function step(n args: { backend: BackendWasm, inputs: StepInputs, attrs: StepAttrs }): TensorInfo {
 const { backend, inputs, attrs } = args;
 const { alpha } = attrs;
 const { x } = inputs;
 const xId = backend.dataIdMap.get(x.dataId).id;
 const out = backend.makeOutput(x.shape, x.dtype);
 const outId = backend.dataIdMap.get(out.dataId).id;
 wasmStep(xId, alpha, CppDType[x.dtype], outId);
 return out;
 }
 export const stepConfig: KernelConfig = {
 kernelName: Step,
 backendName: 'wasm',
 setupFunc: setup,
 kernelFunc: step as {} as KernelFunc;
 };
 /**
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 * permissions and limitations under the License.
 */
}

import { KernelConfig, KernelFunc, slice_util, StridedSlice, StridedSliceAttrs, StridedSliceInputs, TensorInfo, util } from '@tensorflow/tfjs-core';
import { BackendWasm } from '../backend_wasm';
import { reshape } from './Reshape';
import { slice } from './Slice';
let wasmStridedSlice: (
 xId: number, xStridesBytes: Uint8Array, xRank: number,
 beginBytes: Uint8Array, endBytes: Uint8Array, stridesBytes: Uint8Array,
 outShapeBytes: Uint8Array, outStridesBytes: Uint8Array,
 outShapeLength: number, outId: number) => void;
function setup(backend: BackendWasm): void {
 wasmStridedSlice = backend.wasm.cwrap(StridedSlice, null /*void*/, [
 'number', // xId
 'array', // xStrides
 'number', // xRank
 'array', // beginBytes
 'array', // endBytes
 'array', // stridesBytes
 'array', // outShapeBytes
 'array', // outStridesBytes
 'number', // outShapeLength
 'number', // outId
]);
 export function stridedSlice(args: {
 backend: BackendWasm,
 inputs: StridedSliceInputs,
 attrs: StridedSliceAttrs
 }): TensorInfo {
 const { backend, inputs, attrs } = args;
 const { x } = inputs;
 const {
 begin, end, strides, beginMask, endMask, ellipsisMask,
 newAxisMask, shrinkAxisMask
 } = attrs;
 const {
 finalShapeSparse, finalShape, isIdentity, sliceDim0,
 isSimpleSlice, begin: $begin, end: $end, strides: $strides
 } = slice_util.sliceInfo(x.shape, begin, end, strides, beginMask, endMask, ellipsisMask, newAxisMask, shrinkAxisMask);
 let result;
 if (isIdentity) {
 // Optimization #1, slice is a no-op plus reshape
 result = reshape({ inputs: { x }, backend, attrs: { shape: finalShape } });
 } else if (sliceDim0 || isSimpleSlice) {
 // Optimization #2, slice is memory contiguous
 (only occurs in dim 0)
 util.assert(x.shape.length >= 1, () => `Input must have rank at least 1, got: ${x.shape.length}`);
 const size = slice_util.computeOutShape($begin, $end, $strides);
 // To tolerate begin[0] > end[0] (a 0-output slice), we min(begin, end).
 const sliced = slice({ inputs: { x }, backend, attrs: { begin: $begin, size } });
 result = reshape({ inputs: { x: sliced }, backend, attrs: { shape: finalShape } });
 backend.disposeData(sliced.dataId);
 } else {
 const out = backend.makeOutput(finalShapeSparse, 'float32');
 const xId = backend.dataIdMap.get(x.dataId).id;
 const xStridesBytes = new Uint8Array(new Int32Array(util.computeStrides(x.shape)).buffer);
 const beginBytes = new Uint8Array(new Int32Array($begin).buffer);
 const endBytes = new Uint8Array(new Int32Array($end).buffer);
 const stridesBytes = new Uint8Array(new Int32Array($strides).buffer);
 const outputShapeBytes = new Uint8Array(new Int32Array(finalShapeSparse).buffer);
 const outStridesBytes = new Uint8Array(new Int32Array(util.computeStrides(finalShapeSparse)).buffer);
 const outId = backend.dataIdMap.get(out.dataId).id;
 wasmStridedSlice(xId, xStridesBytes, x.shape.length, beginBytes, endBytes, stridesBytes, outputShapeBytes, outStridesBytes, finalShapeSparse.length, outId);
 result = reshape({ inputs: { x: out }, backend, attrs: { shape: finalShape } });
 backend.disposeData(out.dataId);
 }
 }
}

```

```

}\n\n return result;\n}\n\nexport const stridedSliceConfig: KernelConfig = {\n kernelName: StridedSlice,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: stridedSlice as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a\n copy of the License\n at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in\n writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT\n WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific\n language governing permissions and\n * limitations under the License.\n *\n =====\n *\n *\nimport {KernelConfig, Sub} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from\n './binary_kernel';\nconst supportsFullBroadcast = true;\nexport const subConfig: KernelConfig =\ncreateBinaryKernelConfig(Sub, supportsFullBroadcast);\n", "/*\n * @license\n * Copyright 2019 Google LLC. All\n Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this\n file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *\n Unless required by applicable law or agreed to in writing, software\n distributed under the License is\n distributed on an "AS IS" BASIS,\n WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either\n express or implied.\n See the License for the specific language governing permissions and\n limitations under\n the License.\n *\n =====\n *\n *\nimport {backend_util, KernelConfig, KernelFunc, Sum, SumAttrs, SumInputs, TensorInfo, util} from\n '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport\n {permuteAxesAndTranspose} from './kernel_utils';\nimport {CppType} from './types';\n\nlet wasmSum: (xId:\n number, reduceSize: number, dtype: number, outId: number) =>\n void;\n\nfunction setup(backend:\n BackendWasm): void {\n wasmSum = backend.wasm.cwrap(Sum, null /*void*/, [\n 'number', // input_id\n 'number', // reduce_size\n 'number', // dtype\n 'number', // out_id\n]);\n\n function sum(args: {backend: BackendWasm, inputs: SumInputs, attrs:\n SumAttrs}): \n TensorInfo {\n const {backend, inputs, attrs} = args;\n const {axis, keepDims} = attrs;\n const\n {x} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n const\n {transposed, axes, originalAxes, inputWasTransposed} =\n permuteAxesAndTranspose(x, axis, backend);\n let reductionAxes = axes;\n if (inputWasTransposed) {\n const transposedId =\n backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId !== xId) {\n // transpose was not a no-op. We\n will need to dispose of this\n // once we are done.\n input = transposed;\n inputId = transposedId;\n reductionAxes =\n backend_util.getInnerMostAxes(\n reductionAxes.length, input.shape.length);\n }\n }\n backend_util.assertAxesAreInnerMostDims(\n 'sum', reductionAxes, input.shape.length);\n const [outShape,\n reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n const reduceSize\n = util.sizeFromShape(reduceShape);\n const out = backend.makeOutput(outShape, input.dtype);\n if\n (util.sizeFromShape(input.shape) !== 0) {\n const outId =\n backend.dataIdMap.get(out.dataId).id;\n wasmSum(inputId, reduceSize, CCppType[out.dtype], outId);\n }\n if (inputWasTransposed) {\n // dispose of\n the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n if (keepDims) {\n // reshape\n const\n newShape =\n backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n return out;\n }\n\n export const sumConfig: KernelConfig = {\n kernelName: Sum,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: sum as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2021 Google\n LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not\n use this file except\n in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,

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software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\nimport {KernelConfig, Tan} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from './unary_kernel';\nexport const tanConfig: KernelConfig = createUnaryKernelConfig(Tan);\n","/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\nimport {KernelConfig, Tanh} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from './unary_kernel';\nexport const tanhConfig: KernelConfig = createUnaryKernelConfig(Tanh);\n","/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\nimport {KernelConfig, KernelFunc, Tile, TileAttrs, TileInputs} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {CppType} from './types';\nlet wasmTile: (n xId: number, xShape: Uint8Array, xShapeSize: number, newShape: Uint8Array, newShapeSize: number, dtype: number, outId: number) => void;\nfunction setup(backend: BackendWasm) {\n wasmTile = backend.wasm.cwrap(Tile, null /* void */, [\n 'number', // x_id\n 'array', // x_shape\n 'number', // x_shape.length\n 'array', // new_shape\n 'number', // new_shape.length\n 'number' // out_id\n]);\n}\nfunction tile(\n args: {inputs: TileInputs, backend: BackendWasm, attrs: TileAttrs}) {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const {reps} = attrs;\n const newShape: number[] = new Array(x.shape.length);\n for (let i = 0; i < newShape.length; i++) {\n newShape[i] = x.shape[i] * reps[i];\n }\n const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n const newShapeBytes = new Uint8Array(new Int32Array(newShape).buffer);\n const out = backend.makeOutput(newShape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmTile(\n xId, xShapeBytes, x.shape.length, newShapeBytes, newShape.length,\n CCppType[out.dtype], outId);\n return out;\n}\nexport const tileConfig: KernelConfig = {\n kernelName: Tile,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: tile as {} as KernelFunc\n};\n","/**\n * @license\n * Copyright 2020 Google LLC.
```

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```
=====\n*\nimport {KernelConfig, KernelFunc, TensorInfo, TopK, TopKAttrs, TopKInputs} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {CppType} from './types';\nlet wasmTopK: (n xId: number, xShapeBytes: Uint8Array, xShapeLength: number, xDtype: CCppType, k: number, sorted:
```

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boolean,
 outValuesId: number,\n outIndicesId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n
wasmTopK = backend.wasm.cwrap(TopK, null /* void */, [\n 'number', // xId\n 'array', // x.shape\n 'number', // x.shape.length\n 'number', // x.dtype\n 'number', // k\n 'bool', // sorted\n 'number', // outValuesId\n 'number', // outIndicesId\n]);\n\nexport const topk:\n (args: {inputs: TopKInputs, backend: BackendWasm,
attrs: TopKAttrs}) =>\n TensorInfo[] | TensorInfo = ({inputs, backend, attrs}) => {\n const {x} = inputs;\n const {k, sorted} = attrs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const xShapeBytes
= new Uint8Array(new Int32Array(x.shape).buffer);\n const outputShape = x.shape.slice();\n
outputShape[outputShape.length - 1] = k;\n const outValues = backend.makeOutput(outputShape, x.dtype);\n
 const outValuesId = backend.dataIdMap.get(outValues.dataId).id;\n
 const outIndices = backend.makeOutput(outputShape, 'int32');\n const outIndicesId =
backend.dataIdMap.get(outIndices.dataId).id;\n const xId, xShapeBytes, x.shape.length,
CppDType[x.dtype], k, sorted,\n outValuesId, outIndicesId);\n return [outValues, outIndices];\n
};\n\nexport const topKConfig: KernelConfig = {\n kernelName: TopK,\n backendName: 'wasm',\n setupFunc:
setup,\n kernelFunc: topk as {} as KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2021 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR
CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing
permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {KernelConfig, KernelFunc, TensorInfo, Transform, TransformAttrs, TransformInputs, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nlet wasmTransform: (\n imageId:
number, transformsId: number, isBatchTransform: boolean,\n batch: number, outHeight: number, outWidth:
number, numChannels: number,\n imageWidth: number, imageHeight: number, strides: Uint8Array,\n stridesLength: number, interpolationModeId: number, fillModeId: number,\n fillValue: number, outId: number)
=> void;\n\nfunction setup(backend: BackendWasm): void {\n wasmTransform = backend.wasm.cwrap(Transform,
null /*void*/, [\n 'number', // imageId\n 'number', // transformsId\n 'bool', // isBatchTransform\n
 'number', // batch\n 'number', // outHeight\n 'number', // outWidth\n 'number', // numChannels\n
 'number', // imageWidth\n 'number', // imageHeight\n 'array', // strides\n 'number', // stridesLength\n
 'number', // interpolationModeId\n 'number', // fillModeId\n 'number', // fillValue\n 'number' // outId\n
]);\n\nfunction transform(\n args:\n {backend: BackendWasm, inputs: TransformInputs, attrs:
TransformAttrs});\n TensorInfo {\n const {backend, inputs, attrs} = args;\n const {image, transforms} = inputs;\n
const {interpolation, fillMode, fillValue, outputShape} = attrs;\n const [batch, imageHeight, imageWidth,
numChannels] = image.shape;\n const [outHeight, outWidth] =\n outputShape != null ? outputShape :
[imageHeight, imageWidth];\n const outShape =\n [batch, outHeight, outWidth,\n numChannels] as
[number, number, number, number];\n const strides =\n new Uint8Array(new
Int32Array(util.computeStrides(image.shape)).buffer);\n\n const out = backend.makeOutput(outShape, image.dtype);\n const outId =
backend.dataIdMap.get(out.dataId).id;\n\n const imageData = backend.dataIdMap.get(image.dataId);\n const
imageId = imageData.id;\n\n const transformsData = backend.dataIdMap.get(transforms.dataId);\n const
transformsId = transformsData.id;\n\n const interpolationModeId = interpolation === 'nearest' ? 1 : 2;\n let
fillModeId;\n switch (fillMode) {\n case 'constant':\n fillModeId = 1;\n break;\n case 'reflect':\n
fillModeId = 2;\n break;\n case 'wrap':\n fillModeId = 3;\n break;\n case 'nearest':\n fillModeId =
4;\n break;\n default:\n fillModeId = 1;\n break;\n }\n\n wasmTransform(\n imageId, transformsId,
(transforms.shape[0] > 1), batch, outHeight,\n outWidth, numChannels, imageWidth, imageHeight, strides,\n

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image.shape.length - 1, interpolationModeId, fillModeId, fillValue,\n outId);\n\n return out;\n}\n\nexport const transformConfig: KernelConfig = {\n kernelName: Transform,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: transform as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *\n *=====\n *\nimport { KernelConfig, KernelFunc, TensorInfo, Unpack, UnpackAttrs, UnpackInputs }
from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { slice } from
'/Slice';\n\nfunction unpack(\n args: { inputs: UnpackInputs, backend: BackendWasm, attrs: UnpackAttrs }):\nTensorInfo[] {\n const { inputs, backend, attrs } = args;\n const { value } = inputs;\n let { axis } = attrs;\n if (axis <
0) {\n axis += value.shape.length;\n }\n const numOutputs = value.shape[axis];\n const rank =
value.shape.length;\n const outShape: number[] = new Array(rank - 1);\n let outIndex = 0;\n for (let i = 0; i < rank;\n i++) {\n if (i !== axis) {\n outShape[outIndex++] = value.shape[i];\n }\n const outs: TensorInfo[] = new
Array(numOutputs);\n const begin = new Array(rank).fill(0);\n const size = value.shape.slice();\n size[axis] = 1;\n for (let i = 0; i < outs.length; i++) {\n begin[axis] = i;\n outs[i] = slice({ inputs: { x: value },
attrs: { begin, size }, backend});\n }\n return outs.map(({ dataId, dtype,
shape: outShape }));\n}\n\nexport const unpackConfig: KernelConfig = {\n kernelName: Unpack,\n backendName: 'wasm',\n kernelFunc: unpack as { } as KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *\n *=====\n *\nimport { KernelConfig, KernelFunc, ZerosLike, ZerosLikeInputs } from '@tensorflow/tfjs-core';\nimport
{ BackendWasm }
from '../backend_wasm';\n\nfunction zerosLike(args: { inputs: ZerosLikeInputs, backend: BackendWasm }) {\n
const { inputs: { x }, backend } = args;\n const out = backend.makeOutput(x.shape, x.dtype);\n const outVals =
backend.toArrayFromHeap(out);\n outVals.fill(0);\n return out;\n}\n\nexport const zerosLikeConfig:
KernelConfig = {\n kernelName: ZerosLike,\n backendName: 'wasm',\n kernelFunc: zerosLike as { } as
KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License
for the specific language governing permissions and\n * limitations under the License.\n *\n *=====\n *\n\nWe explicitly import the modular kernels so they get registered in the\n// global registry when we compile the
library. A modular build would replace\n// the contents of this file and import only the kernels that are
needed.\nimport { KernelConfig, registerKernel } from '@tensorflow/tfjs-core';\nimport { fusedMatMulConfig }
from './kernels/_FusedMatMul';\nimport { absConfig } from './kernels/Abs';\nimport { addConfig } from
'/kernels/Add';\nimport { addNConfig } from './kernels/AddN';\nimport { allConfig } from './kernels/All';\nimport

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{anyConfig} from './kernels/Any';\nimport {argMaxConfig} from './kernels/ArgMax';\nimport {avgPoolConfig}
from './kernels/AvgPool';\nimport {batchMatMulConfig} from './kernels/BatchMatMul';\nimport
{batchToSpaceNDConfig} from './kernels/BatchToSpaceND';\nimport {castConfig} from './kernels/Cast';\nimport
{ceilConfig} from './kernels/Ceil';\nimport {clipByValueConfig} from './kernels/ClipByValue';\nimport
{concatConfig} from './kernels/Concat';\nimport {conv2DConfig} from './kernels/Conv2D';\nimport
{conv2DBackpropInputConfig} from './kernels/Conv2DBackpropInput';\nimport {cosConfig} from
 './kernels/Cos';\nimport {coshConfig} from './kernels/Cosh';\nimport {cropAndResizeConfig} from
 './kernels/CropAndResize';\nimport {cumsumConfig} from './kernels/Cumsum';\nimport {depthToSpaceConfig}
from './kernels/DepthToSpace';\nimport {depthwiseConv2dNativeConfig} from
 './kernels/DepthwiseConv2dNative';\nimport {eluConfig} from './kernels/Elu';\nimport {equalConfig} from
 './kernels/Equal';\nimport {expConfig} from './kernels/Exp';\nimport {expandDimsConfig} from
 './kernels/ExpandDims';\nimport {fillConfig} from './kernels/Fill';\nimport {flipLeftRightConfig} from
 './kernels/FlipLeftRight';\nimport {floorConfig} from './kernels/Floor';\nimport {floorDivConfig} from
 './kernels/FloorDiv';\nimport
{fusedBatchNormConfig} from './kernels/FusedBatchNorm';\nimport {fusedConv2DConfig} from
 './kernels/FusedConv2D';\nimport {fusedDepthwiseConv2DConfig} from
 './kernels/FusedDepthwiseConv2D';\nimport {gatherNdConfig} from './kernels/GatherNd';\nimport
{gatherV2Config} from './kernels/GatherV2';\nimport {greaterConfig} from './kernels/Greater';\nimport
{greaterEqualConfig} from './kernels/GreaterEqual';\nimport {identityConfig} from './kernels/Identity';\nimport
{leakyReluConfig} from './kernels/LeakyRelu';\nimport {lessConfig} from './kernels/Less';\nimport
{lessEqualConfig} from './kernels/LessEqual';\nimport {logConfig} from './kernels/Log';\nimport
{logicalAndConfig} from './kernels/LogicalAnd';\nimport {maxConfig} from './kernels/Max';\nimport
{maximumConfig} from './kernels/Maximum';\nimport {maxPoolConfig} from './kernels/MaxPool';\nimport
{meanConfig} from './kernels/Mean';\nimport {minConfig} from './kernels/Min';\nimport {minimumConfig} from
 './kernels/Minimum';\nimport
{mirrorPadConfig} from './kernels/MirrorPad';\nimport {multiplyConfig} from './kernels/Multiply';\nimport
{negConfig} from './kernels/Neg';\nimport {nonMaxSuppressionV3Config} from
 './kernels/NonMaxSuppressionV3';\nimport {nonMaxSuppressionV4Config} from
 './kernels/NonMaxSuppressionV4';\nimport {nonMaxSuppressionV5Config} from
 './kernels/NonMaxSuppressionV5';\nimport {notEqualConfig} from './kernels/NotEqual';\nimport {oneHotConfig}
from './kernels/OneHot';\nimport {onesLikeConfig} from './kernels/OnesLike';\nimport {packConfig} from
 './kernels/Pack';\nimport {padV2Config} from './kernels/PadV2';\nimport {powConfig} from
 './kernels/Pow';\nimport {preluConfig} from './kernels/Prelu';\nimport {prodConfig} from './kernels/Prod';\nimport
{rangeConfig} from './kernels/Range';\nimport {realDivConfig} from './kernels/RealDiv';\nimport {reluConfig}
from './kernels/Relu';\nimport {relu6Config} from './kernels/Relu6';\nimport {reshapeConfig} from
 './kernels/Reshape';\nimport {resizeBilinearConfig}
from './kernels/ResizeBilinear';\nimport {reverseConfig} from './kernels/Reverse';\nimport
{rotateWithOffsetConfig} from './kernels/RotateWithOffset';\nimport {roundConfig} from
 './kernels/Round';\nimport {rsqrtConfig} from './kernels/Rsqrt';\nimport {scatterNdConfig} from
 './kernels/ScatterNd';\nimport {selectConfig} from './kernels/Select';\nimport {sigmoidConfig} from
 './kernels/Sigmoid';\nimport {sinConfig} from './kernels/Sin';\nimport {sliceConfig} from './kernels/Slice';\nimport
{softmaxConfig} from './kernels/Softmax';\nimport {spaceToBatchNDConfig} from
 './kernels/SpaceToBatchND';\nimport {splitVConfig} from './kernels/SplitV';\nimport {sqrtConfig} from
 './kernels/Sqrt';\nimport {squareConfig} from './kernels/Square';\nimport {squaredDifferenceConfig} from
 './kernels/SquaredDifference';\nimport {stepConfig} from './kernels/Step';\nimport {stridedSliceConfig} from
 './kernels/StridedSlice';\nimport {subConfig} from './kernels/Sub';\nimport {sumConfig} from
 './kernels/Sum';\nimport

```



```

WasmBackendModuleThreadedSimd || {};\n\nfunction
GROWABLE_HEAP_I8(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}
return
HEAP8}function
GROWABLE_HEAP_U8(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)
}return HEAPU8}function
GROWABLE_HEAP_I32(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)
}return HEAP32}function
GROWABLE_HEAP_U32(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer
)}return HEAPU32}function
GROWABLE_HEAP_F64(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer
)}return HEAPF64}var Module=typeof
WasmBackendModuleThreadedSimd!=="undefined"?WasmBackendModuleThreadedSimd: {};var
readyPromiseResolve,readyPromiseReject;Module["ready"]=new
Promise(function(resolve,reject){readyPromiseResolve=resolve;readyPromiseReject=reject});var
moduleOverrides={};var key;for(key in
Module){if(Module.hasOwnProperty(key)){moduleOverrides[key]=Module[key]}}var arguments_=[];var
thisProgram=\.\/this.program";var quit_=function(status,toThrow){throw
toThrow};var ENVIRONMENT_IS_WEB=false;var ENVIRONMENT_IS_WORKER=false;var
ENVIRONMENT_IS_NODE=false;var ENVIRONMENT_IS_SHELL=false;ENVIRONMENT_IS_WEB=typeof
window==="object";ENVIRONMENT_IS_WORKER=typeof
importScripts==="function";ENVIRONMENT_IS_NODE=typeof process==="object"&&typeof
process.versions==="object"&&typeof
process.versions.node==="string";ENVIRONMENT_IS_SHELL=!ENVIRONMENT_IS_WEB&&!ENVIRONM
ENT_IS_NODE&&!ENVIRONMENT_IS_WORKER;var
ENVIRONMENT_IS_PTHREAD=Module["ENVIRONMENT_IS_PTHREAD"]||false;if(ENVIRONMENT_IS_P
THREAD){buffer=Module["buffer"];var scriptDirectory=\.\/";function
locateFile(path){if(Module["locateFile"]){return Module["locateFile"](path,scriptDirectory)}return
scriptDirectory+path}var read_,readAsync,readBinary,setWindowTitle;var nodeFS;var
nodePath;if(ENVIRONMENT_IS_NODE){if(ENVIRONMENT_IS_WORKER){scriptDirectory=require(\.\/path\).
dirname(scriptDirectory)+\^"}else{scriptDirectory=__dirname+\^"}read_=function
shell_read(filename,binary){if(!nodeFS)nodeFS=require(\fs\);if(!nodePath)nodePath=require(\path\);filename=
nodePath["normalize"](filename);return
nodeFS["readFileSync"](filename,binary?null:\utf8\)};readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret};if(process["argv"].length>1){thisProgram=process["argv"][1].replace(/\\/g,\^)}arguments_=process["arg
v"].slice(2);process["on"](\uncaughtException,function(ex){if(!(ex instanceof ExitStatus)){throw
ex}});process["on"](\unhandledRejection,abort);quit_=function(status){process["exit"](status)};Module["insp
ect"]=function(){return"[Emscripten Module object]"};var
nodeWorkerThreads;try{nodeWorkerThreads=require(\worker_threads\)}catch(e){console.error("The
\worker_threads\ module is not supported in this node.js build - perhaps a newer version is needed?");throw
e}global.Worker=nodeWorkerThreads.Worker}else if(ENVIRONMENT_IS_SHELL){if(typeof
read!="undefined"){read_=function shell_read(f){return read(f)}readBinary=function readBinary(f){var
data;if(typeof readbuffer==="function"){return new
Uint8Array(readbuffer(f))}data=read(f,\binary\);assert(typeof data==="object");return data};if(typeof
scriptArgs!="undefined"){arguments_=scriptArgs}else if(typeof
arguments!="undefined"){arguments_=arguments}if(typeof
quit==="function"){quit_=function(status){quit(status)}}if(typeof print!="undefined"){if(typeof

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console===\undefined\");console={};console.log=print;console.warn=console.error=typeof
printErr!==\undefined"?printErr:print}}else
if(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER){if(ENVIRONMENT_IS_WORKER){scriptDire
ctory=self.location.href}else if(typeof
document!==\undefined"&&document.currentScript){scriptDirectory=document.currentScript.src}if(typeof
_scriptDir !== \undefined" &&
_scriptDir){scriptDirectory=_scriptDir}if(scriptDirectory.indexOf(\blob:\")!==(0){scriptDirectory=scriptDirectory.s
ubstr(0,scriptDirectory.lastIndexOf(\^")+1)}else{scriptDirectory=""}}if(ENVIRONMENT_IS_NODE){read_=fun
ction
shell_read(filename,binary){if(!nodeFS)nodeFS=require(\fs\");if(!nodePath)nodePath=require(\path\");filename=n
odePath[\normalize\](filename);return
nodeFS[\readFileSync\](filename,binary?null:\utf8\");readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret}}else{read_=function(url){var xhr=new XMLHttpRequest;xhr.open(\GET",url,false);xhr.send(null);return
xhr.responseText};if(ENVIRONMENT_IS_WORKER){readBinary=function(url){var xhr=new
XMLHttpRequest;xhr.open(\GET",url,false);xhr.responseType="arraybuffer";xhr.send(null);return new
Uint8Array(xhr.response)}}readAsync=function(url,onload,onerror){var xhr=new
XMLHttpRequest;xhr.open(\GET",url,true);xhr.responseType="arraybuffer";xhr.onload=function(){if(xhr.status
==200|xhr.status==0&&xhr.response){onload(xhr.response);return}onerror();}xhr.onerror=onerror;xhr.send(null)
}setWindowTitle=function(title){document.title=title}}else{if(ENVIRONMENT_IS_NODE){if(typeof
performance===\undefined\"){global.performance=require(\perf_hooks\").performance}}var
out=Module[\print\"]||console.log.bind(console);var err=Module[\printErr\"]||console.warn.bind(console);for(key
in
moduleOverrides){if(moduleOverrides.hasOwnProperty(key)){Module[key]=moduleOverrides[key]}}moduleOverr
ides=null;if(Module[\arguments\"])arguments_=Module[\arguments\"];if(Module[\thisProgram\"])thisProgram=
Module[\thisProgram\"];if(Module[\quit\"])quit_=Module[\quit\"];function
warnOnce(text){if(!warnOnce.shown)warnOnce.shown={};if(!warnOnce.shown[text]){warnOnce.shown[text]=1;er
r(text)}}var Atomics_load=Atomics.load;var Atomics_store=Atomics.store;var
Atomics_compareExchange=Atomics.compareExchange;var
wasmBinary;if(Module[\wasmBinary\"])wasmBinary=Module[\wasmBinary\"];var
noExitRuntime=Module[\noExitRuntime\"]||true;if(typeof WebAssembly!=="object"){abort(\no
native wasm support detected")}var wasmMemory;var wasmModule;var ABORT=false;var
EXITSTATUS;function assert(condition,text){if(!condition){abort(\Assertion failed: \"+text)}}function
getCFunc(ident){var func=Module[_"+ident];assert(func,\Cannot call unknown function \"+ident+", make sure
it is exported");return func}function ccall(ident,returnType,argTypes,args,opts){var
toC={\string":function(str){var ret=0;if(str===null&&str!==undefined&&str===0){var
len=(str.length<<2)+1;ret=stackAlloc(len);stringToUTF8(str,ret,len)}return ret},\array":function(arr){var
ret=stackAlloc(arr.length);writeArrayToMemory(arr,ret);return ret}};function
convertReturnValue(ret){if(returnType===\string\")return UTF8ToString(ret);if(returnType===\boolean\")return
Boolean(ret);return ret}var func=getCFunc(ident);var cArgs=[];var stack=0;if(args){for(var
i=0;i<args.length;i++){var
converter=toC[argTypes[i]];if(converter){if(stack===0)stack=stackSave();cArgs[i]=converter(args[i])}else{cArgs[i
]=args[i]}}var
ret=func.apply(null,cArgs);ret=convertReturnValue(ret);if(stack!==0)stackRestore(stack);return ret}function
cwrap(ident,returnType,argTypes,opts){argTypes=argTypes||[];var
numericArgs=argTypes.every(function(type){return type===\number\");var
numericRet=returnType!=="string";if(numericRet&&numericArgs&&!opts){return getCFunc(ident)}return
function(){return ccall(ident,returnType,argTypes,arguments,opts)}}function

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UTF8ArrayToString(heap,idx,maxBytesToRead){ var endIdx=idx+maxBytesToRead;var
str="";while(!(idx>=endIdx)){ var u0=heap[idx++];if(!u0)return
str;if(!(u0&128)){ str+=String.fromCharCode(u0);continue } var
u1=heap[idx++]&63;if((u0&224)==192){ str+=String.fromCharCode((u0&31)<<6|u1);continue } var
u2=heap[idx++]&63;if((u0&240)==224){ u0=(u0&15)<<12|u1<<6|u2}else{ u0=(u0&7)<<18|u1<<12|u2<<6|heap[id
x++]&63 }if(u0<65536){ str+=String.fromCharCode(u0) }else{ var ch=u0-
65536;str+=String.fromCharCode(55296|ch>>10,56320|ch&1023) } }return str }function
UTF8ToString(ptr,maxBytesToRead){ return
ptr?UTF8ArrayToString(GROWABLE_HEAP_U8(),ptr,maxBytesToRead):"" }function
stringToUTF8Array(str,heap,outIdx,maxBytesToWrite){ if(!(maxBytesToWrite>0))return 0;var startIdx=outIdx;var
endIdx=outIdx+maxBytesToWrite-1;for(var i=0;i<str.length;++i){ var
u=str.charCodeAt(i);if(u>=55296&&u<=57343){ var
u1=str.charCodeAt(++i);u=65536+((u&1023)<<10)|u1&1023 }if(u<=127){ if(outIdx>=endIdx)break;heap[outIdx++
]=u }else if(u<=2047){ if(outIdx+1>=endIdx)break;heap[outIdx++]=192|u>>6;heap[outIdx++]=128|u&63 }else
if(u<=65535){ if(outIdx+2>=endIdx)break;heap[outIdx++]=224|u>>12;heap[outIdx++]=128|u>>6&63;heap[outIdx
++]=128|u&63 }else { if(outIdx+3>=endIdx)break;heap[outIdx++]=240|u>>18;heap[outIdx++]=128|u>>12&63;heap[
outIdx++]=128|u>>6&63;heap[outIdx++]=128|u&63 } }heap[outIdx]=0;return outIdx-startIdx }function
stringToUTF8(str,outPtr,maxBytesToWrite){ return
stringToUTF8Array(str,GROWABLE_HEAP_U8(),outPtr,maxBytesToWrite) }function lengthBytesUTF8(str){ var
len=0;for(var i=0;i<str.length;++i){ var
u=str.charCodeAt(i);if(u>=55296&&u<=57343)u=65536+((u&1023)<<10)|str.charCodeAt(++i)&1023;if(u<=127)+
+len;else if(u<=2047)len+=2;else if(u<=65535)len+=3;else len+=4 }return len }function
writeArrayToMemory(array,buffer){ GROWABLE_HEAP_I8().set(array,buffer) }function
alignUp(x,multiple){ if(x%multiple>0){ x+=multiple-x%multiple }return x }var
buffer,HEAP8,HEAPU8,HEAP16,HEAPU16,HEAP32,HEAPU32,HEAPF32,HEAPF64;function
updateGlobalBufferAndViews(buf){ buffer=buf;Module["HEAP8"]=HEAP8=new
Int8Array(buf);Module["HEAP16"]=HEAP16=new Int16Array(buf);Module["HEAP32"]=HEAP32=new
Int32Array(buf);Module["HEAPU8"]=HEAPU8=new Uint8Array(buf);Module["HEAPU16"]=HEAPU16=new
Uint16Array(buf);Module["HEAPU32"]=HEAPU32=new
Uint32Array(buf);Module["HEAPF32"]=HEAPF32=new
Float32Array(buf);Module["HEAPF64"]=HEAPF64=new Float64Array(buf) }var
INITIAL_MEMORY=Module["INITIAL_MEMORY"]||16777216;if(ENVIRONMENT_IS_PTHREAD){ wasmM
emory=Module["wasmMemory"];buffer=Module["buffer"]}else { if(Module["wasmMemory"]){ wasmMemory=
Module["wasmMemory"]}else { wasmMemory=new
WebAssembly.Memory({ "initial":INITIAL_MEMORY/65536,"maximum":2147483648/65536,"shared":true });
if(!(wasmMemory.buffer instanceof SharedArrayBuffer)){ err("requested a shared WebAssembly.Memory but the
returned buffer is not a SharedArrayBuffer, indicating that while the browser has SharedArrayBuffer it does not
have WebAssembly threads support - you may need to set a
flag");if(ENVIRONMENT_IS_NODE){ console.log("(on node you may need: --experimental-wasm-threads --
experimental-wasm-bulk-memory and also use a recent version)")}throw Error("bad
memory") } }if(wasmMemory){ buffer=wasmMemory.buffer }INITIAL_MEMORY=buffer.byteLength;updateGlob
alBufferAndViews(buffer);var wasmTable;var __ATPRERUN__=[];var __ATINIT__=[];var __ATMAIN__=[];var
__ATEXIT__=[];var __ATPOSTRUN__=[];var runtimeInitialized=false;var
runtimeExited=false;if(!ENVIRONMENT_IS_PTHREAD)__ATINIT__.push({ func:function(){ __wasm_call_ctor
s() } });function
preRun(){ if(ENVIRONMENT_IS_PTHREAD)return;if(Module["preRun"]){ if(typeof
Module["preRun"]=="function")Module["preRun"]=[Module["preRun"]];while(Module["preRun"].length){ a
ddOnPreRun(Module["preRun"].shift()) } }callRuntimeCallbacks(__ATPRERUN__) }function

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initRuntime(){runtimeInitialized=true;if(ENVIRONMENT_IS_PTHREAD)return;callRuntimeCallbacks(__ATINIT__)}function
preMain(){if(ENVIRONMENT_IS_PTHREAD)return;callRuntimeCallbacks(__ATMAIN__)}function
exitRuntime(){if(ENVIRONMENT_IS_PTHREAD)return;runtimeExited=true}function
postRun(){if(ENVIRONMENT_IS_PTHREAD)return;if(Module["postRun"]){if(typeof
Module["postRun"]!="function")Module["postRun"]=[Module["postRun"]];while(Module["postRun"].length){addOnPostRun(Module["postRun"].shift())}callRuntimeCallbacks(__ATPOSTRUN__)}function
addOnPreRun(cb){__ATPRERUN__.unshift(cb)}function addOnPostRun(cb){__ATPOSTRUN__.unshift(cb)}var
runDependencies=0;var runDependencyWatcher=null;var dependenciesFulfilled=null;function
addRunDependency(id){assert(!ENVIRONMENT_IS_PTHREAD,"addRunDependency cannot be used in a
pthread
worker");runDependencies++;if(Module["monitorRunDependencies"]){Module["monitorRunDependencies"]((run
Dependencies))}function removeRunDependency(id){runDependencies--
;if(Module["monitorRunDependencies"]){Module["monitorRunDependencies"]((runDependencies))if(runDepend
encies==0){if(runDependencyWatcher!=null){clearInterval(runDependencyWatcher);runDependencyWatcher=null}
if(dependenciesFulfilled){var
callback=dependenciesFulfilled;dependenciesFulfilled=null;callback()}}Module["preloadedImages"]={};Module
["preloadedAudios"]={};function
abort(what){if(Module["onAbort"]){Module["onAbort"](what)}if(ENVIRONMENT_IS_PTHREAD)console.err
or("Pthread aborting at "+(new
Error).stack);what+="\n";err(what);ABORT=true;EXITSTATUS=1;what="abort("+what+"). Build with -s
ASSERTIONS=1 for more info.";var e=new WebAssembly.RuntimeError(what);readyPromiseReject(e);throw
e}function hasPrefix(str,prefix){return
String.prototype.startsWith?str.startsWith(prefix):str.indexOf(prefix)===0}var
dataURIPrefix="data:application/octet-stream;base64,";function isDataURI(filename){return
hasPrefix(filename,dataURIPrefix)}var fileURIPrefix="file://^";function isFileURI(filename){return
hasPrefix(filename,fileURIPrefix)}var wasmBinaryFile="tfjs-backend-wasm-threaded-
simd.wasm";if(!isDataURI(wasmBinaryFile)){wasmBinaryFile=locateFile(wasmBinaryFile)}function
getBinary(file){try{if(file===wasmBinaryFile&&wasmBinary){return new
Uint8Array(wasmBinary)}if(readBinary){return readBinary(file)}else{throw"both async and sync fetching of the
wasm failed"}}catch(err){abort(err)}}function
getBinaryPromise(){if(!wasmBinary&&(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER)){if(typeof
fetch==="function"&&!isFileURI(wasmBinaryFile)){return fetch(wasmBinaryFile,{credentials:"same-
origin"}).then(function(response){if(!response["ok"]){throw"failed to load wasm binary file at
"+wasmBinaryFile+""}return
response["arrayBuffer"]()}).catch(function(){return getBinary(wasmBinaryFile)})}else{if(readAsync){return new
Promise(function(resolve,reject){readAsync(wasmBinaryFile,function(response){resolve(new
Uint8Array(response))},reject)}))}return Promise.resolve().then(function(){return
getBinary(wasmBinaryFile)})}function createWasm(){var info={"a":asmLibraryArg};function
receiveInstance(instance,module){var
exports=instance.exports;Module["asm"]=exports;wasmTable=Module["asm"]["I"];wasmModule=module;if(!E
NVIRONMENT_IS_PTHREAD){var
numWorkersToLoad=PThread.unusedWorkers.length;PThread.unusedWorkers.forEach(function(w){PThread.load
WasmModuleToWorker(w,function(){if(--numWorkersToLoad)removeRunDependency("wasm-
instantiate")})))}if(!ENVIRONMENT_IS_PTHREAD){addRunDependency("wasm-instantiate")}function
receiveInstantiatedSource(output){receiveInstance(output["instance"],output["module"])}function
instantiateArrayBuffer(receiver){return getBinaryPromise().then(function(binary){return

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WebAssembly.instantiate(binary,info)).then(receiver,function(reason){err("\failed to asynchronously prepare
wasm: \""+reason);abort(reason)}}function instantiateAsync(){if(!wasmBinary&&typeof
WebAssembly.instantiateStreaming===\"function\"&&!isDataURI(wasmBinaryFile)&&!isFileURI(wasmBinaryFil
e)&&typeof fetch===\"function\"){return fetch(wasmBinaryFile,{credentials:\"same-
origin\"}).then(function(response){var result=WebAssembly.instantiateStreaming(response,info);return
result.then(receiveInstantiatedSource,function(reason){err(\"wasm streaming compile failed: \""+reason);err(\"falling
back to ArrayBuffer instantiation\");return instantiateArrayBuffer(receiveInstantiatedSource)}))}else{return
instantiateArrayBuffer(receiveInstantiatedSource)}if(Module[\"instantiateWasm\"]){try{var
exports=Module[\"instantiateWasm\"](info,receiveInstance);return exports}catch(e){err(\"Module.instantiateWasm
callback failed with error: \"+e);return false}}instantiateAsync().catch(Promise.reject);return{}}var
ASM_CONSTS={10520:function(){throw\"Canceled!\"},10538:function($0,$1){setTimeout(function(){__emscript
en_do_dispatch_to_thread($0,$1),0});function initPthreadsJS(){PThread.initRuntime()}function
callRuntimeCallbacks(callbacks){while(callbacks.length>0){var callback=callbacks.shift();if(typeof
callback===\"function\"){callback(Module);continue}var func=callback.func;if(typeof
func===\"number\"){if(callback.arg===undefined){wasmTable.get(func)}else{wasmTable.get(func)(callback.arg
)}}else{func(callback.arg===undefined?null:callback.arg)}}}var
ERRNO_CODES={EPERM:63,ENOENT:44,ESRCH:71,EINTR:27,EIO:29,ENXIO:60,E2BIG:1,ENOEXEC:45,E
BADF:8,ECHILD:12,EAGAIN:6,EWOULDBLOCK:6,ENOMEM:48,EACCES:2,EFAULT:21,ENOTBLK:105,EB
USY:10,EEXIST:20,EXDEV:75,ENODEV:43,ENODIR:54,EISDIR:31,EINVAL:28,ENFILE:41,EMFILE:33,EN
OTTY:59,ETXTBSY:74,EFBIG:22,ENOSPC:51,ESPIPE:70,EROFS:69,EMLINK:34,EPIPE:64,EDOM:18,ERAN
GE:68,ENOMSG:49,EIDRM:24,ECHRNG:106,EL2NSYNC:156,EL3HLT:107,EL3RST:108,ELNRNG:109,EUNA
TCH:110,ENOSIG:111,EL2HLT:112,EDEADLK:16,ENOLCK:46,EBADE:113,EBADR:114,EXFULL:115,ENOA
NO:104,EBADRQC:103,EBADSLT:102,EDEADLOCK:16,EBFONT:101,ENOSTR:100,ENODATA:116,ETIME:
117,ENOSR:118,ENONET:119,ENOPKG:120,EREMOTE:121,ENOLINK:47,EADV:122,ESRMNT:123,ECOMM
:124,EPROTO:65,EMULTIHOP:36,EDOTDOT:125,EBADMSG:9,ENOTUNIQ:126,EBADFD:127,EREMCHG:1
28,ELIBACC:129,ELIBBAD:130,ELIBSCN:131,ELIBMAX:132,ELIBEXEC:133,ENOSYS:52,ENOTEMPTY:55,
ENAMETOOLONG:37,ELOOP:32,EOPNOTSUPP:138,EPFNOSUPPORT:139,ECONNRESET:15,ENOBUFS:42,
EAFNOSUPPORT:5,EPROTOTYPE:67,ENOTSOCK:57,ENOPROTOOPT:50,ESHUTDOWN:140,ECONNREFU
SED:14,EADDRINUSE:3,ECONNABORTED:13,ENETUNREACH:40,ENETDOWN:38,ETIMEDOUT:73,EHOS
TDOWN:142,EHOSTUNREACH:23,EINPROGRESS:26,EALREADY:7,EDESTADDRREQ:17,EMSGSIZE:35,E
PROTONOSUPPORT:66,ESOCKTNOSUPPORT:137,EADDRNOTAVAIL:4,ENETRESET:39,EISCONN:30,EN
OTCONN:53,ETOOMANYREFS:141,EUSERS:136,EDQUOT:19,ESTALE:72,ENOTSUP:138,ENOMEDIUM:14
8,EILSEQ:25,E_OVERFLOW:61,ECANCELED:11,ENOTRECOVERABLE:56,EOWNERDEAD:62,ESTRPIPE:13
5};function
__emscripten_futex_wake(addr,count){if(addr<=0||addr>GROWABLE_HEAP_I8().length||addr&3!=0||count<0)retu
rn-28;if(count==0)return 0;if(count>=2147483647)count=Infinity;var
mainThreadWaitAddress=Atomics.load(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2);var
mainThreadWoken=0;if(mainThreadWaitAddress==addr){var
loadedAddr=Atomics.compareExchange(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2,mainTh
readWaitAddress,0);if(loadedAddr==mainThreadWaitAddress){--count;mainThreadWoken=1;if(count<=0)return
1}}var ret=Atomics.notify(GROWABLE_HEAP_I32(),addr>>2,count);if(ret>=0)return
ret+mainThreadWoken;throw\"Atomics.notify returned an unexpected value
\"+ret}Module[\"__emscripten_futex_wake\"]=__emscripten_futex_wake;function
killThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw\"Internal Error! killThread() can only ever be
called from main application thread!\";if(!pthread_ptr)throw\"Internal Error! Null pthread_ptr in
killThread!\";GROWABLE_HEAP_I32()[pthread_ptr+12>>2]=0;var
pthread=PThread.pthreads[pthread_ptr];pthread.worker.terminate();PThread.freeThreadData(pthread);PThread.runni
ngWorkers.splice(PThread.runningWorkers.indexOf(pthread.worker),1);pthread.worker.pthread=undefined}functio

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n cancelThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw\`Internal Error! cancelThread() can only
ever be called from main application thread!\`;if(!pthread_ptr)throw\`Internal Error! Null pthread_ptr in
cancelThread!\`;var
pthread=PThread.threads[pthread_ptr];pthread.worker.postMessage({"cmd\`:\`cancel\`"})function
cleanupThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw\`Internal Error! cleanupThread() can only
ever be called from main application thread!\`;if(!pthread_ptr)throw\`Internal Error! Null pthread_ptr in
cleanupThread!\`;var
pthread=PThread.threads[pthread_ptr];if(pthread){GROWABLE_HEAP_I32()[pthread_ptr+12>>2]=0;var
worker=pthread.worker;PThread.returnWorkerToPool(worker)}var
PThread={unusedWorkers:[],runningWorkers:[],initMainThreadBlock:function(){var
pthreadPoolSize=8;for(var
i=0;i<pthreadPoolSize;++i){PThread.allocateUnusedWorker()}},initRuntime:function(){var
tb=_malloc(228);for(var
i=0;i<228/4;++i)GROWABLE_HEAP_U32()[tb/4+i]=0;GROWABLE_HEAP_I32()[tb+12>>2]=tb;var
headPtr=tb+152;GROWABLE_HEAP_I32()[headPtr>>2]=headPtr;var tlsMemory=_malloc(512);for(var
i=0;i<128;++i)GROWABLE_HEAP_U32()[tlsMemory/4+i]=0;Atomics.store(GROWABLE_HEAP_U32(),tb+100
>>2,tlsMemory);Atomics.store(GROWABLE_HEAP_U32(),tb+40>>2,tb);__emscripten_thread_init(tb,!ENVIRON
MENT_IS_WORKER,1);__emscripten_register_main_browser_thread_id(tb);initWorker:function(){},threads:{},t
hreadExitHandlers:[],setThreadStatus:function(){},runExitHandlers:function(){while(PThread.threadExitHandlers.l
ength>0){PThread.threadExitHandlers.pop()}if(ENVIRONMENT_IS_PTHREAD&&_pthread_self())__pthread
_tsd_run_dtors()},runExitHandlersAndDeinitThread:function(tb,exitCode){Atomics.store(GROWABLE_HEAP_U
32(),tb+56>>2,1);Atomics.store(GROWABLE_HEAP_U32(),tb+60>>2,0);PThread.runExitHandlers();Atomics.stor
e(GROWABLE_HEAP_U32(),tb+4>>2,exitCode);Atomics.store(GROWABLE_HEAP_U32(),tb+0>>2,1);_emscri
pten_futex_wake(tb+0,2147483647);__emscripten_thread_init(0,0,0)},threadExit:function(exitCode){var
tb=_pthread_self();if(tb){PThread.runExitHandlersAndDeinitThread(tb,exitCode);if(ENVIRONMENT_IS_PTHRE
AD){postMessage({"cmd\`:\`exit\`"})}}},threadCancel:function(){PThread.runExitHandlersAndDeinitThread(_pthr
ead_self(),-1);postMessage({"cmd\`:\`cancelDone\`"})},terminateAllThreads:function(){for(var t in
PThread.threads){var
pthread=PThread.threads[t];if(pthread&&pthread.worker){PThread.returnWorkerToPool(pthread.worker)}PThre
ad.threads={};for(var i=0;i<PThread.unusedWorkers.length;++i){var
worker=PThread.unusedWorkers[i];worker.terminate()}PThread.unusedWorkers=[];for(var
i=0;i<PThread.runningWorkers.length;++i){var worker=PThread.runningWorkers[i];var
pthread=worker.pthread;PThread.freeThreadData(pthread);worker.terminate()}PThread.runningWorkers=[],freeTh
readData:function(pthread){if(!pthread)return;if(pthread.threadInfoStruct){var
tlsMemory=GROWABLE_HEAP_I32()[pthread.threadInfoStruct+100>>2];GROWABLE_HEAP_I32()[pthread.thr
eadInfoStruct+100>>2]=0;_free(tlsMemory);_free(pthread.threadInfoStruct)}pthread.threadInfoStruct=0;if(pthread.
allocatedOwnStack&&pthread.stackBase)_free(pthread.stackBase);pthread.stackBase=0;if(pthread.worker)pthread.
worker.pthread=null},returnWorkerToPool:function(worker){PThread.runWithoutMainThreadQueuedCalls(funcio
n){delete
PThread.threads[worker.pthread.threadInfoStruct];PThread.unusedWorkers.push(worker);PThread.runningWorker
s.splice(PThread.runningWorkers.indexOf(worker),1);PThread.freeThreadData(worker.pthread);worker.pthread=un
defined}},runWithoutMainThreadQueuedCalls:function(func){GROWABLE_HEAP_I32()[__emscripten_allow_main_runti
me_queued_calls>>2]=0;try{func()}finally{GROWABLE_HEAP_I32()[__emscripten_allow_main_runti
me_queued_calls>>2]=1}},receiveObjectTransfer:function(data){},loadWasmModuleToWorker:function(worker,o
nFinishedLoading){worker.onmessage=function(e){var
d=e["data"];var
cmd=d["cmd"];if(worker.pthread)PThread.currentProxiedOperationCallerThread=worker.pthread.threadInfoStruct;
if(d["targetThread"]&&d["targetThread"]!=_pthread_self())var

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thread=PThread.pthreads[d.targetThread];if(thread){ thread.worker.postMessage(e.data,d[\"transferList\"])}else {con
sole.error('Internal error! Worker sent a message \''+cmd+'\' to target pthread '+d[\"targetThread\"]+\", but that
thread no longer
exists!\")}PThread.currentProxiedOperationCallerThread=undefined;return }if(cmd===\"processQueuedMainThread
Work\"){_emscripten_main_thread_process_queued_calls()}else
if(cmd===\"spawnThread\"){spawnThread(e.data)}else
if(cmd===\"cleanupThread\"){cleanupThread(d[\"thread\"])}else
if(cmd===\"killThread\"){killThread(d[\"thread\"])}else
if(cmd===\"cancelThread\"){cancelThread(d[\"thread\"])}else
if(cmd===\"loaded\"){ worker.loaded=true;if(onFinishedLoading)onFinishedLoading(worker);if(worker.runPthread)
{ worker.runPthread();delete
worker.runPthread } }else if(cmd===\"print\"){out(\"Thread \"+d[\"threadId\"]+\": \"+d[\"text\"])}else
if(cmd===\"printErr\"){err(\"Thread \"+d[\"threadId\"]+\": \"+d[\"text\"])}else if(cmd===\"alert\"){alert(\"Thread
\"+d[\"threadId\"]+\": \"+d[\"text\"])}else if(cmd===\"exit\"){var
detached=worker.pthread&&Atomics.load(GROWABLE_HEAP_U32(),worker.pthread.threadInfoStruct+64>>2);if
(detached){PThread.returnWorkerToPool(worker)} }else
if(cmd===\"exitProcess\"){try {exit(d[\"returnCode\"])}catch(e){if(e instanceof ExitStatus)return;throw e } }else
if(cmd===\"cancelDone\"){PThread.returnWorkerToPool(worker)}else
if(cmd===\"objectTransfer\"){PThread.receiveObjectTransfer(e.data)}else
if(e.data.target===\"setimmediate\"){ worker.postMessage(e.data)}else{err(\"worker sent an unknown command
\'"+cmd)\")}PThread.currentProxiedOperationCallerThread=undefined};worker.onerror=function(e){err(\"pthread sent
an error! \"+e.filename+\":\"+e.lineno+\":
\'+e.message)};if(ENVIRONMENT_IS_NODE){ worker.on(\"message\",function(data){ worker.onmessage({ data:d
ata})});worker.on(\"error\",function(data){ worker.onerror(data)});worker.on(\"exit\",function(data){})} } worker.post
Message({\"cmd\": \"load\", \"urlOrBlob\": Module[\"mainScriptUrlOrBlob\"]|_scriptDir, \"wasmMemory\": wasmMe
mory, \"wasmModule\": wasmModule}),allocateUnusedWorker:function(){ var
pthreadMainJs=locateFile(\"tfjs-backend-wasm-threaded-simd.worker.js\");PThread.unusedWorkers.push(new
Worker(pthreadMainJs)),getNewWorker:function(){if(PThread.unusedWorkers.length===0){PThread.allocateUnus
edWorker();PThread.loadWasmModuleToWorker(PThread.unusedWorkers[0])}if(PThread.unusedWorkers.length>
0)return PThread.unusedWorkers.pop();else return null},busySpinWait:function(msecs){ var
t=performance.now()+msecs;while(performance.now()<t){}}};function
establishStackSpace(stackTop,stackMax){_emscripten_stack_set_limits(stackTop,stackMax);stackRestore(stackTop
)}Module[\"establishStackSpace\"]=establishStackSpace;function
getNoExitRuntime(){return noExitRuntime }Module[\"getNoExitRuntime\"]=getNoExitRuntime;function
invokeEntryPoint(ptr, arg){ return
wasmTable.get(ptr)(arg)}Module[\"invokeEntryPoint\"]=invokeEntryPoint;function
__assert_fail(condition,filename,line,func){ abort(\"Assertion failed: \"+UTF8ToString(condition)+\", at:
\'+[filename?UTF8ToString(filename):\"unknown filename\"],line,func?UTF8ToString(func):\"unknown
function\")}function __call_main(argc,argv){ var returnCode=_main(argc,argv)}var
_emscripten_get_now;if(ENVIRONMENT_IS_NODE){_emscripten_get_now=function(){var
t=process[\"hrtime\"]();return t[0]*1e3+t[1]/1e6 } }else
if(ENVIRONMENT_IS_PTHREAD){_emscripten_get_now=function(){return performance.now()-
Module[\"__performance_now_clock_drift\"]} }else if(typeof
dateNow!=\"undefined\"){_emscripten_get_now=dateNow }else _emscripten_get_now=function(){return
performance.now()};function setErrNo(value){GROWABLE_HEAP_I32()[__errno_location()>>2]=value;return
value }function _atexit(func, arg){if(ENVIRONMENT_IS_PTHREAD)return
_emscripten_proxy_to_main_thread_js(1,1,func, arg)}function
_emscripten_notify_thread_queue(targetThreadId,mainThreadId){if(targetThreadId===mainThreadId){ postMessag

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e({"cmd\":"processQueuedMainThreadWork\"))else
if(ENVIRONMENT_IS_PTHREAD){postMessage({"targetThread\":"targetThreadId,\\"cmd\":"processThreadQueue\
e\"})}else{var pthread=PThread.pthreads[targetThreadId];var
worker=pthread&&pthread.worker;if(!worker){return}worker.postMessage({"cmd\":"processThreadQueue\"})}ret
urn 1}function _abort(){abort()}function _emscripten_asm_const_int(code,sigPtr,argbuf){var
args=readAsmConstArgs(sigPtr,argbuf);return ASM_CONSTS[code].apply(null,args)}function
_emscripten_conditional_set_current_thread_status(expectedStatus,newStatus){}function
_emscripten_futex_wait(addr,val,timeout){if(addr<=0||addr>GROWABLE_HEAP_I8().length||addr&3!=0)return-
28;if(!ENVIRONMENT_IS_WEB){var
ret=Atomics.wait(GROWABLE_HEAP_I32(),addr>>2,val,timeout);if(ret===\\"timed-out\\")return-
73;if(ret===\\"not-equal\\")return-6;if(ret===\\"ok\\")return
0;throw\\"Atomics.wait returned an unexpected value
\\"+ret}else{if(Atomics.load(GROWABLE_HEAP_I32(),addr>>2)!=val){return-6}var
tNow=performance.now();var tEnd=tNow+timeout;var
lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2,addr);while(1){tNo
w=performance.now();if(tNow>tEnd){lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emscripten_mai
n_thread_futex>>2,0);return-
73}lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2,0);if(lastAddr==
0){break}_emscripten_main_thread_process_queued_calls();if(Atomics.load(GROWABLE_HEAP_I32(),addr>>2)!
=val){return-
6}lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2,addr)}return
0}}function
_emscripten_memcpy_big(dest,src,num){GROWABLE_HEAP_U8().copyWithin(dest,src,src+num)}function
_emscripten_num_logical_cores(){if(ENVIRONMENT_IS_NODE)return require("\\os\\").cpus().length;return
navigator[\\\"hardwareConcurrency\\\"]}function
_emscripten_proxy_to_main_thread_js(index,sync){var numCallArgs=arguments.length-2;var
stack=stackSave();var serializedNumCallArgs=numCallArgs;var args=stackAlloc(serializedNumCallArgs*8);var
b=args>>3;for(var i=0;i<numCallArgs;i++){var arg=arguments[2+i];GROWABLE_HEAP_F64()[b+i]=arg}var
ret=_emscripten_run_in_main_runtime_thread_js(index,serializedNumCallArgs,args,sync);stackRestore(stack);retur
n ret}var _emscripten_receive_on_main_thread_js_callArgs=[];var readAsmConstArgsArray=[];function
readAsmConstArgs(sigPtr,buf){readAsmConstArgsArray.length=0;var
ch;buf>>=2;while(ch=GROWABLE_HEAP_U8()[sigPtr++){var
double=ch<105;if(double&&buf&1)buf++;readAsmConstArgsArray.push(double?GROWABLE_HEAP_F64()[buf
++>>1]:GROWABLE_HEAP_I32()[buf]);++buf}return readAsmConstArgsArray}function
_emscripten_receive_on_main_thread_js(index,numCallArgs,args){_emscripten_receive_on_main_thread_js_callA
rgs.length=numCallArgs;var b=args>>3;for(var
i=0;i<numCallArgs;i++){_emscripten_receive_on_main_thread_js_callArgs[i]=GROWABLE_HEAP_F64()[b+i]}v
ar
isEmAsmConst=index<0;var func=!isEmAsmConst?proxiedFunctionTable[index]:ASM_CONSTS[-index-
1];return func.apply(null,_emscripten_receive_on_main_thread_js_callArgs)}function
_emscripten_get_heap_size(){return GROWABLE_HEAP_U8().length}function
emscripten_realloc_buffer(size){try{wasmmemory.grow(size-
buffer.byteLength+65535>>>16);updateGlobalBufferAndViews(wasmmemory.buffer);return
1}catch(e){}}function _emscripten_resize_heap(requestedSize){var
oldSize=_emscripten_get_heap_size();if(requestedSize<=oldSize){return false}var
maxHeapSize=2147483648;if(requestedSize>maxHeapSize){return false}for(var
cutDown=1;cutDown<=4;cutDown*=2){var
overGrownHeapSize=oldSize*(1+.2/cutDown);overGrownHeapSize=Math.min(overGrownHeapSize,requeste

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+100663296);var
newSize=Math.min(maxHeapSize,alignUp(Math.max(requestedSize,overGrownHeapSize),65536));var
replacement=emscripten_realloc_buffer(newSize);if(replacement){return true }return false }var
JSEvents={inEventHandler:0,removeAllEventListeners:function(){for(var
i=JSEvents.eventHandlers.length-1;i>=0;--
i){JSEvents._removeHandler(i)}JSEvents.eventHandlers=[];JSEvents.deferredCalls=[]},registerRemoveEventListe
ners:function(){if(!JSEvents.removeEventListenersRegistered){__ATEXIT__.push(JSEvents.removeAllEventListene
rs);JSEvents.removeEventListenersRegistered=true}},deferredCalls:[,deferCall:function(targetFunction,precedence
,argsList){function arraysHaveEqualContent(arrA,arrB){if(arrA.length!=arrB.length)return false;for(var i in
arrA){if(arrA[i]!=arrB[i])return false}return true}for(var i in JSEvents.deferredCalls){var
call=JSEvents.deferredCalls[i];if(call.targetFunction==targetFunction&&arraysHaveEqualContent(call.argsList,args
List))return}}JSEvents.deferredCalls.push({targetFunction:targetFunction,precedence:precedence,argsList:argsList
});JSEvents.deferredCalls.sort(function(x,y){return
x.precedence<y.precedence})},removeDeferredCalls:function(targetFunction){for(var
i=0;i<JSEvents.deferredCalls.length;++i){if(JSEvents.deferredCalls[i].targetFunction==targetFunction){JSEvents.d
eferredCalls.splice(i,1);--i}},canPerformEventHandlerRequests:function(){return
JSEvents.inEventHandler&&JSEvents.currentEventHandler.allowsDeferredCalls},runDeferredCalls:function(){if(!J
SEvents.canPerformEventHandlerRequests()){return}for(var i=0;i<JSEvents.deferredCalls.length;++i){var
call=JSEvents.deferredCalls[i];JSEvents.deferredCalls.splice(i,1);--
i;call.targetFunction.apply(null,call.argsList)},eventHandlers:[,removeAllHandlersOnTarget:function(target,event
TypeString){for(var
i=0;i<JSEvents.eventHandlers.length;++i){if(JSEvents.eventHandlers[i].target==target&&(!eventTypeString||event
TypeString==JSEvents.eventHandlers[i].eventTypeString)){JSEvents._removeHandler(i--
)}}},_removeHandler:function(i){var
h=JSEvents.eventHandlers[i];h.target.removeEventListener(h.eventTypeString,h.eventListenerFunc,h.useCapture);J
SEvents.eventHandlers.splice(i,1)},registerOrRemoveHandler:function(eventHandler){var
jsEventHandler=function
jsEventHandler(event){++JSEvents.inEventHandler;JSEvents.currentEventHandler=eventHandler;JSEvents.runDef
erredCalls();eventHandler.handlerFunc(event);JSEvents.runDeferredCalls();--
JSEvents.inEventHandler};if(eventHandler.callbackfunc){eventHandler.eventListenerFunc=jsEventHandler;eventH
andler.target.addEventListener(eventHandler.eventTypeString,jsEventHandler,eventHandler.useCapture);JSEvents.e
ventHandlers.push(eventHandler);JSEvents.registerRemoveEventListeners()}else{for(var
i=0;i<JSEvents.eventHandlers.length;++i){if(JSEvents.eventHandlers[i].target==eventHandler.target&&JSEvents.e
ventHandlers[i].eventTypeString==eventHandler.eventTypeString){JSEvents._removeHandler(i--
)}}},queueEventHandlerOnThread_iiii:function(targetThread,eventHandlerFunc,eventTypeId,eventData,userData)
{var stackTop=stackSave();var
varargs=stackAlloc(12);GROWABLE_HEAP_I32()[varargs>>2]=eventTypeId;GROWABLE_HEAP_I32()[varargs
+4>>2]=eventData;GROWABLE_HEAP_I32()[varargs+8>>2]=userData;__emscripten_call_on_thread(0,targetThre
ad,637534208,eventHandlerFunc,eventData,varargs);stackRestore(stackTop)},getTargetThreadForEventCallback:f
unction(targetThread){switch(targetThread){case
1:return 0;case 2:return PThread.currentProxiedOperationCallerThread;default:return
targetThread}},getNodeNameForTarget:function(target){if(!target)return"";if(target==window)return"#window";
if(target==screen)return"#screen";return
target&&target.nodeName?target.nodeName:""},fullscreenEnabled:function(){return
document.fullscreenEnabled||document.webkitFullscreenEnabled}};function stringToNewUTF8(jsString){var
length=lengthBytesUTF8(jsString)+1;var cString=_malloc(length);stringToUTF8(jsString,cString,length);return
cString}function
_emscripten_set_offscreencanvas_size_on_target_thread_js(targetThread,targetCanvas,width,height){var

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stackTop=stackSave();var varargs=stackAlloc(12);var
targetCanvasPtr=0;if(targetCanvas){targetCanvasPtr=stringToNewUTF8(targetCanvas)}GROWABLE_HEAP_I32(
)[varargs>>2]=targetCanvasPtr;GROWABLE_HEAP_I32()[varargs+4>>2]=width;GROWABLE_HEAP_I32()[var
args+8>>2]=height;_emscripten_call_on_thread(0,targetThread,657457152,0,targetCanvasPtr,varargs);stackRestor
e(stackTop)}function
_emscripten_set_offscreencanvas_size_on_target_thread(targetThread,targetCanvas,width,height){targetCanvas=tar
getCanvas?UTF8ToString(targetCanvas):\"\";_emscripten_set_offscreencanvas_size_on_target_thread_js(targetThr
ead,targetCanvas,width,height)}function maybeCStringToJsString(cString){return
cString>2?UTF8ToString(cString):cString}var specialHTMLTargets=[0,typeof
document!=="undefined"?document:0,typeof window!=="undefined"?window:0];function
findEventTarget(target){target=maybeCStringToJsString(target);var
domElement=specialHTMLTargets[target]||(typeof
document!=="undefined"?document.querySelector(target):undefined);return domElement}function
findCanvasEventTarget(target){return findEventTarget(target)}function
_emscripten_set_canvas_element_size_calling_thread(target,width,height){var
canvas=findCanvasEventTarget(target);if(!canvas)return-
4;if(canvas.canvasSharedPtr){GROWABLE_HEAP_I32()[canvas.canvasSharedPtr>>2]=width;GROWABLE_HEA
P_I32()[canvas.canvasSharedPtr+4>>2]=height}if(canvas.offscreenCanvas||!canvas.controlTransferredOffscreen){if
(canvas.offscreenCanvas)canvas=canvas.offscreenCanvas;var
autoResizeViewport=false;if(canvas.GLctxObject&&canvas.GLctxObject.GLctx){var
prevViewport=canvas.GLctxObject.GLctx.getParameter(2978);autoResizeViewport=prevViewport[0]===0&&prev
Viewport[1]===0&&prevViewport[2]===canvas.width&&prevViewport[3]===canvas.height}canvas.width=width;
canvas.height=height;if(autoResizeViewport){canvas.GLctxObject.GLctx.viewport(0,0,width,height)}else
if(canvas.canvasSharedPtr){var
targetThread=GROWABLE_HEAP_I32()[canvas.canvasSharedPtr+8>>2];_emscripten_set_offscreencanvas_size_o
n_target_thread(targetThread,target,width,height);return 1}else{return-4}return 0}function
_emscripten_set_canvas_element_size_main_thread(target,width,height){if(ENVIRONMENT_IS_PTHREAD)retur
n
_emscripten_proxy_to_main_thread_js(2,1,target,width,height);return
_emscripten_set_canvas_element_size_calling_thread(target,width,height)}function
_emscripten_set_canvas_element_size(target,width,height){var
canvas=findCanvasEventTarget(target);if(canvas){return
_emscripten_set_canvas_element_size_calling_thread(target,width,height)}else{return
_emscripten_set_canvas_element_size_main_thread(target,width,height)}}function
_emscripten_set_current_thread_status(newStatus){}function
_emscripten_set_thread_name(threadId,name){}function __webgl_enable_ANGLE_instanced_arrays(ctx){var
ext=ctx.getExtension(\"ANGLE_instanced_arrays\");if(ext){ctx[\"vertexAttribDivisor\"]=function(index,divisor){ex
t[\"vertexAttribDivisorANGLE\"](index,divisor)};ctx[\"drawArraysInstanced\"]=function(mode,first,count,primcou
nt){ext[\"drawArraysInstancedANGLE\"](mode,first,count,primcount)};ctx[\"drawElementsInstanced\"]=function(
mode,count,type,indices,primcount){ext[\"drawElementsInstancedANGLE\"](mode,count,type,indices,primcount)};
return
1}}function __webgl_enable_OES_vertex_array_object(ctx){var
ext=ctx.getExtension(\"OES_vertex_array_object\");if(ext){ctx[\"createVertexArray\"]=function(){return
ext[\"createVertexArrayOES\"]();ctx[\"deleteVertexArray\"]=function(vao){ext[\"deleteVertexArrayOES\"](vao)};
ctx[\"bindVertexArray\"]=function(vao){ext[\"bindVertexArrayOES\"](vao)};ctx[\"isVertexArray\"]=function(vao)
{return ext[\"isVertexArrayOES\"](vao)};return 1}}function __webgl_enable_WEBGL_draw_buffers(ctx){var
ext=ctx.getExtension(\"WEBGL_draw_buffers\");if(ext){ctx[\"drawBuffers\"]=function(n,bufs){ext[\"drawBuffers
WEBGL\"](n,bufs)};return 1}}function

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__webgl_enable_WEBGL_multi_draw(ctx){return!(ctx.multiDrawWebgl=ctx.getExtension(\`"WEBGL_multi_dra
w\`))}var
GL={counter:1,buffers:[],programs:[],framebuffers:[],renderbuffers:[],textures:[],uniforms:[],shaders:[],vaos:[],cont
exts:{},offscreenCanvases:{},timerQueriesEXT:[],programInfos:{},stringCache:{},unpackAlignment:4,recordError:
function
 recordError(errorCode){if(!GL.lastError){GL.lastError=errorCode}},getNewId:function(table){var
ret=GL.counter++;for(var i=table.length;i<ret;i++){table[i]=null}return
ret},getSource:function(shader,count,string,length){var source=\`";for(var i=0;i<count;++i){var
len=length?GROWABLE_HEAP_I32()[length+i*4>>2]:-
1;source+=UTF8ToString(GROWABLE_HEAP_I32()[string+i*4>>2],len<0?undefined:len)}return
source},createContext:function(canvas,webGLContextAttributes){var
ctx=canvas.getContext(\`"webgl\`,webGLContextAttributes);if(!ctx)return 0;var
handle=GL.registerContext(ctx,webGLContextAttributes);return
handle},registerContext:function(ctx,webGLContextAttributes){var
handle=_malloc(8);GROWABLE_HEAP_I32()[handle+4>>2]=_pthread_self();var
context={handle:handle,attributes:webGLContextAttributes,version:webGLContextAttributes.majorVersion,GLctx:
ctx};if(ctx.canvas)ctx.canvas.GLctxObject=context;GL.contexts[handle]=context;if(typeof
webGLContextAttributes.enableExtensionsByDefault===\`"undefined\`"||webGLContextAttributes.enableExtensions
ByDefault){GL.initExtensions(context)}return
handle},makeContextCurrent:function(contextHandle){GL.currentContext=GL.contexts[contextHandle];Module.ctx
=GLctx=GL.currentContext&&GL.currentContext.GLctx;return!(contextHandle&&!GLctx)},getContext:function(c
ontextHandle){return
GL.contexts[contextHandle]},deleteContext:function(contextHandle){if(GL.currentContext===GL.contexts[contex
tHandle])GL.currentContext=null;if(typeof
JSEvents===\`"object\`)JSEvents.removeAllHandlersOnTarget(GL.contexts[contextHandle].GLctx.canvas);if(GL.co
ntexts[contextHandle]&&GL.contexts[contextHandle].GLctx.canvas)GL.contexts[contextHandle].GLctx.canvas.GL
ctxObject=undefined;_free(GL.contexts[contextHandle].handle);GL.contexts[contextHandle]=null},initExtensions:f
unction(context){if(!context)context=GL.currentContext;if(context.initExtensionsDone)return;context.initExtension
sDone=true;var
GLctx=context.GLctx;__webgl_enable_ANGLE_instanced_arrays(GLctx);__webgl_enable_OES_vertex_array_obj
ect(GLctx);__webgl_enable_WEBGL_draw_buffers(GLctx);GLctx.disjointTimerQueryExt=GLctx.getExtension(\`"
EXT_disjoint_timer_query\`);__webgl_enable_WEBGL_multi_draw(GLctx);var
exts=GLctx.getSupportedExtensions()||[];exts.forEach(function(ext){if(ext.indexOf(\`"lose_context\`)<0&&ext.inde
xOf(\`"debug\`)<0){GLctx.getExtension(ext)}})},populateUniformTable:function(program){var
p=GL.programs[program];var
ptable=GL.programInfos[program]={uniforms:{},maxUniformLength:0,maxAttributeLength:-
1,maxUniformBlockNameLength:-1};var utable=ptable.uniforms;var
numUniforms=GLctx.getProgramParameter(p,35718);for(var i=0;i<numUniforms;++i){var
u=GLctx.getActiveUniform(p,i);var
name=u.name;ptable.maxUniformLength=Math.max(ptable.maxUniformLength,name.length+1);if(name.slice(-
1)===\`"]\`"){name=name.slice(0,name.lastIndexOf(\`"[\`))}var loc=GLctx.getUniformLocation(p,name);if(loc){var
id=GL.getNewId(GL.uniforms);utable[name]=[u.size,id];GL.uniforms[id]=loc;for(var
j=1;j<u.size;++j){var
n=name+\`"[\`+j+\`"]\`;loc=GLctx.getUniformLocation(p,n);id=GL.getNewId(GL.uniforms);GL.uniforms[id]=loc}}
}};var __emscripten_webgl_power_preferences=[\`"default\`,\`"low-power\`,\`"high-performance\`];function
__emscripten_webgl_do_create_context(target,attributes){var a=attributes>>2;var
powerPreference=GROWABLE_HEAP_I32()[a+(24>>2)];var
contextAttributes={\`"alpha\`:!!GROWABLE_HEAP_I32()[a+(0>>2)],\`"depth\`:!!GROWABLE_HEAP_I32()[a+(4

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>>2)],\"stencil\"::!!GROWABLE_HEAP_I32()[a+(8>>2)],\"antialias\"::!!GROWABLE_HEAP_I32()[a+(12>>2)],\"p
remultipliedAlpha\"::!!GROWABLE_HEAP_I32()[a+(16>>2)],\"preserveDrawingBuffer\"::!!GROWABLE_HEAP_
I32()[a+(20>>2)],\"powerPreference\"::__emscripten_webgl_power_preferences[powerPreference],\"failIfMajorPerf
ormanceCaveat\"::!!GROWABLE_HEAP_I32()[a+(28>>2)],majorVersion:GROWABLE_HEAP_I32()[a+(32>>2)],
minorVersion:GROWABLE_HEAP_I32()[a+(36>>2)],enableExtensionsByDefault:GROWABLE_HEAP_I32()[a+(
40>>2)],explicitSwapControl:GROWABLE_HEAP_I32()[a+(44>>2)],proxyContextToMainThread:GROWABLE_
_HEAP_I32()[a+(48>>2)],renderViaOffscreenBackBuffer:GROWABLE_HEAP_I32()[a+(52>>2)]};var
canvas=findCanvasEventTarget(target);if(!canvas){return 0}if(contextAttributes.explicitSwapControl){return
0}var contextHandle=GL.createContext(canvas,contextAttributes);return contextHandle}function
_emscripten_webgl_create_context(a0,a1){return _emscripten_webgl_do_create_context(a0,a1)}var
SYSCALLS={mappings:{},buffers:[null,[],[]],printChar:function(stream,curr){var
buffer=SYSCALLS.buffers[stream];if(curr===0||curr===10){(stream===1?out:err)(UTF8ArrayToString(buffer,0));
buffer.length=0}else{buffer.push(curr)},varargs:undefined,get:function(){SYSCALLS.varargs+=4;var
ret=GROWABLE_HEAP_I32()[SYSCALLS.varargs-4>>2];return ret},getStr:function(ptr){var
ret=UTF8ToString(ptr);return ret},get64:function(low,high){return low}};function
_fd_close(fd){if(ENVIRONMENT_IS_PTHREAD)return _emscripten_proxy_to_main_thread_js(3,1,fd);return
0}function _fd_seek(fd,offset_low,offset_high,whence,newOffset){if(ENVIRONMENT_IS_PTHREAD)return
_emscripten_proxy_to_main_thread_js(4,1,fd,offset_low,offset_high,whence,newOffset)}function
_fd_write(fd,iow,iovcnt,pnum){if(ENVIRONMENT_IS_PTHREAD)return
_emscripten_proxy_to_main_thread_js(5,1,fd,iow,iovcnt,pnum);var num=0;for(var i=0;i<iovcnt;i++){var
ptr=GROWABLE_HEAP_I32()[iow+i*8>>2];var len=GROWABLE_HEAP_I32()[iow+(i*8+4)>>2];for(var
j=0;j<len;j++){SYSCALLS.printChar(fd,GROWABLE_HEAP_U8()[ptr+j])}num+=len}GROWABLE_HEAP_I32
()[pnum>>2]=num;return 0}function _pthread_cleanup_pop(execute){var
routine=PThread.threadExitHandlers.pop();if(execute)routine()}function
_pthread_cleanup_push(routine,arg){PThread.threadExitHandlers.push(function(){wasmTable.get(routine)(arg)})}f
unction spawnThread(threadParams){if(ENVIRONMENT_IS_PTHREAD)throw\"Internal Error! spawnThread()
can only ever be called from main application thread!\";var
worker=PThread.getNewWorker();if(worker.pthread!==undefined)throw\"Internal
error!\";if(!threadParams.pthread_ptr)throw\"Internal
error, no pthread ptr!\";PThread.runningWorkers.push(worker);var tlsMemory=_malloc(128*4);for(var
i=0;i<128;++){GROWABLE_HEAP_I32()[tlsMemory+i*4>>2]=0}var
stackHigh=threadParams.stackBase+threadParams.stackSize;var
pthread=PThread.pthreads[threadParams.pthread_ptr]={worker:worker,stackBase:threadParams.stackBase,stackSize
:threadParams.stackSize,allocatedOwnStack:threadParams.allocatedOwnStack,threadInfoStruct:threadParams.pthrea
d_ptr};var
tis=pthread.threadInfoStruct>>2;Atomics.store(GROWABLE_HEAP_U32(),tis+(64>>2),threadParams.detached);A
tomics.store(GROWABLE_HEAP_U32(),tis+(100>>2),tlsMemory);Atomics.store(GROWABLE_HEAP_U32(),tis
+(40>>2),pthread.threadInfoStruct);Atomics.store(GROWABLE_HEAP_U32(),tis+(80>>2),threadParams.stackSiz
e);Atomics.store(GROWABLE_HEAP_U32(),tis+(76>>2),stackHigh);Atomics.store(GROWABLE_HEAP_U32(),t
is+(104>>2),threadParams.stackSize);Atomics.store(GROWABLE_HEAP_U32(),tis+(104+8>>2),stackHigh);Atom
ics.store(GROWABLE_HEAP_U32(),tis+(104+12>>2),threadParams.detached);var
global_libc=_emscripten_get_global_libc();var
global_locale=global_libc+40;Atomics.store(GROWABLE_HEAP_U32(),tis+(172>>2),global_locale);worker.pthr
ead=pthread;var
msg={\"cmd\": \"run\", \"start_routine\": threadParams.startRoutine, \"arg\": threadParams.arg, \"threadInfoStruct\": thre
adParams.pthread_ptr, \"stackBase\": threadParams.stackBase, \"stackSize\": threadParams.stackSize};worker.runPthrea
d=function(){msg.time=performance.now();worker.postMessage(msg,threadParams.transferList)};if(worker.loaded
){worker.runPthread();delete worker.runPthread}}function

```

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pthread_create(pthread_ptr,attr,start_routine,arg){if(typeof SharedArrayBuffer===\undefined){err(\Current
environment does not support SharedArrayBuffer, pthreads are not available!\");return
6}if(!pthread_ptr){err(\pthread_create called with a null thread pointer!\");return 28}var transferList=[];var
error=0;if(ENVIRONMENT_IS_PTHREAD&&(transferList.length===0||error)){return
_emsripten_sync_run_in_main_thread_4(687865856,pthread_ptr,attr,start_routine,arg)}if(error)return
error;var stackSize=0;var stackBase=0;var detached=0;if(attr&&attr!-
1){stackSize=GROWABLE_HEAP_I32()[attr>>2];stackSize+=81920;stackBase=GROWABLE_HEAP_I32()[attr+
8>>2];detached=GROWABLE_HEAP_I32()[attr+12>>2]!==0}else{stackSize=2097152}var
allocatedOwnStack=stackBase==0;if(allocatedOwnStack){stackBase=_memalign(16,stackSize)}else{stackBase=
stackSize;assert(stackBase>0)}var threadInfoStruct=_malloc(228);for(var
i=0;i<228>>2;++)GROWABLE_HEAP_U32()[threadInfoStruct>>2+i]=0;GROWABLE_HEAP_I32()[pthread_p
tr>>2]=threadInfoStruct;GROWABLE_HEAP_I32()[threadInfoStruct+12>>2]=threadInfoStruct;var
headPtr=threadInfoStruct+152;GROWABLE_HEAP_I32()[headPtr>>2]=headPtr;var
threadParams={stackBase:stackBase,stackSize:stackSize,allocatedOwnStack:allocatedOwnStack,detached:detached
,startRoutine:start_routine,pthread_ptr:threadInfoStruct,arg:arg,transferList:transferList};if(ENVIRONMENT_IS_P
THREAD){threadParams.cmd=\spawnThread\;postMessage(threadParams,transferList)}else{spawnThread(thread
Params)}return
0}function __pthread_testcancel_js(){if(!ENVIRONMENT_IS_PTHREAD)return;var
tb=__pthread_self();if(!tb)return;var
cancelDisabled=Atomics.load(GROWABLE_HEAP_U32(),tb+56>>2);if(cancelDisabled)return;var
canceled=Atomics.load(GROWABLE_HEAP_U32(),tb+0>>2);if(canceled==2)throw\Canceled!\}function
_emsripten_check_blocking_allowed(){if(ENVIRONMENT_IS_NODE)return;if(ENVIRONMENT_IS_WORKE
R)return;warnOnce(\Blocking on the main thread is very dangerous, see
https://emscripten.org/docs/porting/pthreads.html#blocking-on-the-main-browser-thread)}function
__emsripten_do_pthread_join(thread,status,block){if(!thread){err(\pthread_join attempted on a null thread
pointer!\");return
ERRNO_CODES.ESRCH}if(ENVIRONMENT_IS_PTHREAD&&__pthread_self()==thread){err(\PThread
\'+thread+\'' is attempting to join to itself!\");return ERRNO_CODES.EDEADLK}else
if(!ENVIRONMENT_IS_PTHREAD&&_emsripten_main_browser_thread_id()==thread){err(\Main
thread \'+thread+\'' is attempting to join to itself!\");return ERRNO_CODES.EDEADLK}var
self=GROWABLE_HEAP_I32()[thread+12>>2];if(self!==thread){err(\pthread_join attempted on thread
\'+thread+\'', which does not point to a valid thread, or does not exist anymore!\");return
ERRNO_CODES.ESRCH}var
detached=Atomics.load(GROWABLE_HEAP_U32(),thread+64>>2);if(detached){err(\Attempted to join thread
\'+thread+\'', which was already detached!\");return
ERRNO_CODES.EINVAL}if(block){_emsripten_check_blocking_allowed()}for(;;){var
threadStatus=Atomics.load(GROWABLE_HEAP_U32(),thread+0>>2);if(threadStatus==1){var
threadExitCode=Atomics.load(GROWABLE_HEAP_U32(),thread+4>>2);if(status)GROWABLE_HEAP_I32()[sta
tus>>2]=threadExitCode;Atomics.store(GROWABLE_HEAP_U32(),thread+64>>2,1);if(!ENVIRONMENT_IS_PT
HREAD)cleanupThread(thread);else postMessage({\cmd\:\cleanupThread\,\thread\':thread});return
0}if(!block){return
ERRNO_CODES.EBUSY}}__pthread_testcancel_js();if(!ENVIRONMENT_IS_PTHREAD)_emsripten_main_thre
ad_process_queued_calls();_emsripten_futex_wait(thread+0,threadStatus,ENVIRONMENT_IS_PTHREAD?100:1
)}function
pthread_join(thread,status){return __emsripten_do_pthread_join(thread,status,true)}function
_sysconf(name){if(ENVIRONMENT_IS_PTHREAD)return
_emsripten_proxy_to_main_thread_js(6,1,name);switch(name){case 30:return 16384;case 85:var
maxHeapSize=2147483648;return maxHeapSize/16384;case 132:case 133:case 12:case 137:case 138:case 15:case

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235:case 16:case 17:case 18:case 19:case 20:case 149:case 13:case 10:case 236:case 153:case 9:case 21:case 22:case 159:case 154:case 14:case 77:case 78:case 139:case 82:case 68:case 67:case 164:case 11:case 29:case 47:case 48:case 95:case 52:case 51:case 46:return 200809;case 27:case 246:case 127:case 128:case 23:case 24:case 160:case 161:case 181:case 182:case 242:case 183:case 184:case 243:case 244:case 245:case 165:case 178:case 179:case 49:case 50:case 168:case 169:case 175:case 170:case 171:case 172:case 97:case 76:case 32:case 173:case 35:case 80:case 81:case 79:return-1;case 176:case 177:case 7:case 155:case 8:case 157:case 125:case 126:case 92:case 93:case 129:case 130:case 131:case 94:case 91:return 1;case 74:case 60:case 69:case 70:case 4:return 1024;case 31:case 42:case 72:return 32;case 87:case 26:case 33:return 2147483647;case 34:case 1:return 47839;case 38:case 36:return 99;case 43:case 37:return 2048;case 0:return 2097152;case 3:return 65536;case 28:return 32768;case 44:return 32767;case 75:return 16384;case 39:return 1e3;case 89:return 700;case 71:return 256;case 40:return 255;case 2:return 100;case 180:return 64;case 25:return 20;case 5:return 16;case 6:return 6;case 73:return 4;case 84:{if(typeof navigator===\"object\")return navigator[\"hardwareConcurrency\"]||1;return 1}}setErrNo(28);return-1}if(!ENVIRONMENT\_IS\_PTHREAD)PThread.initMainThreadBlock();var GLctx;var proxiedFunctionTable=[null,\_atexit,\_emscripten\_set\_canvas\_element\_size\_main\_thread,\_fd\_close,\_fd\_seek,\_fd\_write,\_sysconf];var asmLibraryArg={\"e\":\_\_assert\_fail,\"r\":\_\_call\_main,\"x\":\_emscripten\_notify\_thread\_queue,\"b\":\_abort,\"y\":\_emscripten\_asm\_const\_int,\"j\":\_emscripten\_conditional\_set\_current\_thread\_status,\"d\":\_emscripten\_futex\_wait,\"c\":\_emscripten\_futex\_wake,\"f\":\_emscripten\_get\_now,\"p\":\_emscripten\_memcpy\_big,\"A\":\_emscripten\_num\_logical\_cores,\"u\":\_emscripten\_receive\_on\_main\_thread\_js,\"q\":\_emscripten\_resize\_heap,\"v\":\_emscripten\_set\_canvas\_element\_size,\"i\":\_emscripten\_set\_current\_thread\_status,\"s\":\_emscripten\_set\_thread\_name,\"w\":\_emscripten\_webgl\_create\_context,\"l\":\_fd\_close,\"n\":\_fd\_seek,\"g\":\_fd\_write,\"o\":initPthreadsJS,\"a\":wasmMemory||Module[\"wasmMemory\"],\"z\":\_pthread\_cleanup\_pop,\"k\":\_pthread\_cleanup\_push,\"h\":\_pthread\_create,\"m\":\_pthread\_join,\"t\":\_sysconf};var asm=createWasm();var \_\_wasm\_call\_ctors=Module[\"\_\_wasm\_call\_ctors\"]=function(){return(\_\_wasm\_call\_ctors=Module[\"\_\_wasm\_call\_ctors\"])=Module[\"asm\"][\"B\"]).apply(null,arguments)};var \_init=Module[\"\_init\"]=function(){return(\_init=Module[\"\_init\"]=Module[\"asm\"][\"C\"]).apply(null,arguments)};var \_init\_with\_threads\_count=Module[\"\_init\_with\_threads\_count\"]=function(){return(\_init\_with\_threads\_count=Module[\"\_init\_with\_threads\_count\"]=Module[\"asm\"][\"D\"]).apply(null,arguments)};var \_get\_threads\_count=Module[\"\_get\_threads\_count\"]=function(){return(\_get\_threads\_count=Module[\"\_get\_threads\_count\"]=Module[\"asm\"][\"E\"]).apply(null,arguments)};var \_register\_tensor=Module[\"\_register\_tensor\"]=function(){return(\_register\_tensor=Module[\"\_register\_tensor\"]=Module[\"asm\"][\"F\"]).apply(null,arguments)};var \_dispose\_data=Module[\"\_dispose\_data\"]=function(){return(\_dispose\_data=Module[\"\_dispose\_data\"]=Module[\"asm\"][\"G\"]).apply(null,arguments)};var \_dispose=Module[\"\_dispose\"]=function(){return(\_dispose=Module[\"\_dispose\"]=Module[\"asm\"][\"H\"]).apply(null,arguments)};var \_Abs=Module[\"\_Abs\"]=function(){return(\_Abs=Module[\"\_Abs\"]=Module[\"asm\"][\"J\"]).apply(null,arguments)};var \_Add=Module[\"\_Add\"]=function(){return(\_Add=Module[\"\_Add\"]=Module[\"asm\"][\"K\"]).apply(null,arguments)};var \_AddN=Module[\"\_AddN\"]=function(){return(\_AddN=Module[\"\_AddN\"]=Module[\"asm\"][\"L\"]).apply(null,arguments)};var \_All=Module[\"\_All\"]=function(){return(\_All=Module[\"\_All\"]=Module[\"asm\"][\"M\"]).apply(null,arguments)};var \_Any=Module[\"\_Any\"]=function(){return(\_Any=Module[\"\_Any\"]=Module[\"asm\"][\"N\"]).apply(null,arguments)};var

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_ArgMax=Module["_ArgMax"]=function(){return(_ArgMax=Module["_ArgMax"]=Module["asm"][["O"]]).apply(null,arguments)};var
_AvgPool=Module["_AvgPool"]=function(){return(_AvgPool=Module["_AvgPool"]=Module["asm"][["P"]]).apply(null,arguments)};var
_BatchMatMul=Module["_BatchMatMul"]=function(){return(_BatchMatMul=Module["_BatchMatMul"]=Module["asm"][["Q"]]).apply(null,arguments)};var
_Ceil=Module["_Ceil"]=function(){return(_Ceil=Module["_Ceil"]=Module["asm"][["R"]]).apply(null,arguments)};var
_ClipByValue=Module["_ClipByValue"]=function(){return(_ClipByValue=Module["_ClipByValue"]=Module["asm"][["S"]]).apply(null,arguments)};var
_Conv2D=Module["_Conv2D"]=function(){return(_Conv2D=Module["_Conv2D"]=Module["asm"][["T"]]).apply(null,arguments)};var
_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=function(){return(_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=Module["asm"][["U"]]).apply(null,arguments)};var
_Cos=Module["_Cos"]=function(){return(_Cos=Module["_Cos"]=Module["asm"][["V"]]).apply(null,arguments)};var
_Cosh=Module["_Cosh"]=function(){return(_Cosh=Module["_Cosh"]=Module["asm"][["W"]]).apply(null,arguments)};var
_CropAndResize=Module["_CropAndResize"]=function(){return(_CropAndResize=Module["_CropAndResize"]=Module["asm"][["X"]]).apply(null,arguments)};var
_Cumsum=Module["_Cumsum"]=function(){return(_Cumsum=Module["_Cumsum"]=Module["asm"][["Y"]]).apply(null,arguments)};var
_DepthToSpace=Module["_DepthToSpace"]=function(){return(_DepthToSpace=Module["_DepthToSpace"]=Module["asm"][["Z"]]).apply(null,arguments)};var
_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=function(){return(_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=Module["asm"][["_"]]).apply(null,arguments)};var
_Elu=Module["_Elu"]=function(){return(_Elu=Module["_Elu"]=Module["asm"][["$"]]).apply(null,arguments)};var
_Equal=Module["_Equal"]=function(){return(_Equal=Module["_Equal"]=Module["asm"][["aa"]]).apply(null,arguments)};var
_Exp=Module["_Exp"]=function(){return(_Exp=Module["_Exp"]=Module["asm"][["ba"]]).apply(null,arguments)};var
_FlipLeftRight=Module["_FlipLeftRight"]=function(){return(_FlipLeftRight=Module["_FlipLeftRight"]=Module["asm"][["ca"]]).apply(null,arguments)};var
_Floor=Module["_Floor"]=function(){return(_Floor=Module["_Floor"]=Module["asm"][["da"]]).apply(null,arguments)};var
_FloorDiv=Module["_FloorDiv"]=function(){return(_FloorDiv=Module["_FloorDiv"]=Module["asm"][["ea"]]).apply(null,arguments)};var
_FusedBatchNorm=Module["_FusedBatchNorm"]=function(){return(_FusedBatchNorm=Module["_FusedBatchNorm"]=Module["asm"][["fa"]]).apply(null,arguments)};var
_FusedConv2D=Module["_FusedConv2D"]=function(){return(_FusedConv2D=Module["_FusedConv2D"]=Module["asm"][["ga"]]).apply(null,arguments)};var
_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=function(){return(_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=Module["asm"][["ha"]]).apply(null,arguments)};var
_Gather=Module["_Gather"]=function(){return(_Gather=Module["_Gather"]=Module["asm"][["ia"]]).apply(null,arguments)};var
_GatherNd=Module["_GatherNd"]=function(){return(_GatherNd=Module["_GatherNd"]=Module["asm"][["ja"]]).apply(null,arguments)};var

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_Greater=Module["_Greater"]=function(){return(_Greater=Module["_Greater"]=Module["asm"][\["ka\"]).apply(
null,arguments)};var
_GreaterEqual=Module["_GreaterEqual"]=function(){return(_GreaterEqual=Module["_GreaterEqual"]=Module["asm"][\["la\"]).apply(null,arguments)};var
_LeakyRelu=Module["_LeakyRelu"]=function(){return(_LeakyRelu=Module["_LeakyRelu"]=Module["asm"][\["ma\"]).apply(null,arguments)};var
_Less=Module["_Less"]=function(){return(_Less=Module["_Less"]=Module["asm"][\["na\"]).apply(null,arguments)};var
_LessEqual=Module["_LessEqual"]=function(){return(_LessEqual=Module["_LessEqual"]=Module["asm"][\["oa\"]).apply(null,arguments)};var
_Log=Module["_Log"]=function(){return(_Log=Module["_Log"]=Module["asm"][\["pa\"]).apply(null,arguments)};var
_LogicalAnd=Module["_LogicalAnd"]=function(){return(_LogicalAnd=Module["_LogicalAnd"]=Module["asm"][\["qa\"]).apply(null,arguments)};var
_Max=Module["_Max"]=function(){return(_Max=Module["_Max"]=Module["asm"][\["ra\"]).apply(null,arguments)};var
_MaxPool=Module["_MaxPool"]=function(){return(_MaxPool=Module["_MaxPool"]=Module["asm"][\["sa\"]).apply(null,arguments)};var
_Maximum=Module["_Maximum"]=function(){return(_Maximum=Module["_Maximum"]=Module["asm"][\["ta\"]).apply(null,arguments)};var
_Mean=Module["_Mean"]=function(){return(_Mean=Module["_Mean"]=Module["asm"][\["ua\"]).apply(null,arguments)};var
_Min=Module["_Min"]=function(){return(_Min=Module["_Min"]=Module["asm"][\["va\"]).apply(null,arguments)};var
_Minimum=Module["_Minimum"]=function(){return(_Minimum=Module["_Minimum"]=Module["asm"][\["wa\"]).apply(null,arguments)};var
_MirrorPad=Module["_MirrorPad"]=function(){return(_MirrorPad=Module["_MirrorPad"]=Module["asm"][\["xa\"]).apply(null,arguments)};var
_Multiply=Module["_Multiply"]=function(){return(_Multiply=Module["_Multiply"]=Module["asm"][\["ya\"]).apply(null,arguments)};var
_Neg=Module["_Neg"]=function(){return(_Neg=Module["_Neg"]=Module["asm"][\["za\"]).apply(null,arguments)};var
_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=function(){return(_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=Module["asm"][\["Aa\"]).apply(null,arguments)};var
_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=function(){return(_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=Module["asm"][\["Ba\"]).apply(null,arguments)};var
_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=function(){return(_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=Module["asm"][\["Ca\"]).apply(null,arguments)};var
_NotEqual=Module["_NotEqual"]=function(){return(_NotEqual=Module["_NotEqual"]=Module["asm"][\["Da\"]).apply(null,arguments)};var
_OneHot=Module["_OneHot"]=function(){return(_OneHot=Module["_OneHot"]=Module["asm"][\["Ea\"]).apply(null,arguments)};var
_PadV2=Module["_PadV2"]=function(){return(_PadV2=Module["_PadV2"]=Module["asm"][\["Fa\"]).apply(null,arguments)};var
_Pow=Module["_Pow"]=function(){return(_Pow=Module["_Pow"]=Module["asm"][\["Ga\"]).apply(null,arguments)};var
_Prelu=Module["_Prelu"]=function(){return(_Prelu=Module["_Prelu"]=Module["asm"][\["Ha\"]).apply(null,arguments)};var

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_Prod=Module["_Prod"]=function(){return(_Prod=Module["_Prod"]=Module["asm"][["Ia"]]).apply(null,arguments)};var
_RealDiv=Module["_RealDiv"]=function(){return(_RealDiv=Module["_RealDiv"]=Module["asm"][["Ja"]]).apply(null,arguments)};var
_RelU=Module["_Relu"]=function(){return(_Relu=Module["_Relu"]=Module["asm"][["Ka"]]).apply(null,arguments)};var
_RelU6=Module["_Relu6"]=function(){return(_Relu6=Module["_Relu6"]=Module["asm"][["La"]]).apply(null,arguments)};var
_ResizeBilinear=Module["_ResizeBilinear"]=function(){return(_ResizeBilinear=Module["_ResizeBilinear"]=Module["asm"][["Ma"]]).apply(null,arguments)};var
_Reverse=Module["_Reverse"]=function(){return(_Reverse=Module["_Reverse"]=Module["asm"][["Na"]]).apply(null,arguments)};var
_RotateWithOffset=Module["_RotateWithOffset"]=function(){return(_RotateWithOffset=Module["_RotateWithOffset"]=Module["asm"][["Oa"]]).apply(null,arguments)};var
_Round=Module["_Round"]=function(){return(_Round=Module["_Round"]=Module["asm"][["Pa"]]).apply(null,arguments)};var
_Rsqrt=Module["_Rsqrt"]=function(){return(_Rsqrt=Module["_Rsqrt"]=Module["asm"][["Qa"]]).apply(null,arguments)};var
_ScatterNd=Module["_ScatterNd"]=function(){return(_ScatterNd=Module["_ScatterNd"]=Module["asm"][["Ra"]]).apply(null,arguments)};var
_SelectV2=Module["_SelectV2"]=function(){return(_SelectV2=Module["_SelectV2"]=Module["asm"][["Sa"]]).apply(null,arguments)};var
_Sigmoid=Module["_Sigmoid"]=function(){return(_Sigmoid=Module["_Sigmoid"]=Module["asm"][["Ta"]]).apply(null,arguments)};var
_Sin=Module["_Sin"]=function(){return(_Sin=Module["_Sin"]=Module["asm"][["Ua"]]).apply(null,arguments)};var
_Softmax=Module["_Softmax"]=function(){return(_Softmax=Module["_Softmax"]=Module["asm"][["Va"]]).apply(null,arguments)};var
_Sqrt=Module["_Sqrt"]=function(){return(_Sqrt=Module["_Sqrt"]=Module["asm"][["Wa"]]).apply(null,arguments)};var
_Square=Module["_Square"]=function(){return(_Square=Module["_Square"]=Module["asm"][["Xa"]]).apply(null,arguments)};var
_SquaredDifference=Module["_SquaredDifference"]=function(){return(_SquaredDifference=Module["_SquaredDifference"]=Module["asm"][["Ya"]]).apply(null,arguments)};var
_Step=Module["_Step"]=function(){return(_Step=Module["_Step"]=Module["asm"][["Za"]]).apply(null,arguments)};var
_StridedSlice=Module["_StridedSlice"]=function(){return(_StridedSlice=Module["_StridedSlice"]=Module["asm"][["a"]]).apply(null,arguments)};var
_Sub=Module["_Sub"]=function(){return(_Sub=Module["_Sub"]=Module["asm"][["$a"]]).apply(null,arguments)};var
_Sum=Module["_Sum"]=function(){return(_Sum=Module["_Sum"]=Module["asm"][["ab"]]).apply(null,arguments)};var
_Tan=Module["_Tan"]=function(){return(_Tan=Module["_Tan"]=Module["asm"][["bb"]]).apply(null,arguments)};var
_Tanh=Module["_Tanh"]=function(){return(_Tanh=Module["_Tanh"]=Module["asm"][["cb"]]).apply(null,arguments)};var
_Tile=Module["_Tile"]=function(){return(_Tile=Module["_Tile"]=Module["asm"][["db"]]).apply(null,arguments)};var

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_TopK=Module["_TopK"]=function(){return(_TopK=Module["_TopK"]=Module["asm"][["eb"]]).apply(null,arguments)};var
_Transform=Module["_Transform"]=function(){return(_Transform=Module["_Transform"]=Module["asm"][["fb"]]).apply(null,arguments)};var
_Transpose=Module["_Transpose"]=function(){return(_Transpose=Module["_Transpose"]=Module["asm"][["gb"]]).apply(null,arguments)};var
__FusedMatMul=Module["__FusedMatMul"]=function(){return(__FusedMatMul=Module["__FusedMatMul"]=Module["asm"][["hb"]]).apply(null,arguments)};var
_malloc=Module["_malloc"]=function(){return(_malloc=Module["_malloc"]=Module["asm"][["ib"]]).apply(null,arguments)};var
_free=Module["_free"]=function(){return(_free=Module["_free"]=Module["asm"][["jb"]]).apply(null,arguments)};var
__errno_location=Module["__errno_location"]=function(){return(__errno_location=Module["__errno_location"]=Module["asm"][["kb"]]).apply(null,arguments)};var
_emsripten_get_global_libc=Module["_emsripten_get_global_libc"]=function(){return(_emsripten_get_global_libc=Module["_emsripten_get_global_libc"]=Module["asm"][["lb"]]).apply(null,arguments)};var
_thread_self=Module["_thread_self"]=function(){return(_thread_self=Module["_thread_self"]=Module["asm"][["mb"]]).apply(null,arguments)};var
__pthread_tsd_run_dtors=Module["__pthread_tsd_run_dtors"]=function(){return(__pthread_tsd_run_dtors=Module["__pthread_tsd_run_dtors"]=Module["asm"][["nb"]]).apply(null,arguments)};var
_emsripten_main_thread_process_queued_calls=Module["_emsripten_main_thread_process_queued_calls"]=function(){return(_emsripten_main_thread_process_queued_calls=Module["_emsripten_main_thread_process_queued_calls"]=Module["asm"][["ob"]]).apply(null,arguments)};var
_emsripten_current_thread_process_queued_calls=Module["_emsripten_current_thread_process_queued_calls"]=function(){return(_emsripten_current_thread_process_queued_calls=Module["_emsripten_current_thread_process_queued_calls"]=Module["asm"][["pb"]]).apply(null,arguments)};var
_emsripten_register_main_browser_thread_id=Module["_emsripten_register_main_browser_thread_id"]=function(){return(_emsripten_register_main_browser_thread_id=Module["_emsripten_register_main_browser_thread_id"]=Module["asm"][["qb"]]).apply(null,arguments)};var
_emsripten_main_browser_thread_id=Module["_emsripten_main_browser_thread_id"]=function(){return(_emsripten_main_browser_thread_id=Module["_emsripten_main_browser_thread_id"]=Module["asm"][["rb"]]).apply(null,arguments)};var
__emsripten_do_dispatch_to_thread=Module["__emsripten_do_dispatch_to_thread"]=function(){return(__emsripten_do_dispatch_to_thread=Module["__emsripten_do_dispatch_to_thread"]=Module["asm"][["sb"]]).apply(null,arguments)};var
_emsripten_sync_run_in_main_thread_4=Module["_emsripten_sync_run_in_main_thread_4"]=function(){return(_emsripten_sync_run_in_main_thread_4=Module["_emsripten_sync_run_in_main_thread_4"]=Module["asm"][["tb"]]).apply(null,arguments)};var
_emsripten_run_in_main_runtime_thread_js=Module["_emsripten_run_in_main_runtime_thread_js"]=function(){return(_emsripten_run_in_main_runtime_thread_js=Module["_emsripten_run_in_main_runtime_thread_js"]=Module["asm"][["ub"]]).apply(null,arguments)};var
__emsripten_call_on_thread=Module["__emsripten_call_on_thread"]=function(){return(__emsripten_call_on_thread=Module["__emsripten_call_on_thread"]=Module["asm"][["vb"]]).apply(null,arguments)};var
_emsripten_tls_init=Module["_emsripten_tls_init"]=function(){return(_emsripten_tls_init=Module["_emsripten_tls_init"]=Module["asm"][["wb"]]).apply(null,arguments)};var
__emsripten_thread_init=Module["__emsripten_thread_init"]=function(){return(__emsripten_thread_init=Module["__emsripten_thread_init"]=Module["asm"][["xb"]]).apply(null,arguments)};var
stackSave=Module["stackSave"]=function(){return(stackSave=Module["stackSave"]=Module["asm"][["yb"]]).a

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ply(null,arguments)};var
stackRestore=Module["stackRestore"]=function(){return(stackRestore=Module["stackRestore"]=Module["asm"]
)[["zb"]].apply(null,arguments)};var
stackAlloc=Module["stackAlloc"]=function(){return(stackAlloc=Module["stackAlloc"]=Module["asm"])[["Ab"]
)].apply(null,arguments)};var
_emsripten_stack_set_limits=Module["_emsripten_stack_set_limits"]=function(){return(_emsripten_stack_set_
limits=Module["_emsripten_stack_set_limits"]=Module["asm"])[["Bb"]].apply(null,arguments)};var
_memalign=Module["_memalign"]=function(){return(_memalign=Module["_memalign"]=Module["asm"])[["Cb
"]].apply(null,arguments)};var
__emsripten_allow_main_runtime_queued_calls=Module["__emsripten_allow_main_runtime_queued_calls"]=1
0512;var
__emsripten_main_thread_futex=Module["__emsripten_main_thread_futex"]=12148;Module["cwrap"]=cwrap
;Module["PThread"]=PThread;Module["PThread"]=PThread;Module["wasmMemory"]=wasmMemory;Module
["ExitStatus"]=ExitStatus;var
calledRun;function ExitStatus(status){this.name="ExitStatus";this.message="Program terminated with
exit("+status+")";this.status=status}dependenciesFulfilled=function
runCaller(){if(!calledRun)run();if(!calledRun)dependenciesFulfilled=runCaller};function
run(args){args=args||arguments;if(runDependencies>0){return}if(ENVIRONMENT_IS_PTHREAD){readyPromis
eResolve(Module);initRuntime();postMessage({"cmd":"loaded"});return}preRun();if(runDependencies>0){retur
n}function
doRun(){if(calledRun)return;calledRun=true;Module["calledRun"]=true;if(ABORT)return;initRuntime();preMain(
);readyPromiseResolve(Module);if(Module["onRuntimeInitialized"])Module["onRuntimeInitialized"]();postRun(
)}if(Module["setStatus"]){Module["setStatus"]("Running...");setTimeout(function(){setTimeout(function(){Mo
dule["setStatus"]("")},1)}else{doRun()})}Module["run"]=run;function
exit(status,implicit){if(implicit&&noExitRuntime&&status===0){return}if(!implicit){if(ENVIRONMENT_IS_PT
HREAD){postMessage({"cmd":"exitProcess","returnCode":status});throw
new
ExitStatus(status)}else{}}if(noExitRuntime){}}else{PThread.terminateAllThreads();EXITSTATUS=status;exitRunti
me();if(Module["onExit"])Module["onExit"](status);ABORT=true}quit_(status,new
ExitStatus(status))}if(Module["preInit"]){if(typeof
Module["preInit"]=="function")Module["preInit"]=[Module["preInit"]];while(Module["preInit"].length>0){
Module["preInit"].pop()}if(ENVIRONMENT_IS_PTHREAD){noExitRuntime=false;PThread.initWorker()}run
();\n\n return WasmBackendModuleThreadedSimd.ready\n\n\n);)\n\nif (typeof exports === 'object' && typeof
module === 'object')\n module.exports = WasmBackendModuleThreadedSimd;\nelse if (typeof define ===
'function' && define['amd'])\n define([], function() { return WasmBackendModuleThreadedSimd; });\nelse if
(typeof exports === 'object')\n exports["WasmBackendModuleThreadedSimd"]
= WasmBackendModuleThreadedSimd;\n","export const wasmWorkerContents = 'var Module={};function
threadPrintErr){ var text=Array.prototype.slice.call(arguments).join(" ");console.error(text)}function
threadAlert){ var text=Array.prototype.slice.call(arguments).join(
"\n");postMessage({ cmd:"alert",text:text,threadId:Module["_pthread_self"]})}var
err=threadPrintErr;this.alert=threadAlert;Module["instantiateWasm"]=function(info,receiveInstance){ var
instance=new
WebAssembly.Instance(Module["wasmModule"],info);Module["wasmModule"]=null;receiveInstance(instance);r
eturn instance.exports};function
moduleLoaded(){ }this.onmessage=function(e){ try {if(e.data.cmd===load){Module["wasmModule"]=e.data.wa
smModule;Module["wasmMemory"]=e.data.wasmMemory;Module["buffer"]=Module["wasmMemory"].buffer;
Module["ENVIRONMENT_IS_PTHREAD"]=true;if(typeof
e.data.urlOrBlob===string){importScripts(e.data.urlOrBlob)}else{ var

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objectUrl=URL.createObjectURL(e.data.urlOrBlob);importScripts(objectUrl);URL.revokeObjectURL(objectUrl)}
WasmBackendModuleThreadedSimd(Module).then(function(instance){Module=instance;moduleLoaded()})else
if(e.data.cmd===\"objectTransfer\"){Module[\"PThread\"].receiveObjectTransfer(e.data)}else
if(e.data.cmd===\"run\"){Module[\"__performance_now_clock_drift\"]=performance.now()-
e.data.time;Module[\"__emscripten_thread_init\"](e.data.threadInfoStruct,0,0);var max=e.data.stackBase;var
top=e.data.stackBase+e.data.stackSize;Module[\"establishStackSpace\"](top,max);Module[\"__emscripten_tls_init\"](
);Module[\"PThread\"].receiveObjectTransfer(e.data);Module[\"PThread\"].setThreadStatus(Module[\"_pthread_self
\")(0,1);try{var
result=Module[\"invokeEntryPoint\"](e.data.start_routine,e.data.arg);if(!Module[\"getNoExitRuntime\"]())Module[
\"PThread\"].threadExit(result)}catch(ex){if(ex===\"Canceled!\"){Module[\"PThread\"].threadCancel()}else
if(ex!==\"unwind\")if(ex instanceof
Module[\"ExitStatus\"]){if(Module[\"getNoExitRuntime\"]()){}}else{Module[\"PThread\"].threadExit(ex.status)}}el
se{Module[\"PThread\"].threadExit(-2);throw
ex}}}}else
if(e.data.cmd===\"cancel\")if(Module[\"_pthread_self\"]()){Module[\"PThread\"].threadCancel()}else
if(e.data.target===\"setimmediate\"){}else
if(e.data.cmd===\"processThreadQueue\")if(Module[\"_pthread_self\"]()){Module[\"__emscripten_current_thread_
process_queued_calls\"]()}else{err(\"worker.js received unknown command
\"+e.data.cmd);err(e.data)}}catch(ex){err(\"worker.js onmessage() captured an uncaught exception:
\"+ex);if(ex&&ex.stack)err(ex.stack);throw ex}};if(typeof process===\"object\"&&typeof
process.versions===\"object\"&&typeof process.versions.node===\"string\"){self={location:{href:__filename}};var
onmessage=this.onmessage;var
nodeWorkerThreads=require(\"worker_threads\");global.Worker=nodeWorkerThreads.Worker;var
parentPort=nodeWorkerThreads.parentPort;parentPort.on(\"message\",function(data){onmessage({data:data})});var
nodeFS=require(\"fs\");var nodeRead=function(filename){return
nodeFS.readFileSync(filename,\"utf8\")};function
globalEval(x){global.require=require;global.Module=Module;eval.call(null,x)}importScripts=function(f){globalEva
l(nodeRead(f));postMessage=function(msg){parentPort.postMessage(msg)};if(typeof
performance===\"undefined\"){performance={now:function(){return Date.now()}}};\", \"nvar
WasmBackendModule = (function() {\n var _scriptDir = typeof document !== 'undefined' &&
document.currentScript ? document.currentScript.src : undefined;\n if (typeof __filename !== 'undefined')
_scriptDir = _scriptDir || __filename;\n return (\nfunction(WasmBackendModule) {\n WasmBackendModule =
WasmBackendModule || {};\n\nvar Module=typeof
WasmBackendModule!=\"undefined\"?WasmBackendModule: {} ;var
readyPromiseResolve,readyPromiseReject;Module[\"ready\"]=new
Promise(function(resolve,reject){readyPromiseResolve=resolve;readyPromiseReject=reject});var
moduleOverrides={ };var key;for(key in
Module){if(Module.hasOwnProperty(key)){ moduleOverrides[key]=Module[key] }}var
arguments_=[];var thisProgram=\"./this.program\";var quit_=function(status,toThrow){throw toThrow};var
ENVIRONMENT_IS_WEB=false;var ENVIRONMENT_IS_WORKER=false;var
ENVIRONMENT_IS_NODE=false;var ENVIRONMENT_IS_SHELL=false;ENVIRONMENT_IS_WEB=typeof
window===\"object\";ENVIRONMENT_IS_WORKER=typeof
importScripts===\"function\";ENVIRONMENT_IS_NODE=typeof process===\"object\"&&typeof
process.versions===\"object\"&&typeof
process.versions.node===\"string\";ENVIRONMENT_IS_SHELL=!ENVIRONMENT_IS_WEB&&!ENVIRONM
ENT_IS_NODE&&!ENVIRONMENT_IS_WORKER;var scriptDirectory=\"\";function
locateFile(path){if(Module[\"locateFile\"]){return Module[\"locateFile\"](path,scriptDirectory)}return
scriptDirectory+path}var read_,readAsync,readBinary,setWindowTitle;var nodeFS;var

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nodePath;if(ENVIRONMENT_IS_NODE){if(ENVIRONMENT_IS_WORKER){scriptDirectory=require("path").
dirname(scriptDirectory)+"^"}else{scriptDirectory=__dirname+"^"}read_=function
shell_read(filename,binary){if(!nodeFS)nodeFS=require("fs");if(!nodePath)nodePath=require("path");filename=n
odePath["normalize"](filename);return
nodeFS["readFileSync"](filename,binary?null:"utf8");}readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret};if(process["argv"].length>1){thisProgram=process["argv"][1].replace(/\\/g,"^")}arguments_=process["arg
v"].slice(2);process["on"]("uncaughtException",function(ex){if(!(ex instanceof ExitStatus)){throw
ex}});process["on"]("unhandledRejection",abort);quit_=function(status){process["exit"](status)};Module["insp
ect"]=function(){return"[Emscripten Module object]"}else if(ENVIRONMENT_IS_SHELL){if(typeof
read!="undefined"){read_=function shell_read(f){return read(f)}readBinary=function readBinary(f){var
data;if(typeof readbuffer==="function"){return new
Uint8Array(readbuffer(f))}data=read(f,"binary");assert(typeof data==="object");return data};if(typeof
scriptArgs!="undefined"){arguments_=scriptArgs}else
if(typeof arguments!="undefined"){arguments_=arguments}if(typeof
quit==="function"){quit_=function(status){quit(status)}}if(typeof print!="undefined"){if(typeof
console==="undefined")console={};console.log=print;console.warn=console.error=typeof
printErr!="undefined"?printErr:print}else
if(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER){if(ENVIRONMENT_IS_WORKER){scriptDire
ctory=self.location.href}else if(typeof
document!="undefined"&&document.currentScript){scriptDirectory=document.currentScript.src}if(!_scriptDir){s
criptDirectory=_scriptDir}if(scriptDirectory.indexOf("blob:")!==0){scriptDirectory=scriptDirectory.substr(0,script
Directory.lastIndexOf("^")+1)}else{scriptDirectory=""}}read_=function(url){var xhr=new
XMLHttpRequest;xhr.open("GET",url,false);xhr.send(null);return
xhr.responseText};if(ENVIRONMENT_IS_WORKER){readBinary=function(url){var xhr=new
XMLHttpRequest;xhr.open("GET",url,false);xhr.responseType="arraybuffer";xhr.send(null);return
new Uint8Array(xhr.response)}}readAsync=function(url,onload,onerror){var xhr=new
XMLHttpRequest;xhr.open("GET",url,true);xhr.responseType="arraybuffer";xhr.onload=function(){if(xhr.status
==200||xhr.status==0&&xhr.response){onload(xhr.response);return}onerror();}xhr.onerror=onerror;xhr.send(null)}
}setWindowTitle=function(title){document.title=title}else{var
out=Module["print"]||console.log.bind(console);var err=Module["printErr"]||console.warn.bind(console);for(key
in
moduleOverrides){if(moduleOverrides.hasOwnProperty(key)){Module[key]=moduleOverrides[key]}}moduleOverr
ides=null;if(Module["arguments"])arguments_=Module["arguments"];if(Module["thisProgram"])thisProgram=
Module["thisProgram"];if(Module["quit"])quit_=Module["quit"];var
wasmBinary;if(Module["wasmBinary"])wasmBinary=Module["wasmBinary"];var
noExitRuntime=Module["noExitRuntime"]||true;if(typeof WebAssembly!="object"){abort("no native wasm
support detected")}var wasmMemory;var
ABORT=false;var EXITSTATUS;function assert(condition,text){if(!condition){abort("Assertion failed:
"+text)}}function getCFunc(ident){var func=Module["_"+ident];assert(func,"Cannot call unknown function
"+ident+", make sure it is exported");return func}function ccall(ident,returnType,argTypes,args,opts){var
toC={"string":function(str){var ret=0;if(str===null&&str===undefined&&str===0){var
len=(str.length<<2)+1;ret=stackAlloc(len);stringToUTF8(str,ret,len)}return ret},"array":function(arr){var
ret=stackAlloc(arr.length);writeArrayToMemory(arr,ret);return ret}};function
convertReturnValue(ret){if(returnType==="string")return UTF8ToString(ret);if(returnType==="boolean")return
Boolean(ret);return ret}var func=getCFunc(ident);var cArgs=[];var stack=0;if(args){for(var
i=0;i<args.length;i++){var
converter=toC[argTypes[i]];if(converter){if(stack===0)stack=stackSave();cArgs[i]=converter(args[i])}else{cArgs[i]

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]=args[i] } } var ret=func.apply(null,cArgs);ret=convertReturnValue(ret);if(stack!==(0))stackRestore(stack);return
ret}function cwrap(ident,returnType,argTypes,opts){ argTypes=argTypes||[];var
numericArgs=argTypes.every(function(type){ return type==="number"});var
numericRet=returnType!="string";if(numericRet&&numericArgs&&!opts){ return getCFunc(ident)}return
function(){ return ccall(ident,returnType,argTypes,arguments,opts) } } var UTF8Decoder=typeof
TextDecoder!="undefined"?new TextDecoder("utf8"):undefined;function
UTF8ArrayToString(heap,idx,maxBytesToRead){ var endIdx=idx+maxBytesToRead;var
endPtr=idx;while(heap[endPtr]&&!(endPtr>=endIdx))++endPtr;if(endPtr-
idx>16&&heap.subarray&&UTF8Decoder){ return UTF8Decoder.decode(heap.subarray(idx,endPtr))}else{ var
str="";while(idx<endPtr){ var u0=heap[idx++];if(!(u0&128)){ str+=String.fromCharCode(u0);continue } var
u1=heap[idx++]&63;if((u0&224)==192){ str+=String.fromCharCode((u0&31)<<6|u1);continue } var
u2=heap[idx++]&63;if((u0&240)==224){ u0=(u0&15)<<12|u1<<6|u2}else{ u0=(u0&7)<<18|u1<<12|u2<<6|heap[id
x++]&63}if(u0<65536){ str+=String.fromCharCode(u0)}else{ var
ch=u0-65536;str+=String.fromCharCode(55296|ch>>10,56320|ch&1023) } } return str}function
UTF8ToString(ptr,maxBytesToRead){ return
ptr?UTF8ArrayToString(HEAPU8,ptr,maxBytesToRead):""}function
stringToUTF8Array(str,heap,outIdx,maxBytesToWrite){ if(!(maxBytesToWrite>0))return 0;var startIdx=outIdx;var
endIdx=outIdx+maxBytesToWrite-1;for(var i=0;i<str.length;++i){ var
u=str.charCodeAt(i);if(u>=55296&&u<=57343){ var
u1=str.charCodeAt(++i);u=65536+((u&1023)<<10|u1&1023)}if(u<=127){ if(outIdx>=endIdx)break;heap[outIdx++]
=u}else if(u<=2047){ if(outIdx+1>=endIdx)break;heap[outIdx++]=192|u>>6;heap[outIdx++]=128|u&63}else
if(u<=65535){ if(outIdx+2>=endIdx)break;heap[outIdx++]=224|u>>12;heap[outIdx++]=128|u>>6&63;heap[outIdx
++]=128|u&63}else { if(outIdx+3>=endIdx)break;heap[outIdx++]=240|u>>18;heap[outIdx++]=128|u>>12&63;heap[
outIdx++]=128|u>>6&63;heap[outIdx++]=128|u&63 } heap[outIdx]=0;return outIdx-startIdx}function
stringToUTF8(str,outPtr,maxBytesToWrite){ return
stringToUTF8Array(str,HEAPU8,outPtr,maxBytesToWrite)}function
writeArrayToMemory(array,buffer){ HEAP8.set(array,buffer)}function
alignUp(x,multiple){ if(x%multiple>0){ x+=multiple-x%multiple}return x}var
buffer,HEAP8,HEAPU8,HEAP16,HEAPU16,HEAP32,HEAPU32,HEAPF32,HEAPF64;function
updateGlobalBufferAndViews(buf){ buffer=buf;Module["HEAP8"]=HEAP8=new
Int8Array(buf);Module["HEAP16"]=HEAP16=new Int16Array(buf);Module["HEAP32"]=HEAP32=new
Int32Array(buf);Module["HEAPU8"]=HEAPU8=new Uint8Array(buf);Module["HEAPU16"]=HEAPU16=new
Uint16Array(buf);Module["HEAPU32"]=HEAPU32=new
Uint32Array(buf);Module["HEAPF32"]=HEAPF32=new
Float32Array(buf);Module["HEAPF64"]=HEAPF64=new Float64Array(buf)}var
INITIAL_MEMORY=Module["INITIAL_MEMORY"]||16777216;var wasmTable;var __ATPRERUN__=[];var
__ATINIT__=[];var __ATMAIN__=[];var __ATPOSTRUN__=[];var
runtimeInitialized=false;__ATINIT__.push({ func:function(){ __wasm_call_ctors()}});function
preRun(){ if(Module["preRun"]){ if(typeof
Module["preRun"]=="function")Module["preRun"]=[Module["preRun"]];while(Module["preRun"].length){ a
ddOnPreRun(Module["preRun"].shift()) } callRuntimeCallbacks(__ATPRERUN__)}function
initRuntime(){ runtimeInitialized=true;callRuntimeCallbacks(__ATINIT__)}function
preMain(){ callRuntimeCallbacks(__ATMAIN__)}function postRun(){ if(Module["postRun"]){ if(typeof
Module["postRun"]=="function")Module["postRun"]=[Module["postRun"]];while(Module["postRun"].lengt
h){ addOnPostRun(Module["postRun"].shift()) } callRuntimeCallbacks(__ATPOSTRUN__)}function
addOnPreRun(cb){ __ATPRERUN__.unshift(cb)}function addOnPostRun(cb){ __ATPOSTRUN__.unshift(cb)}var
runDependencies=0;var runDependencyWatcher=null;var dependenciesFulfilled=null;function
addRunDependency(id){ runDependencies++;if(Module["monitorRunDependencies"]){ Module["monitorRunDep

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dependencies\")(runDependencies)}function removeRunDependency(id){runDependencies--
;if(Module[\"monitorRunDependencies\"]){Module[\"monitorRunDependencies\"](runDependencies)}if(runDepend
encies==0){if(runDependencyWatcher!==null){clearInterval(runDependencyWatcher);runDependencyWatcher=nul
l}if(dependenciesFulfilled){var
callback=dependenciesFulfilled;dependenciesFulfilled=null;callback()}}Module[\"preloadedImages\"]={};Module
[\"preloadedAudios\"]={};function
abort(what){if(Module[\"onAbort\"]){Module[\"onAbort\"](what)}what+=\"\";err(what);ABORT=true;EXITSTAT
US=1;what=\"abort(\\'+what+\\')\". Build with -s ASSERTIONS=1 for more info.\";var e=new
WebAssembly.RuntimeError(what);readyPromiseReject(e);throw e}function hasPrefix(str,prefix){return
String.prototype.startsWith?str.startsWith(prefix):str.indexOf(prefix)===0}var
dataURIPrefix=\"data:application/octet-stream;base64,\";function isDataURI(filename){return
hasPrefix(filename,dataURIPrefix)}var fileURIPrefix=\"file://\";function isFileURI(filename){return
hasPrefix(filename,fileURIPrefix)}var wasmBinaryFile=\"tfjs-backend-
wasm.wasm\";if(!isDataURI(wasmBinaryFile)){wasmBinaryFile=locateFile(wasmBinaryFile)}function
getBinary(file){try{if(file===wasmBinaryFile&&wasmBinary){return new
Uint8Array(wasmBinary)}if(readBinary){return readBinary(file)}else{throw\"both async and sync fetching of the
wasm failed\"}}catch(err){abort(err)}}function
getBinaryPromise(){if(!wasmBinary&&(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER)){if(typeof
fetch===\"function\"&&!isFileURI(wasmBinaryFile)){return fetch(wasmBinaryFile,{credentials:\"same-
origin\"}).then(function(response){if(!response[\"ok\"]){throw\"failed to load wasm binary file at
\\'+wasmBinaryFile+\\'\"}return response[\"arrayBuffer\"]()).catch(function(){return
getBinary(wasmBinaryFile)})}else{if(readAsync){return new
Promise(function(resolve,reject){readAsync(wasmBinaryFile,function(response){resolve(new
Uint8Array(response)),reject}))})}return Promise.resolve().then(function(){return
getBinary(wasmBinaryFile)})}function createWasm(){var info={\"a\":asmLibraryArg};function
receiveInstance(instance,module){var
exports=instance.exports;Module[\"asm\"]=exports;wasmMemory=Module[\"asm\"][\"j\"];updateGlobalBufferAnd
Views(wasmMemory.buffer);wasmTable=Module[\"asm\"][\"r\"];removeRunDependency(\"wasm-
instantiate\")}addRunDependency(\"wasm-instantiate\");function
receiveInstantiatedSource(output){receiveInstance(output[\"instance\"])}function
instantiateArrayBuffer(receiver){return getBinaryPromise().then(function(binary){return
WebAssembly.instantiate(binary,info)}).then(receiver,function(reason){err(\"failed to asynchronously prepare
wasm: \\'+reason);abort(reason)})}function instantiateAsync(){if(!wasmBinary&&typeof
WebAssembly.instantiateStreaming===\"function\"&&!isDataURI(wasmBinaryFile)&&!isFileURI(wasmBinaryFil
e)&&typeof fetch===\"function\"){return fetch(wasmBinaryFile,{credentials:\"same-
origin\"}).then(function(response){var result=WebAssembly.instantiateStreaming(response,info);return
result.then(receiveInstantiatedSource,function(reason){err(\"wasm streaming compile failed: \\'+reason);err(\"falling
back to
ArrayBuffer instantiation\");return instantiateArrayBuffer(receiveInstantiatedSource)}))}else{return
instantiateArrayBuffer(receiveInstantiatedSource)}if(Module[\"instantiateWasm\"]){try{var
exports=Module[\"instantiateWasm\"](info,receiveInstance);return exports}catch(e){err(\"Module.instantiateWasm
callback failed with error: \\'+e);return false}}instantiateAsync().catch(readyPromiseReject);return{}}function
callRuntimeCallbacks(callbacks){while(callbacks.length>0){var callback=callbacks.shift();if(typeof
callback===\"function\"){callback(Module);continue}var func=callback.func;if(typeof
func===\"number\"){if(callback.arg===undefined){wasmTable.get(func)}else{wasmTable.get(func)(callback.arg)
}}else{func(callback.arg===undefined?null:callback.arg)}}function _abort(){abort()}function
_emscripten_memcpy_big(dest,src,num){HEAPU8.copyWithin(dest,src,src+num)}function
_emscripten_get_heap_size(){return HEAPU8.length}function

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emscripten_realloc_buffer(size){try{wasmmemory.grow(size-
buffer.byteLength+65535>>>16);updateGlobalBufferAndViews(wasmmemory.buffer);return
1}catch(e){}}function _emscripten_resize_heap(requestedSize){var oldSize=_emscripten_get_heap_size();var
maxHeapSize=2147483648;if(requestedSize>maxHeapSize){return false}for(var
cutDown=1;cutDown<=4;cutDown*=2){var
overGrownHeapSize=oldSize*(1+.2/cutDown);overGrownHeapSize=Math.min(overGrownHeapSize,requestedSize
+100663296);var
newSize=Math.min(maxHeapSize,alignUp(Math.max(requestedSize,overGrownHeapSize),65536));var
replacement=emscripten_realloc_buffer(newSize);if(replacement){return true}}return false}var
SYSCALLS={mappings:{},buffers:[null,[],[]],printChar:function(stream,curr){var
buffer=SYSCALLS.buffers[stream];if(curr===0||curr===10){(stream===1?out:err)(UTF8ArrayToString(buffer,0));
buffer.length=0}else{buffer.push(curr)}},varargs:undefined,get:function(){SYSCALLS.varargs+=4;var
ret=HEAP32[SYSCALLS.varargs-4>>2];return ret},getStr:function(ptr){var ret=UTF8ToString(ptr);return
ret},get64:function(low,high){return
low}};function _fd_close(fd){return 0}function _fd_seek(fd,offset_low,offset_high,whence,newOffset){}function
_fd_write(fd,iow,iowcnt,pnum){var num=0;for(var i=0;i<iowcnt;i++){var ptr=HEAP32[iow+i*8>>2];var
len=HEAP32[iow+(i*8+4)>>2];for(var
j=0;j<len;j++){SYSCALLS.printChar(fd,HEAPU8[ptr+j])}num+=len}HEAP32[pnum>>2]=num;return 0}function
_thread_create(){return 6}function _pthread_join(){return 28}function
setErrNo(value){HEAP32[___errno_location()>>2]=value;return value}function
_sysconf(name){switch(name){case 30:return 16384;case 85:var maxHeapSize=2147483648;return
maxHeapSize/16384;case 132:case 133:case 12:case 137:case 138:case 15:case 235:case 16:case 17:case 18:case
19:case 20:case 149:case 13:case 10:case 236:case 153:case 9:case 21:case 22:case 159:case 154:case 14:case
77:case 78:case 139:case 82:case 68:case 67:case 164:case 11:case 29:case 47:case 48:case 95:case 52:case 51:case
46:return 200809;case 27:case 246:case 127:case 128:case 23:case 24:case 160:case
161:case 181:case 182:case 242:case 183:case 184:case 243:case 244:case 245:case 165:case 178:case 179:case
49:case 50:case 168:case 169:case 175:case 170:case 171:case 172:case 97:case 76:case 32:case 173:case 35:case
80:case 81:case 79:return-1;case 176:case 177:case 7:case 155:case 8:case 157:case 125:case 126:case 92:case
93:case 129:case 130:case 131:case 94:case 91:return 1;case 74:case 60:case 69:case 70:case 4:return 1024;case
31:case 42:case 72:return 32;case 87:case 26:case 33:return 2147483647;case 34:case 1:return 47839;case 38:case
36:return 99;case 43:case 37:return 2048;case 0:return 2097152;case 3:return 65536;case 28:return 32768;case
44:return 32767;case 75:return 16384;case 39:return 1e3;case 89:return 700;case 71:return 256;case 40:return
255;case 2:return 100;case 180:return 64;case 25:return 20;case 5:return 16;case 6:return 6;case 73:return 4;case
84:{if(typeof navigator===\"object\")return navigator[\"hardwareConcurrency\"]||1;return 1}}setErrNo(28);return-
1}var
asmLibraryArg={\"a\":_abort,\"d\":_emscripten_memcpy_big,\"e\":_emscripten_resize_heap,\"f\":_fd_close,\"c\":_f
d_seek,\"b\":_fd_write,\"h\":_pthread_create,\"g\":_pthread_join,\"i\":_sysconf};var asm=createWasm();var
__wasm_call_ctors=Module[\"__wasm_call_ctors\"]=function(){return(__wasm_call_ctors=Module[\"__wasm
_call_ctors\"]=Module[\"asm\"][\"k\"]).apply(null,arguments)};var
_init=Module[\"_init\"]=function(){return(_init=Module[\"_init\"]=Module[\"asm\"][\"l\"]).apply(null,arguments)};
var
_init_with_threads_count=Module[\"_init_with_threads_count\"]=function(){return(_init_with_threads_count=Mod
ule[\"_init_with_threads_count\"]=Module[\"asm\"][\"m\"]).apply(null,arguments)};var
_get_threads_count=Module[\"_get_threads_count\"]=function(){return(_get_threads_count=Module[\"_get_threads
_count\"]=Module[\"asm\"][\"n\"]).apply(null,arguments)};var
_register_tensor=Module[\"_register_tensor\"]=function(){return(_register_tensor=Module[\"_register_tensor\"]=M
odule[\"asm\"][\"o\"]).apply(null,arguments)};var

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_dispose_data=Module["_dispose_data"]=function(){return(_dispose_data=Module["_dispose_data"]=Module["asm"][["p"]]).apply(null,arguments)};var
_dispose=Module["_dispose"]=function(){return(_dispose=Module["_dispose"]=Module["asm"][["q"]]).apply(null,arguments)};var
_Abs=Module["_Abs"]=function(){return(_Abs=Module["_Abs"]=Module["asm"][["s"]]).apply(null,arguments)};var
_Add=Module["_Add"]=function(){return(_Add=Module["_Add"]=Module["asm"][["t"]]).apply(null,arguments)};var
_AddN=Module["_AddN"]=function(){return(_AddN=Module["_AddN"]=Module["asm"][["u"]]).apply(null,arguments)};var
_All=Module["_All"]=function(){return(_All=Module["_All"]=Module["asm"][["v"]]).apply(null,arguments)};var
_Any=Module["_Any"]=function(){return(_Any=Module["_Any"]=Module["asm"][["w"]]).apply(null,arguments)};var
_ArgMax=Module["_ArgMax"]=function(){return(_ArgMax=Module["_ArgMax"]=Module["asm"][["x"]]).apply(null,arguments)};var
_AvgPool=Module["_AvgPool"]=function(){return(_AvgPool=Module["_AvgPool"]=Module["asm"][["y"]]).apply(null,arguments)};var
_BatchMatMul=Module["_BatchMatMul"]=function(){return(_BatchMatMul=Module["_BatchMatMul"]=Module["asm"][["z"]]).apply(null,arguments)};var
_Ceil=Module["_Ceil"]=function(){return(_Ceil=Module["_Ceil"]=Module["asm"][["A"]]).apply(null,arguments)};var
_ClipByValue=Module["_ClipByValue"]=function(){return(_ClipByValue=Module["_ClipByValue"]=Module["asm"][["B"]]).apply(null,arguments)};var
_Conv2D=Module["_Conv2D"]=function(){return(_Conv2D=Module["_Conv2D"]=Module["asm"][["C"]]).apply(null,arguments)};var
_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=function(){return(_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=Module["asm"][["D"]]).apply(null,arguments)};var
_Cos=Module["_Cos"]=function(){return(_Cos=Module["_Cos"]=Module["asm"][["E"]]).apply(null,arguments)};var
_Cosh=Module["_Cosh"]=function(){return(_Cosh=Module["_Cosh"]=Module["asm"][["F"]]).apply(null,arguments)};var
_CropAndResize=Module["_CropAndResize"]=function(){return(_CropAndResize=Module["_CropAndResize"]=Module["asm"][["G"]]).apply(null,arguments)};var
_Cumsum=Module["_Cumsum"]=function(){return(_Cumsum=Module["_Cumsum"]=Module["asm"][["H"]]).apply(null,arguments)};var
_DepthToSpace=Module["_DepthToSpace"]=function(){return(_DepthToSpace=Module["_DepthToSpace"]=Module["asm"][["I"]]).apply(null,arguments)};var
_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=function(){return(_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=Module["asm"][["J"]]).apply(null,arguments)};var
_Elu=Module["_Elu"]=function(){return(_Elu=Module["_Elu"]=Module["asm"][["K"]]).apply(null,arguments)};var
_Equal=Module["_Equal"]=function(){return(_Equal=Module["_Equal"]=Module["asm"][["L"]]).apply(null,arguments)};var
_Exp=Module["_Exp"]=function(){return(_Exp=Module["_Exp"]=Module["asm"][["M"]]).apply(null,arguments)};var
_FlipLeftRight=Module["_FlipLeftRight"]=function(){return(_FlipLeftRight=Module["_FlipLeftRight"]=Module["asm"][["N"]]).apply(null,arguments)};var

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_Floor=Module["_Floor"]=function(){return(_Floor=Module["_Floor"]=Module["asm"][_"O"]).apply(null,arguments)};var
_FloorDiv=Module["_FloorDiv"]=function(){return(_FloorDiv=Module["_FloorDiv"]=Module["asm"][_"P"]).apply(null,arguments)};var
_FusedBatchNorm=Module["_FusedBatchNorm"]=function(){return(_FusedBatchNorm=Module["_FusedBatchNorm"]=Module["asm"][_"Q"]).apply(null,arguments)};var
_FusedConv2D=Module["_FusedConv2D"]=function(){return(_FusedConv2D=Module["_FusedConv2D"]=Module["asm"][_"R"]).apply(null,arguments)};var
_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=function(){return(_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=Module["asm"][_"S"]).apply(null,arguments)};var
_Gather=Module["_Gather"]=function(){return(_Gather=Module["_Gather"]=Module["asm"][_"T"]).apply(null,arguments)};var
_GatherNd=Module["_GatherNd"]=function(){return(_GatherNd=Module["_GatherNd"]=Module["asm"][_"U"]).apply(null,arguments)};var
_Greater=Module["_Greater"]=function(){return(_Greater=Module["_Greater"]=Module["asm"][_"V"]).apply(null,arguments)};var
_GreaterEqual=Module["_GreaterEqual"]=function(){return(_GreaterEqual=Module["_GreaterEqual"]=Module["asm"][_"W"]).apply(null,arguments)};var
_LeakyRelu=Module["_LeakyRelu"]=function(){return(_LeakyRelu=Module["_LeakyRelu"]=Module["asm"][_"X"]).apply(null,arguments)};var
_Less=Module["_Less"]=function(){return(_Less=Module["_Less"]=Module["asm"][_"Y"]).apply(null,arguments)};var
_LessEqual=Module["_LessEqual"]=function(){return(_LessEqual=Module["_LessEqual"]=Module["asm"][_"Z"]).apply(null,arguments)};var
_Log=Module["_Log"]=function(){return(_Log=Module["_Log"]=Module["asm"][_" _"]).apply(null,arguments)};var
_LogicalAnd=Module["_LogicalAnd"]=function(){return(_LogicalAnd=Module["_LogicalAnd"]=Module["asm"][_"$"]).apply(null,arguments)};var
_Max=Module["_Max"]=function(){return(_Max=Module["_Max"]=Module["asm"][_"aa"]).apply(null,arguments)};var
_MaxPool=Module["_MaxPool"]=function(){return(_MaxPool=Module["_MaxPool"]=Module["asm"][_"ba"]).apply(null,arguments)};var
_Maximum=Module["_Maximum"]=function(){return(_Maximum=Module["_Maximum"]=Module["asm"][_"ca"]).apply(null,arguments)};var
_Mean=Module["_Mean"]=function(){return(_Mean=Module["_Mean"]=Module["asm"][_"da"]).apply(null,arguments)};var
_Min=Module["_Min"]=function(){return(_Min=Module["_Min"]=Module["asm"][_"ea"]).apply(null,arguments)};var
_Minimum=Module["_Minimum"]=function(){return(_Minimum=Module["_Minimum"]=Module["asm"][_"fa"]).apply(null,arguments)};var
_MirrorPad=Module["_MirrorPad"]=function(){return(_MirrorPad=Module["_MirrorPad"]=Module["asm"][_"ga"]).apply(null,arguments)};var
_Multiply=Module["_Multiply"]=function(){return(_Multiply=Module["_Multiply"]=Module["asm"][_"ha"]).apply(null,arguments)};var
_Neg=Module["_Neg"]=function(){return(_Neg=Module["_Neg"]=Module["asm"][_"ia"]).apply(null,arguments)};var
_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=function(){return(_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=Module["asm"][_"ja"]).apply(null,arguments)};var

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_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=function(){return(_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=Module["asm"][["ka"]]).apply(null,arguments)};var
_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=function(){return(_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=Module["asm"][["la"]]).apply(null,arguments)};var
_NotEqual=Module["_NotEqual"]=function(){return(_NotEqual=Module["_NotEqual"]=Module["asm"][["ma"]]).apply(null,arguments)};var
_OneHot=Module["_OneHot"]=function(){return(_OneHot=Module["_OneHot"]=Module["asm"][["na"]]).apply(null,arguments)};var
_PadV2=Module["_PadV2"]=function(){return(_PadV2=Module["_PadV2"]=Module["asm"][["oa"]]).apply(null,arguments)};var
_Pow=Module["_Pow"]=function(){return(_Pow=Module["_Pow"]=Module["asm"][["pa"]]).apply(null,arguments)};var
_Prelu=Module["_Prelu"]=function(){return(_Prelu=Module["_Prelu"]=Module["asm"][["qa"]]).apply(null,arguments)};var
_Prod=Module["_Prod"]=function(){return(_Prod=Module["_Prod"]=Module["asm"][["ra"]]).apply(null,arguments)};var
_RealDiv=Module["_RealDiv"]=function(){return(_RealDiv=Module["_RealDiv"]=Module["asm"][["sa"]]).apply(null,arguments)};var
_RelU=Module["_Relu"]=function(){return(_Relu=Module["_Relu"]=Module["asm"][["ta"]]).apply(null,arguments)};var
_RelU6=Module["_Relu6"]=function(){return(_Relu6=Module["_Relu6"]=Module["asm"][["ua"]]).apply(null,arguments)};var
_ResizeBilinear=Module["_ResizeBilinear"]=function(){return(_ResizeBilinear=Module["_ResizeBilinear"]=Module["asm"][["va"]]).apply(null,arguments)};var
_Reverse=Module["_Reverse"]=function(){return(_Reverse=Module["_Reverse"]=Module["asm"][["wa"]]).apply(null,arguments)};var
_RotateWithOffset=Module["_RotateWithOffset"]=function(){return(_RotateWithOffset=Module["_RotateWithOffset"]=Module["asm"][["xa"]]).apply(null,arguments)};var
_Round=Module["_Round"]=function(){return(_Round=Module["_Round"]=Module["asm"][["ya"]]).apply(null,arguments)};var
_Rsqrt=Module["_Rsqrt"]=function(){return(_Rsqrt=Module["_Rsqrt"]=Module["asm"][["za"]]).apply(null,arguments)};var
_ScatterNd=Module["_ScatterNd"]=function(){return(_ScatterNd=Module["_ScatterNd"]=Module["asm"][["Aa"]]).apply(null,arguments)};var
_SelectV2=Module["_SelectV2"]=function(){return(_SelectV2=Module["_SelectV2"]=Module["asm"][["Ba"]]).apply(null,arguments)};var
_Sigmoid=Module["_Sigmoid"]=function(){return(_Sigmoid=Module["_Sigmoid"]=Module["asm"][["Ca"]]).apply(null,arguments)};var
_Sin=Module["_Sin"]=function(){return(_Sin=Module["_Sin"]=Module["asm"][["Da"]]).apply(null,arguments)};var
_Softmax=Module["_Softmax"]=function(){return(_Softmax=Module["_Softmax"]=Module["asm"][["Ea"]]).apply(null,arguments)};var
_Sqrt=Module["_Sqrt"]=function(){return(_Sqrt=Module["_Sqrt"]=Module["asm"][["Fa"]]).apply(null,arguments)};var
_Square=Module["_Square"]=function(){return(_Square=Module["_Square"]=Module["asm"][["Ga"]]).apply(null,arguments)};var
_SquaredDifference=Module["_SquaredDifference"]=function(){return(_SquaredDifference=Module["_SquaredDifference"]=Module["asm"][["Ha"]]).apply(null,arguments)};var

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_Step=Module["_Step"]=function(){return(_Step=Module["_Step"]=Module["asm"][["Ia"]]).apply(null,arguments)};var
_StridedSlice=Module["_StridedSlice"]=function(){return(_StridedSlice=Module["_StridedSlice"]=Module["asm"][["Ja"]]).apply(null,arguments)};var
_Sub=Module["_Sub"]=function(){return(_Sub=Module["_Sub"]=Module["asm"][["Ka"]]).apply(null,arguments)};var
_Sum=Module["_Sum"]=function(){return(_Sum=Module["_Sum"]=Module["asm"][["La"]]).apply(null,arguments)};var
_Tan=Module["_Tan"]=function(){return(_Tan=Module["_Tan"]=Module["asm"][["Ma"]]).apply(null,arguments)};var
_Tanh=Module["_Tanh"]=function(){return(_Tanh=Module["_Tanh"]=Module["asm"][["Na"]]).apply(null,arguments)};var
_Tile=Module["_Tile"]=function(){return(_Tile=Module["_Tile"]=Module["asm"][["Oa"]]).apply(null,arguments)};var
_TopK=Module["_TopK"]=function(){return(_TopK=Module["_TopK"]=Module["asm"][["Pa"]]).apply(null,arguments)};var
_Transform=Module["_Transform"]=function(){return(_Transform=Module["_Transform"]=Module["asm"][["Qa"]]).apply(null,arguments)};var
_Transpose=Module["_Transpose"]=function(){return(_Transpose=Module["_Transpose"]=Module["asm"][["Ra"]]).apply(null,arguments)};var
__FusedMatMul=Module["__FusedMatMul"]=function(){return(__FusedMatMul=Module["__FusedMatMul"]=Module["asm"][["Sa"]]).apply(null,arguments)};var
_malloc=Module["_malloc"]=function(){return(_malloc=Module["_malloc"]=Module["asm"][["Ta"]]).apply(null,arguments)};var
_free=Module["_free"]=function(){return(_free=Module["_free"]=Module["asm"][["Ua"]]).apply(null,arguments)};var
__errno_location=Module["__errno_location"]=function(){return(__errno_location=Module["__errno_location"]=Module["asm"][["Va"]]).apply(null,arguments)};var
stackSave=Module["stackSave"]=function(){return(stackSave=Module["stackSave"]=Module["asm"][["Wa"]]).apply(null,arguments)};var
stackRestore=Module["stackRestore"]=function(){return(stackRestore=Module["stackRestore"]=Module["asm"][["Xa"]]).apply(null,arguments)};var
stackAlloc=Module["stackAlloc"]=function(){return(stackAlloc=Module["stackAlloc"]=Module["asm"][["Ya"]]).apply(null,arguments)};Module["cwrap"]=cwrap;var calledRun;function
ExitStatus(status){this.name="ExitStatus";this.message="Program terminated with
exit("+status+")";this.status=status}dependenciesFulfilled=function
runCaller(){if(!calledRun)run();if(!calledRun)dependenciesFulfilled=runCaller};function
run(args){args=args||arguments;if(runDependencies>0){return}preRun();if(runDependencies>0){return}function
doRun(){if(calledRun)return;calledRun=true;Module["calledRun"]=true;if(ABORT)return;initRuntime();preMain(
);readyPromiseResolve(Module);if(Module["onRuntimeInitialized"])Module["onRuntimeInitialized"]();postRun(
)}if(Module["setStatus"]){Module["setStatus"]("Running...");setTimeout(function(){setTimeout(function(){Module["setStatus"]("");},1);doRun()},1)}else{doRun()}}Module["run"]=run;if(Module["preInit"]){if(typeof
Module["preInit"]=="function")Module["preInit"]=Module["preInit"];while(Module["preInit"].length>0){
Module["preInit"].pop()}}run();\n\n return WasmBackendModule.ready\n\n);nif (typeof exports ===
'object' && typeof module === 'object')\n module.exports = WasmBackendModule;\nelse if (typeof define ===
'function' && define['amd'])\n define([], function() { return WasmBackendModule; });\nelse if (typeof exports ===
'object')\n exports["WasmBackendModule"] = WasmBackendModule;\n"/**\n * @license\n * Copyright 2019
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you

```

may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \*\n \* http://www.apache.org/licenses/LICENSE-2.0\n \*\n \* Unless required by applicable law or agreed to in writing,  
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OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language  
governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\nimport './flags_wasm';\nimport { backend_util, BackendTimingInfo, DataStorage, DataType, deprecationWarn,
engine, env, KernelBackend, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { BackendWasmModule,
WasmFactoryConfig } from './wasm-out/tfjs-backend-wasm';\nimport { BackendWasmThreadedSimdModule } from
 './wasm-out/tfjs-backend-wasm-threaded-simd';\nimport wasmFactoryThreadedSimd from './wasm-out/tfjs-
backend-wasm-threaded-simd.js';\n// @ts-ignore\nimport { wasmWorkerContents } from './wasm-out/tfjs-backend-
wasm-threaded-simd.worker.js';\nimport wasmFactory from './wasm-out/tfjs-backend-wasm.js';\n\ninterface
TensorData {\n id: number;\n memoryOffset: number;\n shape: number[];\n dtype: DataType;\n refCount:
number;\n /** Only used for string tensors, storing encoded bytes. */\n stringBytes?: Uint8Array[];\n}\n\nexport
type DataId = object; // object instead of {} to force non-primitive.\nexport class BackendWasm extends
KernelBackend {\n // 0 is reserved for null data ids.\n private dataIdNextNumber = 1;\n dataIdMap:
DataStorage<TensorData>;\n\n constructor(public
wasm: BackendWasmModule|BackendWasmThreadedSimdModule) {\n super();\n this.wasm.tfjs.initWithThreadsCount(threadsCount);\n actualThreadsCount = this.wasm.tfjs.getThreadsCount();\n this.dataIdMap = new DataStorage(this, engine());\n }\n\n write(values: backend_util.BackendValues, shape:
number[], dtype: DataType): DataId {\n const dataId = {id: this.dataIdNextNumber++};\n this.move(dataId, values, shape, dtype, 1);\n return dataId;\n }\n\n numDataIds(): number {\n return
this.dataIdMap.numDataIds();\n }\n\n async time(f: () => void): Promise<BackendTimingInfo> {\n const start =
util.now();\n f();\n const kernelMs = util.now() - start;\n return {kernelMs};\n }\n\n move(\n dataId:
DataId, values: backend_util.BackendValues, shape: number[],
dtype: DataType, refCount: number): void {\n const id = this.dataIdNextNumber++;\n if (dtype === 'string') {\n const stringBytes = values as Uint8Array[];\n\n this.dataIdMap.set(\n dataId,\n {id, stringBytes, shape, dtype, memoryOffset: null, refCount});\n return;\n }\n\n const size = util.sizeFromShape(shape);\n const numBytes = size *
util.bytesPerElement(dtype);\n const memoryOffset = this.wasm._malloc(numBytes);\n\n this.dataIdMap.set(dataId, {id, memoryOffset, shape, dtype, refCount});\n this.wasm.tfjs.registerTensor(id, size,
memoryOffset);\n\n if (values != null) {\n this.wasm.HEAPU8.set(\n new Uint8Array(\n (values
as backend_util.TypedArray).buffer,\n (values as backend_util.TypedArray).byteOffset, numBytes),\n memoryOffset);\n }\n\n async read(dataId: DataId): Promise<backend_util.BackendValues> {\n return
this.readSync(dataId);\n }\n\n readSync(dataId: DataId): backend_util.BackendValues {\n const {memoryOffset,
dtype, shape, stringBytes} =\n this.dataIdMap.get(dataId);\n if (dtype === 'string') {\n return
stringBytes;\n }\n const bytes = this.wasm.HEAPU8.slice(\n memoryOffset,\n memoryOffset +
util.sizeFromShape(shape) * util.bytesPerElement(dtype));\n return typedArrayFromBuffer(bytes.buffer, dtype);\n }\n\n /**\n * Dispose the memory if the dataId has 0 refCount. Return true if the memory\n * is released, false
otherwise.\n * @param dataId\n * @oaram force Optional, remove the data regardless of refCount\n */\n disposeData(dataId: DataId, force = false): boolean {\n if (this.dataIdMap.has(dataId)) {\n const data =
this.dataIdMap.get(dataId);\n data.refCount--;\n if (!force && data.refCount > 0) {\n return false;\n }\n this.wasm._free(data.memoryOffset);\n this.wasm.tfjs.disposeData(data.id);\n }\n this.dataIdMap.delete(dataId);\n return true;\n }\n\n /** Return refCount of a `TensorData` */\n refCount(dataId: DataId): number {\n if (this.dataIdMap.has(dataId)) {\n const tensorData =
this.dataIdMap.get(dataId);\n return tensorData.refCount;\n }\n return 0;\n }\n\n incRef(dataId: DataId) {\n const data = this.dataIdMap.get(dataId);\n if (data != null) {\n data.refCount++;\n }\n }\n\n floatPrecision():
32 {\n return 32;\n }\n\n // Returns the memory offset of a tensor. Useful for debugging and unit\n // testing.\n }\n}
```



```

getMemoryOffset(dataId: DataId): number {\n return this.dataIdMap.get(dataId).memoryOffset;\n }\n\n
dispose() {\n this.wasm.tfjs.dispose();\n if ('PThread' in this.wasm) {\n
this.wasm.PThread.terminateAllThreads();\n }\n this.wasm = null;\n }\n\n
memory() {\n return {unreliable: false};\n }\n\n
/**\n * Make a tensor info for the output of an op. If `memoryOffset` is not\n * present, this method allocates memory on the WASM heap. If `memoryOffset`\n * is present, the memory was allocated elsewhere (in c++) and we just record\n * the pointer where that memory lives.\n */\n makeOutput(shape: number[], dtype: DataType, memoryOffset?: number):\n TensorInfo {\n let dataId: {};\n if (memoryOffset == null) {\n dataId = this.write(null /* values */, shape, dtype);\n } else {\n const id = this.dataIdNextNumber++;\n dataId = {id};\n this.dataIdMap.set(dataId, {id, memoryOffset, shape, dtype, refCount: 1});\n const size = util.sizeFromShape(shape);\n this.wasm.tfjs.registerTensor(id, size, memoryOffset);\n }\n return {dataId, shape, dtype};\n }\n\n
typedArrayFromHeap({shape, dtype, dataId}: TensorInfo):\n backend_util.TypedArray {\n const buffer = this.wasm.HEAPU8.buffer;\n const {memoryOffset} = this.dataIdMap.get(dataId);\n const size = util.sizeFromShape(shape);\n switch (dtype) {\n case 'float32':\n return new Float32Array(buffer, memoryOffset, size);\n case 'int32':\n return new Int32Array(buffer, memoryOffset, size);\n case 'bool':\n return new Uint8Array(buffer, memoryOffset, size);\n default:\n throw new Error('Unknown dtype ${dtype}');\n }\n }\n\n
function createInstantiateWasmFunc(path: string) {\n // this will be replace by rollup plugin patchWechatWebAssembly in\n // miniprogram's output.\n // tslint:disable-next-line:no-any\n return (imports: any, callback: any) => {\n util.fetch(path, {credentials: 'same-origin'}).then((response) => {\n if (!response['ok']) {\n imports.env.a(`failed to load wasm binary file at '${path}'`);\n }\n response.arrayBuffer().then(binary => {\n WebAssembly.instantiate(binary, imports).then(output => {\n callback(output.instance, output.module);\n });\n });\n });\n return {};\n });\n\n
/**\n * Returns the path of the WASM binary.\n */\n @param simdSupported whether SIMD is supported\n @param threadsSupported whether multithreading is supported\n @param wasmModuleFolder the directory containing the WASM binaries.\n */\n function getPathToWasmBinary(\n simdSupported: boolean, threadsSupported: boolean,\n wasmModuleFolder: string) {\n if (wasmPath != null) {\n // If wasmPath is defined, the user has supplied a full path to\n // the vanilla .wasm binary.\n return wasmPath;\n }\n let path: WasmBinaryName = 'tfjs-backend-wasm.wasm';\n if (simdSupported && threadsSupported) {\n path = 'tfjs-backend-wasm-threaded-simd.wasm';\n } else if (simdSupported) {\n path = 'tfjs-backend-wasm-simd.wasm';\n }\n if (wasmFileMap != null) {\n if (wasmFileMap[path] != null) {\n return wasmFileMap[path];\n }\n }\n return wasmModuleFolder + path;\n }\n\n
/**\n * Initializes the wasm module and creates the js <--> wasm bridge.\n */\n @param NOTE: We wrap the wasm module in a object with property 'wasm'\n instead of returning Promise<BackendWasmModule> to avoid freezing Chrome\n (last tested in Chrome 76).\n */\n export async function init(): Promise<{wasm: BackendWasmModule}> {\n const [simdSupported, threadsSupported] = await Promise.all([\n env().getAsync('WASM_HAS_SIMD_SUPPORT'),\n env().getAsync('WASM_HAS_MULTITHREAD_SUPPORT')\n]);\n return new Promise((resolve, reject) => {\n const factoryConfig: WasmFactoryConfig = {};\n /**\n * This function overrides the Emscripten module locateFile utility.\n */\n @param path The relative path to the file that needs to be loaded.\n @param prefix The path to the main JavaScript file's directory.\n */\n factoryConfig.locateFile = (path, prefix) => {\n if (path.endsWith('.worker.js')) {\n const response = wasmWorkerContents;\n const blob = new Blob([response], {type: 'application/javascript'});\n return URL.createObjectURL(blob);\n }\n if (path.endsWith('.wasm')) {\n return getPathToWasmBinary(\n simdSupported as boolean, threadsSupported as boolean,\n wasmPathPrefix != null ? wasmPathPrefix : prefix);\n }\n return prefix + path;\n };\n // Use the instantiateWasm override when system fetch is not available.\n // Reference: https://github.com/emscripten-core/emscripten/blob/2bca083cbbd5a4133db61fbd74d04f7feecfa907/tests/manual_wasm_instantiate.html#L170\n if (customFetch) {\n factoryConfig.instantiateWasm =\n
```

```

createInstantiateWasmFunc(getPathToWasmBinary(\n simdSupported as boolean, threadsSupported as
boolean,\n wasmPathPrefix != null ? wasmPathPrefix : ''));\n }\n\n let initialized = false;\n factoryConfig.onAbort = () => {\n if (initialized) {\n // Emscripten already called console.warn so no need to
double log.\n return;\n }\n if (initAborted) {\n // Emscripten calls `onAbort` twice, resulting in double
error\n // messages.\n return;\n }\n initAborted = true;\n const rejectMsg =\n 'Make sure the
server can serve the `.wasm` file relative to the '+\n 'bundled
js file. For more details see https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-wasm/README.md#using-
bundlers';\n reject({message: rejectMsg});\n };\n\n let wasm: Promise<BackendWasmModule>;\n // If
`wasmPath` has been defined we must initialize the vanilla module.\n if (threadsSupported && simdSupported
&& wasmPath == null) {\n factoryConfig.mainScriptUrlOrBlob = new Blob(\n [var
WasmBackendModuleThreadedSimd = `+\n wasmFactoryThreadedSimd.toString()),\n {type:
'text/javascript'});\n wasm = wasmFactoryThreadedSimd(factoryConfig);\n } else {\n // The wasmFactory
works for both vanilla and SIMD binaries.\n wasm = wasmFactory(factoryConfig);\n }\n\n // The WASM
module has been successfully created by the factory.\n // Any error will be caught by the onAbort callback defined
above.\n wasm.then((module) => {\n initialized = true;\n initAborted = false;\n\n const voidReturnType:
string = null;\n // Using the tfjs namespace to avoid conflict with emscripten's API.\n module.tfjs = {\n
init: module.cwrap('init', null, []),\n initWithThreadsCount:\n module.cwrap('init_with_threads_count',
null, ['number']),\n getThreadsCount: module.cwrap('get_threads_count', 'number', []),\n registerTensor:
module.cwrap(\n 'register_tensor', null,\n [\n 'number', // id\n 'number', // size\n
'number', // memoryOffset\n]),\n disposeData: module.cwrap('dispose_data', voidReturnType,
['number']),\n dispose: module.cwrap('dispose', voidReturnType, []),\n }; \n\n resolve({wasm: module});\n
 });\n });\n\nfunction typedArrayFromBuffer(\n buffer: ArrayBuffer, dtype: DataType):
backend_util.TypedArray {\n switch (dtype) {\n case 'float32':\n return new Float32Array(buffer);\n case
'int32':\n return new Int32Array(buffer);\n\n case 'bool':\n return new Uint8Array(buffer);\n default:\n throw new Error(`Unknown dtype ${dtype}`);\n }\n}\n\nconst wasmBinaryNames = [\n 'tfjs-backend-wasm.wasm', 'tfjs-backend-wasm-simd.wasm',\n 'tfjs-
backend-wasm-threaded-simd.wasm'\n] as const ;\ntype WasmBinaryName = typeof
wasmBinaryNames[number];\n\nlet wasmPath: string = null;\nlet wasmPathPrefix: string = null;\nlet wasmFileMap:
{[key in WasmBinaryName]?: string} = {};\nlet initAborted = false;\nlet customFetch = false;\n\n/**\n *
@deprecated Use `setWasmPaths` instead.\n * Sets the path to the `.wasm` file which will be fetched when the
wasm\n * backend is initialized. See\n * https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-
wasm/README.md#using-bundlers\n * for more details.\n * @param path wasm file path or url\n * @param
usePlatformFetch optional boolean to use platform fetch to download\n * the wasm file, default to false.\n *\n *
@doc {heading: 'Environment', namespace: 'wasm'}\n\n * \n\nexport function setWasmPath(path: string, usePlatformFetch = false): void {\n deprecationWarn(\n
'setWasmPath has been deprecated in favor of setWasmPaths and '+\n ' will be removed in a future release.);\n if
(initAborted) {\n throw new Error(\n 'The WASM backend was already initialized. Make sure you call '+\n
 '\n `setWasmPath()` before you call `tf.setBackend()` or `tf.ready()`');\n }\n wasmPath = path;\n customFetch =
usePlatformFetch;\n}\n\n/**\n * Configures the locations of the WASM binaries.\n *\n * ```js\n * setWasmPaths({\n
* 'tfjs-backend-wasm.wasm': 'renamed.wasm',\n * 'tfjs-backend-wasm-simd.wasm': 'renamed-simd.wasm',\n *
'tfjs-backend-wasm-threaded-simd.wasm': 'renamed-threaded-simd.wasm'\n * });\n * tf.setBackend('wasm');\n *\n *
```\n *\n * @param prefixOrFileMap This can be either a string or object:\n * - (string) The path to the directory
where the WASM binaries are located.\n * Note that this prefix will be used to load each
binary (vanilla,\n * SIMD-enabled, threading-enabled, etc.).\n * - (object) Mapping from names of WASM
binaries to custom\n * full paths specifying the locations of those binaries. This is useful if\n * your WASM
binaries are not all located in the same directory, or if your\n * WASM binaries have been renamed.\n * @param
usePlatformFetch optional boolean to use platform fetch to download\n * the wasm file, default to false.\n *\n *
@doc {heading: 'Environment', namespace: 'wasm'}\n *\nexport function setWasmPaths(\n  prefixOrFileMap:

```

```

string|{[key in WasmBinaryName]?: string},\n usePlatformFetch = false): void {\n if (initAborted) {\n throw
new Error(\n    `The WASM backend was already initialized. Make sure you call ' +\n    `setWasmPaths()
before you call `tf.setBackend() or ' +\n    `tf.ready()`)};\n }\n\n if (typeof prefixOrFileMap === 'string') {\n
wasmPathPrefix = prefixOrFileMap;\n } else {\n    wasmFileMap = prefixOrFileMap;\n
    const missingPaths =\n        wasmBinaryNames.filter(name => wasmFileMap[name] == null);\n    if
(missingPaths.length > 0) {\n        throw new Error(\n            `There were no entries found for the following binaries: `
+\n            `${missingPaths.join(',')}`. Please either call setWasmPaths with a ` +\n            `map providing a path for
each binary, or with a string indicating ` +\n            `the directory where all the binaries can be found.`);\n    }\n }\n\n\n customFetch = usePlatformFetch;\n}\n\n/** Used in unit tests. */\nexport function resetWasmPath(): void {\n
wasmPath = null;\n    wasmPathPrefix = null;\n    wasmFileMap = {};\n    customFetch = false;\n    initAborted =
false;\n}\n\nlet threadsCount = -1;\nlet actualThreadsCount = -1;\n\n/**\n * Sets the number of threads that will be
used by XNNPACK to create\n * threadpool (default to the number of logical CPU cores).\n * This must be
called before calling `tf.setBackend('wasm')`.\n */\nexport function setThreadsCount(numThreads:
number) {\n    threadsCount = numThreads;\n}\n\n/**\n * Gets the actual threads count that is used by
XNNPACK.\n * It is set after the backend is intialized.\n */\nexport function getThreadsCount(): number {\n if
(actualThreadsCount === -1) {\n    throw new Error(`WASM backend not initialized.`);\n }\n return
actualThreadsCount;\n}\n\n","/** @license See the LICENSE file. *\n\n// This code is auto-generated, do not modify
this file!\n\nconst version = '3.11.0';\nexport {version};\n","/**\n * @license\n * Copyright 2020 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND,\n * either express or implied.\n * See the License for the specific language governing permissions and\n * limitations
under the License.\n *\n *
===== \n\n
*/\n\nimport './flags_wasm';\n\nimport {registerBackend} from 'tensorflow/tfjs-core';\n\nimport {BackendWasm,
init} from './backend_wasm';\n\nexport {BackendWasm, getThreadsCount, setThreadsCount, setWasmPath,
setWasmPaths} from './backend_wasm';\n\nexport {version as version_wasm} from './version';\n\nconst
WASM_PRIORITY = 2;\nregisterBackend('wasm', async () => {\n    const {wasm} = await init();\n    return new
BackendWasm(wasm);\n},\n    WASM_PRIORITY);\n\n], "names":["_FusedMatMul","util","Abs","backend_util","Add","AddN","Identity","setup",
"Transpose","All","Any","wasmFunc","ArgMax","AvgPool","Reshape","BatchMatMul","slice_util","buffer","sliceI
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DBackpropInput","Cos","Cosh","CropAndResize","Cumsum","DepthToSpace","DepthwiseConv2dNative","Elu","s
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"FusedConv2D","FusedDepthwiseConv2D","GatherNd","gather_util","GatherV2","Greater","GreaterEqual","setup
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V,UAAU;MACV,UAAU;MACV,eAAe;MACf,eAAe;MACf,YAAy;MACZ,eAAe;GAChB,CAAC;EAEF,KAAK, MAAM,YAAy,IAAI,aAAa,EAAE;MACxCC,uBAAc,CAAC,YAAy,CAAC,CAAC;;;EC3N/B;;;;;;;EAmBA, MAAM,GAAG,GAAGC,YAAG,EAAE,CAAC;EAEIB;;;EAGA;EACA,GAAG,CAAC,YAAy;EACZ;EACA;EAC A;EACA,uBAAuB,EAAE,YAAy,WAAW,CAAC,QAAQ,CAAC,IAAI,UAAU,CAAC;MACvE,CAAC,EAAE,EA AE,EAAE,GAAG,EAAE,GAAG,EAAE,CAAC,EAAE,CAAC,EAAE,CAAC,EAAE,CAAC,EAAE,CAAC,EAAE, CAAC,EAAE,CAAC,EAAI,EAAE,EAAE,CAAC,EAAG,CAAC,EAAE,CAAC;MACrD,CAAC,EAAE,CAAC,EA AG,CAAC,EAAI,EAAE,EAAG,CAAC,EAAE,CAAC,EAAE,CAAC,EAAE,CAAC,EAAE,EAAE,EAAE,CAAC,E AAE,GAAG,EAAE,EAAE,EAAE,EAAE,EAAE,EAAE;GACpD,CAAC,CAAC,CAAC,CAAC;EAET;;;EAGA;EA CA,GAAG,CAAC,YAAy,CAAC,8BAA8B,EAAE;;;MAG/C,IAAI,GAAG,CAAC,GAAG,CAAC,SAAS,CAAC,E AAE;UACtB,OAAO,KAAK,CAAC;OACd;MAED,IAAI;;;UAGF,IAAI,cAAc,EAAE,CAAC,KAAK,CAAC,WAA W,CAAC,IAAI,iBAAiB,CAAC,CAAC,CAAC,CAAC,CAAC;;;UAGjE,OAAO,WAAW,CAAC,QAAQ,CAAC,IA AI,UAAU,CAAC;cACzC,CAAC,EAAE,EAAE,EAAE,GAAG,EAAE,GAAG,EAAE,CAAC,EAAE,CAAC,EAAG, CAAC,EAAG,CAAC,EAAE,CAAC,EAAE,CAAC,EAAE,CAAC,EAAG,EAAE,EAAE,CAAC,EAAI,CAAC,EAA G,CAAC,EAAE,CAAC,EAAE,CAAC,EAAG,CAAC,EAAE,CAAC;cACpE,CAAC,EAAE,CAAC,EAAG,CAAC,E AAI,CAAC,EAAI,CAAC,EAAE,EAAE,EAAE,EAAE,EAAE,CAAC,EAAE,CAAC,EAAE,CAAC,EAAE,EAAE,E AAE,CAAC,EAAG,GAAG,EAAE,EAAE,EAAE,CAAC,EAAE,CAAC,EAAE,EAAE,EAAE,EAAE;WACnE,CAA C,CAAC,CAAC;OACL;MAAC,OAAO,CAAC,EAAE;UACV,OAAO,KAAK,CAAC;OACd;EACH,CAAC,CAAC; ;;;;;;ECzDF,IAAI,6BAA6B,GAAG,CAAC,WAAW;EACd,EAAE,IAAI,UAAU,GAAG,OAAO,QAAQ,KAAK, WAAW,IAAI,QAAQ,CAAC,aAAa,GAAG,QAAQ,CAAC,aAAa,CAAC,GAAG,GAAG,SAAS,CAAC;EACtH,EA AE,IAAI,OAAO,UAAU,KAAK,WAAW,EAAE,UAAU,GAAG,UAAU,IAAI,UAAU,CAAC;EAC/E,EAAE;EACF, SAAS,6BAA6B,EAAE;EACxC,EAAE,6BAA6B,GAAG,6BAA6B,IAAI,EAAE,CAAC;AACtE;EACA,SAAS,gBA AgB,EAAE,CAAC,GAAG,UAAU,CAAC,MAAM,EAAE,MAAM,CAAC,CAAC,0BAA0B,CAAC,UAAU,CAAC, MAAM,EAAC,CAAC,OAAO,KAAK,CAAC,SAAS,gBAAgB,EAAE,CAAC,GAAG,UAAU,CAAC,MAAM,EAA E,MAAM,CAAC,CAAC,0BAA0B,CAAC,UAAU,CAAC,MAAM,EAAC,CAAC,OAAO,MAAM,CAAC,SAAS,iB AAI,CAAC,GAAG,UAAU,CAAC,MAAM,EAAE,MAAM,CAAC,CAAC,0BAA0B,CAAC,UAAU,CAAC ,MAAM,EAAC,CAAC,OAAO,MAAM,CAAC,SAAS,iBAAiB,EAAE,CAAC,GAAG,UAAU,CAAC,MAAM,EAA E,MAAM,CAAC,CAAC,0BAA0B,CAAC,UAAU,CAAC,MAAM,EAAC,CAAC,OAAO,OAAO,CAAC,SAAS,iB AAI,CAAC,GAAG,UAAU,CAAC,MAAM,EAAE,MAAM,CAAC,CAAC,0BAA0B,CAAC,UAAU,CAAC ,MAAM,EAAC,CAAC,OAAO,OAAO,CAAC,IAAI,MAAM,CAAC,OAAO,6BAA6B,GAAG,WAAW,CAAC,6BA A6B,CAAC,EAAE,CAAC,IAAI,mBAAmB,CAAC,kBAaKB,CAAC,MAAM,CAAC,OAAO,CAAC,CAAC,IAAI, OAAO,CAAC,SAAS,OAAO,CAAC,MAAM,CAAC,CAAC,mBAAmB,CAAC,OAAO,CAAC,kBAaKB,CAAC,O AAM,CAAC,CAAC,CAAC,IAAI,eAAe,CAAC,EAAE,CAAC,IAAI,GAAG,CAAC,IAAI,GAAG,IAAI,MAAM,C AAC,CAAC,GAAG,MAAM,CAAC,cAAc,CAAC,GAAG,CAAC,CAAC,CAAC,eAAe,CAAC,GAAG,CAAC,CAA C,MAAM,CAAC,GAAG,EAAC,CAAC,CAAC,IAAI,UAAU,CAAC,EAAE,CAAC,IAAI,WAAW,CAAC,gBAAg B,CAAC,IAAI,KAAK,CAAC,SAAS,MAAM,CAAC,OAAO,CAAC,CAAC,MAAM,OAAO,CAAC,CAAC,IAAI,k BAaKB,CAAC,KAAK,CAAC,IAAI,qBAaQB,CAAC,KAAK,CAAC,IAAI,mBAAmB,CAAC,KAAK,CAAC,IAAI ,oBAAoB,CAAC,KAAK,CAAC,kBAaKB,CAAC,OAAO,MAAM,GAAG,QAAQ,CAAC,qBAaQB,CAAC,OAAO, aAAa,GAAG,UAAU,CAAC,mBAAmB,CAAC,OAAO,OAAO,GAAG,QAAQ,EAAE,OAAO,OAAO,CAAC,QAA Q,GAAG,QAAQ,EAAE,OAAO,OAAO,CAAC,QAAQ,CAAC,IAAI,GAAG,QAAQ,CAAC,oBAAoB,CAAC,CAA C,kBAaKB,EAAE,CAAC,mBAAmB,EAAE,CAAC,qBAaQB,CAAC,IAAI,sBAAsB,CAAC,MAAM,CAAC,wBA AwB,CAAC,EAAE,KAAK,CAAC,GAAG,sBAAsB,CAAC,CAAC,MAAM,CAAC,MAAM,CAAC,QAAQ,EAAC, CAAC,IAAI,eAAe,CAAC,EAAE,CAAC,SAAS,UAAU,CAAC,IAAI,CAAC,CAAC,GAAG,MAAM,CAAC,YAA Y,CAAC,CAAC,CAAC,OAAO,MAAM,CAAC,YAAy,CAAC,CAAC,IAAI,CAAC,eAAe,CAAC,CAAC,OAAO,e AAe,CAAC,IAAI,KAAK,KAAK,CAAC,SAAS,CAAC,UAAU,CAAGB,IAAI,MAAM,CAAC,IAAI,QAAQ,CAAC, GAAG,mBAAmB,CAAC,CAAC,GAAG,qBAaQB,CAAC,CAAC,eAAe,CAACC,IAAe,CAAC,OAAO,CAAC,eA Ae,CAAC,CAAC,IAAG,CAAC,KAAI,CAAC,eAAe,CAAC,SAAS,CAAC,IAAG,CAAC,KAAK,CAAC,SAAS,UA AU,CAAC,QAAQ,CAAC,MAAM,CAAC,CAAC,GAAG,CAAC,MAAM,CAAC,MAAM,CAACC,EAAa,CAAC,G AAG,CAAC,QAAQ,CAAC,QAAQ,CAACD,IAAe,CAAC,QAAQ,CAAC,QAAQ,CAAC,WAAW,CAAC,CAAC,Q

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Found

in path(s):

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/tf-backend-wasm.es2017.js.map

No license file was found, but licenses were detected in source scan.

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```
=====
*/
import { backend_util, KernelConfig, KernelFunc, Prod, ProdAttrs, ProdInputs, TensorInfo, util } from
'@tensorflow/tfjs-core';
import { BackendWasm } from './backend_wasm';
import
{ permuteAxesAndTranspose } from './kernel_utils';
import { CppDType } from './types';
let wasmProd: (
  xId: number, reduceSize: number,
  dtype: number, outId: number) => void;
function setup(backend:
BackendWasm): void {
  wasmProd = backend.wasm.cwrap(Prod, null /*void*/, [
    'number', 'number',
    'number', 'number'
  ]);
  function prod(args: {
    backend: BackendWasm,
    inputs: ProdInputs,
    attrs:
    ProdAttrs
  }): TensorInfo {
    const { backend, inputs, attrs } = args;
    const { axis, keepDims } = attrs;
    const { x
    = inputs;
    const xId = backend.dataIdMap.get(x.dataId).id;
    let inputId = xId;
    let input = x;
    const
    { transposed, axes, originalAxes, inputWasTransposed } =
    permuteAxesAndTranspose(x, axis, backend);
    let reductionAxes = axes;
    if (inputWasTransposed) {
      const transposedId =
      backend.dataIdMap.get(transposed.dataId).id;
      if (transposedId !== xId) {
        // transpose was not a no-op. We
        will need to dispose of this
        // once we are done.
        input = transposed;
        inputId = transposedId;
        reductionAxes = backend_util.getInnerMostAxes(
          reductionAxes.length, input.shape.length);
      }
      backend_util.assertAxesAreInnerMostDims(
        'prod', reductionAxes, input.shape.length);
      const [outShape,
      reduceShape] =
      backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);
      const reduceSize
      = util.sizeFromShape(reduceShape);
      const out = backend.makeOutput(outShape, input.dtype);
      if
      (util.sizeFromShape(input.shape) !== 0) {
        const outId = backend.dataIdMap.get(out.dataId).id;
        wasmProd(inputId, reduceSize, CppDType[out.dtype], outId);
      }
      if (inputWasTransposed) {
        // dispose of
        the transposed tensor.
        backend.disposeData(transposed.dataId);
      }
      if (keepDims) {
        // reshape
        const newShape =
        backend_util.expandShapeToKeepDim(out.shape, originalAxes);
        out.shape = newShape;
      }
      return
      out;
    }
  }
  export const prodConfig: KernelConfig = {
    kernelName: Prod,
    backendName: 'wasm',
    setupFunc:
    setup,
    kernelFunc: prod as {} as KernelFunc
  };
}
```

Found in path(s):

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Prod.js.map

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* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/starter/parcel/index.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/starter/webpack/src/index.js

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*/

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```
=====  
*  
\nimport {backend_util, FusedConv2D, FusedConv2DAttrs, FusedConv2DInputs, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';  
\nimport {BackendWasm} from '../backend_wasm';  
\nimport {FusableActivation} from './types';  
\nlet wasmFusedConv2d(xId: number, batchSize: number, inputHeight: number, inputWidth: number, filterId: number, filterHeight: number, filterWidth: number, biasId: number, padTop: number, padRight: number, padBottom: number, padLeft: number, isSamePad: number, dilationHeight: number, dilationWidth: number, strideHeight: number, strideWidth: number, inputChannels: number, outputChannels: number, activation: number, preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) => void;  
\nfunction setup(backend: BackendWasm) {\n  wasmFusedConv2d = backend.wasm.cwrap(FusedConv2D, null /* void */, [\n    'number', // xId\n    'number', // batchSize\n    'number', // inputHeight\n    'number', // inputWidth\n    'number', // filterId\n    'number', // filterHeight\n    'number', // filterWidth\n    'number', // biasId\n    'number', // padTop\n    'number', // padRight\n    'number', // padBottom\n    'number', // padLeft\n    'number', // isSamePad\n    'number', // dilationHeight\n    'number', // dilationWidth\n    'number', // strideHeight\n    'number', // strideWidth\n    'number', // inputChannels\n    'number', // outputChannels\n    'number', // activation\n    'number', // preluActivationWeightsId\n    'number', // leakyreluAlpha\n    'number', // outId\n  ]);\n}\nfunction fusedConv2d(args: {\n  inputs: FusedConv2DInputs,\n  backend: BackendWasm,\n  attrs: FusedConv2DAttrs\n}) {\n  const {inputs, attrs, backend} = args;\n  const {x, filter, bias, preluActivationWeights} = inputs;\n  const {strides, pad, dilations, dataFormat, dimRoundingMode, activation, leakyreluAlpha} = attrs;\n  const convInfo = backend_util.computeConv2DInfo(x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations, pad, dimRoundingMode);\n  const fusedActivation = FusableActivation[activation as {} as keyof typeof FusableActivation];\n  if (fusedActivation == null) {\n    throw new Error(`${activation} activation not yet supported for FusedConv2D`);\n  }\n  const xId = backend.dataIdMap.get(x.dataId).id;\n  const filterId = backend.dataIdMap.get(filter.dataId).id;\n  const outputChannels = convInfo.outChannels;\n  let biasId = 0;\n  if (bias != null) {\n    const biasData = backend.dataIdMap.get(bias.dataId);\n    if (biasData.shape.length !== 1) {\n      throw new Error(`FusedConv2D only supports rank-1 bias but got`);\n    }\n    if (biasData.shape[0] !== outputChannels) {\n      throw new Error(`FusedConv2D bias shape (${biasData.shape}) does not match the number of output channels (${outputChannels})`);\n    }\n    biasId = biasData.id;\n  }\n  const filterHeight = convInfo.filterHeight;\n  const filterWidth = convInfo.filterWidth;\n  const padTop = convInfo.padInfo.top;\n  const padRight = convInfo.padInfo.right;\n  const padBottom = convInfo.padInfo.bottom;\n  const padLeft = convInfo.padInfo.left;\n  const dilationHeight = convInfo.dilationHeight;\n  const dilationWidth = convInfo.dilationWidth;\n  const strideHeight = convInfo.strideHeight;\n  const strideWidth = convInfo.strideWidth;\n  const inputChannels = convInfo.inChannels;\n  const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;\n  const batchSize = convInfo.batchSize;\n  const inHeight = convInfo.inHeight;\n  const inWidth = convInfo.inWidth;\n  if (dataFormat !== 'NHWC') {\n    throw new Error(`wasm backend FusedConv2D does not support dataFormat: ${dataFormat}. Please use 'NHWC'.`);\n  }\n  const out = backend.makeOutput(convInfo.outShape, 'float32');\n  const outId = backend.dataIdMap.get(out.dataId).id;\n  const preluActivationWeightsId = preluActivationWeights == null ? 0 : backend.dataIdMap.get(preluActivationWeights.dataId).id;\n  wasmFusedConv2d(xId, batchSize, inHeight,
```

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inWidth, filterId, filterHeight, filterWidth,\n    biasId, padTop, padRight, padBottom, padLeft, isSamePad,\n    dilationHeight,\n    dilationWidth, strideHeight, strideWidth, inputChannels, outputChannels,\n    fusedActivation,\n    preluActivationWeightsId, leakyreluAlpha || 0, outId);\n\nreturn out;\n}\n\nexport const fusedConv2DConfig:\n    KernelConfig = {\n    kernelName: FusedConv2D,\n    backendName: 'wasm',\n    setupFunc: setup,\n    kernelFunc:\n        fusedConv2d as {} as KernelFunc\n};\n}}
```

Found in path(s):

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```

```
=====\n*\n\nimport { KernelConfig, KernelFunc, Tile, TileAttrs, TileInputs } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { CppDType } from '../types';\n\nlet wasmTile: (xId: number, xShape: Uint8Array, xShapeSize: number, newShape: Uint8Array, newShapeSize: number, dtype: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n    wasmTile = backend.wasm.cwrap(Tile, null /* void */, [\n        'number', // x_id\n        'array', // x_shape\n        'number', // x_shape.length\n        'array', // new_shape\n        'number', // new_shape.length\n        'number' // out_id\n    ]);\n\n    function tile(\n        args: { inputs: TileInputs, backend: BackendWasm, attrs: TileAttrs }) {\n        const { inputs, backend, attrs } = args;\n        const { x } = inputs;\n        const xId = backend.dataIdMap.get(x.dataId).id;\n
```

```

const {reps} = attrs;\n\n const newShape: number[] = new Array(x.shape.length);\n for (let i = 0; i <
newShape.length; i++) {\n  newShape[i] = x.shape[i] * reps[i];\n }\n const xShapeBytes = new Uint8Array(new
Int32Array(x.shape).buffer);\n const newShapeBytes = new Uint8Array(new Int32Array(newShape).buffer);\n\n
const out = backend.makeOutput(newShape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmTile(\n  xId, xShapeBytes, x.shape.length, newShapeBytes, newShape.length,\n  CppDType[out.dtype],
outId);\n return out;\n}\n\nexport const tileConfig: KernelConfig = {\n  kernelName: Tile,\n  backendName:
'wasm',\n  setupFunc: setup,\n  kernelFunc: tile as { } as KernelFunc\n};\n"}

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Found in path(s):

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Tile.js.map

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BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\nimport {Equal, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
'/binary_kernel';\n\nconst supportsFullBroadcast = false;\nexport const equalConfig: KernelConfig =\ncreateBinaryKernelConfig(Equal, supportsFullBroadcast, 'bool');\n"}

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Found in path(s):

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Equal.js.map

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License.\n
* =====
*\nimport {KernelConfig, Ceil} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'/unary_kernel';\n\nexport const ceilConfig: KernelConfig = createUnaryKernelConfig(Ceil);\n"}

```

Found in path(s):

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Ceil.js.map

No license file was found, but licenses were detected in source scan.

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```

```
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```

```
=====\n *\n\nimport './flags_wasm';\nimport {registerBackend} from '@tensorflow/tfjs-core';\nimport {BackendWasm, init} from './backend_wasm';\nexport {BackendWasm, getThreadsCount, setThreadsCount, setWasmPath, setWasmPaths} from './backend_wasm';\nexport {version as version_wasm} from './version';\nconst WASM_PRIORITY = 2;\nregisterBackend('wasm', async () => {\n  const {wasm} = await init();\n  return new BackendWasm(wasm);\n}, WASM_PRIORITY);\n}]
```

Found in path(s):

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/base.js.map

No license file was found, but licenses were detected in source scan.

```
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```
=====\n*\n\nimport {backend_util, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {transpose} from './Transpose';\n\n/**\n * Compute permutation axes and do a transpose if necessary.\n * Used by reduction ops.\n * @param x input TensorInfo\n * @param axis reduction axes\n * @param backend wasm backend instance\n */\nexport function permuteAxesAndTranspose(\n  x: TensorInfo,\n  axis: number|number[], backend: BackendWasm): {\n  transposed: TensorInfo|null,\n  axes: number[],\n  originalAxes: number[],\n  inputWasTransposed: boolean}\n {\n  const xShape = x.shape;\n  const xRank = x.shape.length;\n  const originalAxes = util.parseAxisParam(axis, xShape);\n  let axes = originalAxes;\n  const permutedAxes = backend_util.getAxesPermutation(axes,\n    xRank);\n  let xTransposed = null;\n  let inputWasTransposed = false;\n  if (permutedAxes != null) {\n    const newShape: number[] = new Array(xRank);\n    for (let i = 0; i < newShape.length; i++) {\n      newShape[i] = xShape[permutedAxes[i]];\n    }\n    axes = backend_util.getInnerMostAxes(axes.length, xRank);\n    xTransposed =\n      transpose({inputs: {x}, attrs: {perm: permutedAxes}, backend});\n    const xId =\n      backend.dataIdMap.get(x.dataId).id;\n    const transposedId = backend.dataIdMap.get(xTransposed.dataId).id;\n    if (transposedId !== xId) {\n      inputWasTransposed = true;\n    }\n  }\n  return {transposed: xTransposed,\n    originalAxes, axes, inputWasTransposed};\n}\n\n}}
```

Found in path(s):

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/kernel_utils.js.map

No license file was found, but licenses were detected in source scan.

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```

Found in path(s):

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/LessEqual.js.map

No license file was found, but licenses were detected in source scan.

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limitations under the License.\n *
```

```
=====\n*\n\nimport { KernelConfig, KernelFunc, Prelu, PreluInputs } from '@tensorflow/tfjs-core';\n\nimport
{ BackendWasm } from './backend_wasm';\n\nimport { cast } from './Cast';\n\nlet wasmPrelu: (xId: number,
weightsId: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n  wasmPrelu =
backend.wasm.cwrap(Prelu, null /* void */, [\n    'number', // x_id\n    'number', // weights_id\n    'number' //
out_id\n  ]);\n\n  function prelu(args: { inputs: PreluInputs, backend: BackendWasm }) {\n    const { inputs, backend
} = args;\n    const { x, alpha } = inputs;\n    const xId = backend.dataIdMap.get(x.dataId).id;\n    const weightsId =
backend.dataIdMap.get(alpha.dataId).id;\n\n    let inputId = xId;\n    const input = x;\n    let castedInput = input;\n    if (input.dtype !== 'float32') {\n      castedInput =
cast({ backend, inputs: { x }, attrs: { dtype: 'float32' }});\n      inputId = backend.dataIdMap.get(castedInput.dataId).id;\n    }\n\n    const out = backend.makeOutput(x.shape, 'float32');\n    const outId = backend.dataIdMap.get(out.dataId).id;\n\n    wasmPrelu(inputId, weightsId, outId);\n\n    if (input.dtype !== 'float32') {\n      backend.disposeData(castedInput.dataId);\n    }\n\n    return out;\n  }\n\n  nextexport const preluConfig: KernelConfig = {\n    kernelName: Prelu,\n    backendName: 'wasm',\n    setupFunc: setup,\n    kernelFunc: prelu as {} as KernelFunc\n  };"}\n\n]]
```

Found in path(s):

```
*/opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
wasm/dist/kernels/Prelu.js.map
```

No license file was found, but licenses were detected in source scan.

```
{ "version":3,"file":"SquaredDifference.js","sourceRoot":"","sources":["../../src/kernels/SquaredDifference.ts"],"names":[],"mappings":"AAAA;;;;;;;;;;;GAeG;AACH,OAAO,EAAe,iBAAiB,EAAC,MAAM,uBAAuB,CAAC;AACtE,OAAO,EAAC,wBAAwB,EAAC,MAAM,iBAAiB,CAAC;AACzD,MAAM,qBAAqB,GAAG,IAAI,CAAC;AACnC,MAAM,CAAC,MAAM,uBAAuB,GACHc,wBAAwB,CAAC,iBAAiB,EAAE,qBAAqB,CAAC,CAAC","sourcesContent":["/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the\n * specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\nimport {KernelConfig, SquaredDifference} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from './binary_kernel';\nconst supportsFullBroadcast = true;\nexport const squaredDifferenceConfig: KernelConfig =\n  createBinaryKernelConfig(SquaredDifference, supportsFullBroadcast);\n"]}
```

Found in path(s):

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/SquaredDifference.js.map

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```

```
=====\n*/
```

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***** */

/**

* @deprecated Use `setWasmPaths` instead.
* Sets the path to the `wasm` file which will be fetched when the wasm
* backend is initialized. See
* <https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-wasm/README.md#using-bundlers>
* for more details.
* @param path wasm file path or url
* @param
usePlatformFetch optional boolean to use platform fetch to download
* the wasm file, default to false.
*
* @doc {heading: 'Environment', namespace: 'wasm'}
*/

Found in path(s):

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/tf-backend-wasm.node.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/miniprogram/index.js

No license file was found, but licenses were detected in source scan.

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```
=====\n*\n\nimport {env} from '@tensorflow/tfjs-core';\n\nconst ENV = env();\n\n**\n * True if SIMD is supported.\n *\n// From: https://github.com/GoogleChromeLabs/wasm-feature-detect\nENV.registerFlag(\n // This typed array passed in to WebAssembly.validate is WebAssembly binary\n // code. In this case it is a small program that contains SIMD\n // instructions.\n 'WASM_HAS_SIMD_SUPPORT', async () => WebAssembly.validate(new Uint8Array([\n 0, 97, 115, 109, 1, 0, 0, 0, 1, 4, 1, 96, 0, 0, 3,\n 2, 1, 0, 10, 9, 1, 7, 0, 65, 0, 253, 15, 26, 11\n ]));\n\n**\n * True if threads are supported.\n *\n// From: https://github.com/GoogleChromeLabs/wasm-feature-detect\nENV.registerFlag('WASM_HAS_MULTITHREAD_SUPPORT',\n async () => {\n // TODO(annxingyuan): Enable node support once this is resolved:\n // https://github.com/tensorflow/tfjs/issues/3830\n if (ENV.get('IS_NODE')) {\n return false;\n }\n\n try {\n // Test for transferability of SABs (needed for Firefox)\n // https://groups.google.com/forum#!msg/mozilla.dev.platform/IHkBZIHETpA/dwsMNchWEQAJ\n new MessageChannel().port1.postMessage(new SharedArrayBuffer(1));\n // This typed array is a WebAssembly program containing threaded\n // instructions.\n return WebAssembly.validate(new Uint8Array([\n 0, 97, 115, 109, 1, 0, 0, 0, 1, 4, 1, 96, 0, 0, 3, 2, 1, 0, 5,\n 4, 1, 3, 1, 1, 10, 11, 1, 9, 0, 65, 0, 254, 16, 2, 0, 26, 11\n ]));\n } catch (e) {\n return false;\n }\n});\n\n"]}
```

Found in path(s):

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/flags_wasm.js.map

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```
=====\n*\n\nimport { backend_util, Conv2DBackpropInput, Conv2DBackpropInputAttrs, Conv2DBackpropInputInputs,  
KernelConfig, KernelFunc, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from  
'./backend_wasm';\n\nlet wasmConv2DBackpropInput: (\n  dyId: number, filterId: number, batchSize: number,  
filterHeight: number,\n  filterWidth: number, inHeight: number, inWidth: number, inChannels: number,\n  outHeight: number, outWidth: number, outChannels: number,\n  strideHeight: number, strideWidth: number,  
topPad: number, leftPad: number,\n  fltS0: number, fltS1: number, fltS2: number, xBatchStride: number,\n  xRowStride: number, xColStride: number, xChannelStride: number,\n  yBatchStride: number, yRowStride:  
number, yColStride: number,\n  yChannelStride: number, outId: number) => void;\n\nfunction setup(backend:  
BackendWasm): void {\n  wasmConv2DBackpropInput = backend.wasm.cwrap(Conv2DBackpropInput, null, [\n    'number', // dyId\n    'number', // filterId\n    'number', // batchSize\n    'number', // filterHeight\n    'number', //
```


filterWidth\n

```
'number', // inHeight\n 'number', // inWidth\n 'number', // inChannels\n 'number', // outHeight\n 'number', // outWidth\n 'number', // outChannels\n 'number', // strideHeight\n 'number', // strideWidth\n 'number', // topPad\n 'number', // leftPad\n 'number', // fltS0\n 'number', // fltS1\n 'number', // fltS2\n 'number', // xBatchStride\n 'number', // xRowStride\n 'number', // xColStride\n 'number', // xChannelStride\n 'number', // yBatchStride\n 'number', // yRowStride\n 'number', // yColStride\n 'number', // yChannelStride\n 'number', // outId\n ]);\n\nfunction conv2DBackpropInput(args: {\n backend: BackendWasm,\n inputs: Conv2DBackpropInputInputs,\n attrs: Conv2DBackpropInputAttrs\n}): TensorInfo {\n const {backend, inputs, attrs} = args;\n const {dy, filter} = inputs;\n const {strides, pad, dataFormat, dimRoundingMode, inputShape} = attrs;\n\n const dilations = 1;\n\n const $dataFormat = backend_util.convertConv2DDataFormat(dataFormat);\n\n const convInfo = backend_util.computeConv2DInfo(\n inputShape, filter.shape as [number, number, number, number], strides,\n dilations, pad, dimRoundingMode, false /* depthwise */, $dataFormat);\n\n const {\n batchSize,\n filterHeight,\n filterWidth,\n inChannels,\n inHeight,\n inWidth,\n outChannels,\n outHeight,\n outWidth,\n strideHeight,\n strideWidth\n } = convInfo;\n\n const topPad = filterHeight - 1 - convInfo.padInfo.top;\n const leftPad = filterWidth - 1 - convInfo.padInfo.left;\n\n const isChannelsLast = convInfo.dataFormat === 'channelsLast';\n const dxStrides = util.computeStrides(convInfo.inShape);\n const dyStrides = util.computeStrides(dy.shape);\n const [fltS0, fltS1, fltS2] = util.computeStrides(filter.shape);\n const xBatchStride = dxStrides[0];\n const xRowStride = isChannelsLast ? dxStrides[1] : dxStrides[2];\n const xColStride = isChannelsLast ? dxStrides[2] : 1;\n const xChannelStride = isChannelsLast ? 1 : dxStrides[1];\n const yBatchStride = dyStrides[0];\n const yRowStride = isChannelsLast ? dyStrides[1] : dyStrides[2];\n const yColStride = isChannelsLast ? dyStrides[2] : 1;\n const yChannelStride = isChannelsLast ? 1 : dyStrides[1];\n\n const out = backend.makeOutput(convInfo.inShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n const dyId = backend.dataIdMap.get(dy.dataId).id;\n const filterId = backend.dataIdMap.get(filter.dataId).id;\n\n wasmConv2DBackpropInput(\n dyId, filterId, batchSize, filterHeight, filterWidth, inHeight, inWidth,\n inChannels, outHeight, outWidth, outChannels, strideHeight, strideWidth,\n topPad, leftPad, fltS0, fltS1, fltS2, xBatchStride, xRowStride,\n xColStride, xChannelStride, yBatchStride, yRowStride, yColStride,\n yChannelStride, outId);\n\n return out;\n}\n\nexport const conv2DBackpropInputConfig: KernelConfig = {\n kernelName: Conv2DBackpropInput,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: conv2DBackpropInput as {} as KernelFunc\n};\n\n}}
```

Found in path(s):

```
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Conv2DBackpropInput.js.map
```

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```

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* =====
*/

Found in path(s):

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/kernel_utils.js

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/kernel_utils.d.ts

*

/opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/kernel_utils.ts

1.188 @tensorflow/tfjs-backend-webgl 3.11.0

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1.189 @tensorflow/tfjs-backend-cpu 3.11.0

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```

1.190 @tensorflow-models/body-pix 2.2

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 */

```

Found in path(s):

```

* /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/body-pix.min.js
* /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/body-pix.esm.js

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*/

Found in path(s):

- * /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/keypoints.d.ts
- * /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/multi_person/decode_pose.d.ts
- *
- /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/version_test.js
- * /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/blur.js
- * /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/decode_part_map.d.ts
- * /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/multi_person/util.d.ts
- * /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/setup_test.js
- * /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/version_test.d.ts
- * /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/multi_person/util.js
- * /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/single_person/decode_single_pose.d.ts
- *
- /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/multi_person/build_part_with_score_queue.d.ts
- * /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/setup_test.d.ts
- * /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/single_person/argmax2d.js
- * /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/single_person/util.js
- * /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/output_rendering_util.js
- * /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/single_person/util.d.ts
- * /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/single_person/argmax2d.d.ts
- * /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/output_rendering_util.d.ts
- *

```

/opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-
pix/dist/multi_person/build_part_with_score_queue.js
* /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-
pix/dist/multi_person/decode_pose.js
* /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-
pix/dist/blur.d.ts
* /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-
pix/dist/keypoints.js
* /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-
pix/dist/decode_part_map.js
* /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-
pix/run_tests.ts
* /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-
pix/dist/single_person/decode_single_pose.js

```

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```

{"version":3,"file":"body-
pix.min.js","sources":["../src/decode_part_map.ts","../src/base_model.ts","../src/mobilenet.ts","../src/keypoints.ts","..
../src/multi_person/util.ts","../src/multi_person/decode_multiple_masks_cpu.ts","../src/multi_person/decode_multiple
_masks_webgl.ts","../src/multi_person/decode_instance_masks.ts","../src/multi_person/max_heap.ts","../src/multi_p
erson/build_part_with_score_queue.ts","../src/multi_person/decode_pose.ts","../src/multi_person/decode_multiple_p
oses.ts","../src/resnet.ts","../src/saved_models.ts","../src/util.ts","../src/body_pix_model.ts","../src/output_rendering_
util.ts","../src/blur.ts","../src/part_channels.ts","../src/version.ts"],"sourcesContent":["/**\n * @license\n * Copyright
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=====
\n
*/\n\nimport * as tf from '@tensorflow/tfjs-core';\n\n/**\n * Takes the sigmoid of the part heatmap output and
generates a 2d one-hot\n * tensor with ones where the part's score has the maximum value.\n * @param
partHeatmapScores\n * \nfunction toFlattenedOneHotPartMap(partHeatmapScores: tf.Tensor3D): tf.Tensor2D {\n
const numParts = partHeatmapScores.shape[2];\n const partMapLocations = tf.argmax(partHeatmapScores, 2);\n
const partMapFlattened = tf.reshape(partMapLocations, [-1]);\n\n return tf.oneHot(partMapFlattened,\n
numParts) as tf.Tensor2D;\n}\n\nfunction clipByMask2d(image: tf.Tensor2D, mask: tf.Tensor2D): tf.Tensor2D {\n
return tf.mul(image, mask);\n}\n\n/**\n * Takes the sigmoid of the segmentation output, and generates a
segmentation\n * mask with a 1 or 0 at each pixel where there is a person or not a person. The\n * segmentation
threshold determines the threshold of a score for a pixel for it\n * to be considered part of a person.\n * @param
segmentScores A 3d-tensor of the sigmoid of the segmentation output.\n * @param segmentationThreshold The
minimum that segmentation values must have\n * to be considered part of the person. Affects the generation of
the\n * segmentation mask and the clipping of the colored part image.\n * @returns A segmentation mask with a
1 or 0 at each pixel where there is a\n * person or not a person.\n */\n\nexport function toMaskTensor(\n
segmentScores: tf.Tensor2D, threshold: number): tf.Tensor2D {\n return tf.tidy(\n () =>\n
(tf.cast(tf.greater(\n segmentScores, tf.scalar(threshold)), 'int32') as tf.Tensor2D));\n}\n\n/**\n *
Takes the sigmoid of the person and part map output, and returns a 2d tensor\n * of an image with the corresponding
value at each pixel corresponding to the\n * part with the highest value. These part ids are clipped by the
segmentation\n * mask. Wherever the a pixel is clipped by the segmentation mask, its value\n * will set to -1,

```

indicating that there is no part in that pixel.

- @param segmentScores A 3d-tensor of the sigmoid of the segmentation output.
- @param partHeatmapScores A 3d-tensor of the sigmoid of the part heatmap

output.

The third dimension corresponds to the part.

- @returns A 2d tensor of an image with the corresponding value at each pixel
- corresponding to the part with the highest value. These part ids are clipped
- by the segmentation mask. It will have values of -1 for pixels that are
- outside of the body and do not have a corresponding part.

```

export function decodePartSegmentation(
  segmentationMask: tf.Tensor2D,
  partHeatmapScores: tf.Tensor3D): tf.Tensor2D {
  const [partMapHeight, partMapWidth, numParts] =
    partHeatmapScores.shape;
  return tf.tidy(() => {
    const flattenedMap =
      toFlattenedOneHotPartMap(partHeatmapScores);
    const partNumbers = tf.expandDims(tf.range(0, numParts, 1,
      'int32'), 1);
    const partMapFlattened =
      tf.cast(tf.matmul(flattenedMap, partNumbers as tf.Tensor2D),
        'int32');
    const partMap = tf.reshape(partMapFlattened, [partMapHeight, partMapWidth]);
    const partMapShiftedUpForClipping = tf.add(partMap, tf.scalar(1, 'int32'));
    return tf.sub(clipByMask2d(
      partMapShiftedUpForClipping as tf.Tensor2D, segmentationMask)
      , tf.scalar(1, 'int32'));
  });
}

export function decodeOnlyPartSegmentation(partHeatmapScores: tf.Tensor3D):
  tf.Tensor2D {
  const [partMapHeight, partMapWidth, numParts] = partHeatmapScores.shape;
  return tf.tidy(() => {
    const flattenedMap = toFlattenedOneHotPartMap(partHeatmapScores);
    const partNumbers = tf.expandDims(tf.range(0, numParts, 1, 'int32'), 1);
    const partMapFlattened =
      tf.cast(tf.matmul(flattenedMap, partNumbers as tf.Tensor2D), 'int32');
    return tf.reshape(partMapFlattened, [partMapHeight, partMapWidth]);
  });
}

```

====

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```

import * as tfconv from '@tensorflow/tfjs-converter';
import * as tf from '@tensorflow/tfjs-core';
import {BodyPixOutputStride} from './types';

/**
 * BodyPix supports using various convolution neural network
 * models (e.g. ResNet and MobileNetV1) as its underlying base model.
 * The following BaseModel interface defines a unified interface for
 * creating such BodyPix base models. Currently both MobileNet (in
 * ./mobilenet.ts) and ResNet (in ./resnet.ts) implements the BaseModel
 * interface. New base models that conform to the BaseModel interface
 * can be added to BodyPix.
 */
export abstract class BaseModel {
  constructor(
    protected readonly model: tfconv.GraphModel,
    public readonly outputStride: BodyPixOutputStride) {
    const inputShape =
      this.model.inputs[0].shape as [number, number, number, number];
    tf.util.assert(
      (inputShape[1] === -1) && (inputShape[2] === -1),
      () => `Input shape [${inputShape[1]},
        ${inputShape[2]}] ` +
      `must both be equal to or -1`);
  }

  abstract preprocessInput(input: tf.Tensor3D):
    tf.Tensor3D;

  /**
   * Predicts intermediate Tensor representations.
   * @param input The input RGB image of the base model.
   * A Tensor of shape: [inputResolution, inputResolution, 3].
   * @return A dictionary of base model's intermediate predictions.
   * The returned dictionary should contains the following elements:
   * - heatmapScores: A Tensor3D that represents the keypoint heatmap scores.
   * - offsets: A Tensor3D that represents the offsets.
   * - displacementFwd: A Tensor3D that represents the forward displacement.
   * - displacementBwd: A Tensor3D that represents the backward displacement.
   * - segmentation: A Tensor3D that represents the segmentation of all
   * people.
   * - longOffsets: A Tensor3D that represents the long offsets used for
   * instance grouping.
   * - partHeatmaps: A Tensor3D that represents the body part segmentation.
   */
  predict(input: tf.Tensor3D): {
    heatmapScores: tf.Tensor3D,
    offsets: tf.Tensor3D,
    displacementFwd: tf.Tensor3D,
    displacementBwd: tf.Tensor3D,
    segmentation: tf.Tensor3D,
    partHeatmaps: tf.Tensor3D,
    longOffsets: tf.Tensor3D,
    partOffsets: tf.Tensor3D
  }
}

```

```

return tf.tidy(() => {\n  const asFloat = this.preprocessInput(tf.cast(input, 'float32'));\n  const asBatch =
tf.expandDims(asFloat, 0);\n  const results = this.model.predict(asBatch) as tf.Tensor4D[];\n  const results3d:
tf.Tensor3D[] = results.map(y => tf.squeeze(y, [0]));\n  const namedResults =
this.nameOutputResults(results3d);\n\n  return {\n    heatmapScores: tf.sigmoid(namedResults.heatmap),\n    offsets: namedResults.offsets,\n    displacementFwd: namedResults.displacementFwd,\n    displacementBwd:
namedResults.displacementBwd,\n    segmentation: namedResults.segmentation,\n    partHeatmaps:
namedResults.partHeatmaps,\n    longOffsets: namedResults.longOffsets,\n    partOffsets:
namedResults.partOffsets\n  };\n });\n }\n\n // Because MobileNet and ResNet predict() methods output a
different order for\n // these values, we have a method that needs to be implemented to order them.\n abstract
nameOutputResults(results: tf.Tensor3D[]): {\n  heatmap: tf.Tensor3D,\n  offsets: tf.Tensor3D,\n
displacementFwd: tf.Tensor3D,\n  displacementBwd: tf.Tensor3D,\n  segmentation: tf.Tensor3D,\n
partHeatmaps: tf.Tensor3D,\n  longOffsets: tf.Tensor3D,\n  partOffsets: tf.Tensor3D\n };\n\n /**\n * Releases
the CPU and GPU memory allocated by the model.\n */\n dispose() {\n  this.model.dispose();\n }\n}\n",/**\n *
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=====
*\n\nimport * as tf from '@tensorflow/tfjs-core';\nimport { BaseModel } from './base_model';\n\nexport class
MobileNet extends BaseModel {\n  preprocessInput(input: tf.Tensor3D): tf.Tensor3D {\n    // Normalize the pixels
[0, 255] to be between [-1, 1].\n    return tf.tidy(() => tf.sub(tf.div(input, 127.5), 1.0));\n  }\n\n  nameOutputResults(results: tf.Tensor3D[]) {\n    const [\n      offsets,\n      segmentation,\n      partHeatmaps,\n      longOffsets,\n      heatmap,\n      displacementFwd,\n      displacementBwd,\n      partOffsets,\n      ] = results;\n    return {\n      offsets,\n      segmentation,\n      partHeatmaps,\n      longOffsets,\n      heatmap,\n      displacementFwd,\n      displacementBwd,\n      partOffsets\n    };\n  }\n}\n",/**\n *
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=====
*\n\nexport type Tuple<T> = [T, T];\nexport type StringTuple = Tuple<string>;\nexport type NumberTuple =
Tuple<number>;\n\nexport const PART_NAMES = [\n  'nose', 'leftEye', 'rightEye', 'leftEar', 'rightEar',
'leftShoulder',\n  'rightShoulder', 'leftElbow', 'rightElbow', 'leftWrist', 'rightWrist',\n  'leftHip', 'rightHip', 'leftKnee',
'rightKnee', 'leftAnkle', 'rightAnkle'\n];\n\nexport const NUM_KEYPOINTS = PART_NAMES.length;\n\nexport
interface NumberDict {\n  [jointName: string]: number;\n}\n\nexport const PART_IDS =\nPART_NAMES.reduce((result: NumberDict, jointName, i): NumberDict => {\n  result[jointName] = i;\n  return result;\n }, {});\n\nconst CONNECTED_PART_NAMES: StringTuple[] = [\n  ['leftHip', 'leftShoulder'],
['leftElbow', 'leftShoulder'],\n  ['leftElbow', 'leftWrist'], ['leftHip', 'leftKnee'],\n  ['leftKnee', 'leftAnkle'], ['rightHip',
'rightShoulder'],\n  ['rightElbow', 'rightShoulder'], ['rightElbow',
'rightWrist'],\n  ['rightHip', 'rightKnee'], ['rightKnee', 'rightAnkle'],\n  ['leftShoulder', 'rightShoulder'], ['leftHip',
'rightHip']\n];\n\n/**\n * Define the skeleton. This defines the parent->child relationships of our\n * tree. Arbitrarily
this defines the nose as the root of the tree, however\n * since we will infer the displacement for both parent->child
and\n * child->parent, we can define the tree root as any node.\n */\nexport const POSE_CHAIN: StringTuple[] =

```

```

[\n ['nose', 'leftEye'], ['leftEye', 'leftEar'], ['nose', 'rightEye'],\n ['rightEye', 'rightEar'], ['nose', 'leftShoulder'],\n ['leftShoulder', 'leftElbow'], ['leftElbow', 'leftWrist'],\n ['leftShoulder', 'leftHip'], ['leftHip', 'leftKnee'],\n ['leftKnee', 'leftAnkle'], ['nose', 'rightShoulder'],\n ['rightShoulder', 'rightElbow'], ['rightElbow', 'rightWrist'],\n ['rightShoulder', 'rightHip'], ['rightHip', 'rightKnee'],\n ['rightKnee', 'rightAnkle']]\n];\n\nexport const
CONNECTED_PART_INDICES = CONNECTED_PART_NAMES.map(\n
  ([jointNameA, jointNameB]) =>\n    ([PART_IDS[jointNameA], PART_IDS[jointNameB]]);\n)", "/**\n *
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law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {NUM_KEYPOINTS} from './keypoints';\nimport {Padding, Part, TensorBuffer3D, Vector2D} from
'./types';\n\nexport function getScale(\n  [height, width]: [number,
number],\n  [inputResolutionY, inputResolutionX]: [number, number],\n  padding: Padding): [number, number]
{\n  const {top: padT, bottom: padB, left: padL, right: padR} = padding;\n  const scaleY = inputResolutionY / (padT
+ padB + height);\n  const scaleX = inputResolutionX / (padL + padR + width);\n  return [scaleX,
scaleY];\n}\n\nexport function getOffsetPoint(\n  y: number, x: number, keypoint: number, offsets:
TensorBuffer3D): Vector2D {\n  return {\n    y: offsets.get(y, x, keypoint),\n    x: offsets.get(y, x, keypoint +
NUM_KEYPOINTS)\n  };\n}\n\nexport function getImageCoords(\n  part: Part, outputStride: number, offsets:
TensorBuffer3D): Vector2D {\n  const {heatmapY, heatmapX, id: keypoint} = part;\n  const {y, x} =
getOffsetPoint(heatmapY, heatmapX, keypoint, offsets);\n  return {\n    x: part.heatmapX * outputStride + x,\n    y:
part.heatmapY * outputStride + y\n  };\n}\n\nexport function fillArray<T>(element: T, size: number): T[] {\n  const
result: T[] = new Array(size);\n\n  for (let i = 0; i < size; i++) {\n    result[i] = element;\n  }\n\n  return result;\n}\n\nexport function clamp(a: number,
min: number, max: number): number {\n  if (a < min) {\n    return min;\n  }\n  if (a > max) {\n    return max;\n  }\n
return a;\n}\n\nexport function squaredDistance(\n  y1: number, x1: number, y2: number, x2: number): number {\n
const dy = y2 - y1;\n  const dx = x2 - x1;\n  return dy * dy + dx * dx;\n}\n\nexport function addVectors(a:
Vector2D, b: Vector2D): Vector2D {\n  return {x: a.x + b.x, y: a.y + b.y};\n}\n\nexport function clampVector(a:
Vector2D, min: number, max: number): Vector2D {\n  return {y: clamp(a.y, min, max), x: clamp(a.x, min,
max)};\n}\n)", "/**\n * @license\n * Copyright 2019 Google Inc. All Rights Reserved.\n * Licensed under the
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distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *
=====
*\n\nimport {NUM_KEYPOINTS} from './keypoints';\nimport {Padding, Pose} from './types';\n\nimport
{getScale} from './util';\n\ninterface Pair {\n  x: number;\n  y: number;\n}\n\nfunction computeDistance(embedding:
Pair[], pose: Pose, minPartScore = 0.3) {\n  let distance = 0.0;\n  let numKpt = 0;\n  for (let p = 0; p <
embedding.length; p++) {\n    if (pose.keypoints[p].score > minPartScore) {\n      numKpt += 1;\n      distance +=
(embedding[p].x - pose.keypoints[p].position.x) ** 2 +\n        (embedding[p].y - pose.keypoints[p].position.y) **
2;\n    }\n  }\n\n  if (numKpt === 0) {\n    distance = Infinity;\n  } else {\n    distance = distance / numKpt;\n  }\n  return
distance;\n}\n\nfunction convertToPositionInOutput(\n  position: Pair, [padT, padL]: [number, number],\n  [scaleX, scaleY]: [number, number], stride: number): Pair {\n  const y = Math.round((((padT + position.y + 1.0) *

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scaleY - 1.0) / stride);\n const x = Math.round(((padL + position.x + 1.0) * scaleX - 1.0) / stride);\n return {x,\n y};\n}\n\nfunction getEmbedding(\n  location: Pair, keypointIndex: number,\n  convertToPosition: (pair: Pair) =>\n  Pair, outputResolutionX: number,\n  longOffsets: Float32Array, refineSteps: number,\n  [height, width]: [number,\n number]): Pair {\n  const newLocation = convertToPosition(location);\n  const nn = newLocation.y * \n  outputResolutionX + newLocation.x;\n  let dy = longOffsets[NUM_KEYPOINTS * (2 * nn) + keypointIndex];\n  let dx = longOffsets[NUM_KEYPOINTS * (2 * nn + 1) + keypointIndex];\n  let y = location.y + dy;\n  let x = \n  location.x\n  + dx;\n  for (let t = 0; t < refineSteps; t++) {\n    y = Math.min(y, height - 1);\n    x = Math.min(x, width - 1);\n    const newPos = convertToPosition({x, y});\n    const nn = newPos.y * outputResolutionX + newPos.x;\n    dy = \n    longOffsets[NUM_KEYPOINTS * (2 * nn) + keypointIndex];\n    dx = longOffsets[NUM_KEYPOINTS * (2 * nn\n    + 1) + keypointIndex];\n    y = y + dy;\n    x = x + dx;\n  }\n  return {x, y};\n}\n\nfunction\n  matchEmbeddingToInstance(\n  location: Pair, longOffsets: Float32Array, poses: Pose[],\n  numKptForMatching:\n number, [padT, padL]: [number, number],\n  [scaleX, scaleY]: [number, number], outputResolutionX: number,\n  [height, width]: [number, number], stride: number,\n  refineSteps: number): number {\n  const embed: Pair[] = [];\n  const convertToPosition = (pair: Pair) =>\n  convertToPositionInOuput(pair, [padT, padL], [scaleX, scaleY],\n  stride);\n  for (let keypointsIndex = 0; keypointsIndex < numKptForMatching;\n  keypointsIndex++) {\n    const embedding = getEmbedding(\n      location, keypointsIndex, convertToPosition, outputResolutionX,\n      longOffsets, refineSteps, [height, width]);\n    embed.push(embedding);\n  }\n  let kMin = -1;\n  let kMinDist = \n  Infinity;\n  for (let k = 0; k < poses.length; k++) {\n    const dist = computeDistance(embed, poses[k]);\n    if (dist < \n    kMinDist) {\n      kMin = k;\n      kMinDist = dist;\n    }\n  }\n  return kMin;\n}\n\nfunction getOutputResolution(\n  [inputResolutionY, inputResolutionX]: [number, number],\n  stride: number): [number, number] {\n  const \n  outputResolutionX = Math.round((inputResolutionX - 1.0) / stride + 1.0);\n  const outputResolutionY = \n  Math.round((inputResolutionY - 1.0) / stride + 1.0);\n  return [outputResolutionX, outputResolutionY];\n}\n\nexport\n  function decodeMultipleMasksCPU(\n  segmentation: Uint8Array, longOffsets: Float32Array,\n  posesAboveScore: Pose[], height: number, width: number, stride: number,\n  [inHeight, inWidth]: [number,\n number], padding: Padding,\n  refineSteps: number, numKptForMatching = 5): Uint8Array[] {\n  const dataArray = \n  posesAboveScore.map(x => new Uint8Array(height * width).fill(0));\n  const {top: padT, left: padL} = \n  padding;\n  const [scaleX, scaleY] =\n  getScale([height, width], [inHeight, inWidth], padding);\n  const \n  [outputResolutionX, ] =\n  getOutputResolution([inHeight, inWidth], stride);\n  for (let i = 0; i < height; i += 1) {\n    for (let j = 0; j < width; j += 1) {\n      const n = i * width + j;\n      const prob = segmentation[n];\n      if (prob === \n      1) {\n        const kMin = matchEmbeddingToInstance(\n          {x: j, y: i}, longOffsets, posesAboveScore,\n          numKptForMatching,\n          [padT, padL], [scaleX, scaleY], outputResolutionX, [height, width],\n          stride,\n          refineSteps);\n        if (kMin >= 0) {\n          dataArray[kMin][n] = 1;\n        }\n      }\n    }\n  }\n  return \n  dataArray;\n}\n\nexport function decodeMultiplePartMasksCPU(\n  segmentation: Uint8Array, longOffsets: Float32Array,\n  partSegmentaion: Uint8Array, posesAboveScore:\n  Pose[], height: number,\n  width: number, stride: number, [inHeight, inWidth]: [number, number],\n  padding:\n  Padding, refineSteps: number,\n  numKptForMatching = 5): Int32Array[] {\n  const dataArray =\n  posesAboveScore.map(x => new Int32Array(height * width).fill(-1));\n  const {top: padT, left: padL} = \n  padding;\n  const [scaleX, scaleY] =\n  getScale([height, width], [inHeight, inWidth], padding);\n  const \n  [outputResolutionX, ] =\n  getOutputResolution([inHeight, inWidth], stride);\n  for (let i = 0; i < height; i += 1) \n  {\n    for (let j = 0; j < width; j += 1) {\n      const n = i * width + j;\n      const prob = segmentation[n];\n      if (prob \n      === 1) {\n        const kMin = matchEmbeddingToInstance(\n          {x: j, y: i}, longOffsets, posesAboveScore,\n          numKptForMatching,\n          [padT, padL], [scaleX, scaleY], outputResolutionX, [height,\n          width],\n          stride, refineSteps);\n        if (kMin >= 0) {\n          dataArray[kMin][n] = partSegmentaion[n];\n        }\n      }\n    }\n  }\n  return dataArray;\n}\n\n"/**\n * @license\n * Copyright 2019 Google Inc. 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*\n\nimport * as tf from '@tensorflow/tfjs-core';\nimport * as tf_webgl from '@tensorflow/tfjs-backend-webgl';\nimport {NUM_KEYPOINTS} from './keypoints';\nimport {Padding, Pose} from './types';\nimport {getScale} from './util';\n\nexport function decodeMultipleMasksWebGl(\n  segmentation: tf.Tensor2D, longOffsets: tf.Tensor3D,\n  posesAboveScore: Pose[], height: number, width: number, stride: number,\n  [inHeight, inWidth]: [number, number], padding: Padding,\n  refineSteps: number, minKptScore: number,\n  maxNumPeople: number):\n  tf.TensorInfo {\n  // The height/width of the image/canvas itself.\n  const [origHeight, origWidth] = segmentation.shape;\n  // The height/width of the output of the model.\n  const [outHeight, outWidth] = longOffsets.shape.slice(0, 2);\n  const shapedLongOffsets: tf.Tensor4D =\n    tf.reshape(longOffsets, [outHeight, outWidth, 2, NUM_KEYPOINTS]);\n  // Make pose tensor of shape [MAX_NUM_PEOPLE, NUM_KEYPOINTS, 3] where\n  // the last 3 coordinates correspond to the score, h and w coordinate of that\n  // keypoint.\n  const poseVals =\n    = new Float32Array(maxNumPeople * NUM_KEYPOINTS * 3).fill(0.0);\n  for (let i = 0; i < posesAboveScore.length; i++) {\n    const poseOffset = i * NUM_KEYPOINTS * 3;\n    const pose = posesAboveScore[i];\n    for (let kp = 0; kp < NUM_KEYPOINTS; kp++) {\n      const keypoint = pose.keypoints[kp];\n      const offset = poseOffset + kp * 3;\n      poseVals[offset] = keypoint.score;\n      poseVals[offset + 1] = keypoint.position.y;\n      poseVals[offset + 2] = keypoint.position.x;\n    }\n  }\n  const [scaleX, scaleY] =\n    getScale([height, width], [inHeight, inWidth], padding);\n  const posesTensor =\n    tf.tensor(poseVals, [maxNumPeople, NUM_KEYPOINTS, 3]);\n  const {top: padT, left: padL} = padding;\n  const program: tf_webgl.GPGPUProgram = {\n    variableNames: ['segmentation', 'longOffsets', 'poses'],\n    outputShape: [origHeight, origWidth],\n    userCode: `\n    int convertToPositionInOut(int pos, int pad, float\n    scale, int stride) {\n      return round(((float(pos +\n      pad) + 1.0) * scale - 1.0) / float(stride));\n    }\n\n    float convertToPositionInOutFloat(\n      int pos, int pad,\n      float scale, int stride) {\n      return ((float(pos + pad) + 1.0) * scale - 1.0) / float(stride);\n    }\n\n    float dist(float\n    x1, float y1, float x2, float y2) {\n      return pow(x1 - x2, 2.0) + pow(y1 - y2, 2.0);\n    }\n\n    float\n    sampleLongOffsets(float h, float w, int d, int k) {\n      float fh = fract(h);\n      float fw = fract(w);\n      int clH =\n      int(ceil(h));\n      int clW = int(ceil(w));\n      int flH = int(floor(h));\n      int flW = int(floor(w));\n      float o11 =\n      getLongOffsets(flH, flW, d, k);\n      float o12 = getLongOffsets(flH, clW, d, k);\n      float o21 =\n      getLongOffsets(clH, flW, d, k);\n      float o22 = getLongOffsets(clH, clW, d, k);\n      float o1 = mix(o11, o12,\n      fw);\n      float o2 = mix(o21, o22, fw);\n      return mix(o1, o2, fh);\n    }\n\n    int findNearestPose(int h, int w) {\n      float prob = getSegmentation(h, w);\n      if (prob < 1.0) {\n        return -1;\n      }\n      // Done(Tyler): convert from output space h/w to strided space.\n      float stridedH = convertToPositionInOutFloat(\n        h, ${padT}, ${scaleY}, ${stride});\n      float stridedW =\n      convertToPositionInOutFloat(\n        w, ${padL}, ${scaleX}, ${stride});\n      float minDist = 1000000.0;\n      int iMin = -1;\n      for (int i = 0; i < ${maxNumPeople}; i++) {\n        float curDistSum = 0.0;\n        int numKpt =\n        0;\n        for (int k = 0; k < ${NUM_KEYPOINTS}; k++) {\n          float dy = sampleLongOffsets(stridedH,\n          stridedW, 0, k);\n          float dx = sampleLongOffsets(stridedH, stridedW, 1, k);\n          float y = float(h) + dy;\n          float x = float(w) + dx;\n          for (int s = 0; s < ${refineSteps}; s++) {\n            int yRounded = round(min(y,\n            float(${height} - 1.0)));\n            int xRounded = round(min(x, float(${width} - 1.0)));\n            float yStrided =\n            convertToPositionInOutFloat(\n              yRounded, ${padT}, ${scaleY}, ${stride});\n            float xStrided = convertToPositionInOutFloat(\n              xRounded, ${padL}, ${scaleX}, ${stride});\n            float dy = sampleLongOffsets(yStrided, xStrided, 0,\n            k);\n            float dx = sampleLongOffsets(yStrided, xStrided, 1, k);\n            y = y + dy;\n            x = x + dx;\n          }\n          float poseScore = getPoses(i, k, 0);\n          float poseY = getPoses(i, k, 1);\n          float poseX =
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getPoses(i, k, 2);\n      if (poseScore > ${minKptScore}) {\n          numKpt = numKpt + 1;\n          curDistSum
= curDistSum + dist(x, y, poseX, poseY);\n      }\n      }\n      if (numKpt > 0 && curDistSum / float(numKpt) <
minDist) {\n          minDist = curDistSum / float(numKpt);\n          iMin = i;\n      }\n      }\n      return iMin;\n  }\n\n  void main() {\n      ivec2 coords = getOutputCoords();\n      int nearestPose = findNearestPose(coords[0],
coords[1]);\n      setOutput(float(nearestPose));\n      }\n  }\n  }\n  const webglBackend = tf.backend() as
tf_webgl.MathBackendWebGL;\n  return webglBackend.compileAndRun(\n      program, [segmentation,
shapedLongOffsets, posesTensor]);\n  }\n  }\n  ", /**\n * @license\n * Copyright 2019 Google Inc. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport * as tf from '@tensorflow/tfjs-core';\nimport
{getBackend} from '@tensorflow/tfjs-core';\nimport {Padding, PartSegmentation, PersonSegmentation, Pose}
from './types';\nimport {decodeMultipleMasksCPU, decodeMultiplePartMasksCPU} from
'./decode_multiple_masks_cpu';\nimport {decodeMultipleMasksWebGl} from
'./decode_multiple_masks_webgl';\n\nexport function toPersonKSegmentation(\n  segmentation: tf.Tensor2D, k:
number): tf.Tensor2D {\n  return tf.tidy(\n    () => (tf.cast(tf.equal(\n      segmentation, tf.scalar(k)), 'int32') as
tf.Tensor2D));\n  }\n}\n\nexport function toPersonKPartSegmentation(\n  segmentation: tf.Tensor2D, bodyParts:
tf.Tensor2D, k: number): tf.Tensor2D {\n  return tf.tidy(\n    () => tf.sub(tf.mul(tf.cast(tf.equal(\n      segmentation,
tf.scalar(k)), 'int32'), tf.add(bodyParts, 1)), 1));\n  }\n}\n\nfunction isWebGLBackend() {\n  return
getBackend() === 'webgl';\n}\n\nexport async function decodePersonInstanceMasks(\n  segmentation:
tf.Tensor2D, longOffsets: tf.Tensor3D, poses:
Pose[],\n  height: number, width: number, stride: number,\n  [inHeight, inWidth]: [number, number], padding:
Padding,\n  minPoseScore = 0.2,\n  refineSteps = 8, minKeypointScore = 0.3,\n  maxNumPeople = 10): Promise<PersonSegmentation[]> {\n  // Filter out poses with smaller score.\n  const posesAboveScore =
poses.filter(pose => pose.score >= minPoseScore);\n  let personSegmentationsData: Uint8Array[];\n  if
(isWebGLBackend()) {\n    const personSegmentations = tf.tidy(() => {\n      const masksTensorInfo =
decodeMultipleMasksWebGl(\n        segmentation, longOffsets, posesAboveScore, height, width, stride,\n        [inHeight, inWidth], padding, refineSteps, minKeypointScore,\n        maxNumPeople);\n      const masksTensor =
tf.engine().makeTensorFromDataId(\n        masksTensorInfo.dataId, masksTensorInfo.shape,\n        masksTensorInfo.dtype) as tf.Tensor2D;\n      return posesAboveScore.map(\n        (_, k) =>
toPersonKSegmentation(masksTensor, k));\n    });\n  }\n  personSegmentationsData =\n    (await Promise.all(personSegmentations.map(mask => mask.data())) as\n  Uint8Array[]);\n  personSegmentations.forEach(x => x.dispose());\n  } else {\n    const segmentationsData =
await segmentation.data() as Uint8Array;\n    const longOffsetsData = await longOffsets.data() as Float32Array;\n    personSegmentationsData = decodeMultipleMasksCPU(\n      segmentationsData, longOffsetsData,
posesAboveScore, height, width,\n      stride, [inHeight, inWidth], padding, refineSteps);\n  }\n  return
personSegmentationsData.map(\n    (data, i) => ({data, pose: posesAboveScore[i], width, height});\n  );\n}\n\nexport
async function decodePersonInstancePartMasks(\n  segmentation: tf.Tensor2D, longOffsets: tf.Tensor3D,\n  partSegmentation:
tf.Tensor2D, poses: Pose[], height: number, width: number,\n  stride: number, [inHeight, inWidth]: [number, number], padding:
Padding,\n  minPoseScore = 0.2, refineSteps = 8, minKeypointScore =
0.3,\n  maxNumPeople = 10): Promise<PartSegmentation[]> {\n  const posesAboveScore = poses.filter(pose =>
pose.score >= minPoseScore);\n  let partSegmentationsByPersonData: Int32Array[];\n  if (isWebGLBackend())

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{\n  const partSegmentations = tf.tidy(() => {\n    const masksTensorInfo = decodeMultipleMasksWebGl(\n
segmentation, longOffsets, posesAboveScore, height, width, stride,\n      [inHeight, inWidth], padding,\n      refineSteps, minKeypointScore,\n      maxNumPeople);\n    const masksTensor =\n
tf.engine().makeTensorFromDataId(\n      masksTensorInfo.dataId, masksTensorInfo.shape,\n      masksTensorInfo.dtype) as tf.Tensor2D;\n\n    return posesAboveScore.map(\n      (_, k) =>\n
toPersonKPartSegmentation(masksTensor, partSegmentation, k));\n  });\n\n  partSegmentationsByPersonData =\n
(await Promise.all(partSegmentations.map(x => x.data()))) as\n    Int32Array[];\n\n  partSegmentations.forEach(x => x.dispose());\n } else\n
{\n  const segmentationsData = await segmentation.data() as Uint8Array;\n  const longOffsetsData = await\n
longOffsets.data() as Float32Array;\n  const partSegmentaionData = await partSegmentation.data() as\n
Uint8Array;\n  partSegmentationsByPersonData = decodeMultiplePartMasksCPU(\n    segmentationsData,\n
longOffsetsData, partSegmentaionData,\n    posesAboveScore, height, width, stride, [inHeight, inWidth],\n
padding,\n    refineSteps);\n } \n\n  return partSegmentationsByPersonData.map(\n    (data, k) => ({pose:\n
posesAboveScore[k], data, height, width}));\n } \n\n", "/*\n * @license\n * Copyright 2019 Google Inc. All Rights\n
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===== \n
*\n\n// algorithm based on Coursera Lecture from Algorithms, Part 1:\n\n//  

https://www.coursera.org/learn/algorithms-part1/lecture/ZjoSM/heapsort\n\nfunction half(k: number) {\n  return\n
Math.floor(k / 2);\n}\n\nexport class MaxHeap<T> {\n  private priorityQueue: T[];\n  private numberOfElements:\n
number;\n  private getElementValue: (element: T) => number;\n  constructor(maxSize: number, getElementValue:\n
(element: T) => number) {\n    this.priorityQueue = new Array(maxSize);\n    this.numberOfElements = -1;\n\n
this.getElementValue = getElementValue;\n  }\n\n  public enqueue(x: T): void {\n\n
this.priorityQueue[++this.numberOfElements] = x;\n    this.swim(this.numberOfElements);\n  }\n\n  public dequeue(): T {\n    const max = this.priorityQueue[0];\n    this.exchange(0, this.numberOfElements--\n
);\n    this.sink(0);\n    this.priorityQueue[this.numberOfElements + 1] = null;\n    return max;\n  }\n\n  public\n
empty(): boolean {\n    return this.numberOfElements === -1;\n  }\n\n  public size(): number {\n    return\n
this.numberOfElements + 1;\n  }\n\n  public all(): T[] {\n    return this.priorityQueue.slice(0, this.numberOfElements\n
+ 1);\n  }\n\n  public max(): T {\n    return this.priorityQueue[0];\n  }\n\n  private swim(k: number): void {\n    while\n
(k > 0 && this.less(half(k), k)) {\n      this.exchange(k, half(k));\n      k = half(k);\n    }\n  }\n\n  private sink(k:\n
number): void {\n    while (2 * k <= this.numberOfElements) {\n      let j = 2 * k;\n      if (j < this.numberOfElements\n
&& this.less(j, j + 1)) {\n        j++;\n      }\n      if (!this.less(k, j)) {\n        break;\n      }\n      this.exchange(k, j);\n\n
k = j;\n    }\n  }\n\n  private getValueAt(i:\n
number): number {\n    return this.getElementValue(this.priorityQueue[i]);\n  }\n\n  private less(i: number, j:\n
number): boolean {\n    return this.getValueAt(i) < this.getValueAt(j);\n  }\n\n  private exchange(i: number, j:\n
number): void {\n    const t = this.priorityQueue[i];\n    this.priorityQueue[i] = this.priorityQueue[j];\n\n
this.priorityQueue[j] = t;\n  }\n}\n\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n *  

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governing permissions and\n * limitations under

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the License.\n *
=====
*\n\nimport {PartWithScore, TensorBuffer3D} from './types';\n\nimport {MaxHeap} from
'./max_heap';\n\nfunction scoreIsMaximumInLocalWindow(\n  keypointId: number, score: number, heatmapY:
number, heatmapX: number,\n  localMaximumRadius: number, scores: TensorBuffer3D): boolean {\n  const
[height, width] = scores.shape;\n\n  let localMaximum = true;\n  const yStart = Math.max(heatmapY -
localMaximumRadius, 0);\n  const yEnd = Math.min(heatmapY + localMaximumRadius + 1, height);\n  for (let
yCurrent = yStart; yCurrent < yEnd; ++yCurrent) {\n    const xStart = Math.max(heatmapX - localMaximumRadius,
0);\n    const xEnd = Math.min(heatmapX + localMaximumRadius + 1, width);\n    for (let xCurrent = xStart;
xCurrent < xEnd; ++xCurrent) {\n      if (scores.get(yCurrent, xCurrent, keypointId) > score) {\n        localMaximum
= false;\n        break;\n      }\n    }\n    if (!localMaximum)
{\n      break;\n    }\n  }\n\n  return localMaximum;\n}\n\n/**\n * Builds a priority queue with part candidate
positions for a specific image in\n * the batch. For this we find all local maxima in the score maps with score\n *
values above a threshold. We create a single priority queue across all parts.\n */\n\nexport function
buildPartWithScoreQueue(\n  scoreThreshold: number, localMaximumRadius: number,\n  scores:
TensorBuffer3D): MaxHeap<PartWithScore> {\n  const [height, width, numKeypoints] = scores.shape;\n\n  const
queue = new MaxHeap<PartWithScore>(\n    height * width * numKeypoints, ({score}) => score);\n\n  for (let
heatmapY = 0; heatmapY < height; ++heatmapY) {\n    for (let heatmapX = 0; heatmapX < width; ++heatmapX) {\n
      for (let keypointId = 0; keypointId < numKeypoints; ++keypointId) {\n        const score = scores.get(heatmapY,
heatmapX, keypointId);\n\n        // Only consider parts with score greater or equal to threshold as\n        // root
candidates.\n\n        if (score < scoreThreshold) {\n          continue;\n        }\n\n        // Only consider keypoints whose score is
maximum in a local window.\n        if (scoreIsMaximumInLocalWindow(\n          keypointId, score, heatmapY,
heatmapX, localMaximumRadius,\n          scores)) {\n          queue.enqueue({score, part: {heatmapY, heatmapX,
id: keypointId}});\n        }\n      }\n    }\n  }\n\n  return queue;\n}\n\n"/**\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n */
=====
*\n\nimport {NumberTuple, PART_IDS, PART_NAMES, POSE_CHAIN} from './keypoints';\n\nimport {Keypoint,
PartWithScore, TensorBuffer3D, Vector2D} from './types';\n\nimport {clamp, getOffsetPoint} from './util';\n\nimport
{addVectors, getImageCoords} from './util';\n\nconst parentChildrenTuples: NumberTuple[] =
POSE_CHAIN.map(\n  ([parentJoinName, childJoinName]): NumberTuple =>\n
  ([PART_IDS[parentJoinName], PART_IDS[childJoinName]]);\n\nconst parentToChildEdges: number[] =\n
parentChildrenTuples.map(([, childJointId]) => childJointId);\n\nconst childToParentEdges: number[] =\n
parentChildrenTuples.map(([\n  parentJointId,\n  ] =>
parentJointId);\n\nfunction getDisplacement(\n  edgeId: number, point: Vector2D, displacements:
TensorBuffer3D): Vector2D {\n  const numEdges =
displacements.shape[2] / 2;\n  return {\n    y: displacements.get(point.y, point.x, edgeId),\n    x:
displacements.get(point.y, point.x, numEdges + edgeId)\n  };\n}\n\nfunction getStridedIndexNearPoint(\n  point:
Vector2D, outputStride: number, height: number,\n  width: number): Vector2D {\n  return {\n    y:
clamp(Math.round(point.y / outputStride), 0, height - 1),\n    x: clamp(Math.round(point.x / outputStride), 0, width -
1)\n  };\n}\n\n/**\n * We get a new keypoint along the `edgeId` for the pose instance, assuming\n * that the position
of the `idSource` part is already known. For this, we\n * follow the displacement vector from the source to target
part (stored in\n * the `i`-t channel of the displacement tensor). The displaced keypoint\n * vector is refined using

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squaredDistance(\n          y, x, correspondingKeypoint.y, correspondingKeypoint.x) <= \n
squaredNmsRadius; \n }); \n \n * Score the newly proposed object instance without taking into account \n * the
scores of the parts that overlap with any previously detected \n
* instance. \n */ \n function getInstanceScore(\n  existingPoses: Pose[], squaredNmsRadius: number, \n
instanceKeypoints: Keypoint[]): number { \n  let notOverlappedKeypointScores = instanceKeypoints.reduce(\n
(result, {position, score}, keypointId): number => { \n    if (!withinNmsRadiusOfCorrespondingPoint(\n
existingPoses, squaredNmsRadius, position, keypointId)) { \n      result += score; \n    } \n    return result; \n
}, 0.0); \n \n  return notOverlappedKeypointScores /= instanceKeypoints.length; \n } \n \n // A point (y, x) is considered
as root part candidate if its score is a \n // maximum in a window |y - y'| <= kLocalMaximumRadius, |x - x'| <= \n //
kLocalMaximumRadius. \n \n const kLocalMaximumRadius = 1; \n \n /** \n * Detects multiple poses and finds their parts
from part scores and \n * displacement vectors. It returns up to `maxDetections` object instance \n * detections in
decreasing root score order. It works as follows: We first \n * create a priority
queue with local part score maxima above \n * `scoreThreshold`, considering all parts at the same time. Then we \n *
iteratively pull the top element of the queue (in decreasing score order) \n * and treat it as a root candidate for a new
object instance. To avoid \n * duplicate detections, we reject the root candidate if it is within a disk \n * of
`nmsRadius` pixels from the corresponding part of a previously detected \n * instance, which is a form of part-based
non-maximum suppression (NMS). If \n * the root candidate passes the NMS check, we start a new object instance \n *
detection, treating the corresponding part as root and finding the \n * positions of the remaining parts by following
the displacement vectors \n * along the tree-structured part graph. We assign to the newly detected \n * instance a
score equal to the sum of scores of its parts which have not \n * been claimed by a previous instance (i.e., those at
least `nmsRadius` \n * pixels away from the corresponding part of all previously
detected \n * instances), divided by the total number of parts `numParts`. \n * \n * @param heatmapScores 3-D tensor
with shape `[height, width, numParts]`. \n * The value of heatmapScores[y, x, k] is the score of placing the `k`-th \n
* object part at position `(y, x)`. \n * \n * @param offsets 3-D tensor with shape `[height, width, numParts * 2]`. \n
* The value of [offsets[y, x, k], offsets[y, x, k + numParts]] is the \n * short range offset vector of the `k`-th object
part at heatmap \n * position `(y, x)`. \n * \n * @param displacementsFwd 3-D tensor of shape \n * `[height, width, 2
* num_edges]`, where `num_edges = num_parts - 1` is the \n * number of edges (parent-child pairs) in the tree. It
contains the forward \n * displacements between consecutive part from the root towards the leaves. \n * \n * @param
displacementsBwd 3-D tensor of shape \n * `[height, width, 2 * num_edges]`, where `num_edges = num_parts - 1` is
the \n * number of edges (parent-child pairs) in the tree. It contains
the backward \n * displacements between consecutive part from the root towards the leaves. \n * \n * @param
outputStride The output stride that was used when feed-forwarding \n * through the PoseNet model. Must be 32, 16,
or 8. \n * \n * @param maxPoseDetections Maximum number of returned instance detections per \n * image. \n * \n *
@param scoreThreshold Only return instance detections that have root part \n * score greater or equal to this value.
Defaults to 0.5. \n * \n * @param nmsRadius Non-maximum suppression part distance. It needs to be \n * strictly
positive. Two parts suppress each other if they are less than \n * `nmsRadius` pixels away. Defaults to 20. \n * \n
* @return An array of poses and their scores, each containing keypoints and \n * the corresponding keypoint scores. \n
*/ \n \n export function decodeMultiplePoses(\n  scoresBuffer: TensorBuffer3D, offsetsBuffer: TensorBuffer3D, \n
displacementsFwdBuffer: TensorBuffer3D, \n  displacementsBwdBuffer: TensorBuffer3D, outputStride: number, \n
maxPoseDetections: number, scoreThreshold = 0.5, nmsRadius = 20): Pose[] { \n  const poses: Pose[] = []; \n \n
const queue = buildPartWithScoreQueue(\n  scoreThreshold, kLocalMaximumRadius, scoresBuffer); \n \n const
squaredNmsRadius = nmsRadius * nmsRadius; \n \n // Generate at most maxDetections object instances per image
in \n // decreasing root part score order. \n while (poses.length < maxPoseDetections && !queue.empty()) { \n //
The top element in the queue is the next root candidate. \n const root = queue.dequeue(); \n \n // Part-based non-
maximum suppression: We reject a root candidate if it \n // is within a disk of `nmsRadius` pixels from the
corresponding part of \n // a previously detected instance. \n const rootImageCoords = \n
getImageCoords(root.part, outputStride, offsetsBuffer); \n if (withinNmsRadiusOfCorrespondingPoint(\n
poses, squaredNmsRadius, rootImageCoords, root.part.id)) { \n continue; \n } \n \n // Start a new detection

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instance at the position of the root.\n  const keypoints = decodePose(\n    root, scoresBuffer, offsetsBuffer,\n    outputStride, displacementsFwdBuffer,\n    displacementsBwdBuffer);\n\n  const score =\n    getInstanceScore(poses, squaredNmsRadius, keypoints);\n  poses.push({keypoints, score});\n}\n\nreturn\nposes;\n}\n", "/*\n * @license\n * Copyright 2019 Google Inc. All Rights Reserved.\n * Licensed under the Apache\n * License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You\n * may obtain a copy of the License at\n * https://www.apache.org/licenses/LICENSE-2.0\n * Unless required\n * by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\"\n * BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the\n * License for the specific language governing permissions and\n * limitations under the License.\n *
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=====\n*\n\nimport * as tf from '@tensorflow/tfjs-core';\nimport { BaseModel } from './base_model';\nconst\nimageNetMean = [-123.15, -115.90, -103.06];\nexport class ResNet extends BaseModel {\n  preprocessInput(input: tf.Tensor3D): tf.Tensor3D {\n    return tf.add(input, imageNetMean);\n  }\n\n  nameOutputResults(results: tf.Tensor3D[]) {\n    const [\n      displacementBwd,\n      displacementFwd,\n      heatmap,\n      longOffsets,\n      offsets,\n      partHeatmaps,\n      segmentation,\n      partOffsets,\n    ] = results;\n    return [\n      offsets,\n      segmentation,\n      partHeatmaps,\n      longOffsets,\n      heatmap,\n      displacementFwd,\n      displacementBwd,\n      partOffsets\n    ];\n  }\n}\n", "/*\n * @license\n * Copyright 2019\n * Google Inc. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you\n * may not use this file except in compliance with the License.\n * You\n * may obtain a copy of the License at\n * https://www.apache.org/licenses/LICENSE-2.0\n * Unless required\n * by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\"\n * BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the\n * License for the specific language governing permissions and\n * limitations under the License.\n *
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=====\n*\n\nconst RESNET50_BASE_URL =\n  'https://storage.googleapis.com/tfjs-\n  models/savedmodel/bodypix/resnet50';\nconst MOBILENET_BASE_URL =\n  'https://storage.googleapis.com/tfjs-models/savedmodel/bodypix/mobilenet';\n\n// The BodyPix 2.0 ResNet50\nmodels use the latest TensorFlow.js 1.0 model\n// format.\nexport function resNet50SavedModel(stride: number,\n  quantBytes: number): string {\n  const graphJson = `model-stride${stride}.json`;\n  // quantBytes=4 corresponding\n  to the non-quantized\n  full-precision SavedModel.\n  if (quantBytes === 4) {\n    return RESNET50_BASE_URL + `float^` + graphJson;\n  } else {\n    return RESNET50_BASE_URL + `quant${quantBytes}` + graphJson;\n  }\n}\n\n// The BodyPix 2.0\nMobileNetV1 models use the latest TensorFlow.js 1.0 model\n// format.\nexport function mobileNetSavedModel(\n  stride: number, multiplier: number, quantBytes: number): string {\n  const toStr: {[key: number]: string} = {1.0:\n    '100', 0.75: '075', 0.50: '050'};\n  const graphJson = `model-stride${stride}.json`;\n  // quantBytes=4 corresponding\n  to the non-quantized full-precision SavedModel.\n  if (quantBytes === 4) {\n    return MOBILENET_BASE_URL +\n    `float/${toStr[multiplier]}` + graphJson;\n  } else {\n    return MOBILENET_BASE_URL +\n    `quant${quantBytes}/${toStr[multiplier]}` +\n    graphJson;\n  }\n}\n", "/*\n * @license\n * Copyright 2020\n * Google Inc. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you\n * may not use this\n * file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n *
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=====\n*\n\nimport * as tf from '@tensorflow/tfjs-core';\nimport { BodyPixInput, BodyPixOutputStride, Padding } from\n './types';\nimport { Pose, TensorBuffer3D } from './types';\nimport { BodyPixInternalResolution } from
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'/types';\n\nfunction getSizeFromImageLikeElement(input: HTMLImageElement|\nHTMLCanvasElement|\n      OffscreenCanvas): [number, number] {\n  if ('offsetHeight'\n    in input && input.offsetHeight !== 0\n    && 'offsetWidth' in input && input.offsetWidth !== 0) {\n    return\n    [input.offsetHeight, input.offsetWidth];\n  } else if (input.height != null && input.width != null) {\n    return\n    [input.height, input.width];\n  } else {\n    throw new Error(\n      `HTMLImageElement must have height and\n      width attributes set.`);\n  }\n}\n\nfunction getSizeFromVideoElement(input: HTMLVideoElement): [number,\nnumber] {\n  if (input.hasAttribute('height') && input.hasAttribute('width')) {\n    // Prioritizes user specified height\n    and width.\n    // We can't test the .height and .width properties directly,\n    // because they evaluate to 0 if unset.\n    return [input.height, input.width];\n  } else {\n    return [input.videoHeight, input.videoWidth];\n  }\n}\n\nexport\nfunction getInputSize(input: BodyPixInput): [number, number] {\n  if ((typeof (HTMLCanvasElement) !==\n'undefined' &&\n  input instanceof HTMLCanvasElement) ||\n  (typeof (OffscreenCanvas)\n    !== 'undefined' &&\n  input instanceof OffscreenCanvas) ||\n  (typeof (HTMLImageElement) !==\n'undefined' &&\n  input instanceof HTMLImageElement)) {\n    return getSizeFromImageLikeElement(input);\n  } else if (typeof (ImageData) !== 'undefined' && input instanceof ImageData) {\n    return [input.height,\ninput.width];\n  } else if (\n  typeof (HTMLVideoElement) !== 'undefined' &&\n  input instanceof\nHTMLVideoElement) {\n    return getSizeFromVideoElement(input);\n  } else if (input instanceof tf.Tensor) {\n    return [input.shape[0], input.shape[1]];\n  } else {\n    throw new Error(`error: Unknown input type: ${input}`);\n  }\n}\n\nfunction isValidInputResolution(\n  resolution: number, outputStride: number): boolean {\n  return\n  (resolution - 1) % outputStride === 0;\n}\n\nexport function toValidInputResolution(\n  inputResolution: number,\n  outputStride: BodyPixOutputStride): number {\n  if (isValidInputResolution(inputResolution, outputStride)) {\n    return inputResolution;\n  }\n  return Math.floor(inputResolution / outputStride) * outputStride + 1;\n}\n\nconst\nINTERNAL_RESOLUTION_STRING_OPTIONS = {\n  low: 'low',\n  medium: 'medium',\n  high: 'high',\n  full:\n'full'\n};\n\nconst\nINTERNAL_RESOLUTION_PERCENTAGES = {\n\n[INTERNAL_RESOLUTION_STRING_OPTIONS.low]: 0.25,\n\n[INTERNAL_RESOLUTION_STRING_OPTIONS.medium]: 0.5,\n\n[INTERNAL_RESOLUTION_STRING_OPTIONS.high]: 0.75,\n\n[INTERNAL_RESOLUTION_STRING_OPTIONS.full]: 1.0\n};\n\nconst\nMIN_INTERNAL_RESOLUTION = 0.1;\nconst\nMAX_INTERNAL_RESOLUTION = 2.0;\n\nfunction toInternalResolutionPercentage(\n  internalResolution: BodyPixInternalResolution): number {\n  if (typeof internalResolution === 'string') {\n    const\nresult = INTERNAL_RESOLUTION_PERCENTAGES[internalResolution];\n    tf.util.assert(\n      typeof result\n      === 'number',\n      () => `string value of inputResolution must be one of ${\n      Object.values(INTERNAL_RESOLUTION_STRING_OPTIONS)\n        .join(',')\n      } but was ${internalResolution}`);\n    return result;\n  } else {\n    tf.util.assert(\n      typeof internalResolution ===\n      'number' &&\n      internalResolution <= MAX_INTERNAL_RESOLUTION &&\n      internalResolution\n      >= MIN_INTERNAL_RESOLUTION,\n      () =>\n      `inputResolution must be a string or number between\n      ${\n      MIN_INTERNAL_RESOLUTION\n      } and ${\n      MAX_INTERNAL_RESOLUTION\n      }, but ` +\n      `was ${internalResolution}`);\n    return internalResolution;\n  }\n}\n\nexport function\n  toInputResolutionHeightAndWidth(\n    internalResolution: BodyPixInternalResolution,\n    outputStride:\n    BodyPixOutputStride,\n    [inputHeight, inputWidth]: [number, number]): [number, number] {\n    const\n    internalResolutionPercentage =\n      toInternalResolutionPercentage(internalResolution);\n    return [\n      toValidInputResolution(\n        inputHeight * internalResolutionPercentage, outputStride),\n      toValidInputResolution(\n        inputWidth * internalResolutionPercentage,\n        outputStride)\n    ];\n}\n\nexport function toInputTensor(input: BodyPixInput) {\n  // TODO: tf.browser.fromPixels\n  types to support OffscreenCanvas\n  // @ts-ignore\n  return input instanceof tf.Tensor ? input :\n  tf.browser.fromPixels(input);\n}\n\nexport function\n  resizeAndPadTo(\n    imageTensor: tf.Tensor3D, [targetH,\n    targetW]: [number, number],\n    flipHorizontal = false): {\n  resizedAndPadded: tf.Tensor3D,\n  paddedBy:\n  [[number, number], [number, number]]\n} {\n  const [height, width] = imageTensor.shape;\n  const\n  targetAspect =\n  targetW / targetH;\n  const\n  aspect =\n  width / height;\n  let\n  resizeW: number;\n  let\n  resizeH: number;\n  let\n  padL:

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number;\n let padR: number;\n let padT: number;\n let padB: number;\n\n if (aspect > targetAspect) {\n // resize
to have the larger dimension match the shape.\n resizeW = targetW;\n resizeH = Math.ceil(resizeW / aspect);\n\n
const padHeight = targetH - resizeH;\n padL = 0;\n padR = 0;\n padT = Math.floor(padHeight
/ 2);\n padB = targetH - (resizeH + padT);\n } else {\n resizeH = targetH;\n resizeW = Math.ceil(targetH *
aspect);\n\n const padWidth = targetW - resizeW;\n padL = Math.floor(padWidth / 2);\n padR = targetW -
(resizeW + padL);\n padT = 0;\n padB = 0;\n }\n\n const resizedAndPadded = tf.tidy(() => {\n // resize to
have largest dimension match image\n let resized: tf.Tensor3D;\n if (flipHorizontal) {\n resized =
tf.image.resizeBilinear(\n tf.reverse(imageTensor, 1), [resizeH, resizeW]);\n } else {\n resized =
tf.image.resizeBilinear(imageTensor, [resizeH, resizeW]);\n }\n\n const padded = tf.pad3d(resized, [[padT,
padB], [padL, padR], [0, 0]]);\n\n return padded;\n });\n\n return {resizedAndPadded, paddedBy: [[padT, padB],
[padL, padR]]};\n}\n\nexport function scaleAndCropToInputTensorShape(\n tensor: tf.Tensor3D,\n [inputTensorHeight, inputTensorWidth]: [number, number],\n [resizedAndPaddedHeight,
resizedAndPaddedWidth]: [number, number],\n [[padT, padB], [padL, padR]]: [[number, number], [number,
number]],\n applySigmoidActivation = false): tf.Tensor3D {\n return tf.tidy(() => {\n let inResizedAndPadded:
tf.Tensor3D = tf.image.resizeBilinear(tensor,\n [resizedAndPaddedHeight, resizedAndPaddedWidth], true);\n\n if (applySigmoidActivation) {\n inResizedAndPadded = tf.sigmoid(inResizedAndPadded);\n }\n\n return
removePaddingAndResizeBack(\n inResizedAndPadded, [inputTensorHeight, inputTensorWidth],\n [[padT, padB], [padL, padR]]);\n });\n}\n\nexport function removePaddingAndResizeBack(\n resizedAndPadded:
tf.Tensor3D,\n [originalHeight, originalWidth]: [number, number],\n [[padT, padB], [padL, padR]]: [[number,
number], [number, number]]):\n tf.Tensor3D {\n return tf.tidy(() => {\n const batchedImage: tf.Tensor4D =
tf.expandDims(resizedAndPadded);\n return tf.squeeze(tf.image.\n .cropAndResize(\n
batchedImage, [[\n padT / (originalHeight + padT + padB - 1.0),\n padL / (originalWidth +
padL + padR - 1.0),\n (padT + originalHeight - 1.0) \/\n (originalHeight + padT + padB - 1.0),\n
(padL + originalWidth - 1.0) / (originalWidth + padL + padR - 1.0)\n ]],\n [0], [originalHeight,
originalWidth]), [0]);\n });\n}\n\nexport function resize2d(\n tensor: tf.Tensor2D, resolution: [number, number],\n nearestNeighbor?: boolean): tf.Tensor2D {\n return tf.tidy(() => {\n const batchedImage: tf.Tensor4D =
tf.expandDims(tensor, 2);\n return tf.squeeze(\n tf.image.resizeBilinear(batchedImage, resolution,
nearestNeighbor));\n });\n}\n\nexport function padAndResizeTo(\n input: BodyPixInput, [targetH, targetW]:
[number, number]):\n {resized: tf.Tensor3D, padding: Padding} {\n const [height, width] = getInputSize(input);\n const targetAspect = targetW / targetH;\n const aspect
= width / height;\n let [padT, padB, padL, padR] = [0, 0, 0, 0];\n if (aspect < targetAspect) {\n // pads the width\n
padT = 0;\n padB = 0;\n padL = Math.round(0.5 * (targetAspect * height - width));\n padR = Math.round(0.5
* (targetAspect * height - width));\n } else {\n // pads the height\n padT = Math.round(0.5 * ((1.0 /
targetAspect) * width - height));\n padB = Math.round(0.5 * ((1.0 / targetAspect) * width - height));\n padL =
0;\n padR = 0;\n }\n\n const resized: tf.Tensor3D = tf.tidy(() => {\n let imageTensor = toInputTensor(input);\n imageTensor = tf.pad3d(imageTensor, [[padT, padB], [padL, padR], [0, 0]]);\n\n return
tf.image.resizeBilinear(imageTensor, [targetH, targetW]);\n });\n\n return {resized, padding: {top: padT, left: padL,
right: padR, bottom: padB}};\n}\n\nexport async function toTensorBuffers3D(tensors: tf.Tensor3D[]):\n Promise<TensorBuffer3D[]> {\n return Promise.all(tensors.map(tensor => tensor.buffer()));\n}\n\nexport
function scalePose(\n pose: Pose, scaleY: number, scaleX: number, offsetY = 0,\n offsetX = 0): Pose {\n return
{\n score: pose.score,\n keypoints: pose.keypoints.map(({score, part, position}) => ({\n
score,\n part,\n position: {\n x: position.x *
scaleX + offsetX,\n y: position.y * scaleY + offsetY\n }}))\n });\n}\n\nexport function scalePoses(\n poses: Pose[], scaleY: number, scaleX: number, offsetY = 0,
offsetX = 0) {\n if (scaleX === 1 && scaleY === 1 && offsetY === 0 && offsetX === 0) {\n return poses;\n
}\n return poses.map(pose => scalePose(pose, scaleY, scaleX, offsetY, offsetX));\n}\n\nexport function
flipPoseHorizontal(pose: Pose, imageWidth: number): Pose {\n return {\n score: pose.score,\n

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keypoints: pose.keypoints.map(\n    ({score, part, position}) => ({\n        score,\n        part,\n        position: {x:
imageWidth - 1 - position.x, y: position.y}\n    }));\n\n\nexport function flipPosesHorizontal(poses: Pose[],
imageWidth: number) {\n    if (imageWidth <= 0) {\n        return poses;\n    }\n    return poses.map(pose =>
flipPoseHorizontal(pose, imageWidth));\n\n\nexport function scaleAndFlipPoses(\n    poses: Pose[], [height,
width]: [number, number],\n    [inputResolutionHeight, inputResolutionWidth]: [number, number],\n    padding:
Padding, flipHorizontal: boolean): Pose[] {\n    const scaleY =\n        (height + padding.top + padding.bottom) /
(inputResolutionHeight);\n    const scaleX =\n        (width + padding.left + padding.right) /
(inputResolutionWidth);\n\n    const scaledPoses =\n        scalePoses(poses, scaleY, scaleX, -padding.top, -
padding.left);\n\n    if (flipHorizontal) {\n        return flipPosesHorizontal(scaledPoses, width);\n    } else {\n        return
scaledPoses;\n    }\n}

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};\n}\n", "\n**\n * @license\n * Copyright 2019 Google Inc. All Rights Reserved.\n * Licensed under the Apache
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License for the specific language governing permissions and\n * limitations under the License.\n *

```

=====
*\n\nimport * as tfconv from '@tensorflow/tfjs-converter';\nimport * as tf from '@tensorflow/tfjs-core';\n\nimport
{BaseModel} from './base_model';\nimport {decodeOnlyPartSegmentation, decodePartSegmentation,
toMaskTensor} from './decode_part_map';\nimport
{MobileNet} from './mobilenet';\nimport {decodePersonInstanceMasks, decodePersonInstancePartMasks} from
'/multi_person/decode_instance_masks';\nimport {decodeMultiplePoses} from
'/multi_person/decode_multiple_poses';\nimport {ResNet} from './resnet';\nimport {mobileNetSavedModel,
resNet50SavedModel} from './saved_models';\nimport {BodyPixArchitecture, BodyPixInput,
BodyPixInternalResolution, BodyPixMultiplier, BodyPixOutputStride, BodyPixQuantBytes, Padding} from
'/types';\nimport {PartSegmentation, PersonSegmentation, SemanticPartSegmentation,
SemanticPersonSegmentation} from './types';\nimport {getInputSize, padAndResizeTo,
scaleAndCropToInputTensorShape, scaleAndFlipPoses, toInputResolutionHeightAndWidth, toTensorBuffers3D}
from './util';\n\nconst APPLY_SIGMOID_ACTIVATION = true;\nconst FLIP_POSES_AFTER_SCALING =
false;\n\n**\n * BodyPix model loading is configurable using the following config dictionary.\n * \n *
`architecture`: BodyPixArchitecture. It determines which BodyPix
architecture\n * to load. The supported architectures are: MobileNetV1 and ResNet50.\n * \n * `outputStride`:
Specifies the output stride of the BodyPix model.\n * The smaller the value, the larger the output resolution, and
more accurate\n * the model at the cost of speed. Set this to a larger value to increase speed\n * at the cost of
accuracy. Stride 32 is supported for ResNet and\n * stride 8,16,32 are supported for various MobileNetV1 models.\n
*\n * `multiplier`: An optional number with values: 1.01, 1.0, 0.75, or\n * 0.50. The value is used only by MobileNet
architecture. It is the float\n * multiplier for the depth (number of channels) for all convolution ops.\n * The larger
the value, the larger the size of the layers, and more accurate\n * the model at the cost of speed. Set this to a
smaller\n * value to increase speed\n * at the cost of accuracy.\n * \n * `modelUrl`: An optional string that
specifies custom url
of the model. This\n * is useful for area/countries that don't have access
to the model hosted on\n * GCP.\n * \n * `quantBytes`: An optional number with values: 1, 2, or 4. This
parameter\n * affects weight quantization in the models. The available options are\n * 1 byte, 2 bytes, and 4 bytes.
The higher the value, the larger the model size\n * and thus the longer the loading time, the lower the value, the
shorter the\n * loading time but lower the accuracy.\n * \n\nexport interface ModelConfig {\n    architecture:
BodyPixArchitecture;\n    outputStride: BodyPixOutputStride;\n    multiplier?: BodyPixMultiplier;\n    modelUrl?:
string;\n    quantBytes?: BodyPixQuantBytes;\n}\n\n// The default configuration for loading MobileNetV1 based
BodyPix.\n// (And for references, the default configuration for loading ResNet\n// based PoseNet is also
included).\n// \n\nconst RESNET_CONFIG = {\n//    architecture: 'ResNet50',\n//    outputStride: 32,\n//

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quantBytes: 4,\n// } as ModelConfig;\n/```\n\nconst MOBILENET_V1_CONFIG = {\n  architecture:
'MobileNetV1',\n
  outputStride: 16,\n  quantBytes: 4,\n  multiplier: 0.75,\n} as ModelConfig;\n\nconst VALID_ARCHITECTURE:
BodyPixArchitecture[] = ['MobileNetV1', 'ResNet50'];\n\nconst VALID_STRIDE: {[id: string]:
BodyPixOutputStride[]} = {\n  'MobileNetV1': [8, 16, 32],\n  'ResNet50': [32, 16]\n};\n\nconst
VALID_MULTIPLIER: {[id: string]: BodyPixMultiplier[]} = {\n  'MobileNetV1': [0.50, 0.75, 1.0],\n  'ResNet50':
[1.0]\n};\n\nconst VALID_QUANT_BYTES: BodyPixQuantBytes[] = [1, 2, 4];\n\nfunction
validateModelConfig(config: ModelConfig): ModelConfig {\n  config = config || MOBILENET_V1_CONFIG;\n
if (config.architecture == null) {\n  config.architecture = 'MobileNetV1';\n }\n
if ((VALID_ARCHITECTURE.indexOf(config.architecture) < 0) {\n  throw new Error(\n    `Invalid architecture
${config.architecture}.` +\n    `Should be one of ${VALID_ARCHITECTURE}`);\n })\n
if (config.outputStride == null) {\n  config.outputStride = 16;\n }\n
if ((VALID_STRIDE[config.architecture].indexOf(config.outputStride)
< 0) {\n  throw new Error(\n    `Invalid outputStride ${config.outputStride}.` +\n    `Should be one of
${VALID_STRIDE[config.architecture]}` +\n    `for architecture ${config.architecture}.`);\n })\n
if (config.multiplier == null) {\n  config.multiplier = 1.0;\n }\n
if ((VALID_MULTIPLIER[config.architecture].indexOf(config.multiplier) < 0) {\n  throw new Error(\n    `Invalid
multiplier ${config.multiplier}.` +\n    `Should be one of ${VALID_MULTIPLIER[config.architecture]}` +\n
    `for architecture ${config.architecture}.`);\n })\n
if (config.quantBytes == null) {\n  config.quantBytes = 4;\n }\n
if ((VALID_QUANT_BYTES.indexOf(config.quantBytes) < 0) {\n  throw new Error(\n    `Invalid
quantBytes ${config.quantBytes}.` +\n    `Should be one of ${VALID_QUANT_BYTES}` +\n    `for
architecture ${config.architecture}.`);\n })\n
return config;\n}\n\n/**\n * BodyPix inference is configurable using
the following config dictionary.\n
 * `flipHorizontal`: If the left-right keypoint of poses/part segmentation\n
 * should be flipped/mirrored horizontally. This should be set to true for\n
 * videos where the video is by default flipped horizontally (i.e. a
webcam),\n
 * and you want the person & body part segmentation to be returned in the proper\n
 * orientation.\n
 * `internalResolution`: Defaults to 'medium'. The internal resolution\n
 * percentage that the input is resized to before inference. The larger the\n
 * internalResolution the more accurate the model at the cost of slower\n
 * prediction times. Available values are 'low', 'medium', 'high', 'full', or a\n
 * percentage value between 0 and 1. The values 'low', 'medium', 'high',
and\n
 * 'full' map to 0.25, 0.5, 0.75, and 1.0 correspondingly.\n
 * `segmentationThreshold`: The minimum that segmentation values must\n
 * have to be considered part of the person. Affects the generation of the\n
 * segmentation mask. More specifically, it is the threshold
used to binarize\n
 * the intermediate person segmentation probability. The probability of each\n
 * pixel belongs to a person is in range [0, 1]. If the probability is greater\n
 * than the `segmentationThreshold`, it will be set to 1 otherwise 0.\n
 */\n\nexport interface InferenceConfig {\n  flipHorizontal?: boolean;\n  internalResolution?:
BodyPixInternalResolution;\n  segmentationThreshold?: number;\n}\n\n/**\n * Person Inference Config\n
 * `maxDetections`: Defaults to 10. Maximum number of person pose detections per\n
 * image.\n
 * `scoreThreshold`: Defaults to 0.4. Only return person pose that have root\n
 * part score greater or equal to this value.\n
 * `nmsRadius`: Defaults to 20. Non-maximum suppression part distance in pixels.\n
 * It needs to be strictly positive. Two pose keypoints suppress each other if\n
 * they are less than `nmsRadius` pixels away.\n
 */\n\nexport interface PersonInferenceConfig extends InferenceConfig {\n  maxDetections?: number;\n
scoreThreshold?: number;\n  nmsRadius?: number;\n}\n\n/**\n * Multiple Person Instance Inference Config\n
 * `maxDetections`: Defaults to 10. Maximum number of returned instance\n
 * segmentation and pose detections per image.\n
 * `scoreThreshold`: Defaults to 0.4. Only returns and uses person\n
 * poses for instance segmentation assignment when the pose has root part
score\n
 * greater or equal to this value.\n
 * `nmsRadius`: Defaults to 20. Non-maximum suppression part distance in
pixels.\n
 * It needs to be strictly positive. Two parts suppress each other if
they are\n
 * less than `nmsRadius` pixels away.\n
 * `minKeypointScore`: Default to 0.3. Keypoints above the

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score are used\n * for matching and assigning segmentation mask to each person.\n *\n * `refineSteps`: Default to 10. The number of refinement steps used when\n * assigning the instance segmentation. It needs to be strictly positive. The\n * larger the higher the accuracy and slower the inference.\n *\n */\nexport interface

MultiPersonInstanceInferenceConfig

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extends InferenceConfig {\n  maxDetections?: number;\n  scoreThreshold?: number;\n  nmsRadius?: number;\n  minKeypointScore?: number;\n  refineSteps?: number;\n}\n\nexport const PERSON_INFERENCE_CONFIG:\n  PersonInferenceConfig = {\n  flipHorizontal: false,\n  internalResolution: 'medium',\n  segmentationThreshold:\n  0.7,\n  maxDetections: 10,\n  scoreThreshold: 0.4,\n  nmsRadius: 20,\n};\n\nexport const\n  MULTI_PERSON_INSTANCE_INFERENCE_CONFIG:\n  MultiPersonInstanceInferenceConfig = {\n  flipHorizontal: false,\n  internalResolution: 'medium',\n  segmentationThreshold: 0.7,\n  maxDetections:\n  10,\n  scoreThreshold: 0.4,\n  nmsRadius: 20,\n  minKeypointScore: 0.3,\n  refineSteps: 10\n};\n\nfunction validatePersonInferenceConfig(config: PersonInferenceConfig) {\n  const {segmentationThreshold,\n  maxDetections, scoreThreshold, nmsRadius} =\n    config;\n  if (segmentationThreshold < 0.0 ||\n  segmentationThreshold > 1.0) {\n    throw new Error(\n      `segmentationThreshold ${segmentationThreshold}. ` +\n      `Should be in range [0.0, 1.0]`);\n  }\n  if (maxDetections <= 0) {\n    throw new Error(\n      `Invalid maxDetections ${maxDetections}. ` +\n      `Should be > 0`);\n  }\n  if (scoreThreshold < 0.0 || scoreThreshold > 1.0) {\n    throw new Error(\n      `Invalid scoreThreshold ${scoreThreshold}. ` +\n      `Should be in range [0.0, 1.0]`);\n  }\n  if (nmsRadius <= 0)\n  {\n    throw new Error(`Invalid nmsRadius ${nmsRadius}.`);\n  }\n}\n\nfunction\n  validateMultiPersonInstanceInferenceConfig(\n  config: MultiPersonInstanceInferenceConfig) {\n  const {\n  segmentationThreshold,\n  maxDetections,\n  scoreThreshold,\n  nmsRadius,\n  minKeypointScore,\n  refineSteps\n  } = config;\n  if (segmentationThreshold < 0.0 || segmentationThreshold > 1.0) {\n    throw new\n  Error(\n    `segmentationThreshold ${segmentationThreshold}. ` +\n    `Should be in range [0.0, 1.0]`);\n  }\n  if (maxDetections <= 0) {\n    throw new Error(\n      `Invalid maxDetections ${maxDetections}. ` +\n      `Should be > 0`);\n  }\n  if (scoreThreshold < 0.0 || scoreThreshold > 1.0) {\n    throw new Error(\n      `Invalid\n  scoreThreshold ${scoreThreshold}. ` +\n      `Should be in range [0.0, 1.0]`);\n  }\n  if (nmsRadius <= 0)\n  {\n    throw new Error(`Invalid nmsRadius ${nmsRadius}.`);\n  }\n  if (minKeypointScore < 0 || minKeypointScore > 1)\n  {\n    throw new Error(\n      `Invalid minKeypointScore ${minKeypointScore}. ` +\n      `Should be in range [0.0,\n  1.0]`);\n  }\n  if (refineSteps <= 0 || refineSteps > 20) {\n    throw new Error(\n      `Invalid refineSteps\n  ${refineSteps}. ` +\n      `Should be in range [1, 20]`);\n  }\n}\n\nexport class BodyPix {\n  baseModel:\n  BaseModel;\n  constructor(net: BaseModel) {\n    this.baseModel = net;\n  }\n  private\n  predictForPersonSegmentation(input: tf.Tensor3D): {\n    segmentLogits: tf.Tensor3D,\n    heatmapScores:\n    tf.Tensor3D,\n    offsets: tf.Tensor3D,\n    displacementFwd: tf.Tensor3D,\n    displacementBwd: tf.Tensor3D,\n  }\n  {\n    const {\n    segmentation,\n    heatmapScores,\n    offsets,\n    displacementFwd,\n    displacementBwd,\n    } = this.baseModel.predict(input);\n    return {\n    segmentLogits: segmentation,\n    heatmapScores,\n    offsets,\n    displacementFwd,\n    displacementBwd,\n    };\n  }\n  private\n  predictForPersonSegmentationAndPart(input: tf.Tensor3D): {\n    segmentLogits: tf.Tensor3D,\n    partHeatmapLogits: tf.Tensor3D,\n    heatmapScores: tf.Tensor3D,\n    offsets: tf.Tensor3D,\n    displacementFwd:\n    tf.Tensor3D,\n    displacementBwd: tf.Tensor3D,\n  }\n  {\n    const {\n    segmentation,\n    partHeatmaps,\n    heatmapScores,\n    offsets,\n    displacementFwd,\n    displacementBwd\n    } = this.baseModel.predict(input);\n    return {\n    segmentLogits: segmentation,\n    partHeatmapLogits: partHeatmaps,\n    heatmapScores,\n    offsets,\n    displacementFwd,\n    displacementBwd,\n    };\n  }\n  private\n  predictForMultiPersonInstanceSegmentationAndPart(input: tf.Tensor3D):\n  {\n    segmentLogits:\n  tf.Tensor3D,\n    longOffsets: tf.Tensor3D,\n    heatmapScores: tf.Tensor3D,\n    offsets: tf.Tensor3D,\n    displacementFwd: tf.Tensor3D,\n    displacementBwd: tf.Tensor3D,\n    partHeatmaps: tf.Tensor3D\n  }\n  {\n    const {\n    segmentation,\n    longOffsets,\n    heatmapScores,\n    offsets,\n    displacementFwd,\n    displacementBwd,\n    partHeatmaps,\n    } = this.baseModel.predict(input);\n    return {\n    segmentLogits:\n  segmentation,\n    longOffsets,\n    heatmapScores,\n    offsets,\n    displacementFwd,\n    displacementBwd,\n  }
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partHeatmaps\n };\n }\n\n /**\n * Given an image with people, returns a dictionary of all intermediate\n * tensors including: 1) a binary array with 1 for the pixels that are part of\n * the person, and 0 otherwise, 2) heatmapScores, 3) offsets, and 4) paddings.\n * \n * @param input ImageData|HTMLImageElement|HTMLCanvasElement|HTMLVideoElement)\n * The input image to feed through the network.\n * \n * @param internalResolution Defaults to 'medium'. The internal resolution\n * that the input is resized to before inference. The larger the\n * internalResolution the more accurate the model at the cost of slower\n * prediction times. Available values are 'low', 'medium', 'high', 'full', or\n * a percentage value between 0 and 1. The values 'low', 'medium', 'high', and\n * 'full' map to 0.25, 0.5, 0.75, and 1.0 correspondingly.\n * \n * @param segmentationThreshold The minimum that segmentation values must have\n * to be considered part of the person. Affects the generation of the\n * segmentation mask.\n * \n * @return A dictionary containing\n * `segmentation`, `heatmapScores`, `offsets`,\n * and `padding`:\n * - `segmentation`: A 2d Tensor with 1 for the pixels that are part of the\n * person, and 0 otherwise. The width and height correspond to the same\n * dimensions of the input image.\n * - `heatmapScores`: A 3d Tensor of the keypoint heatmaps used by\n * pose estimation decoding.\n * - `offsets`: A 3d Tensor of the keypoint offsets used by pose\n * estimation decoding.\n * - `displacementFwd`: A 3d Tensor of the keypoint forward displacement used\n * by pose estimation decoding.\n * - `displacementBwd`: A 3d Tensor of the keypoint backward displacement used\n * by pose estimation decoding.\n * - `padding`: The padding (unit pixels) being applied to the input image\n * before it is fed into the model.\n */\n segmentPersonActivation(\n input: BodyPixInput, internalResolution:\n BodyPixInternalResolution, segmentationThreshold = 0.5): {\n segmentation: tf.Tensor2D,\n heatmapScores: tf.Tensor3D,\n offsets: tf.Tensor3D,\n displacementFwd: tf.Tensor3D,\n displacementBwd: tf.Tensor3D,\n

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padding: Padding,\n internalResolutionHeightAndWidth: [number, number]\n } {\n const [height, width] =\n getInputSize(input);\n const internalResolutionHeightAndWidth = toInputResolutionHeightAndWidth(\n internalResolution, this.baseModel.outputStride, [height, width]);\n const {resized, padding} =\n padAndResizeTo(input, internalResolutionHeightAndWidth);\n\n const {\n segmentation,\n heatmapScores,\n offsets,\n displacementFwd,\n displacementBwd\n } = tf.tidy(() => {\n const {\n segmentLogits,\n heatmapScores,\n offsets,\n displacementFwd,\n displacementBwd\n } =\n this.predictForPersonSegmentation(resized);\n\n const [resizedHeight, resizedWidth] = resized.shape;\n\n const scaledSegmentScores = scaleAndCropToInputTensorShape(\n segmentLogits, [height, width],\n [resizedHeight, resizedWidth],\n [[padding.top, padding.bottom], [padding.left, padding.right]],\n\n APPLY_SIGMOID_ACTIVATION);\n\n return {\n segmentation: toMaskTensor(\n tf.squeeze(scaledSegmentScores), segmentationThreshold),\n heatmapScores,\n offsets,\n displacementFwd,\n displacementBwd,\n };\n });\n resized.dispose();\n return {\n segmentation,\n heatmapScores,\n offsets,\n displacementFwd,\n displacementBwd,\n padding,\n internalResolutionHeightAndWidth\n };\n }\n\n /**\n * Given an image with many people, returns a\n * PersonSegmentation dictionary\n * that contains the segmentation mask for all people and a single pose.\n * \n * Note: The segmentation mask returned by this method covers all people but\n * the pose works well for one person. If you want to estimate instance-level\n * multiple person segmentation & pose for each person, use\n * `segmentMultiPerson` instead.\n * \n * @param input ImageData|HTMLImageElement|HTMLCanvasElement|HTMLVideoElement)\n * \n * The input image to feed through the network.\n * \n * @param config PersonInferenceConfig object that contains\n * parameters for the BodyPix inference using person decoding.\n * \n * @return A SemanticPersonSegmentation dictionary that contains height,\n * width, the flattened binary segmentation mask and the poses for all people.\n * \n * The width and height correspond to the same dimensions of the input image.\n * \n * - `height`: The height of the segmentation data in pixel unit.\n * - `width`: The width of the segmentation data in pixel unit.\n * - `data`: The flattened Uint8Array of segmentation data. 1 means the pixel\n * belongs to a person and 0 means the pixel doesn't belong to a person. The\n * size of the array is equal to `height` x `width` in row-major order.\n * - `allPoses`: The 2d poses of all people.\n */\n async segmentPerson(\n input:
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BodyPixInput,\n    config: PersonInferenceConfig = PERSON_INFERENCE_CONFIG);\n    Promise<SemanticPersonSegmentation> {\n    config = {...PERSON_INFERENCE_CONFIG, ...config};\n    validatePersonInferenceConfig(config);\n    const {\n    segmentation,\n    heatmapScores,\n    offsets,\n    displacementFwd,\n    displacementBwd,\n    padding,\n    internalResolutionHeightAndWidth\n    } =\n    this.segmentPersonActivation(\n        input, config.internalResolution, config.segmentationThreshold);\n    const [height, width] = segmentation.shape;\n    const result = await segmentation.data() as Uint8Array;\n    segmentation.dispose();\n    const tensorBuffers = await toTensorBuffers3D(\n        [heatmapScores, offsets,\n        displacementFwd, displacementBwd]);\n    const [scoresBuf, offsetsBuf, displacementsFwdBuf,\n        displacementsBwdBuf] =\n        tensorBuffers;\n    let poses = decodeMultiplePoses(\n        scoresBuf, offsetsBuf,\n        displacementsFwdBuf, displacementsBwdBuf,\n        this.baseModel.outputStride, config.maxDetections,\n        config.scoreThreshold,\n        config.nmsRadius);\n    poses = scaleAndFlipPoses(\n        poses, [height, width],\n        internalResolutionHeightAndWidth, padding,\n        FLIP_POSES_AFTER_SCALING);\n    heatmapScores.dispose();\n    offsets.dispose();\n    displacementFwd.dispose();\n    displacementBwd.dispose();\n    return {height, width, data: result, allPoses: poses};\n    }\n    /**\n     * Given an image with multiple people, returns\n     * an array of PersonSegmentation object. Each element in the array corresponding to one\n     * of the people in the input image. In other words, it predicts\n     * instance-level multiple person segmentation & pose for each\n     * person.\n     * The model does standard ImageNet pre-processing before inferring through\n     * the model. The image pixels should have values [0-255].\n     * @param input\n     * ImageData|HTMLImageElement|HTMLCanvasElement|HTMLVideoElement) The input\n     * image to feed through the network.\n     * @param config MultiPersonInferenceConfig\n     * object that contains\n     * parameters for the BodyPix inference using multi-person decoding.\n     * @return An array of PersonSegmentation object, each containing a width,\n     * height, a binary array (1 for the pixels that are part of the\n     * person, and 0 otherwise) and 2D pose. The array size corresponds to the\n     * number of pixels in the image. The width and height correspond to the\n     * dimensions of the image the binary array is shaped to, which are the same\n     * dimensions of the input image.\n     */\n    async segmentMultiPerson(\n        input: BodyPixInput,\n        config: MultiPersonInstanceInferenceConfig =\n            MULTI_PERSON_INSTANCE_INFERENCE_CONFIG):\n        Promise<PersonSegmentation[]> {\n        config = {...MULTI_PERSON_INSTANCE_INFERENCE_CONFIG,\n            ...config};\n        validateMultiPersonInstanceInferenceConfig(config);\n        const [height, width] =\n            getInputSize(input);\n        const internalResolutionHeightAndWidth = toInputResolutionHeightAndWidth(\n            config.internalResolution, this.baseModel.outputStride,\n            [height, width]);\n        const {resized, padding} =\n            padAndResizeTo(input, internalResolutionHeightAndWidth);\n        const {\n            segmentation,\n            longOffsets,\n            heatmapScoresRaw,\n            offsetsRaw,\n            displacementFwdRaw,\n            displacementBwdRaw,\n        } = tf.tidy(() => {\n            const {\n                segmentLogits,\n                longOffsets,\n                heatmapScores,\n                offsets,\n                displacementFwd,\n                displacementBwd,\n            } =\n                this.predictForMultiPersonInstanceSegmentationAndPart(resized);\n            const scaledSegmentScores =\n                scaleAndCropToInputTensorShape(\n                    segmentLogits, [height, width], internalResolutionHeightAndWidth,\n                    [[padding.top, padding.bottom], [padding.left, padding.right]],\n                    APPLY_SIGMOID_ACTIVATION);\n            const longOffsetsResized = false;\n            let scaledLongOffsets;\n            if (longOffsetsResized) {\n                scaledLongOffsets = scaleAndCropToInputTensorShape(\n                    longOffsets, [height, width], internalResolutionHeightAndWidth,\n                    [[padding.top, padding.bottom], [padding.left, padding.right]],\n                    APPLY_SIGMOID_ACTIVATION);\n            } else {\n                scaledLongOffsets = longOffsets;\n            }\n            const segmentation = toMaskTensor(\n                tf.squeeze(scaledSegmentScores),\n                config.segmentationThreshold);\n            return {\n                segmentation,\n                longOffsets: scaledLongOffsets,\n                heatmapScoresRaw: heatmapScores,\n                offsetsRaw: offsets,\n                displacementFwdRaw: displacementFwd,\n                displacementBwdRaw: displacementBwd,\n            };\n        });\n        const tensorBuffers = await toTensorBuffers3D(\n            [heatmapScoresRaw, offsetsRaw, displacementFwdRaw, displacementBwdRaw]);\n        const [scoresBuf,\n            offsetsBuf, displacementsFwdBuf, displacementsBwdBuf] =\n            tensorBuffers;\n        let poses =

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decodeMultiplePoses(\n    scoresBuf, offsetsBuf, displacementsFwdBuf, displacementsBwdBuf,\n        this.baseModel.outputStride, config.maxDetections,\n        config.scoreThreshold, config.nmsRadius);\n\nposes = scaleAndFlipPoses(\n    poses, [height, width], internalResolutionHeightAndWidth, padding,\n    FLIP_POSES_AFTER_SCALING);\n\nconst instanceMasks = await decodePersonInstanceMasks(\n    segmentation, longOffsets, poses, height, width,\n    this.baseModel.outputStride,\n    internalResolutionHeightAndWidth, padding,\n    config.scoreThreshold, config.refineSteps,\n    config.minKeypointScore,\n    config.maxDetections);\n\nresized.dispose();\nsegmentation.dispose();\nlongOffsets.dispose();\nheatmapScoresRaw.dispose();\noffsetsRaw.dispose();\ndisplacementFwdRaw.dispose();\ndisplacementBwdRaw.dispose();\n\nreturn instanceMasks;\n}\n\n/**\n * Given an image with many people, returns a dictionary containing: height,\n * width, a tensor with a part id from 0-24 for the pixels that are\n * part of a corresponding body part, and -1 otherwise. This does standard\n * ImageNet pre-processing before inferring through the model. The image\n * should pixels should have values [0-255].\n * @param input ImageData|HTMLImageElement|HTMLCanvasElement|HTMLVideoElement)\n * The input image to feed through the network.\n * @param internalResolution Defaults to 'medium'. The internal resolution\n * percentage that the input is resized to before inference. The larger the\n * internalResolution the more accurate the model at the cost of slower\n * prediction times. Available values are 'low', 'medium', 'high', 'full', or\n * a percentage value between 0 and 1. The values 'low', 'medium', 'high', and\n * 'full' map to 0.25, 0.5, 0.75, and 1.0 correspondingly.\n * @param segmentationThreshold The minimum that segmentation values must have\n * to be considered part of the person. Affects the clipping of the colored\n * part image.\n * @return A dictionary containing `partSegmentation`, `heatmapScores`,\n * `offsets`, and `padding`:\n * - `partSegmentation`: A 2d Tensor with a part id from 0-24 for\n * the pixels that are part of a corresponding body part, and -1 otherwise.\n * - `heatmapScores`: A 3d Tensor of the keypoint heatmaps used by\n * single-person pose estimation decoding.\n * - `offsets`: A 3d Tensor of the keypoint offsets used by single-person pose\n * estimation decoding.\n * - `displacementFwd`: A 3d Tensor of the keypoint forward displacement\n * used by pose estimation decoding.\n * - `displacementBwd`: A 3d Tensor of the keypoint backward displacement used\n * by pose estimation decoding.\n * - `padding`: The padding (unit pixels) being applied to the input image\n * before it is fed into the model.\n */\nsegmentPersonPartsActivation(\n    input: BodyPixInput, internalResolution: BodyPixInternalResolution,\n    segmentationThreshold = 0.5): {\n    partSegmentation: tf.Tensor2D,\n    heatmapScores: tf.Tensor3D,\n    offsets: tf.Tensor3D,\n    displacementFwd: tf.Tensor3D,\n    displacementBwd: tf.Tensor3D,\n    padding: Padding,\n    internalResolutionHeightAndWidth: [number, number]\n } {\n    const [height, width] = getInputSize(input);\n    const internalResolutionHeightAndWidth =\n        toInputResolutionHeightAndWidth(\n            internalResolution, this.baseModel.outputStride, [height, width]);\n    const {\n        resized,\n        padding,\n    } = padAndResizeTo(input, internalResolutionHeightAndWidth);\n    const {\n        partSegmentation,\n        heatmapScores,\n        offsets,\n        displacementFwd,\n        displacementBwd\n    } =\n        tf.tidy(() => {\n            const {\n                segmentLogits,\n                partHeatmapLogits,\n                heatmapScores,\n                offsets,\n                displacementFwd,\n                displacementBwd\n            } = this.predictForPersonSegmentationAndPart(resized);\n            const [resizedHeight, resizedWidth] = resized.shape;\n            const scaledSegmentScores =\n                scaleAndCropToInputTensorShape(\n                    segmentLogits, [height, width], [resizedHeight, resizedWidth],\n                    [[padding.top, padding.bottom], [padding.left, padding.right]],\n                    APPLY_SIGMOID_ACTIVATION);\n            const scaledPartHeatmapScore = scaleAndCropToInputTensorShape(\n                partHeatmapLogits, [height, width],\n                [resizedHeight, resizedWidth],\n                [[padding.top, padding.bottom], [padding.left, padding.right]],\n                APPLY_SIGMOID_ACTIVATION);\n            const segmentation =\n                toMaskTensor(tf.squeeze(scaledSegmentScores), segmentationThreshold);\n            return {\n                partSegmentation:\n                    decodePartSegmentation(segmentation, scaledPartHeatmapScore),\n                heatmapScores,\n                offsets,\n                displacementFwd,\n                displacementBwd,\n            };\n        });\n    resized.dispose();\n    return {\n        partSegmentation,\n        heatmapScores,\n        offsets,\n        displacementFwd,\n        displacementBwd,\n    };\n}

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padding,\n internalResolutionHeightAndWidth\n

};\n }\n\n /**\n * Given an image with many people, returns a PartSegmentation dictionary that\n * contains the body part segmentation mask for all people and a single pose.\n * Note: The body part segmentation mask returned by this method covers all\n * people but the pose works well when there is one person. If you want to\n * estimate instance-level multiple person body part segmentation & pose for\n * each person, use `segmentMultiPersonParts` instead.\n * @param input

ImageData|HTMLImageElement|HTMLCanvasElement|HTMLVideoElement)\n * The input image to feed through the network.\n * @param config PersonInferenceConfig object that contains\n * parameters for the BodyPix inference using single person decoding.\n * @return A SemanticPartSegmentation dictionary that contains height, width,\n * the flattened binary segmentation mask and the pose for the person. The\n * width and height correspond to

the same dimensions of the input image.\n * - `height`: The height of the person part segmentation data in pixel unit.\n * - `width`: The width of the person part segmentation data in pixel unit.\n * - `data`: The flattened Int32Array of person part segmentation data with a\n * part id from 0-24 for the pixels that are part of a corresponding body\n * part, and -1 otherwise. The size of the array is equal to `height` x\n * `width` in row-major order.\n * - `allPoses`: The 2d poses of all people.\n */\n async segmentPersonParts(\n input:

BodyPixInput,\n config: PersonInferenceConfig = PERSON_INFERENCE_CONFIG):

Promise<SemanticPartSegmentation> {\n config = {...PERSON_INFERENCE_CONFIG, ...config};\n

validatePersonInferenceConfig(config);\n const {\n partSegmentation,\n heatmapScores,\n offsets,\n displacementFwd,\n displacementBwd,\n padding,\n internalResolutionHeightAndWidth\n } =\n this.segmentPersonPartsActivation(\n

input, config.internalResolution, config.segmentationThreshold);\n\n const [height, width] =\n partSegmentation.shape;\n const data = await partSegmentation.data() as Int32Array;\n partSegmentation.dispose();\n\n const tensorBuffers = await toTensorBuffers3D(\n [heatmapScores, offsets,\n displacementFwd, displacementBwd]);\n const [scoresBuf, offsetsBuf, displacementsFwdBuf,\n displacementsBwdBuf] =\n tensorBuffers;\n\n let poses = decodeMultiplePoses(\n scoresBuf, offsetsBuf,\n displacementsFwdBuf, displacementsBwdBuf,\n this.baseModel.outputStride, config.maxDetections,\n config.scoreThreshold, config.nmsRadius);\n\n poses = scaleAndFlipPoses(\n poses, [height, width],\n internalResolutionHeightAndWidth, padding,\n FLIP_POSES_AFTER_SCALING);\n\n heatmapScores.dispose();\n offsets.dispose();\n displacementFwd.dispose();\n displacementBwd.dispose();\n\n return {height, width, data,

allPoses: poses};\n }\n\n /**\n * Given an image with multiple people, returns an *array* of PartSegmentation\n * object. Each element in the array corresponding to one\n * of the people in the input image. In other words, it predicts\n * instance-level multiple person body part segmentation & pose for each\n * person.\n * This does standard ImageNet pre-processing before inferring through\n * the model. The image pixels should have values [0-255].\n * @param input\n *

ImageData|HTMLImageElement|HTMLCanvasElement|HTMLVideoElement) The input\n * image to feed through the network.\n * @param config MultiPersonInferenceConfig object that contains\n * parameters for the BodyPix inference using multi-person decoding.\n * @return An array of PartSegmentation object, each containing a width,\n * height, a flattened array (with part id from 0-24 for the pixels that are\n * part of a corresponding body part, and -1 otherwise) and 2D pose.

The width\n * and height correspond to the dimensions of the image. Each flattened part\n * segmentation array size is equal to `height` x `width`.\n */\n async segmentMultiPersonParts(\n input: BodyPixInput,\n config:

MultiPersonInstanceInferenceConfig =\n MULTI_PERSON_INSTANCE_INFERENCE_CONFIG):

Promise<PartSegmentation[]> {\n config = {...MULTI_PERSON_INSTANCE_INFERENCE_CONFIG,

...config};\n\n validateMultiPersonInstanceInferenceConfig(config);\n const [height, width] =

getInputSize(input);\n const internalResolutionHeightAndWidth = toInputResolutionHeightAndWidth(\n config.internalResolution, this.baseModel.outputStride,\n [height, width]);\n const {resized, padding} =\n

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padAndResizeTo(input, internalResolutionHeightAndWidth);\n const {\n  segmentation,\n  longOffsets,\n  heatmapScoresRaw,\n  offsetsRaw,\n  displacementFwdRaw,\n  displacementBwdRaw,\n  partSegmentation,\n  } = tf.tidy()\n => {\n  const {\n    segmentLogits,\n    longOffsets,\n    heatmapScores,\n    offsets,\n    displacementFwd,\n    displacementBwd,\n    partHeatmaps\n  } =\n  this.predictForMultiPersonInstanceSegmentationAndPart(resized);\n  // decoding with scaling.\n  const\n  scaledSegmentScores = scaleAndCropToInputTensorShape(\n    segmentLogits, [height, width],\n    internalResolutionHeightAndWidth,\n    [[padding.top, padding.bottom], [padding.left, padding.right]],\n    APPLY_SIGMOID_ACTIVATION);\n  // decoding with scaling.\n  const scaledPartSegmentationScores =\n  scaleAndCropToInputTensorShape(\n    partHeatmaps, [height, width], internalResolutionHeightAndWidth,\n    [[padding.top, padding.bottom], [padding.left, padding.right]],\n    APPLY_SIGMOID_ACTIVATION);\n  const scaledLongOffsets = longOffsets;\n  const segmentation = toMaskTensor(\n  tf.squeeze(scaledSegmentScores), config.segmentationThreshold);\n\n  const partSegmentation =\n  decodeOnlyPartSegmentation(scaledPartSegmentationScores);\n  return {\n    segmentation,\n    longOffsets: scaledLongOffsets,\n    heatmapScoresRaw: heatmapScores,\n    offsetsRaw: offsets,\n    displacementFwdRaw: displacementFwd,\n    displacementBwdRaw:\n    displacementBwd,\n    partSegmentation\n  }; }\n\n  const tensorBuffers = await toTensorBuffers3D(\n  [heatmapScoresRaw, offsetsRaw, displacementFwdRaw, displacementBwdRaw]);\n  const [scoresBuf,\n  offsetsBuf, displacementsFwdBuf, displacementsBwdBuf] =\n  tensorBuffers;\n  let poses =\n  decodeMultiplePoses(\n    scoresBuf, offsetsBuf, displacementsFwdBuf, displacementsBwdBuf,\n    this.baseModel.outputStride, config.maxDetections,\n    config.scoreThreshold, config.nmsRadius);\n  poses =\n  scaleAndFlipPoses(\n    poses, [height, width], internalResolutionHeightAndWidth, padding,\n    FLIP_POSES_AFTER_SCALING);\n\n  const instanceMasks = await decodePersonInstancePartMasks(\n    segmentation, longOffsets,\n    partSegmentation, poses, height, width,\n    this.baseModel.outputStride, internalResolutionHeightAndWidth,\n    padding,\n    config.scoreThreshold, config.refineSteps, config.minKeypointScore,\n    config.maxDetections);\n  resized.dispose();\n  segmentation.dispose();\n  longOffsets.dispose();\n  heatmapScoresRaw.dispose();\n  offsetsRaw.dispose();\n  displacementFwdRaw.dispose();\n  displacementBwdRaw.dispose();\n  partSegmentation.dispose();\n  return instanceMasks;\n }\n\n public\n dispose() {\n  this.baseModel.dispose();\n }\n\n\n * Loads the MobileNet BodyPix model.\n * ^\nasync\n function loadMobileNet(config: ModelConfig): Promise<BodyPix> {\n  const outputStride = config.outputStride;\n  const quantBytes = config.quantBytes;\n  const multiplier = config.multiplier;\n  if (tf == null) {\n    throw new\n  Error(\n    `Cannot\n  find TensorFlow.js. If you are using a <script> tag, please ` +\n    `also include @tensorflow/tfjs on the page\n  before using this\n  model.`);\n  }\n  const url = mobileNetSavedModel(outputStride, multiplier,\n  quantBytes);\n  const graphModel = await tfconv.loadGraphModel(config.modelUrl || url);\n  const mobilenet = new\n  MobileNet(graphModel, outputStride);\n  return new BodyPix(mobilenet);\n }\n\n\n * Loads the ResNet BodyPix\n  model.\n  * ^\nasync\n function loadResNet(config: ModelConfig): Promise<BodyPix> {\n  const outputStride =\n  config.outputStride;\n  const quantBytes = config.quantBytes;\n  if (tf == null) {\n    throw new Error(\n    `Cannot find TensorFlow.js. If you are using a <script> tag, please ` +\n    `also include @tensorflow/tfjs on the\n  page before using this\n  model.`);\n  }\n  const url = resNet50SavedModel(outputStride, quantBytes);\n  const\n  graphModel = await tfconv.loadGraphModel(config.modelUrl || url);\n  const resnet = new ResNet(graphModel,\n  outputStride);\n  return new BodyPix(resnet);\n }\n\n\n * Loads the BodyPix model instance from a checkpoint,\n  with the ResNet\n  * or MobileNet architecture. The model to be loaded is configurable using the\n  * config\n  dictionary ModelConfig. Please find more details in the\n  * documentation of the ModelConfig.\n  * ^\n * @param\n  config ModelConfig dictionary that contains parameters for\n  * the BodyPix loading process. Please find more\n  details of each parameters\n  * in the documentation of the ModelConfig interface. The predefined\n  *  
`MOBILENET_V1_CONFIG` and `RESNET_CONFIG` can also be used as references\n  * for defining your

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customized config.\n */\nexport async function load(config: ModelConfig = MOBILENET_V1_CONFIG):\n Promise<BodyPix> {\n  config = validateModelConfig(config);\n  if (config.architecture === 'ResNet50') {\n    return loadResNet(config);\n  } else if (config.architecture === 'MobileNetV1') {\n    return\n    loadMobileNet(config);\n  } else {\n    return null;\n  }\n}\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache\n * License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You\n * may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required\n * by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS"\n * BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the\n * License for the specific language governing permissions and\n * limitations under the License.\n *
=====
*/\n\nimport {cpuBlur} from './blur';\nimport {Color, PartSegmentation, PersonSegmentation} from\n './types';\nimport {SemanticPartSegmentation, SemanticPersonSegmentation} from './types';\nimport {getInputSize}\n from './util';\n\nexport type Canvas = HTMLCanvasElement | OffscreenCanvas;\n\nconst\n  offScreenCanvases: {[name: string]: Canvas} = {};\n\ntype ImageType =\n  HTMLImageElement|HTMLVideoElement|Canvas;\ntype HasDimensions = {\n  width: number,\n  height:\n  number\n};\n\nfunction isSafari() {\n  return\n  (/^(?!chrome|android).*safari/i.test(navigator.userAgent));\n}\n\nfunction assertSameDimensions(\n  {width:\n  widthA, height: heightA}: HasDimensions,\n  {width: widthB, height: heightB}: HasDimensions, nameA: string,\n  nameB: string) {\n  if (widthA !== widthB || heightA !== heightB) {\n    throw new Error(`error: dimensions must\n    match. ${nameA} has dimensions ${\n      widthA}x${heightA}, ${nameB} has dimensions\n    ${widthB}x${heightB}`);\n  }\n}\n\nfunction flipCanvasHorizontal(canvas: Canvas) {\n  const ctx =\n  canvas.getContext('2d');\n  ctx.scale(-1, 1);\n  ctx.translate(-canvas.width, 0);\n}\n\nfunction\n  drawWithCompositing(\n  ctx: CanvasRenderingContext2D|OffscreenCanvasRenderingContext2D,\n  image:\n  Canvas|ImageType,\n  compositeOperation:\n  string) {\n  ctx.globalCompositeOperation = compositeOperation;\n  ctx.drawImage(image, 0, 0);\n}\n\nfunction\n  createOffScreenCanvas(): Canvas {\n  if (typeof document !== 'undefined') {\n    return\n    document.createElement('canvas');\n  } else if (typeof OffscreenCanvas !== 'undefined') {\n    return new\n    OffscreenCanvas(0, 0);\n  } else {\n    throw new Error('Cannot create a canvas in this context');\n  }\n}\n\nfunction\n  ensureOffscreenCanvasCreated(id: string): Canvas {\n  if (!offScreenCanvases[id]) {\n    offScreenCanvases[id] =\n    createOffScreenCanvas();\n  }\n  return offScreenCanvases[id];\n}\n\nfunction drawAndBlurImageOnCanvas(\n  image: ImageType, blurAmount: number, canvas: Canvas) {\n  const {height, width} = image;\n  const ctx =\n  canvas.getContext('2d');\n  canvas.width = width;\n  canvas.height = height;\n  ctx.clearRect(0, 0, width, height);\n  ctx.save();\n  if (isSafari()) {\n    cpuBlur(canvas, image, blurAmount);\n  } else {\n    // tslint:disable:no-any\n    (ctx\n    as any).filter = `blur(${blurAmount}px)`;\n    ctx.drawImage(image, 0, 0, width, height);\n  }\n  ctx.restore();\n}\n\nfunction drawAndBlurImageOnOffScreenCanvas(\n  image: ImageType, blurAmount:\n  number,\n  offscreenCanvasName: string): Canvas {\n  const canvas =\n  ensureOffscreenCanvasCreated(offscreenCanvasName);\n  if (blurAmount === 0) {\n   \n    renderImageToCanvas(image, canvas);\n  } else {\n    drawAndBlurImageOnCanvas(image, blurAmount, canvas);\n  }\n  return canvas;\n}\n\nfunction renderImageToCanvas(image: ImageType, canvas: Canvas) {\n  const {width,\n  height} = image;\n  canvas.width = width;\n  canvas.height = height;\n  const ctx = canvas.getContext('2d');\n  ctx.drawImage(image, 0, 0, width, height);\n}\n\n/**\n * Draw an image on a canvas\n */\nfunction\n  renderImageDataToCanvas(image: ImageData, canvas: Canvas) {\n  canvas.width = image.width;\n  canvas.height\n  = image.height;\n  const ctx = canvas.getContext('2d');\n  ctx.putImageData(image, 0, 0);\n}\n\nfunction\n  renderImageDataToOffScreenCanvas(\n  image: ImageData, canvasName: string): Canvas {\n  const canvas =\n  ensureOffscreenCanvasCreated(canvasName);\n  renderImageDataToCanvas(image, canvas);\n  return\n}

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canvas;\n}\n\n/**\n * Given the output from estimating multi-person segmentation, generates an\n * image with foreground and background color at each pixel determined by the\n * corresponding binary segmentation value at the pixel from the output. In\n * other words, pixels where there is a person will be colored with foreground\n * color and where there is not a person will be colored with background color.\n * \n * @param personOrPartSegmentation The output from\n * `segmentPerson`, `segmentMultiPerson`,\n * `segmentPersonParts` or `segmentMultiPersonParts`. They can\n * be SemanticPersonSegmentation object, an array of PersonSegmentation object,\n * SemanticPartSegmentation object, or an array of PartSegmentation object.\n * \n * @param foreground Default to {r:0, g:0, b:0, a: 0}. The foreground color\n * (r,g,b,a) for visualizing pixels that belong to people.\n * \n * @param background Default to {r:0, g:0, b:0, a: 255}. The background color\n * (r,g,b,a) for visualizing pixels that don't belong to people.\n * \n * @param drawContour Default to false. Whether to draw the contour around each\n * person's segmentation mask or body part mask.\n * \n * @param foregroundIds Default to [1]. The integer values that represent\n * foreground. For person segmentation, 1 is the foreground. For body part\n * segmentation, it can be a subset of all body parts ids.\n * \n * @returns An ImageData with the same width and height of\n * all the PersonSegmentation in multiPersonSegmentation, with opacity and\n * transparency at each pixel determined by the corresponding binary\n * segmentation value at the pixel from the output.\n */\nexport function toMask(\n personOrPartSegmentation: SemanticPersonSegmentation|\n SemanticPartSegmentation|PersonSegmentation[]|PartSegmentation[],\n foreground: Color = {\n r: 0,\n g: 0,\n b: 0,\n a: 0\n },\n background: Color = {\n r: 0,\n g: 0,\n b: 0,\n a: 255\n },\n drawContour = false, foregroundIds: number[] = [1]): ImageData {\n if\n (Array.isArray(personOrPartSegmentation) &&\n personOrPartSegmentation.length === 0) {\n return null;\n }\n\n let multiPersonOrPartSegmentation:\n Array<SemanticPersonSegmentation|SemanticPartSegmentation|\n PersonSegmentation|PartSegmentation>;\n\n if (!Array.isArray(personOrPartSegmentation)) {\n multiPersonOrPartSegmentation = [personOrPartSegmentation];\n } else {\n multiPersonOrPartSegmentation =\n personOrPartSegmentation;\n }\n\n const {width, height} = multiPersonOrPartSegmentation[0];\n const bytes =\n new Uint8ClampedArray(width * height * 4);\n\n function drawStroke(\n bytes: Uint8ClampedArray, row:\n number, column: number, width: number,\n radius: number, color: Color = {r: 0, g: 255, b: 255, a:\n 255}) {\n for (let i = -radius; i <= radius; i++) {\n for (let j = -radius; j <= radius; j++) {\n if (i !== 0 && j\n !== 0) {\n const n = (row + i) * width + (column + j);\n bytes[4 * n + 0] = color.r;\n bytes[4 * n + 1] = color.g;\n bytes[4 * n + 2] = color.b;\n bytes[4 * n + 3] = color.a;\n }\n }\n }\n }\n\n function isSegmentationBoundary(\n segmentationData: Uint8Array|Int32Array,\n row: number,\n column:\n number,\n width: number,\n foregroundIds: number[] = [1],\n radius = 1,\n): boolean {\n let\n numberBackgroundPixels = 0;\n for (let i = -radius; i <= radius; i++) {\n for (let j = -radius; j <= radius; j++)\n {\n if (i !== 0 && j !== 0) {\n const n = (row + i) * width + (column + j);\n if\n (!foregroundIds.some(id => id === segmentationData[n])) {\n numberBackgroundPixels += 1;\n }\n }\n }\n }\n\n return\n numberBackgroundPixels > 0;\n }\n\n for (let i = 0; i < height; i += 1) {\n for (let j = 0; j < width; j += 1) {\n const n = i * width + j;\n bytes[4 * n + 0] = background.r;\n bytes[4 * n + 1] = background.g;\n bytes[4 * n + 2] = background.b;\n bytes[4 * n + 3] = background.a;\n for (let k = 0; k <\n multiPersonOrPartSegmentation.length; k++) {\n if (foregroundIds.some(\n id => id ===\n multiPersonOrPartSegmentation[k].data[n])) {\n bytes[4 * n] = foreground.r;\n bytes[4 * n + 1] =\n foreground.g;\n bytes[4 * n + 2] = foreground.b;\n bytes[4 * n + 3] = foreground.a;\n const\n isBoundary = isSegmentationBoundary(\n multiPersonOrPartSegmentation[k].data, i, j, width,\n foregroundIds);\n if (drawContour && i - 1 >= 0 && i + 1 < height && j - 1 >= 0 &&\n j + 1 < width\n && isBoundary) {\n drawStroke(bytes, i, j, width, 1);\n }\n }\n }\n }\n }\n\n return new ImageData(bytes, width, height);\n}\n\nconst\n RAINBOW_PART_COLORS: Array<[number, number, number]> = [\n [110, 64, 170], [143, 61, 178], [178, 60,\n 178], [210, 62, 167],\n [238, 67, 149], [255, 78, 125], [255, 94, 99], [255, 115, 75],\n [255, 140, 56], [239, 167,

47], [217, 194, 49], [194, 219, 64],\n [175, 240, 91], [135, 245, 87], [96, 247, 96], [64, 243, 115],\n [40, 234, 141], [28, 219, 169], [26, 199, 194], [33, 176, 213],\n [47, 150, 224], [65, 125, 224], [84, 101, 214], [99, 81, 195]\n};\n\n**\n * Given the output from person body part segmentation (or multi-person\n * instance body part segmentation) and an array of colors indexed by part id,\n * generates an image with the corresponding color for each part at each pixel,\n * and white pixels where there is no part.\n *\n * @param partSegmentation The output from segmentPersonParts\n * or segmentMultiPersonParts. The former is a SemanticPartSegmentation\n * object and later is an array of PartSegmentation object.\n *\n * @param partColors A multi-dimensional array of rgb colors indexed by\n * part id. Must have 24 colors, one for every part.\n *\n * @returns An ImageData with the same width and height of all the element in\n * multiPersonPartSegmentation, with the corresponding color for each part at\n * each pixel, and black pixels where there is no part.\n */\nexport function toColoredPartMask(\n partSegmentation: SemanticPartSegmentation|PartSegmentation[],\n partColors: Array<[number, number, number]> =\n RAINBOW_PART_COLORS): ImageData {\n if (Array.isArray(partSegmentation) && partSegmentation.length === 0) {\n return null;\n }\n\n let multiPersonPartSegmentation;\n if (!Array.isArray(partSegmentation)) {\n multiPersonPartSegmentation = [partSegmentation];\n } else {\n multiPersonPartSegmentation = partSegmentation;\n }\n\n const {width, height} = multiPersonPartSegmentation[0];\n const bytes = new Uint8ClampedArray(width * height * 4);\n\n for (let i = 0; i < height * width; ++i) {\n // invert mask. Invert the segmentation mask.\n const j = i * 4;\n bytes[j + 0] = 255;\n bytes[j + 1] = 255;\n bytes[j + 2] = 255;\n bytes[j + 3] = 255;\n\n for (let k = 0; k < multiPersonPartSegmentation.length; k++) {\n const partId = multiPersonPartSegmentation[k].data[i];\n if (partId !== -1) {\n const color = partColors[partId];\n if (!color) {\n throw new Error(`No color could be found for part id \${partId}`);\n }\n bytes[j + 0] = color[0];\n bytes[j + 1] = color[1];\n bytes[j + 2] = color[2];\n bytes[j + 3] = 255;\n }\n }\n }\n\n return new ImageData(bytes, width, height);\n}\n\nconst CANVAS_NAMES = {\n blurred: 'blurred',\n blurredMask: 'blurred-mask',\n mask: 'mask',\n lowresPartMask: 'lowres-part-mask',\n};\n\n**\n * Given an image and a maskImage of type ImageData, draws the image with the\n * mask on top of it onto a canvas.\n *\n * @param canvas The canvas to be drawn onto.\n *\n * @param image The original image to apply the mask to.\n *\n * @param maskImage An ImageData containing the mask. Ideally this should be\n * generated by toMask or toColoredPartMask.\n *\n * @param maskOpacity The opacity of the mask when drawing it on top of the\n * image. Defaults to 0.7. Should be a float between 0 and 1.\n *\n * @param maskBlurAmount How many pixels to blur the mask by. Defaults to 0.\n * Should be an integer between 0 and 20.\n *\n * @param flipHorizontal If the result should be flipped horizontally. Defaults\n * to false.\n */\nexport function drawMask(\n canvas: Canvas, image: ImageType, maskImage: ImageData|null,\n maskOpacity = 0.7, maskBlurAmount = 0, flipHorizontal = false) {\n const [height, width] = getInputSize(image);\n canvas.width = width;\n canvas.height = height;\n\n const ctx = canvas.getContext('2d');\n ctx.save();\n if (flipHorizontal) {\n flipCanvasHorizontal(canvas);\n }\n\n ctx.drawImage(image, 0, 0);\n ctx.globalAlpha = maskOpacity;\n if (maskImage) {\n assertSameDimensions({width, height}, maskImage, 'image', 'mask');\n const mask = renderImageDataToOffScreenCanvas(maskImage, CANVAS_NAMES.mask);\n const blurredMask = drawAndBlurImageOnOffScreenCanvas(\n mask, maskBlurAmount, CANVAS_NAMES.blurredMask);\n ctx.drawImage(blurredMask, 0, 0, width, height);\n }\n ctx.restore();\n}\n\n**\n * Given an image and a maskImage of type ImageData, draws the image with the\n * pixelated mask on top of it onto a canvas.\n *\n * @param canvas The canvas to be drawn onto.\n *\n * @param image The original image to apply the mask to.\n *\n * @param maskImage An ImageData containing the mask. Ideally this should be\n * generated by toColoredPartMask.\n *\n * @param maskOpacity The opacity of the mask when drawing it on top of the\n * image. Defaults to 0.7. Should be a float between 0 and 1.\n *\n * @param maskBlurAmount How many pixels to blur the mask by. Defaults to 0.\n * Should be an integer between 0 and 20.\n *\n * @param flipHorizontal If the result should be flipped horizontally. Defaults\n * to false.\n *\n * @param pixelCellWidth

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The width of each pixel cell. Default to 10 px.\n */\nexport function drawPixelatedMask(\n  canvas: Canvas,\n  image: ImageType, maskImage: ImageData,\n  maskOpacity = 0.7, maskBlurAmount = 0, flipHorizontal = false,\n  pixelCellWidth = 10.0) {\n  const [height, width] = getInputSize(image);\n  assertSameDimensions({ width, height },\n  maskImage, 'image', 'mask');\n\n  const mask = renderImageDataToOffScreenCanvas(maskImage,\n  CANVAS_NAMES.mask);\n  const blurredMask = drawAndBlurImageOnOffScreenCanvas(\n  mask,\n  maskBlurAmount, CANVAS_NAMES.blurredMask);\n\n  canvas.width = blurredMask.width;\n  canvas.height =\n  blurredMask.height;\n\n  const ctx = canvas.getContext('2d');\n  ctx.save();\n  if (flipHorizontal) {\n  flipCanvasHorizontal(canvas);\n  }\n\n  const offscreenCanvas\n  =\n  ensureOffscreenCanvasCreated(CANVAS_NAMES.lowresPartMask);\n  const offscreenCanvasCtx =\n  offscreenCanvas.getContext('2d');\n  offscreenCanvas.width = blurredMask.width * (1.0 / pixelCellWidth);\n  offscreenCanvas.height = blurredMask.height * (1.0 / pixelCellWidth);\n  offscreenCanvasCtx.drawImage(\n  blurredMask, 0, 0, blurredMask.width, blurredMask.height, 0, 0,\n  offscreenCanvas.width,\n  offscreenCanvas.height);\n  ctx.imageSmoothingEnabled = false;\n  ctx.drawImage(\n  offscreenCanvas, 0, 0,\n  offscreenCanvas.width, offscreenCanvas.height, 0,\n  0, canvas.width, canvas.height);\n\n  // Draws vertical grid\n  lines that are `pixelCellWidth` apart from each other.\n  for (let i = 0; i < offscreenCanvas.width; i++) {\n  ctx.beginPath();\n  ctx.strokeStyle = '#ffffff';\n  ctx.moveTo(pixelCellWidth * i, 0);\n  ctx.lineTo(pixelCellWidth\n  * i, canvas.height);\n  ctx.stroke();\n  }\n\n  // Draws horizontal grid lines that are `pixelCellWidth` apart\n  from each\n  // other.\n  for (let i = 0; i < offscreenCanvas.height; i++) {\n  ctx.beginPath();\n  ctx.strokeStyle =\n  '#ffffff';\n  ctx.moveTo(0, pixelCellWidth * i);\n  ctx.lineTo(canvas.width, pixelCellWidth * i);\n  ctx.stroke();\n  }\n\n  ctx.globalAlpha = 1.0 - maskOpacity;\n  ctx.drawImage(image, 0, 0, blurredMask.width,\n  blurredMask.height);\n  ctx.restore();\n  }\n\nfunction createPersonMask(\n  multiPersonSegmentation:\n  PersonSegmentation[]|SemanticPersonSegmentation,\n  edgeBlurAmount: number): Canvas {\n  const\n  backgroundMaskImage = toMask(\n  multiPersonSegmentation, {r: 0, g: 0, b: 0, a: 255},\n  {r: 0, g: 0, b: 0, a:\n  0});\n\n  const backgroundMask =\n  renderImageDataToOffScreenCanvas(backgroundMaskImage,\n  CANVAS_NAMES.mask);\n  if (edgeBlurAmount === 0) {\n  return backgroundMask;\n  } else {\n  return\n  drawAndBlurImageOnOffScreenCanvas(\n  backgroundMask, edgeBlurAmount,\n  CANVAS_NAMES.blurredMask);\n  }\n}\n\n/**\n * Given a personSegmentation\n  and an image, draws the image with its background\n  * blurred onto the canvas.\n  *\n  * @param canvas The canvas\n  to draw the background-blurred image onto.\n  *\n  * @param image The image to blur the background of and\n  draw.\n  *\n  * @param personSegmentation A SemanticPersonSegmentation or an array of\n  * PersonSegmentation\n  object.\n  *\n  * @param backgroundBlurAmount How many pixels in the background blend into each\n  * other.\n  Defaults to 3. Should be an integer between 1 and 20.\n  *\n  * @param edgeBlurAmount How many pixels to blur\n  on the edge between the person\n  * and the background by. Defaults to 3. Should be an integer between 0 and 20.\n  *\n  * @param flipHorizontal If the output should be flipped horizontally. Defaults\n  * to false.\n  */\nexport\n  function drawBokehEffect(\n  canvas: Canvas, image: ImageType,\n  multiPersonSegmentation:\n  SemanticPersonSegmentation|PersonSegmentation[],\n  backgroundBlurAmount = 3, edgeBlurAmount = 3,\n  flipHorizontal = false) {\n  const blurredImage\n  = drawAndBlurImageOnOffScreenCanvas(\n  image, backgroundBlurAmount, CANVAS_NAMES.blurred);\n\n  canvas.width = blurredImage.width;\n  canvas.height = blurredImage.height;\n\n  const ctx =\n  canvas.getContext('2d');\n  if (Array.isArray(multiPersonSegmentation) &&\n  multiPersonSegmentation.length\n  === 0) {\n  ctx.drawImage(blurredImage, 0, 0);\n  return;\n  }\n\n  const personMask =\n  createPersonMask(multiPersonSegmentation, edgeBlurAmount);\n\n  ctx.save();\n  if (flipHorizontal) {\n  flipCanvasHorizontal(canvas);\n  }\n\n  // draw the original image on the final canvas\n  const [height, width] =\n  getInputSize(image);\n  ctx.drawImage(image, 0, 0, width, height);\n\n  // \"destination-in\" - \"The existing canvas\n  content is kept where both the\n  // new shape and existing canvas content overlap. Everything else is made\n  //\n  transparent.\"\n  // crop what's not the person using the mask from the original image\n  drawWithCompositing(ctx,\n  personMask, 'destination-in');\n}

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//\"destination-over\" - \"The existing canvas content is kept where both the
// new shape and existing canvas
content overlap. Everything else is made
// transparent.\"
// draw the blurred background on top of the original
image where it doesn't
// overlap.
drawWithCompositing(ctx, blurredImage, 'destination-over');
ctx.restore();
}
function createBodyPartMask(
  multiPersonPartSegmentation:
  SemanticPartSegmentation|PartSegmentation[],
  bodyPartIdsToMask: number[],
  edgeBlurAmount: number):
  Canvas {
  const backgroundMaskImage = toMask(
    multiPersonPartSegmentation, {r: 0, g: 0, b: 0, a: 0},
    {r: 0, g: 0, b: 0, a: 255}, true, bodyPartIdsToMask);
  const backgroundMask =
  renderImageDataToOffScreenCanvas(backgroundMaskImage,
  CANVAS_NAMES.mask);
  if (edgeBlurAmount
  === 0) {
  return backgroundMask;
  } else {
  return drawAndBlurImageOnOffScreenCanvas(
  backgroundMask, edgeBlurAmount,
  CANVAS_NAMES.blurredMask);
  }
}
* Given a personSegmentation and an image, draws the image with its background
* blurred onto
the canvas.
* @param canvas The canvas to draw the background-blurred image onto.
* @param image
The image to blur the background of and draw.
* @param partSegmentation A SemanticPartSegmentation or
an array of
* PartSegmentation object.
* @param bodyPartIdsToBlur Default to [0, 1] (left-face and right-
face).
An
* array of body part ids to blur. Each must be one of the 24 body part ids.
* @param
backgroundBlurAmount How many pixels in the background blend into each
* other. Defaults to 3. Should be an
integer between 1 and 20.
* @param edgeBlurAmount How many pixels to blur on the edge between the
person
* and the background by. Defaults to 3. Should be an integer between 0 and 20.
* @param
flipHorizontal If the output should be flipped horizontally. Defaults
* to false.
*
export function
blurBodyPart(
  canvas: Canvas,
  image: ImageType,
  partSegmentation: SemanticPartSegmentation|PartSegmentation[],
  bodyPartIdsToBlur =
[0, 1],
  backgroundBlurAmount = 3,
  edgeBlurAmount = 3,
  flipHorizontal = false) {
  const blurredImage =
  drawAndBlurImageOnOffScreenCanvas(
  image, backgroundBlurAmount, CANVAS_NAMES.blurred);
  canvas.width = blurredImage.width;
  canvas.height = blurredImage.height;
  const ctx =
  canvas.getContext('2d');
  if (Array.isArray(partSegmentation) && partSegmentation.length === 0) {
  ctx.drawImage(blurredImage, 0, 0);
  return;
  }
  const bodyPartMask =
  createBodyPartMask(partSegmentation, bodyPartIdsToBlur, edgeBlurAmount);
  ctx.save();
  if (flipHorizontal)
  {
  flipCanvasHorizontal(canvas);
  }
  // draw the original image on the final canvas
  const [height, width] =
  getInputSize(image);
  ctx.drawImage(image, 0, 0, width, height);
  //\"destination-in\" - \"The existing canvas
content is kept where both the
// new shape
and existing canvas content overlap. Everything else is made
// transparent.\"
// crop what's not the person
using the mask from the original image
drawWithCompositing(ctx, bodyPartMask, 'destination-in');
//
\"destination-over\" - \"The existing canvas content is kept where both the
// new shape and existing canvas
content overlap. Everything else is made
// transparent.\"
// draw the blurred background on top of the original
image where it doesn't
// overlap.
drawWithCompositing(ctx, blurredImage, 'destination-over');
ctx.restore();
}
,\"/*
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implied.
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License.
*
=====
*
// method copied from bGlr in https://codepen.io/zhaojun/pen/zZmRQe
export function cpuBlur(
  canvas: HTMLCanvasElement|OffscreenCanvas,
  image:
  HTMLImageElement|HTMLVideoElement|HTMLCanvasElement|OffscreenCanvas,
  blur: number) {
  const
  ctx = canvas.getContext('2d');
  let sum = 0;
  const delta = 5;
  const alphaLeft = 1 / (2 * Math.PI * delta *
  delta);
  const step = blur < 3 ? 1 : 2;
  for (let y = -blur; y <= blur; y += step) {
  for (let x = -blur; x <= blur; x

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+= step) {\n  const weight =\n    alphaLeft * Math.exp(-(x * x + y * y) / (2 * delta * delta));\n  sum +=\n  weight;\n}\n}\nfor (let y = -blur; y <= blur; y += step) {\n  for (let\n    x = -blur; x <= blur; x += step) {\n    ctx.globalAlpha = alphaLeft * Math.exp(-(x * x + y * y) / (2 * delta * delta)) / sum * blur;\n    ctx.drawImage(image, x, y);\n  }\n}\nctx.globalAlpha = 1;\n\n"/**\n * @license\n * Copyright 2020 Google Inc. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n */

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*\n\nexport const PART_CHANNELS: string[] = [\n  'left_face',\n  'right_face',\n  'left_upper_arm_front',\n  'left_upper_arm_back',\n  'right_upper_arm_front',\n  'right_upper_arm_back',\n  'left_lower_arm_front',\n  'left_lower_arm_back',\n  'right_lower_arm_front',\n  'right_lower_arm_back',\n  'left_hand',\n  'right_hand',\n  'torso_front',\n  'torso_back',\n  'left_upper_leg_front',\n  'left_upper_leg_back',\n  'right_upper_leg_front',\n  'right_upper_leg_back',\n  'left_lower_leg_front',\n  'left_lower_leg_back',\n  'right_lower_leg_front',\n  'right_lower_leg_back',\n  'left_feet',\n  'right_feet'\n];\n"/**\n * @license See the LICENSE file. *\n */\n\n// This code is auto-generated, do not modify this file!\nconst version =\n  '2.2.0';\n\nexport\n  {\n    version,\n    names: [\n      'toFlattenedOneHotPartMap',\n      'partHeatmapScores',\n      'numParts',\n      'shape',\n      'partMapLocations',\n      'tf.argmax',\n      'partMapFlattened',\n      'tf.reshape',\n      'tf.oneHot',\n      'toMaskTensor',\n      'segmentScores',\n      'threshold',\n      'tf.tidy',\n      'tf.cast',\n      'tf.greater',\n      'tf.scalar',\n      'decodePartSegmentation',\n      'segmentationMask',\n      '_a',\n      'partMapHeight',\n      'partMapWidth',\n      'image',\n      'mask',\n      'flattenedMap',\n      'partNumbers',\n      'tf.expandDims',\n      'tf.range',\n      'tf.matmul',\n      'partMap',\n      'partMapShiftedUpForClipping',\n      'tf.add',\n      'tf.sub',\n      'tf.mul',\n      'model',\n      'outputStride',\n      'this',\n      'inputShape',\n      'inputs',\n      'tf.util',\n      'assert',\n      'BaseModel',\n      'input',\n      'asFloat',\n      '_this',\n      'preprocessInput',\n      'asBatch',\n      'results3d',\n      'predict',\n      'map',\n      'y',\n      'tf.squeeze',\n      'namedResults',\n      'nameOutputResults',\n      'heatmapScores',\n      'tf.sigmoid',\n      'heatmap',\n      'offsets',\n      'displacementFwd',\n      'displacementBwd',\n      'segmentation',\n      'partHeatmaps',\n      'longOffsets',\n      'partOffsets',\n      'dispose',\n      '__extends',\n      'MobileNet',\n      'tf.div',\n      'results',\n      'PART_NAMES',\n      'NUM_KEYPOINTS',\n      'length',\n      'PART_IDS',\n      'reduce',\n      'result',\n      'jointName',\n      'i',\n      'jointNameA',\n      'jointNameB',\n      'getScale',\n      '_b',\n      'padding',\n      'height',\n      'width',\n      'inputResolutionY',\n      'inputResolutionX',\n      'padT',\n      'padB',\n      'getOffsetPoint',\n      'x',\n      'keypoint',\n      'get',\n      'getImageCoords',\n      'part',\n      'heatmapX',\n      'heatmapY',\n      'clamp',\n      'a',\n      'min',\n      'max',\n      'addVectors',\n      'b',\n      'computeDistance',\n      'embedding',\n      'pose',\n      'minPartScore',\n      'distance',\n      'numKpt',\n      'p',\n      'keypoints',\n      'score',\n      'Math',\n      'position',\n      'Infinity',\n      'getEmbedding',\n      'location',\n      'keypointIndex',\n      'convertToPosition',\n      'outputResolutionX',\n      'refineSteps',\n      'newLocation',\n      'nn',\n      'dy',\n      'dx',\n      't',\n      'newPos',\n      'nn_1',\n      'matchEmbeddingToInstance',\n      'poses',\n      'numKptForMatching',\n      '_c',\n      'stride',\n      'padL',\n      'scaleX',\n      'scaleY',\n      'embed',\n      'pair',\n      'round',\n      'convertToPositionInOutput',\n      'keypointsIndex',\n      'push',\n      'kMin',\n      'kMinDist',\n      'k',\n      'dist',\n      'getOutputResolution',\n      'decodeMultipleMasksWebGL',\n      'posesAboveScore',\n      'minKptScore',\n      'maxNumPeople',\n      'inHeight',\n      'inWidth',\n      'origHeight',\n      'origWidth',\n      'slice',\n      'outHeight',\n      'outWidth',\n      'shapedLongOffsets',\n      'poseVals',\n      'Float32Array',\n      'fill',\n      'poseOffset',\n      'kp',\n      'offset',\n      '_d',\n      'posesTensor',\n      'tf.tensor',\n      'program',\n      'variableNames',\n      'outputShape',\n      'userCode',\n      'tf.backend',\n      'compileAndRun',\n      'isWebGLBackend',\n      'getBackend',\n      'decodePersonInstanceMasks',\n      'minPoseScore',\n      'minKeypointScore',\n      'filter',\n      'personSegmentations',\n      'masksTensorInfo',\n      'masksTensor',\n      'tf.engine',\n      'makeTensorFromDataId',\n      'dataId',\n      'dtype',\n      '_',\n      'tf.equal',\n      'toPersonKSegmentation',\n      'Promise',\n      'all',\n      'data',\n      'personSegmentationsData',\n      'forEach',\n      'segmentationsData',\n      'longOffsetsData',\n      'dataArrays',\n      'Uint8Array',\n      'j',\n      'n',\n      'decodeMultipleMasksCPU',\n      'decodePersonInstancePartMasks',\n      'partSegmentation',\n      'partSegmentations',\n      'bodyParts',\n      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=====
*\n\nimport * as tf from '@tensorflow/tfjs-core';\n\n/**\n * Takes the sigmoid of the part heatmap output and
generates a 2d one-hot\n * tensor with ones where the part's score has the maximum value.\n *\n * @param
partHeatmapScores\n *\nfunction toFlattenedOneHotPartMap(partHeatmapScores: tf.Tensor3D): tf.Tensor2D {\n

```



```

protected readonly model: tfconv.GraphModel,\n    public readonly outputStride: BodyPixOutputStride) {\n
const inputShape =\n    this.model.inputs[0].shape as [number, number, number, number];\n    tf.util.assert(\n        (inputShape[1] === -1) && (inputShape[2] === -1),\n        () => `Input shape [${inputShape[1]},\n    ${inputShape[2]}]` +\n        `must both be equal to or -1`);\n    }\n\n    abstract preprocessInput(input: tf.Tensor3D):\n    tf.Tensor3D;\n\n    /**\n     * Predicts intermediate Tensor representations.\n     *\n     * @param input The input RGB\n     image of the base model.\n     * A Tensor of shape: [`inputResolution`, `inputResolution`, 3].\n     *\n     * @return A\n     dictionary of base model's intermediate predictions.\n     * The returned dictionary should contains the following\n     elements:\n     * - heatmapScores: A Tensor3D that represents the keypoint heatmap scores.\n     * - offsets: A\n     Tensor3D that represents the offsets.\n     * - displacementFwd: A Tensor3D that represents the forward\n     displacement.\n     * - displacementBwd: A Tensor3D that represents the backward displacement.\n     * -\n     segmentation: A Tensor3D that represents the segmentation of all\n     * people.\n     * - longOffsets: A Tensor3D\n     that represents the long offsets used for\n     * instance grouping.\n     * - partHeatmaps: A Tensor3D that represents\n     the body part segmentation.\n     */\n    predict(input: tf.Tensor3D): {\n        heatmapScores: tf.Tensor3D,\n        offsets:\n        tf.Tensor3D,\n        displacementFwd: tf.Tensor3D,\n        displacementBwd: tf.Tensor3D,\n        segmentation:\n        tf.Tensor3D,\n        partHeatmaps: tf.Tensor3D,\n        longOffsets: tf.Tensor3D,\n        partOffsets: tf.Tensor3D\n    } {\n    return tf.tidy(() => {\n        const asFloat = this.preprocessInput(tf.cast(input, 'float32'));\n        const asBatch =\n        tf.expandDims(asFloat, 0);\n        const results = this.model.predict(asBatch) as tf.Tensor4D[];\n        const results3d:\n        tf.Tensor3D[] = results.map(y => tf.squeeze(y, [0]));\n        const namedResults =\n        this.nameOutputResults(results3d);\n\n        return {\n            heatmapScores: tf.sigmoid(namedResults.heatmap),\n            offsets: namedResults.offsets,\n            displacementFwd: namedResults.displacementFwd,\n            displacementBwd:\n            namedResults.displacementBwd,\n            segmentation: namedResults.segmentation,\n            partHeatmaps:\n            namedResults.partHeatmaps,\n            longOffsets: namedResults.longOffsets,\n            partOffsets:\n            namedResults.partOffsets\n        };\n    });\n    }\n\n    // Because MobileNet and ResNet predict() methods output a\n    different order for\n    // these values, we have a method that needs to be implemented to order them.\n    abstract\n    nameOutputResults(results: tf.Tensor3D[]): {\n        heatmap: tf.Tensor3D,\n        offsets: tf.Tensor3D,\n        displacementFwd: tf.Tensor3D,\n        displacementBwd: tf.Tensor3D,\n        segmentation: tf.Tensor3D,\n        partHeatmaps: tf.Tensor3D,\n        longOffsets: tf.Tensor3D,\n        partOffsets: tf.Tensor3D\n    };}\n\n    /**\n     * Releases\n     the CPU and GPU memory allocated by the model.\n     */\n    dispose() {\n        this.model.dispose();\n    }\n\n    /**\n     *\n     @license\n     * Copyright 2019 Google Inc. All Rights Reserved.\n     * Licensed under the Apache License, Version 2.0\n     (the `License`);\n\n     * you may not use this file except in compliance with the License.\n     * You may obtain a copy of the License at\n     *\n     * http://www.apache.org/licenses/LICENSE-2.0\n     *\n     * Unless required by applicable law or agreed to in\n     writing, software\n     * distributed under the License is distributed on an `AS IS` BASIS,\n     * WITHOUT\n     WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n     * See the License for the specific\n     language governing permissions and\n     * limitations under the License.\n     */\n\n    =====\n\n    /**\n     *\n     import * as tf from '@tensorflow/tfjs-core';\n     import { BaseModel } from './base_model';\n     export class\n     MobileNet extends BaseModel {\n         preprocessInput(input: tf.Tensor3D): tf.Tensor3D {\n             // Normalize the pixels\n             [0, 255] to be between [-1, 1].\n             return tf.tidy(() => tf.sub(tf.div(input, 127.5), 1.0));\n         }\n\n         nameOutputResults(results: tf.Tensor3D[]) {\n             const [\n                 offsets,\n                 segmentation,\n                 partHeatmaps,\n                 longOffsets,\n                 heatmap,\n                 displacementFwd,\n                 displacementBwd,\n                 partOffsets,\n                 ] = results;\n             return {\n                 offsets,\n                 segmentation,\n                 partHeatmaps,\n                 longOffsets,\n                 heatmap,\n                 displacementFwd,\n                 displacementBwd,\n                 partOffsets\n             };\n         }\n     }\n\n     /**\n     *\n     @license\n     * Copyright 2019 Google LLC. All Rights Reserved.\n     * Licensed under the Apache License, Version 2.0 (the\n     `License`);\n     * you may not use this file except in compliance with the License.\n     * You may obtain a copy of the\n     License at\n     *\n     * http://www.apache.org/licenses/LICENSE-2.0\n     *\n     * Unless required by applicable law or\n     agreed to in writing, software\n     * distributed under the License is distributed on an `AS IS` BASIS,\n     * WITHOUT\n     WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n     * See the License for

```

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```
=====
*/
export type Tuple<T> = [T, T];
export type StringTuple = Tuple<string>;
export type NumberTuple = Tuple<number>;
export const PART_NAMES = ['nose', 'leftEye', 'rightEye', 'leftEar', 'rightEar', 'leftShoulder', 'rightShoulder', 'leftElbow', 'rightElbow', 'leftWrist', 'rightWrist', 'leftHip', 'rightHip', 'leftKnee', 'rightKnee', 'leftAnkle', 'rightAnkle'];
export const NUM_KEYPOINTS = PART_NAMES.length;
export interface NumberDict { [jointName: string]: number; }
export const PART_IDS = PART_NAMES.reduce((result: NumberDict, jointName, i): NumberDict => { result[jointName] = i; return result; }, {});
const CONNECTED_PART_NAMES: StringTuple[] = ['leftHip', 'leftShoulder', 'leftElbow', 'leftShoulder', 'leftElbow', 'leftWrist', 'leftHip', 'leftKnee', 'leftKnee', 'leftAnkle', 'rightHip', 'rightShoulder', 'rightElbow', 'rightShoulder', 'rightElbow', 'rightWrist', 'rightHip', 'rightKnee', 'rightKnee', 'rightAnkle', 'leftShoulder', 'rightShoulder', 'leftHip', 'rightHip'];
// Define the skeleton. This defines the parent->child relationships of our tree. Arbitrarily this defines the nose as the root of the tree, however since we will infer the displacement for both parent->child and child->parent, we can define the tree root as any node.
export const POSE_CHAIN: StringTuple[] = ['nose', 'leftEye', 'leftEye', 'leftEar', 'nose', 'rightEye', 'rightEye', 'rightEar', 'nose', 'leftShoulder', 'leftShoulder', 'leftElbow', 'leftElbow', 'leftWrist', 'leftShoulder', 'leftHip', 'leftHip', 'leftKnee', 'leftKnee', 'leftAnkle', 'nose', 'rightShoulder', 'rightShoulder', 'rightElbow', 'rightElbow', 'rightWrist', 'rightShoulder', 'rightHip', 'rightHip', 'rightKnee', 'rightKnee', 'rightAnkle'];
export const CONNECTED_PART_INDICES = CONNECTED_PART_NAMES.map(([jointNameA, jointNameB]) => ([PART_IDS[jointNameA], PART_IDS[jointNameB]]));
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=====
*/
import { NUM_KEYPOINTS } from '../keypoints';
import { Padding, Part, TensorBuffer3D, Vector2D } from '../types';
export function getScale(height: number, width: number, inputResolutionY: number, inputResolutionX: number, padding: Padding): [number, number] {
  const { top: padT, bottom: padB, left: padL, right: padR } = padding;
  const scaleY = inputResolutionY / (padT + padB + height);
  const scaleX = inputResolutionX / (padL + padR + width);
  return [scaleX, scaleY];
}
export function getOffsetPoint(y: number, x: number, keypoint: number, offsets: TensorBuffer3D): Vector2D {
  return { y: offsets.get(y, x, keypoint), x: offsets.get(y, x, keypoint + NUM_KEYPOINTS) };
}
export function getImageCoords(part: Part, outputStride: number, offsets: TensorBuffer3D): Vector2D {
  const { heatmapY, heatmapX, id: keypoint } = part;
  const { y, x } = getOffsetPoint(heatmapY, heatmapX, keypoint, offsets);
  return { x: part.heatmapX * outputStride + x, y: part.heatmapY * outputStride + y };
}
export function fillArray<T>(element: T, size: number): T[] {
  const result: T[] = new Array(size);
  for (let i = 0; i < size; i++) { result[i] = element; }
  return result;
}
export function clamp(a: number, min: number, max: number): number {
  if (a < min) return min;
  if (a > max) return max;
  return a;
}
export function squaredDistance(y1: number, x1: number, y2: number, x2: number): number {
  const dy = y2 - y1;
  const dx = x2 - x1;
  return dy * dy + dx * dx;
}
export function addVectors(a: Vector2D, b: Vector2D): Vector2D {
  return { x: a.x + b.x, y: a.y + b.y };
}
export function clampVector(a: Vector2D, min: number, max: number): Vector2D {
  return { y: clamp(a.y, min, max), x: clamp(a.x, min, max) };
}
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```

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```
=====\n*\nimport {NUM_KEYPOINTS} from './keypoints';import {Padding, Pose} from './types';\nimport {getScale} from './util';\ninterface Pair {\n  x: number;\n  y: number;\n}\nfunction computeDistance(embedding: Pair[], pose: Pose, minPartScore = 0.3) {\n  let distance = 0.0;\n  let numKpt = 0;\n  for (let p = 0; p < embedding.length; p++) {\n    if (pose.keypoints[p].score > minPartScore) {\n      numKpt += 1;\n      distance += (embedding[p].x - pose.keypoints[p].position.x) ** 2 +\n        (embedding[p].y - pose.keypoints[p].position.y) ** 2;\n    }\n  }\n  if (numKpt === 0) {\n    distance = Infinity;\n  } else {\n    distance = distance / numKpt;\n  }\n  return distance;\n}\nfunction convertToPositionInOutput(\n  position: Pair, [padT, padL]: [number, number],\n  [scaleX, scaleY]: [number, number], stride: number): Pair {\n  const y = Math.round(((padT + position.y + 1.0) * scaleY - 1.0) / stride);\n  const x = Math.round(((padL + position.x + 1.0) * scaleX - 1.0) / stride);\n  return {x, y};\n}\nfunction getEmbedding(\n  location: Pair, keypointIndex: number, convertToPosition: (pair: Pair) => Pair,\n  outputResolutionX: number, longOffsets: Float32Array, refineSteps: number,\n  [height, width]: [number, number]): Pair {\n  const newLocation = convertToPosition(location);\n  const nn = newLocation.y * outputResolutionX + newLocation.x;\n  let dy = longOffsets[NUM_KEYPOINTS * (2 * nn) + keypointIndex];\n  let dx = longOffsets[NUM_KEYPOINTS * (2 * nn + 1) + keypointIndex];\n  let y = location.y + dy;\n  let x = location.x + dx;\n  for (let t = 0; t < refineSteps; t++) {\n    y = Math.min(y, height - 1);\n    x = Math.min(x, width - 1);\n    const newPos = convertToPosition({x, y});\n    const nn = newPos.y * outputResolutionX + newPos.x;\n    dy = longOffsets[NUM_KEYPOINTS * (2 * nn) + keypointIndex];\n    dx = longOffsets[NUM_KEYPOINTS * (2 * nn + 1) + keypointIndex];\n    y = y + dy;\n    x = x + dx;\n  }\n  return {x, y};\n}\nfunction matchEmbeddingToInstance(\n  location: Pair, longOffsets: Float32Array, poses: Pose[],\n  numKptForMatching: number, [padT, padL]: [number, number],\n  [scaleX, scaleY]: [number, number], outputResolutionX: number,\n  [height, width]: [number, number], stride: number, refineSteps: number): number {\n  const embed: Pair[] = [];\n  const convertToPosition = (pair: Pair) => convertToPositionInOutput(pair, [padT, padL], [scaleX, scaleY], stride);\n  for (let keypointsIndex = 0; keypointsIndex < numKptForMatching; keypointsIndex++) {\n    const embedding = getEmbedding(\n      location, keypointsIndex, convertToPosition, outputResolutionX,\n      longOffsets, refineSteps, [height, width]);\n    embed.push(embedding);\n  }\n  let kMin = -1;\n  let kMinDist = Infinity;\n  for (let k = 0; k < poses.length; k++) {\n    const dist = computeDistance(embed, poses[k]);\n    if (dist < kMinDist) {\n      kMin = k;\n      kMinDist = dist;\n    }\n  }\n  return kMin;\n}\nfunction getOutputResolution(\n  [inputResolutionY, inputResolutionX]: [number, number],\n  stride: number): [number, number] {\n  const outputResolutionX = Math.round((inputResolutionX - 1.0) / stride + 1.0);\n  const outputResolutionY = Math.round((inputResolutionY - 1.0) / stride + 1.0);\n  return [outputResolutionX, outputResolutionY];\n}\nexport function decodeMultipleMasksCPU(\n  segmentation: Uint8Array, longOffsets: Float32Array,\n  posesAboveScore: Pose[], height: number, width: number, stride: number,\n  [inHeight, inWidth]: [number, number], padding: Padding,\n  refineSteps: number, numKptForMatching = 5): Uint8Array[] {\n  const dataArray = posesAboveScore.map(x => new Uint8Array(height * width).fill(0));\n  const {top: padT, left: padL} = padding;\n  const [scaleX, scaleY] = getScale([height, width], [inHeight, inWidth], padding);\n  const [outputResolutionX, ] = getOutputResolution([inHeight, inWidth], stride);\n  for (let i = 0; i < height; i += 1) {\n    for (let j = 0; j < width; j += 1) {\n      const n = i * width + j;\n      const prob = segmentation[n];\n      if (prob === 1) {\n        const kMin = matchEmbeddingToInstance(\n          {x: j, y: i}, longOffsets, posesAboveScore,\n          numKptForMatching, [padT, padL], [scaleX, scaleY], outputResolutionX, [height, width],\n          stride, refineSteps);\n        if (kMin >= 0) {\n          dataArray[kMin][n] = 1;\n        }\n      }\n    }\n  }\n  return dataArray;\n}
```

```

dataArrays;\n}\n\nexport function decodeMultiplePartMasksCPU(\n
  segmentation: Uint8Array, longOffsets: Float32Array,\n  partSegmentaion: Uint8Array, posesAboveScore:
  Pose[], height: number,\n  width: number, stride: number, [inHeight, inWidth]: [number, number],\n  padding:
  Padding, refineSteps: number,\n  numKptForMatching = 5): Int32Array[] {\n  const dataArrays =\n  posesAboveScore.map(x => new Int32Array(height * width).fill(-1));\n  const {top: padT, left: padL} =
  padding;\n  const [scaleX, scaleY] =\n  getScale([height, width], [inHeight, inWidth], padding);\n  const
  [outputResolutionX, ] =\n  getOutputResolution([inHeight, inWidth], stride);\n  for (let i = 0; i < height; i += 1)
  {\n  for (let j = 0; j < width; j += 1) {\n  const n = i * width + j;\n  const prob = segmentation[n];\n  if (prob
  === 1) {\n  const kMin = matchEmbeddingToInstance(\n  {x: j, y: i}, longOffsets, posesAboveScore,
  numKptForMatching,\n  [padT, padL], [scaleX, scaleY], outputResolutionX, [height,
  width],\n  stride, refineSteps);\n  if (kMin >= 0) {\n  dataArrays[kMin][n] = partSegmentaion[n];\n
  }\n  }\n  }\n  }\n  return dataArrays;\n}\n\n"/**\n * @license\n * Copyright 2019 Google Inc. All Rights
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  http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
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  OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
  governing permissions and\n * limitations under the License.\n *
  =====\n
  *\n\nimport * as tf from '@tensorflow/tfjs-core';\nimport * as tf_webgl from '@tensorflow/tfjs-backend-
  webgl';\n\nimport
  {NUM_KEYPOINTS} from '../keypoints';\nimport {Padding, Pose} from '../types';\nimport {getScale} from
  './util';\n\nexport function decodeMultipleMasksWebGl(\n  segmentation: tf.Tensor2D, longOffsets: tf.Tensor3D,\n
  posesAboveScore: Pose[], height: number, width: number, stride: number,\n  [inHeight, inWidth]: [number,
  number], padding: Padding,\n  refineSteps: number, minKptScore: number,\n  maxNumPeople: number):
  tf.TensorInfo {\n  // The height/width of the image/canvas itself.\n  const [origHeight, origWidth] =
  segmentation.shape;\n  // The height/width of the output of the model.\n  const [outHeight, outWidth] =
  longOffsets.shape.slice(0, 2);\n  const shapedLongOffsets: tf.Tensor4D =\n  tf.reshape(longOffsets, [outHeight,
  outWidth, 2, NUM_KEYPOINTS]);\n  // Make pose tensor of shape [MAX_NUM_PEOPLE,
  NUM_KEYPOINTS, 3] where\n  // the last 3 coordinates correspond to the score, h and w coordinate of that\n  //
  keypoint.\n  const poseVals
  = new Float32Array(maxNumPeople * NUM_KEYPOINTS * 3).fill(0.0);\n  for (let i = 0; i <
  posesAboveScore.length; i++) {\n  const poseOffset = i * NUM_KEYPOINTS * 3;\n  const pose =
  posesAboveScore[i];\n  for (let kp = 0; kp < NUM_KEYPOINTS; kp++) {\n  const keypoint =
  pose.keypoints[kp];\n  const offset = poseOffset + kp * 3;\n  poseVals[offset] = keypoint.score;\n
  poseVals[offset + 1] = keypoint.position.y;\n  poseVals[offset + 2] = keypoint.position.x;\n  }\n  }\n  const
  [scaleX, scaleY] =\n  getScale([height, width], [inHeight, inWidth], padding);\n  const posesTensor =
  tf.tensor(poseVals, [maxNumPeople, NUM_KEYPOINTS, 3]);\n  const {top: padT, left: padL} = padding;\n
  const program: tf_webgl.GPGPUProgram = {\n  variableNames: ['segmentation', 'longOffsets', 'poses'],\n
  outputShape: [origHeight, origWidth],\n  userCode: `\n  int convertToPositionInOut(int pos, int pad, float
  scale, int stride) {\n  return round(((float(pos +
  pad) + 1.0) * scale - 1.0) / float(stride));\n  }\n\n  float convertToPositionInOutFloat(\n  int pos, int pad,
  float scale, int stride) {\n  return ((float(pos + pad) + 1.0) * scale - 1.0) / float(stride);\n  }\n\n  float
  dist(float x1, float y1, float x2, float y2) {\n  return pow(x1 - x2, 2.0) + pow(y1 - y2, 2.0);\n  }\n\n  float
  sampleLongOffsets(float h, float w, int d, int k) {\n  float fh = fract(h);\n  float fw = fract(w);\n  int
  clH = int(ceil(h));\n  int clW = int(ceil(w));\n  int flH = int(floor(h));\n  int flW = int(floor(w));\n  float
  o11 = getLongOffsets(flH, flW, d, k);\n  float o12 = getLongOffsets(flH, clW, d, k);\n  float o21 =
  getLongOffsets(clH, flW, d, k);\n  float o22 = getLongOffsets(clH, clW, d, k);\n  float o1 = mix(o11, o12,

```

```

fw);
float o2 = mix(o21, o22, fw);
return mix(o1, o2, fh);
}

int findNearestPose(int h, int w) {
float prob = getSegmentation(h, w);
if (prob < 1.0) {
return -1;
} // Done(Tyler): convert from output space h/w to strided space.
float stridedH = convertToPositionInOutFloat(h, padT, scaleY, stride);
float stridedW = convertToPositionInOutFloat(w, padL, scaleX, stride);
float minDist = 1000000.0;
int iMin = -1;
for (int i = 0; i < maxNumPeople; i++) {
float curDistSum = 0.0;
int numKpt = 0;
for (int k = 0; k < NUM_KEYPOINTS; k++) {
float dy = sampleLongOffsets(stridedH, stridedW, 0, k);
float dx = sampleLongOffsets(stridedH, stridedW, 1, k);
float y = float(h) + dy;
float x = float(w) + dx;
for (int s = 0; s < refineSteps; s++) {
int yRounded = round(min(y, float(height - 1.0)));
int xRounded = round(min(x, float(width - 1.0)));
float yStrided = convertToPositionInOutFloat(yRounded, padT, scaleY, stride);
float xStrided = convertToPositionInOutFloat(xRounded, padL, scaleX, stride);
float dy = sampleLongOffsets(yStrided, xStrided, 0, k);
float dx = sampleLongOffsets(yStrided, xStrided, 1, k);
y = y + dy;
x = x + dx;
}
float poseScore = getPoses(i, k, 0);
float poseY = getPoses(i, k, 1);
float poseX = getPoses(i, k, 2);
if (poseScore > minKptScore) {
numKpt = numKpt + 1;
curDistSum = curDistSum + dist(x, y, poseX, poseY);
}
}
if (numKpt > 0 && curDistSum / float(numKpt) < minDist) {
minDist = curDistSum / float(numKpt);
iMin = i;
}
}
return iMin;
}

void main() {
ivec2 coords = getOutputCoords();
int nearestPose = findNearestPose(coords[0], coords[1]);
setOutput(float(nearestPose));
}
}

const WebGLBackend = tf.backend() as tf_webgl.MathBackendWebGL;
return WebGLBackend.compileAndRun(program, [segmentation, shapedLongOffsets, posesTensor]);
}

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 * BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express
 * or implied. See the License for the specific language governing
 * permissions and limitations under the License.
 */
====
import * as tf from '@tensorflow/tfjs-core';
import {getBackend} from '@tensorflow/tfjs-core';
import {Padding, PartSegmentation, PersonSegmentation, Pose} from './types';
import {decodeMultipleMasksCPU, decodeMultiplePartMasksCPU} from './decode_multiple_masks_cpu';
import {decodeMultipleMasksWebGL} from './decode_multiple_masks_webgl';
export function toPersonKSegmentation(segmentation: tf.Tensor2D, k: number): tf.Tensor2D {
return tf.tidy(() => (tf.cast(tf.equal(segmentation, tf.scalar(k)), 'int32') as tf.Tensor2D));
}
export function toPersonKPartSegmentation(segmentation: tf.Tensor2D, bodyParts: tf.Tensor2D, k: number): tf.Tensor2D {
return tf.tidy(() => tf.sub(tf.mul(tf.cast(tf.equal(segmentation, tf.scalar(k)), 'int32'), tf.add(bodyParts, 1)), 1));
}
function isWebGLBackend() {
return getBackend() === 'webgl';
}
export async function decodePersonInstanceMasks(segmentation: tf.Tensor2D, longOffsets: tf.Tensor3D, poses: Pose[], height: number, width: number, stride: number, [inHeight, inWidth]: [number, number], padding: Padding, minPoseScore = 0.2, refineSteps = 8, minKeypointScore = 0.3, maxNumPeople = 10): Promise<PersonSegmentation[]> {
// Filter out poses with smaller score.
const posesAboveScore = poses.filter(pose => pose.score >= minPoseScore);
let personSegmentationsData: Uint8Array[];
if (isWebGLBackend()) {
const personSegmentations = tf.tidy(() => {
const masksTensorInfo = decodeMultipleMasksWebGL(segmentation, longOffsets, posesAboveScore, height, width, stride, [inHeight, inWidth], padding, refineSteps, minKeypointScore, maxNumPeople);
const masksTensor =

```



```

tf.engine().makeTensorFromDataId(\n      masksTensorInfo.dataId, masksTensorInfo.shape,\n      masksTensorInfo.dtype) as tf.Tensor2D;\n\n      return posesAboveScore.map(\n          (_, k) =>\n          toPersonKSegmentation(masksTensor, k));\n      });\n\n      personSegmentationsData =\n          (await Promise.all(personSegmentations.map(mask => mask.data())) as\n          Uint8Array[]);\n\n      personSegmentations.forEach(x => x.dispose());\n      } else {\n          const segmentationsData =\n          await segmentation.data() as Uint8Array;\n          const longOffsetsData = await longOffsets.data() as Float32Array;\n          personSegmentationsData = decodeMultipleMasksCPU(\n              segmentationsData, longOffsetsData,\n              posesAboveScore, height, width,\n              stride, [inHeight, inWidth], padding, refineSteps);\n      }\n\n      return\n      personSegmentationsData.map(\n          (data, i) => ({data, pose: posesAboveScore[i], width, height});\n      );\n\n      export\n      async function decodePersonInstancePartMasks(\n          segmentation: tf.Tensor2D, longOffsets: tf.Tensor3D,\n          partSegmentation: tf.Tensor2D, poses: Pose[], height: number, width: number,\n          stride: number, [inHeight,\n          inWidth]: [number, number], padding: Padding,\n          minPoseScore = 0.2, refineSteps = 8, minKeypointScore =\n          0.3,\n         \n          maxNumPeople = 10): Promise<PartSegmentation[]> {\n          const posesAboveScore = poses.filter(pose =>\n          pose.score >= minPoseScore);\n          let partSegmentationsByPersonData: Int32Array[];\n          if (isWebGLBackend())\n          {\n              const partSegmentations = tf.tidy(() => {\n                  const masksTensorInfo = decodeMultipleMasksWebGL(\n                  segmentation, longOffsets, posesAboveScore, height, width, stride,\n                  [inHeight, inWidth], padding,\n                  refineSteps, minKeypointScore,\n                  maxNumPeople);\n                  const masksTensor =\n                  tf.engine().makeTensorFromDataId(\n                  masksTensorInfo.dataId, masksTensorInfo.shape,\n                  masksTensorInfo.dtype) as tf.Tensor2D;\n                  return posesAboveScore.map(\n                      (_, k) =>\n                      toPersonKPartSegmentation(masksTensor, partSegmentation, k));\n                  });\n                  partSegmentationsByPersonData =\n                  (await Promise.all(partSegmentations.map(x => x.data())) as\n                  Int32Array[]);\n                  partSegmentations.forEach(x => x.dispose());\n              } else\n              {\n                  const segmentationsData = await segmentation.data() as Uint8Array;\n                  const longOffsetsData = await\n                  longOffsets.data() as Float32Array;\n                  const partSegmentaionData = await partSegmentation.data() as\n                  Uint8Array;\n                  partSegmentationsByPersonData = decodeMultiplePartMasksCPU(\n                  segmentationsData,\n                  longOffsetsData, partSegmentaionData,\n                  posesAboveScore, height, width, stride, [inHeight, inWidth],\n                  padding,\n                  refineSteps);\n              }\n              return partSegmentationsByPersonData.map(\n                  (data, k) => ({pose:\n                  posesAboveScore[k], data, height, width});\n              );\n          }\n          /**\n          * @license\n          * Copyright 2019 Google Inc. All Rights\n          Reserved.\n          * Licensed under the Apache License, Version 2.0 (the \"License\");\n          * you may not use this file\n          except in compliance with the License.\n          * You may obtain a copy of the License at\n          *  

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          the License.\n          *  

          =====\n          *\n          *\n          // algorithm based on Coursera Lecture from Algorithms, Part 1:\n          //  

          https://www.coursera.org/learn/algorithms-part1/lecture/ZjoSM/heapsort\n          \n          function half(k: number) {\n          return\n          Math.floor(k / 2);\n          }\n          \n          export class MaxHeap<T> {\n          private priorityQueue: T[];\n          private numberOfElements:\n          number;\n          private getElementValue: (element: T) => number;\n          constructor(maxSize: number, getElementValue:\n          (element: T) => number) {\n          this.priorityQueue = new Array(maxSize);\n          this.numberOfElements = -1;\n          this.getElementValue = getElementValue;\n          }\n          \n          public enqueue(x: T): void {\n          this.priorityQueue[++this.numberOfElements] = x;\n          this.swim(this.numberOfElements);\n          }\n          \n          public dequeue(): T {\n          const max = this.priorityQueue[0];\n          this.exchange(0, this.numberOfElements--\n          );\n          this.sink(0);\n          this.priorityQueue[this.numberOfElements + 1] = null;\n          return max;\n          }\n          \n          public empty(): boolean {\n          return this.numberOfElements === -1;\n          }\n          \n          public size(): number {\n          return\n          this.numberOfElements + 1;\n          }\n          \n          public all(): T[] {\n          return this.priorityQueue.slice(0, this.numberOfElements

```

```

+ 1);
}

public max(): T {
    return this.priorityQueue[0];
}

private swim(k: number): void {
    while (k > 0 && this.less(half(k), k)) {
        this.exchange(k, half(k));
        k = half(k);
    }
}

private sink(k: number): void {
    while (2 * k <= this.numberOfElements) {
        let j = 2 * k;
        if (j < this.numberOfElements && this.less(j, j + 1)) {
            j++;
        }
        if (!this.less(k, j)) {
            break;
        }
        this.exchange(k, j);
        k = j;
    }
}

private getValueAt(i: number): number {
    return this.getElementValue(this.priorityQueue[i]);
}

private less(i: number, j: number): boolean {
    return this.getValueAt(i) < this.getValueAt(j);
}

private exchange(i: number, j: number): void {
    const t = this.priorityQueue[i];
    this.priorityQueue[i] = this.priorityQueue[j];
    this.priorityQueue[j] = t;
}
}

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 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
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 * limitations under the License.
 */

=====
import {PartWithScore, TensorBuffer3D} from '../types';
import {MaxHeap} from './max_heap';

function scoreIsMaximumInLocalWindow(
    keypointId: number, score: number, heatmapY: number, heatmapX: number,
    localMaximumRadius: number, scores: TensorBuffer3D): boolean {
    const [height, width] = scores.shape;
    let localMaximum = true;
    const yStart = Math.max(heatmapY - localMaximumRadius, 0);
    const yEnd = Math.min(heatmapY + localMaximumRadius + 1, height);
    for (let yCurrent = yStart; yCurrent < yEnd; ++yCurrent) {
        const xStart = Math.max(heatmapX - localMaximumRadius, 0);
        const xEnd = Math.min(heatmapX + localMaximumRadius + 1, width);
        for (let xCurrent = xStart; xCurrent < xEnd; ++xCurrent) {
            if (scores.get(yCurrent, xCurrent, keypointId) > score) {
                localMaximum = false;
                break;
            }
        }
        if (!localMaximum) {
            break;
        }
    }
    return localMaximum;
}

/**
 * Builds a priority queue with part candidate positions for a specific image in the batch. For this we find all local maxima in the score maps with score values above a threshold. We create a single priority queue across all parts.
 */
export function buildPartWithScoreQueue(
    scoreThreshold: number, localMaximumRadius: number, scores: TensorBuffer3D): MaxHeap<PartWithScore> {
    const [height, width, numKeypoints] = scores.shape;
    const queue = new MaxHeap<PartWithScore>(
        height * width * numKeypoints, ({score}) => score);
    for (let heatmapY = 0; heatmapY < height; ++heatmapY) {
        for (let heatmapX = 0; heatmapX < width; ++heatmapX) {
            for (let keypointId = 0; keypointId < numKeypoints; ++keypointId) {
                const score = scores.get(heatmapY, heatmapX, keypointId);
                // Only consider parts with score greater or equal to threshold as root candidates.
                if (score < scoreThreshold) {
                    continue;
                }
                // Only consider keypoints whose score is maximum in a local window.
                if (scoreIsMaximumInLocalWindow(
                    keypointId, score, heatmapY, heatmapX, localMaximumRadius, scores)) {
                    queue.enqueue({score, part: {heatmapY, heatmapX, id: keypointId}});
                }
            }
        }
    }
    return queue;
}

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 * limitations under the License.
 */

=====
import {NumberTuple, PART_IDS, PART_NAMES, POSE_CHAIN} from './keypoints';
import {Keypoint,

```

```

PartWithScore, TensorBuffer3D, Vector2D} from './types';\n\nimport {clamp, getOffsetPoint} from './util';\n\nimport {addVectors, getImageCoords} from './util';\n\nconst parentChildrenTuples: NumberTuple[] =
POSE_CHAIN.map(\n ([parentJoinName, childJoinName]): NumberTuple =>\n ([PART_IDS[parentJoinName], PART_IDS[childJoinName]]);\n\nconst parentToChildEdges: number[] =\n parentChildrenTuples.map(([, childJointId]) => childJointId);\n\nconst childToParentEdges: number[] =\n parentChildrenTuples.map(([\n         parentJointId,\n         ] ) =>\n parentJointId);\n\nfunction getDisplacement(\n edgeId: number, point: Vector2D, displacements:\n TensorBuffer3D): Vector2D {\n const numEdges =\n displacements.shape[2] / 2;\n return {\n y: displacements.get(point.y, point.x, edgeId),\n x:\n displacements.get(point.y, point.x, numEdges + edgeId)\n };}\n\nfunction getStridedIndexNearPoint(\n point:\n Vector2D, outputStride: number, height: number,\n width: number): Vector2D {\n return {\n y:\n clamp(Math.round(point.y / outputStride), 0, height - 1),\n x: clamp(Math.round(point.x / outputStride), 0, width -\n 1)\n };\n}\n\n/**\n * We get a new keypoint along the `edgeId` for the pose instance, assuming\n * that the position\n * of the `idSource` part is already known. For this, we\n * follow the displacement vector from the source to target\n * part (stored in\n * the `i`-th channel of the displacement tensor). The displaced keypoint\n * vector is refined using\n * the offset vector by `offsetRefineStep` times.\n */\nfunction traverseToTargetKeypoint(\n edgeId: number,\n sourceKeypoint: Keypoint, targetKeypointId: number,\n scoresBuffer: TensorBuffer3D, offsets: TensorBuffer3D,\n outputStride: number,\n displacements: TensorBuffer3D, offsetRefineStep = 2): Keypoint {\n const [height,\n width] = scoresBuffer.shape;\n\n // Nearest neighbor interpolation for the source->target displacements.\n const\n sourceKeypointIndices = getStridedIndexNearPoint(\n sourceKeypoint.position, outputStride, height, width);\n\n const displacement =\n getDisplacement(edgeId, sourceKeypointIndices, displacements);\n\n const\n displacedPoint = addVectors(sourceKeypoint.position, displacement);\n\n let targetKeypoint = displacedPoint;\n\n for\n (let i = 0; i < offsetRefineStep; i++) {\n const targetKeypointIndices =\n getStridedIndexNearPoint(targetKeypoint, outputStride, height, width);\n\n const\n offsetPoint = getOffsetPoint(\n targetKeypointIndices.y, targetKeypointIndices.x, targetKeypointId,\n offsets);\n\n targetKeypoint =\n addVectors(\n {\n x: targetKeypointIndices.x * outputStride,\n y: targetKeypointIndices.y\n * outputStride\n },\n {x: offsetPoint.x, y: offsetPoint.y});\n }\n\n const targetKeypointIndices =\n getStridedIndexNearPoint(targetKeypoint, outputStride, height, width);\n\n const\n score = scoresBuffer.get(\n targetKeypointIndices.y, targetKeypointIndices.x, targetKeypointId);\n\n return {position: targetKeypoint, part:\n PART_NAMES[targetKeypointId], score};\n}\n\n/**\n * Follows the displacement fields to decode the full pose of\n * the object\n * instance given the position of a part that acts as root.\n */\n * @return An array of decoded keypoints\n * and their scores for a single pose\n */\nexport function decodePose(\n root: PartWithScore, scores:\n TensorBuffer3D, offsets: TensorBuffer3D,\n outputStride: number, displacementsFwd: TensorBuffer3D,\n displacementsBwd: TensorBuffer3D): Keypoint[] {\n const numParts = scores.shape[2];\n const numEdges =\n parentToChildEdges.length;\n\n const instanceKeypoints: Keypoint[] = new Array(numParts);\n\n // Start a new\n // detection instance at the position of the root.\n const {part: rootPart, score: rootScore} = root;\n const rootPoint =\n getImageCoords(rootPart, outputStride, offsets);\n\n instanceKeypoints[rootPart.id] = {\n score: rootScore,\n part: PART_NAMES[rootPart.id],\n position: rootPoint\n };\n\n // Decode the part positions upwards in the tree,\n // following the backward\n // displacements.\n for (let edge = numEdges - 1; edge >= 0; --edge) {\n const\n sourceKeypointId = parentToChildEdges[edge];\n const\n targetKeypointId = childToParentEdges[edge];\n\n if\n (instanceKeypoints[sourceKeypointId] &&\n !instanceKeypoints[targetKeypointId]) {\n instanceKeypoints[targetKeypointId] =\n traverseToTargetKeypoint(\n edge,\n instanceKeypoints[sourceKeypointId], targetKeypointId, scores,\n offsets, outputStride, displacementsBwd);\n }\n }\n\n // Decode the part positions downwards in the tree, following the forward\n // displacements.\n for (let\n edge = 0;\n edge < numEdges; ++edge) {\n const\n sourceKeypointId = childToParentEdges[edge];\n const\n targetKeypointId =\n parentToChildEdges[edge];\n\n if\n (instanceKeypoints[sourceKeypointId] &&\n !instanceKeypoints[targetKeypointId]) {\n instanceKeypoints[targetKeypointId] =\n traverseToTargetKeypoint(\n

```

edge, instanceKeypoints[sourceKeypointId], targetKeypointId, scores,\n offsets, outputStride,
displacementsFwd);
return instanceKeypoints;\n\n", "/*\n * @license\n * Copyright 2019 Google
Inc. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
<http://www.apache.org/licenses/LICENSE-2.0>\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express
or implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n */

```

=====
*\n\nimport { Keypoint, Pose, TensorBuffer3D } from './types';\n\nimport { buildPartWithScoreQueue } from  

'./build_part_with_score_queue';\nimport { decodePose } from './decode_pose';\nimport { getImageCoords,  

squaredDistance } from './util';\n\nfunction withinNmsRadiusOfCorrespondingPoint(\n poses: Pose[],  

squaredNmsRadius: number, {x, y}: {x: number, y: number},\n keypointId: number): boolean {\n return  

poses.some(({ keypoints }) => {\n const correspondingKeypoint = keypoints[keypointId].position;\n return  

squaredDistance(\n y, x, correspondingKeypoint.y, correspondingKeypoint.x) <= \n  

squaredNmsRadius;\n });\n}\n\n/* Score the newly proposed object instance without taking into account\n * the  

scores of the parts that overlap with any previously detected\n * instance.\n */\nfunction getInstanceScore(\n existingPoses: Pose[], squaredNmsRadius: number,\n instanceKeypoints: Keypoint[]): number {\n let notOverlappedKeypointScores = instanceKeypoints.reduce(\n  

(result, {position, score}, keypointId): number => {\n if (!withinNmsRadiusOfCorrespondingPoint(\n  

existingPoses, squaredNmsRadius, position, keypointId)) {\n result += score;\n }\n return result;\n  

}, 0.0);\n return notOverlappedKeypointScores /= instanceKeypoints.length;\n}\n\n// A point (y, x) is considered  

as root part candidate if its score is a\n// maximum in a window |y - y'| <= kLocalMaximumRadius, |x - x'| <= \n//  

kLocalMaximumRadius.\nconst kLocalMaximumRadius = 1;\n\n/**\n * Detects multiple poses and finds their parts  

from part scores and\n * displacement vectors. It returns up to `maxDetections` object instance\n * detections in  

decreasing root score order. It works as follows: We first\n * create a priority  

queue with local part score maxima above\n * `scoreThreshold`, considering all parts at the same time. Then we\n *  

iteratively pull the top element of the queue (in decreasing score order)\n * and treat it as a root candidate for a new  

object instance. To avoid\n * duplicate detections, we reject the root candidate if it is within a disk\n * of  

`nmsRadius` pixels from the corresponding part of a previously detected\n * instance, which is a form of part-based  

non-maximum suppression (NMS). If\n * the root candidate passes the NMS check, we start a new object instance\n *  

detection, treating the corresponding part as root and finding the\n * positions of the remaining parts by following  

the displacement vectors\n * along the tree-structured part graph. We assign to the newly detected\n * instance a  

score equal to the sum of scores of its parts which have not\n * been claimed by a previous instance (i.e., those at  

least `nmsRadius`\n * pixels away from the corresponding part of all previously  

detected\n * instances), divided by the total number of parts `numParts`.\n *\n * @param heatmapScores 3-D tensor  

with shape `[height, width, numParts]`. The value of heatmapScores[y, x, k]` is the score of placing the `k`-th\n  

* object part at position `(y, x)`.\n *\n * @param offsets 3-D tensor with shape `[height, width, numParts * 2]`. The value of [offsets[y, x, k], offsets[y, x, k + numParts]]` is the\n  

* short range offset vector of the `k`-th object  

part at heatmap\n * position `(y, x)`.\n *\n * @param displacementsFwd 3-D tensor of shape\n * `[height, width, 2 *  

num_edges]`, where `num_edges = num_parts - 1` is the\n * number of edges (parent-child pairs) in the tree. It  

contains the forward\n * displacements between consecutive part from the root towards the leaves.\n *\n * @param  

displacementsBwd 3-D tensor of shape\n * `[height, width, 2 * num_edges]`, where `num_edges = num_parts - 1` is  

the\n * number of edges (parent-child pairs) in the tree. It contains  

the backward\n * displacements between consecutive part from the root towards the leaves.\n *\n * @param  

outputStride The output stride that was used when feed-forwarding\n * through the PoseNet model. Must be 32, 16,  

or 8.\n *\n * @param maxPoseDetections Maximum number of returned instance detections per\n * image.\n */

```

```

@param scoreThreshold Only return instance detections that have root part\n * score greater or equal to this value.
Defaults to 0.5.\n * \n * @param nmsRadius Non-maximum suppression part distance. It needs to be\n * strictly
positive. Two parts suppress each other if they are less than\n * `nmsRadius` pixels away. Defaults to 20.\n * \n *
@return An array of poses and their scores, each containing keypoints and\n * the corresponding keypoint scores.\n
*/\nexport function decodeMultiplePoses(\n  scoresBuffer: TensorBuffer3D, offsetsBuffer: TensorBuffer3D,\n  displacementsFwdBuffer: TensorBuffer3D,\n  displacementsBwdBuffer: TensorBuffer3D, outputStride: number,\n  maxPoseDetections: number, scoreThreshold = 0.5, nmsRadius = 20): Pose[] {\n  const poses: Pose[] = [];\n  const queue = buildPartWithScoreQueue(\n    scoreThreshold, kLocalMaximumRadius, scoresBuffer);\n  const squaredNmsRadius = nmsRadius * nmsRadius;\n  // Generate at most maxDetections object instances per image
in\n  // decreasing root part score order.\n  while (poses.length < maxPoseDetections && !queue.empty()) {\n  //
The top element in the queue is the next root candidate.\n  const root = queue.dequeue();\n  // Part-based non-
maximum suppression: We reject a root candidate if it\n  // is within a disk of `nmsRadius` pixels from the
corresponding part of\n  // a previously detected instance.\n  const rootImageCoords =\n  getImageCoords(root.part, outputStride, offsetsBuffer);\n  if (withinNmsRadiusOfCorrespondingPoint(\n  poses, squaredNmsRadius, rootImageCoords, root.part.id)) {\n  continue;\n  }\n  // Start a new detection
instance at the position of the root.\n  const keypoints = decodePose(\n    root, scoresBuffer, offsetsBuffer,\n  outputStride, displacementsFwdBuffer,\n  displacementsBwdBuffer);\n  const score =
getInstanceScore(poses, squaredNmsRadius, keypoints);\n  poses.push({keypoints, score});\n  }\n  return
poses;\n}\n", "/*\n * @license\n * Copyright 2019 Google Inc. All Rights Reserved.\n * Licensed under the Apache
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by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS"
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport * as tf from '@tensorflow/tfjs-core';\n\nimport { BaseModel } from './base_model';\n\nconst
imageNetMean = [-123.15, -115.90, -103.06];\n\nexport class ResNet extends BaseModel {\n  preprocessInput(input: tf.Tensor3D): tf.Tensor3D {\n  return tf.add(input, imageNetMean);\n  }\n  nameOutputResults(results: tf.Tensor3D[]) {\n  const [\n  displacementBwd,\n  displacementFwd,\n  heatmap,\n  longOffsets,\n  offsets,\n  partHeatmaps,\n  segmentation,\n  partOffsets,\n  ] = results;\n  return {\n  offsets,\n  segmentation,\n  partHeatmaps,\n  longOffsets,\n  heatmap,\n  displacementFwd,\n  displacementBwd,\n  partOffsets\n  };\n  }\n}\n", "/*\n * @license\n * Copyright 2019
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by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS"
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nconst RESNET50_BASE_URL =\n  'https://storage.googleapis.com/tfjs-
models/savedmodel/bodypix/resnet50/';\nconst MOBILENET_BASE_URL =\n  'https://storage.googleapis.com/tfjs-models/savedmodel/bodypix/mobilenet';\n\n// The BodyPix 2.0 ResNet50
models use the latest TensorFlow.js 1.0 model\n// format.\nexport function resNet50SavedModel(stride: number,\n  quantBytes: number): string {\n  const graphJson = `model-stride${stride}.json`;\n  // quantBytes=4 corresponding
to the non-quantized
full-precision SavedModel.\n  if (quantBytes === 4) {\n  return RESNET50_BASE_URL + `float` + graphJson;\n  } else {\n  return RESNET50_BASE_URL + `quant${quantBytes}` + graphJson;\n  }\n}\n\n// The BodyPix 2.0
MobileNetV1 models use the latest TensorFlow.js 1.0 model\n// format.\nexport function mobileNetSavedModel(\n

```

```

stride: number, multiplier: number, quantBytes: number): string {\n  const toStr: {[key: number]: string} = {1.0:
'100', 0.75: '075', 0.50: '050'};\n  const graphJson = `model-stride${stride}.json`;\n  // quantBytes=4 corresponding
to the non-quantized full-precision SavedModel.\n  if (quantBytes === 4) {\n    return MOBILENET_BASE_URL +
`float/${toStr[multiplier]}^` + graphJson;\n  } else {\n    return MOBILENET_BASE_URL +
`quant${quantBytes}/${toStr[multiplier]}^` +\n    graphJson;\n  }\n}\n", "/*\n * @license\n * Copyright 2020
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file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *\n *
=====
*\n\nimport * as tf from '@tensorflow/tfjs-core';\n\nimport {BodyPixInput, BodyPixOutputStride, Padding} from
'./types';\n\nimport {Pose, TensorBuffer3D} from './types';\n\nimport {BodyPixInternalResolution} from
'./types';\n\nfunction getSizeFromImageLikeElement(input: HTMLImageElement|\nHTMLCanvasElement|\nOffscreenCanvas): [number, number] {\n  if ('offsetHeight'
in input && input.offsetHeight !== 0\n    && 'offsetWidth' in input && input.offsetWidth !== 0) {\n    return
[input.offsetHeight, input.offsetWidth];\n  } else if (input.height !== null && input.width !== null) {\n    return
[input.height, input.width];\n  } else {\n    throw new Error(\n    `HTMLImageElement must have height and
width attributes set.`);\n  }\n}\n\nfunction getSizeFromVideoElement(input: HTMLVideoElement): [number,
number] {\n  if (input.hasAttribute('height') && input.hasAttribute('width')) {\n    // Prioritizes user specified height
and width.\n    // We can't test the .height and .width properties directly,\n    // because they evaluate to 0 if unset.\n    return [input.height, input.width];\n  } else {\n    return [input.videoHeight, input.videoWidth];\n  }\n}\n\nexport
function getInputSize(input: BodyPixInput): [number, number] {\n  if ((typeof (HTMLCanvasElement) !==
'undefined' &&\n    input instanceof HTMLCanvasElement) ||\n    (typeof (OffscreenCanvas)
!== 'undefined' &&\n    input instanceof OffscreenCanvas) ||\n    (typeof (HTMLImageElement) !==
'undefined' &&\n    input instanceof HTMLImageElement)) {\n    return getSizeFromImageLikeElement(input);\n  }
else if (typeof (ImageData) !== 'undefined' && input instanceof ImageData) {\n    return [input.height,
input.width];\n  } else if (\n    typeof (HTMLVideoElement) !== 'undefined' &&\n    input instanceof
HTMLVideoElement) {\n    return getSizeFromVideoElement(input);\n  } else if (input instanceof tf.Tensor) {\n    return
[input.shape[0], input.shape[1]]; \n  } else {\n    throw new Error(`error: Unknown input type: ${input}`);\n  }\n}\n\nfunction isValidInputResolution(\n  resolution: number, outputStride: number): boolean {\n  return
(resolution - 1) % outputStride === 0;\n}\n\nexport function toValidInputResolution(\n  inputResolution: number,
outputStride: BodyPixOutputStride): number {\n  if (isValidInputResolution(inputResolution, outputStride)) {\n    return
inputResolution;\n  }\n  return Math.floor(inputResolution / outputStride) * outputStride + 1;\n}\n\nconst
INTERNAL_RESOLUTION_STRING_OPTIONS = {\n  low: 'low',\n  medium: 'medium',\n  high: 'high',\n  full:
'full'\n};\n\nconst INTERNAL_RESOLUTION_PERCENTAGES = {\n
[INTERNAL_RESOLUTION_STRING_OPTIONS.low]: 0.25,\n
[INTERNAL_RESOLUTION_STRING_OPTIONS.medium]: 0.5,\n
[INTERNAL_RESOLUTION_STRING_OPTIONS.high]: 0.75,\n
[INTERNAL_RESOLUTION_STRING_OPTIONS.full]: 1.0\n};\n\nconst MIN_INTERNAL_RESOLUTION =
0.1;\n\nconst MAX_INTERNAL_RESOLUTION = 2.0;\n\nfunction toInternalResolutionPercentage(\n  internalResolution:
BodyPixInternalResolution): number {\n  if (typeof internalResolution === 'string') {\n    const
result = INTERNAL_RESOLUTION_PERCENTAGES[internalResolution];\n    tf.util.assert(\n    typeof result
=== 'number',\n    () => `string value of inputResolution must be one of $\n
Object.values(INTERNAL_RESOLUTION_STRING_OPTIONS)\n    .join(',')`

```

```

but was ${internalResolution}`);\n return result;\n } else {\n   tf.util.assert(\n     typeof internalResolution ===
'number' &&\n     internalResolution <= MAX_INTERNAL_RESOLUTION &&\n     internalResolution
>= MIN_INTERNAL_RESOLUTION,\n     () =>\n       `inputResolution must be a string or number between
${\n         MIN_INTERNAL_RESOLUTION} and ${MAX_INTERNAL_RESOLUTION}, but ` +\n
`was ${internalResolution}`);\n   return internalResolution;\n } }\n\nexport function
toInputResolutionHeightAndWidth(\n  internalResolution: BodyPixInternalResolution,\n  outputStride:
BodyPixOutputStride,\n  [inputHeight, inputWidth]: [number, number]): [number, number] {\n  const
internalResolutionPercentage =\n    toInternalResolutionPercentage(internalResolution);\n  return [\n
toValidInputResolution(\n    inputHeight * internalResolutionPercentage, outputStride),\n
toValidInputResolution(\n    inputWidth * internalResolutionPercentage,\n
    outputStride)\n  ];\n}\n\nexport function toInputTensor(input: BodyPixInput) {\n // TODO: tf.browser.fromPixels
types to support OffscreenCanvas\n // @ts-ignore\n return input instanceof tf.Tensor ? input :
tf.browser.fromPixels(input);\n}\n\nexport function resizeAndPadTo(\n  imageTensor: tf.Tensor3D, [targetH,
targetW]: [number, number],\n  flipHorizontal = false): {\n  resizedAndPadded: tf.Tensor3D,\n  paddedBy:
[[number, number], [number, number]]\n} {\n  const [height, width] = imageTensor.shape;\n  const targetAspect =
targetW / targetH;\n  const aspect = width / height;\n  let resizeW: number;\n  let resizeH: number;\n  let padL:
number;\n  let padR: number;\n  let padT: number;\n  let padB: number;\n  if (aspect > targetAspect) {\n // resize
to have the larger dimension match the shape.\n    resizeW = targetW;\n    resizeH = Math.ceil(resizeW / aspect);\n\n
const padHeight = targetH - resizeH;\n    padL = 0;\n    padR = 0;\n    padT = Math.floor(padHeight
/ 2);\n    padB = targetH - (resizeH + padT);\n  } else {\n    resizeH = targetH;\n    resizeW = Math.ceil(targetH *
aspect);\n\n    const padWidth = targetW - resizeW;\n    padL = Math.floor(padWidth / 2);\n    padR = targetW -
(resizeW + padL);\n    padT = 0;\n    padB = 0;\n  }\n  const resizedAndPadded = tf.tidy(() => {\n // resize to
have largest dimension match image\n    let resized: tf.Tensor3D;\n    if (flipHorizontal) {\n    resized =
tf.image.resizeBilinear(\n      tf.reverse(imageTensor, 1), [resizeH, resizeW]);\n    } else {\n    resized =
tf.image.resizeBilinear(imageTensor, [resizeH, resizeW]);\n    }\n\n    const padded = tf.pad3d(resized, [[padT,
padB], [padL, padR], [0, 0]]);\n    return padded;\n  });\n  return {resizedAndPadded, paddedBy: [[padT, padB],
[padL, padR]]};\n}\n\nexport function scaleAndCropToInputTensorShape(\n  tensor: tf.Tensor3D,\n  [inputTensorHeight, inputTensorWidth]: [number, number],\n  [resizedAndPaddedHeight,
resizedAndPaddedWidth]: [number, number],\n  [[padT, padB], [padL, padR]]: [[number, number], [number,
number]],\n  applySigmoidActivation = false): tf.Tensor3D {\n  return tf.tidy(() => {\n    let inResizedAndPadded:
tf.Tensor3D = tf.image.resizeBilinear(tensor,\n    [resizedAndPaddedHeight, resizedAndPaddedWidth], true);\n    if (applySigmoidActivation) {\n    inResizedAndPadded = tf.sigmoid(inResizedAndPadded);\n    }\n\n    return
removePaddingAndResizeBack(\n    inResizedAndPadded, [inputTensorHeight, inputTensorWidth],\n    [[padT, padB], [padL, padR]]);\n  });\n}\n\nexport function removePaddingAndResizeBack(\n  resizedAndPadded:
tf.Tensor3D,\n  [originalHeight, originalWidth]: [number, number],\n  [[padT, padB], [padL, padR]]: [[number,
number], [number, number]]): tf.Tensor3D {\n  return tf.tidy(() => {\n    const batchedImage: tf.Tensor4D =
tf.expandDims(resizedAndPadded);\n    return tf.squeeze(tf.image\n      .cropAndResize(\n
batchedImage, [[\n        padT / (originalHeight + padT + padB - 1.0),\n        padL / (originalWidth +
padL + padR - 1.0),\n        (padT + originalHeight - 1.0) \/\n        (originalHeight + padT + padB - 1.0),\n
(padL + originalWidth - 1.0) / (originalWidth + padL + padR - 1.0)\n      ]),\n    [0], [originalHeight,
originalWidth]), [0]);\n  });\n}\n\nexport function resize2d(\n  tensor: tf.Tensor2D, resolution: [number, number],\n  nearestNeighbor?: boolean): tf.Tensor2D {\n  return tf.tidy(() => {\n    const batchedImage: tf.Tensor4D =
tf.expandDims(tensor, 2);\n    return tf.squeeze(\n      tf.image.resizeBilinear(batchedImage, resolution,\n      nearestNeighbor));\n  });\n}\n\nexport function padAndResizeTo(\n  input: BodyPixInput, [targetH, targetW]:
[number, number]):\n  {resized: tf.Tensor3D, padding: Padding} {\n  const [height, width] = getInputSize(input);\n  const targetAspect = targetW / targetH;\n  const aspect
= width / height;\n  let [padT, padB, padL, padR] = [0, 0, 0, 0];\n  if (aspect < targetAspect) {\n // pads the width\n
padT = 0;\n    padB = 0;\n    padL = Math.round(0.5 * (targetAspect * height - width));\n    padR = Math.round(0.5

```


more accurate\n * the model at the cost of speed. Set this to a larger value to increase speed\n * at the cost of accuracy. Stride 32 is supported for ResNet and\n * stride 8,16,32 are supported for various MobileNetV1 models.\n * \n * `multiplier`: An optional number with values: 1.01, 1.0, 0.75, or\n * 0.50. The value is used only by MobileNet architecture. It is the float\n * multiplier for the depth (number of channels) for all convolution ops.\n * The larger the value, the larger the size of the layers, and more accurate\n * the model at the cost of speed. Set this to a smaller value to increase speed\n * at the cost of accuracy.\n * \n * `modelUrl`: An optional string that specifies custom url of the model. This\n * is useful for area/countries that don't have access to the model hosted on\n * GCP.\n * \n * `quantBytes`: An optional number with values: 1, 2, or 4. This parameter\n * affects weight quantization in the models. The available options are\n * 1 byte, 2 bytes, and 4 bytes. The higher the value, the larger the model size\n * and thus the longer the loading time, the lower the value, the shorter the\n * loading time but lower the accuracy.\n */\nexport interface ModelConfig {\n architecture: BodyPixArchitecture;\n outputStride: BodyPixOutputStride;\n multiplier?: BodyPixMultiplier;\n modelUrl?: string;\n quantBytes?: BodyPixQuantBytes;\n}\n\n// The default configuration for loading MobileNetV1 based BodyPix.\n// (And for references, the default configuration for loading ResNet\n// based PoseNet is also included).\n// const RESNET_CONFIG = {\n// architecture: 'ResNet50',\n// outputStride: 32,\n// quantBytes: 4,\n// } as ModelConfig;\n// const MOBILENET_V1_CONFIG = {\n architecture: 'MobileNetV1',\n\n outputStride: 16,\n quantBytes: 4,\n multiplier: 0.75,\n} as ModelConfig;\n\nconst VALID_ARCHITECTURE: BodyPixArchitecture[] = ['MobileNetV1', 'ResNet50'];\nconst VALID_STRIDE: {[id: string]: BodyPixOutputStride[]} = {\n 'MobileNetV1': [8, 16, 32],\n 'ResNet50': [32, 16]\n};\n\nconst VALID_MULTIPLIER: {[id: string]: BodyPixMultiplier[]} = {\n 'MobileNetV1': [0.50, 0.75, 1.0],\n 'ResNet50': [1.0]\n};\n\nconst VALID_QUANT_BYTES: BodyPixQuantBytes[] = [1, 2, 4];\n\nfunction validateModelConfig(config: ModelConfig): ModelConfig {\n config = config || MOBILENET_V1_CONFIG;\n\n if (config.architecture == null) {\n config.architecture = 'MobileNetV1';\n }\n\n if (VALID_ARCHITECTURE.indexOf(config.architecture) < 0) {\n throw new Error(\n `Invalid architecture \${config.architecture}. ` +\n `Should be one of \${VALID_ARCHITECTURE}`);\n }\n\n if (config.outputStride == null) {\n config.outputStride = 16;\n }\n\n if (VALID_STRIDE[config.architecture].indexOf(config.outputStride) < 0) {\n throw new Error(\n `Invalid outputStride \${config.outputStride}. ` +\n `Should be one of \${VALID_STRIDE[config.architecture]} ` +\n `for architecture \${config.architecture}.`);\n }\n\n if (config.multiplier == null) {\n config.multiplier = 1.0;\n }\n\n if (VALID_MULTIPLIER[config.architecture].indexOf(config.multiplier) < 0) {\n throw new Error(\n `Invalid multiplier \${config.multiplier}. ` +\n `Should be one of \${VALID_MULTIPLIER[config.architecture]} ` +\n `for architecture \${config.architecture}.`);\n }\n\n if (config.quantBytes == null) {\n config.quantBytes = 4;\n }\n\n if (VALID_QUANT_BYTES.indexOf(config.quantBytes) < 0) {\n throw new Error(\n `Invalid quantBytes \${config.quantBytes}. ` +\n `Should be one of \${VALID_QUANT_BYTES} ` +\n `for architecture \${config.architecture}.`);\n }\n\n return config;\n}\n\n/**\n * BodyPix inference is configurable using the following config dictionary.\n * \n * `flipHorizontal`: If the left-right keypoint of poses/part segmentation\n * should be flipped/mirrored horizontally. This should be set to true for\n * videos where the video is by default flipped horizontally (i.e. a webcam),\n * and you want the person & body part segmentation to be returned in the proper\n * orientation.\n * \n * `internalResolution`: Defaults to 'medium'. The internal resolution\n * percentage that the input is resized to before inference. The larger the\n * internalResolution the more accurate the model at the cost of slower\n * prediction times. Available values are 'low', 'medium', 'high', 'full', or a\n * percentage value between 0 and 1. The values 'low', 'medium', 'high', and\n * 'full' map to 0.25, 0.5, 0.75, and 1.0 correspondingly.\n * \n * `segmentationThreshold`: The minimum that segmentation values must\n * have to be considered part of the person. Affects the generation of the\n * segmentation mask. More specifically, it is the threshold

used to binarize the intermediate person segmentation probability. The probability of each pixel belongs to a person is in range [0, 1]. If the probability is greater than the `segmentationThreshold`, it will be set to 1 otherwise 0.

```

export interface InferenceConfig {
  flipHorizontal?: boolean;
  internalResolution?: BodyPixInternalResolution;
  segmentationThreshold?: number;
}

export interface PersonInferenceConfig extends InferenceConfig {
  maxDetections?: number;
  scoreThreshold?: number;
  nmsRadius?: number;
}

export interface MultiplePersonInstanceInferenceConfig extends InferenceConfig {
  maxDetections?: number;
  scoreThreshold?: number;
  nmsRadius?: number;
  minKeypointScore?: number;
  refineSteps?: number;
}

export const PERSON_INFERENCE_CONFIG: PersonInferenceConfig = {
  flipHorizontal: false,
  internalResolution: 'medium',
  segmentationThreshold: 0.7,
  maxDetections: 10,
  scoreThreshold: 0.4,
  nmsRadius: 20,
};

export const MULTI_PERSON_INSTANCE_INFERENCE_CONFIG: MultiplePersonInstanceInferenceConfig = {
  flipHorizontal: false,
  internalResolution: 'medium',
  segmentationThreshold: 0.7,
  maxDetections: 10,
  scoreThreshold: 0.4,
  nmsRadius: 20,
  minKeypointScore: 0.3,
  refineSteps: 10,
};

function validatePersonInferenceConfig(config: PersonInferenceConfig) {
  const { segmentationThreshold, maxDetections, scoreThreshold, nmsRadius } = config;
  if (segmentationThreshold < 0.0 || segmentationThreshold > 1.0) {
    throw new Error(`segmentationThreshold ${segmentationThreshold}. Should be in range [0.0, 1.0]`);
  }
  if (maxDetections <= 0) {
    throw new Error(`Invalid maxDetections ${maxDetections}. Should be > 0`);
  }
  if (scoreThreshold < 0.0 || scoreThreshold > 1.0) {
    throw new Error(`Invalid scoreThreshold ${scoreThreshold}. Should be in range [0.0, 1.0]`);
  }
  if (nmsRadius <= 0) {
    throw new Error(`Invalid nmsRadius ${nmsRadius}.`);
  }
}

function validateMultiPersonInstanceInferenceConfig(config: MultiplePersonInstanceInferenceConfig) {
  const { segmentationThreshold, maxDetections, scoreThreshold, nmsRadius, minKeypointScore, refineSteps } = config;
  if (segmentationThreshold < 0.0 || segmentationThreshold > 1.0) {
    throw new Error(`segmentationThreshold ${segmentationThreshold}. Should be in range [0.0, 1.0]`);
  }
  if (maxDetections <= 0) {
    throw new Error(`Invalid maxDetections ${maxDetections}. Should be > 0`);
  }
  if (scoreThreshold < 0.0 || scoreThreshold > 1.0) {
    throw new Error(`Invalid scoreThreshold ${scoreThreshold}. Should be in range [0.0, 1.0]`);
  }
  if (nmsRadius <= 0) {
    throw new Error(`Invalid nmsRadius ${nmsRadius}.`);
  }
  if (minKeypointScore < 0 || minKeypointScore > 1) {
    throw new Error(`Invalid minKeypointScore ${minKeypointScore}. Should be in range [0.0, 1.0]`);
  }
  if (refineSteps <= 0 || refineSteps > 20) {
    throw new Error(`Invalid refineSteps ${refineSteps}. Should be in range [1, 20]`);
  }
}

export class BodyPix {
  baseModel: BaseModel;

  constructor(net: BaseModel) {
    this.baseModel = net;
  }

  private predictForPersonSegmentation(input: tf.Tensor3D): {
    segmentLogits: tf.Tensor3D,
    heatmapScores:

```

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tf.Tensor3D,\n offsets: tf.Tensor3D,\n displacementFwd: tf.Tensor3D,\n displacementBwd: tf.Tensor3D,\n }
{\n const {\n segmentation,\n heatmapScores,\n offsets,\n displacementFwd,\n displacementBwd,\n } = this.baseModel.predict(input);\n return {\n segmentLogits: segmentation,\n heatmapScores,\n offsets,\n displacementFwd,\n displacementBwd,\n };\n }\n\n private
predictForPersonSegmentationAndPart(input: tf.Tensor3D): {\n segmentLogits: tf.Tensor3D,\n partHeatmapLogits: tf.Tensor3D,\n heatmapScores: tf.Tensor3D,\n offsets: tf.Tensor3D,\n displacementFwd:
tf.Tensor3D,\n displacementBwd: tf.Tensor3D,\n } {\n const {\n segmentation,\n partHeatmaps,\n heatmapScores,\n offsets,\n displacementFwd,\n displacementBwd\n } = this.baseModel.predict(input);\n
return {\n segmentLogits: segmentation,\n partHeatmapLogits: partHeatmaps,\n heatmapScores,\n
offsets,\n displacementFwd,\n displacementBwd,\n };\n }\n\n private
predictForMultiPersonInstanceSegmentationAndPart(input: tf.Tensor3D):\n {\n segmentLogits:
tf.Tensor3D,\n longOffsets: tf.Tensor3D,\n heatmapScores: tf.Tensor3D,\n offsets: tf.Tensor3D,\n
displacementFwd: tf.Tensor3D,\n displacementBwd: tf.Tensor3D,\n partHeatmaps: tf.Tensor3D\n } {\n
const {\n segmentation,\n longOffsets,\n heatmapScores,\n offsets,\n displacementFwd,\n
displacementBwd,\n partHeatmaps,\n } = this.baseModel.predict(input);\n return {\n segmentLogits:
segmentation,\n longOffsets,\n heatmapScores,\n offsets,\n displacementFwd,\n displacementBwd,\n
partHeatmaps\n };\n }\n\n /**\n * Given an image with people, returns a dictionary of all intermediate\n *
tensors including: 1) a binary array with 1 for the pixels that are part of\n * the
person, and 0 otherwise, 2) heatmapScores, 3) offsets, and 4) paddings.\n * \n * @param input
ImageData|HTMLImageElement|HTMLCanvasElement|HTMLVideoElement)\n * The input image to feed
through the network.\n * \n * @param internalResolution Defaults to 'medium'. The internal resolution\n * that
the input is resized to before inference. The larger the\n * internalResolution the more accurate the model at the
cost of slower\n * prediction times. Available values are 'low', 'medium', 'high', 'full', or\n * a percentage value
between 0 and 1. The values 'low', 'medium', 'high', and\n * 'full' map to 0.25, 0.5, 0.75, and 1.0 correspondingly.\n
*\n * @param segmentationThreshold The minimum that segmentation values must have\n * to be considered
part of the person. Affects the generation of the\n * segmentation mask.\n * \n * @return A dictionary containing
`segmentation`, `heatmapScores`, `offsets`,\n * and `padding`:\n * - `segmentation`: A 2d Tensor with
1 for the pixels that are part of the\n * person, and 0 otherwise. The width and height correspond to the same\n *
dimensions of the input image.\n * - `heatmapScores`: A 3d Tensor of the keypoint heatmaps used by\n * pose
estimation decoding.\n * - `offsets`: A 3d Tensor of the keypoint offsets used by pose\n * estimation decoding.\n
*\n * - `displacementFwd`: A 3d Tensor of the keypoint forward displacement used\n * by pose estimation decoding.\n
*\n * - `displacementBwd`: A 3d Tensor of the keypoint backward displacement used\n * by pose estimation
decoding.\n * - `padding`: The padding (unit pixels) being applied to the input image\n * before it is fed into the
model.\n */\n segmentPersonActivation(\n input: BodyPixInput, internalResolution:
BodyPixInternalResolution,\n segmentationThreshold = 0.5): {\n segmentation: tf.Tensor2D,\n
heatmapScores: tf.Tensor3D,\n offsets: tf.Tensor3D,\n displacementFwd: tf.Tensor3D,\n displacementBwd:
tf.Tensor3D,\n
padding: Padding,\n internalResolutionHeightAndWidth: [number, number]\n } {\n const [height, width] =
getInputSize(input);\n const internalResolutionHeightAndWidth = toInputResolutionHeightAndWidth(\n
internalResolution, this.baseModel.outputStride, [height, width]);\n const {resized, padding} =\n
padAndResizeTo(input, internalResolutionHeightAndWidth);\n\n const {\n segmentation,\n
heatmapScores,\n offsets,\n displacementFwd,\n displacementBwd\n } = tf.tidy(() => {\n const {\n
segmentLogits,\n heatmapScores,\n offsets,\n displacementFwd,\n displacementBwd\n } =
this.predictForPersonSegmentation(resized);\n\n const [resizedHeight, resizedWidth] = resized.shape;\n\n
const scaledSegmentScores = scaleAndCropToInputTensorShape(\n segmentLogits, [height, width],
[resizedHeight, resizedWidth],\n [[padding.top, padding.bottom], [padding.left, padding.right]],\n
APPLY_SIGMOID_ACTIVATION);\n\n return {\n segmentation: toMaskTensor(\n
tf.squeeze(scaledSegmentScores), segmentationThreshold),\n heatmapScores,\n offsets,\n

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displacementFwd,\n displacementBwd,\n });\n });\n resized.dispose();\n return {\n segmentation,\n heatmapScores,\n offsets,\n displacementFwd,\n displacementBwd,\n padding,\n internalResolutionHeightAndWidth\n });\n }\n\n /**\n * Given an image with many people, returns a
PersonSegmentation dictionary\n * that contains the segmentation mask for all people and a single pose.\n *\n * Note: The segmentation mask returned by this method covers all people but\n * the pose works well for one
person. If you want to estimate instance-level\n * multiple person segmentation & pose for each person, use\n *
`segmentMultiPerson` instead.\n *\n * @param input
ImageData|HTMLImageElement|HTMLCanvasElement|HTMLVideoElement)\n
* The input image to feed through the network.\n *\n * @param config PersonInferenceConfig object that
contains\n * parameters for the BodyPix inference using person decoding.\n *\n * @return A
SemanticPersonSegmentation dictionary that contains height,\n * width, the flattened binary segmentation mask
and the poses for all people.\n * The width and height correspond to the same dimensions of the input image.\n * -
`height`: The height of the segmentation data in pixel unit.\n * - `width`: The width of the segmentation data in
pixel unit.\n * - `data`: The flattened Uint8Array of segmentation data. 1 means the pixel\n * belongs to a person
and 0 means the pixel doesn't belong to a person. The\n * size of the array is equal to `height` x `width` in row-
major order.\n * - `allPoses`: The 2d poses of all people.\n */\n\n async segmentPerson(\n input:
BodyPixInput,\n config: PersonInferenceConfig = PERSON_INFERENCE_CONFIG):
Promise<SemanticPersonSegmentation> {\n config = {...PERSON_INFERENCE_CONFIG, ...config};\n\n
validatePersonInferenceConfig(config);\n\n const {\n segmentation,\n heatmapScores,\n offsets,\n
displacementFwd,\n displacementBwd,\n padding,\n internalResolutionHeightAndWidth\n } =\n
this.segmentPersonActivation(\n input, config.internalResolution, config.segmentationThreshold);\n\n
const [height, width] = segmentation.shape;\n\n const result = await segmentation.data() as Uint8Array;\n\n
segmentation.dispose();\n\n const tensorBuffers = await toTensorBuffers3D(\n [heatmapScores, offsets,
displacementFwd, displacementBwd]);\n const [scoresBuf, offsetsBuf, displacementsFwdBuf,
displacementsBwdBuf] =\n tensorBuffers;\n\n let poses = decodeMultiplePoses(\n scoresBuf, offsetsBuf,
displacementsFwdBuf, displacementsBwdBuf,\n this.baseModel.outputStride, config.maxDetections,\n
config.scoreThreshold,\n config.nmsRadius);\n\n poses = scaleAndFlipPoses(\n poses, [height, width],
internalResolutionHeightAndWidth, padding,\n FLIP_POSES_AFTER_SCALING);\n\n
heatmapScores.dispose();\n offsets.dispose();\n displacementFwd.dispose();\n displacementBwd.dispose();\n\n
return {height, width, data: result, allPoses: poses};\n }\n\n /**\n * Given an image with multiple people, returns
an *array* of\n * PersonSegmentation object. Each element in the array corresponding to one\n * of the people in
the input image. In other words, it predicts\n * instance-level multiple person segmentation & pose for each
person.\n *\n * The model does standard ImageNet pre-processing before inferring through\n * the model. The
image pixels should have values [0-255].\n *\n * @param input\n *
ImageData|HTMLImageElement|HTMLCanvasElement|HTMLVideoElement) The input\n * image to feed
through the network.\n *\n * @param config MultiPersonInferenceConfig
object that contains\n * parameters for the BodyPix inference using multi-person decoding.\n *\n * @return An
array of PersonSegmentation object, each containing a width,\n * height, a binary array (1 for the pixels that are
part of the\n * person, and 0 otherwise) and 2D pose. The array size corresponds to the\n * number of pixels in the
image. The width and height correspond to the\n * dimensions of the image the binary array is shaped to, which are
the same\n * dimensions of the input image.\n */\n\n async segmentMultiPerson(\n input: BodyPixInput,\n
config: MultiPersonInstanceInferenceConfig =\n MULTI_PERSON_INSTANCE_INFERENCE_CONFIG):
Promise<PersonSegmentation[]> {\n config = {...MULTI_PERSON_INSTANCE_INFERENCE_CONFIG,
...config};\n\n validateMultiPersonInstanceInferenceConfig(config);\n\n const [height, width] =
getInputSize(input);\n\n const internalResolutionHeightAndWidth = toInputResolutionHeightAndWidth(\n
config.internalResolution, this.baseModel.outputStride,\n [height, width]);\n\n const {resized, padding} =\n
padAndResizeTo(input, internalResolutionHeightAndWidth);\n\n const {\n segmentation,\n longOffsets,\n

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heatmapScoresRaw,\n  offsetsRaw,\n  displacementFwdRaw,\n  displacementBwdRaw,\n  } = tf.tidy(() =>
{\n  const {\n  segmentLogits,\n  longOffsets,\n  heatmapScores,\n  offsets,\n  displacementFwd,\n  displacementBwd,\n  } =
this.predictForMultiPersonInstanceSegmentationAndPart(resized);\n  const scaledSegmentScores =
scaleAndCropToInputTensorShape(\n  segmentLogits, [height, width], internalResolutionHeightAndWidth,\n  [[padding.top, padding.bottom], [padding.left, padding.right]],\n  APPLY_SIGMOID_ACTIVATION);\n  const longOffsetsResized = false;\n  let scaledLongOffsets;\n  if (longOffsetsResized) {\n  scaledLongOffsets = scaleAndCropToInputTensorShape(\n  longOffsets, [height, width], internalResolutionHeightAndWidth,\n  [[padding.top, padding.bottom], [padding.left, padding.right]],\n  APPLY_SIGMOID_ACTIVATION);\n  } else {\n  scaledLongOffsets
= longOffsets;\n  }\n\n  const segmentation = toMaskTensor(\n  tf.squeeze(scaledSegmentScores),
config.segmentationThreshold);\n\n  return {\n  segmentation,\n  longOffsets: scaledLongOffsets,\n  heatmapScoresRaw: heatmapScores,\n  offsetsRaw: offsets,\n  displacementFwdRaw: displacementFwd,\n  displacementBwdRaw: displacementBwd,\n  };\n\n  const tensorBuffers = await toTensorBuffers3D(\n  [heatmapScoresRaw, offsetsRaw, displacementFwdRaw, displacementBwdRaw]);\n  const [scoresBuf,
offsetsBuf, displacementsFwdBuf, displacementsBwdBuf] =\n  tensorBuffers;\n\n  let poses =
decodeMultiplePoses(\n  scoresBuf, offsetsBuf, displacementsFwdBuf, displacementsBwdBuf,\n  this.baseModel.outputStride, config.maxDetections,\n  config.scoreThreshold, config.nmsRadius);\n\n  poses = scaleAndFlipPoses(\n  poses, [height, width], internalResolutionHeightAndWidth, padding,\n  FLIP_POSES_AFTER_SCALING);\n\n  const instanceMasks = await decodePersonInstanceMasks(\n  segmentation, longOffsets, poses, height, width,\n  this.baseModel.outputStride,
internalResolutionHeightAndWidth, padding,\n  config.scoreThreshold, config.refineSteps,
config.minKeypointScore,\n  config.maxDetections);\n\n  resized.dispose();\n  segmentation.dispose();\n  longOffsets.dispose();\n  heatmapScoresRaw.dispose();\n  offsetsRaw.dispose();\n  displacementFwdRaw.dispose();\n  displacementBwdRaw.dispose();\n\n  return instanceMasks;\n  };\n\n  /**\n  *
Given an image with many people, returns a dictionary containing: height,\n  * width, a tensor with a part id from 0-
24 for the pixels that are\n  * part of a
corresponding body part, and -1 otherwise. This does standard\n  * ImageNet pre-processing before inferring
through the model. The image\n  * should pixels should have values [0-255].\n  * @param input
ImageData|HTMLImageElement|HTMLCanvasElement|HTMLVideoElement)\n  * The input image to feed
through the network.\n  * @param internalResolution Defaults to 'medium'. The internal resolution\n  *
percentage that the input is resized to before inference. The larger the\n  * internalResolution the more accurate the
model at the cost of slower\n  * prediction times. Available values are 'low', 'medium', 'high', 'full', or\n  * a
percentage value between 0 and 1. The values 'low', 'medium', 'high', and\n  * 'full' map to 0.25, 0.5, 0.75, and 1.0
correspondingly.\n  * @param segmentationThreshold The minimum that segmentation values must have\n  *
to be considered part of the person. Affects the clipping of the colored\n  * part image.\n  * @return A
dictionary
containing `partSegmentation`, `heatmapScores`,\n  * `offsets`, and `padding`:\n  * - `partSegmentation`: A 2d
Tensor with a part id from 0-24 for\n  * the pixels that are part of a corresponding body part, and -1 otherwise.\n  *
- `heatmapScores`: A 3d Tensor of the keypoint heatmaps used by\n  * single-person pose estimation decoding.\n  *
- `offsets`: A 3d Tensor of the keypoint offsets used by single-person pose\n  * estimation decoding.\n  *
- `displacementFwd`: A 3d Tensor of the keypoint forward displacement\n  * used by pose estimation decoding.\n  *
- `displacementBwd`: A 3d Tensor of the keypoint backward displacement used\n  * by pose estimation decoding.\n  *
- `padding`: The padding (unit pixels) being applied to the input image\n  * before it is fed into the model.\n  */\n  segmentPersonPartsActivation(\n  input: BodyPixInput, internalResolution: BodyPixInternalResolution,\n  segmentationThreshold = 0.5): {\n  partSegmentation: tf.Tensor2D,\n  heatmapScores: tf.Tensor3D,\n  offsets: tf.Tensor3D,\n  displacementFwd: tf.Tensor3D,\n  displacementBwd:
tf.Tensor3D,\n  padding: Padding,\n  internalResolutionHeightAndWidth: [number, number]\n  } {\n  const

```

```

[height, width] = getInputSize(input);\n  const internalResolutionHeightAndWidth =
toInputResolutionHeightAndWidth(\n    internalResolution, this.baseModel.outputStride, [height, width]);\n
const {\n  resized,\n  padding,\n } = padAndResizeTo(input, internalResolutionHeightAndWidth);\n\n const
{\n  partSegmentation,\n  heatmapScores,\n  offsets,\n  displacementFwd,\n  displacementBwd\n } =
tf.tidy(() => {\n  const {\n    segmentLogits,\n    partHeatmapLogits,\n    heatmapScores,\n    offsets,\n    displacementFwd,\n    displacementBwd\n } = this.predictForPersonSegmentationAndPart(resized);\n\n
const [resizedHeight, resizedWidth] = resized.shape;\n\n  const scaledSegmentScores
= scaleAndCropToInputTensorShape(\n    segmentLogits, [height, width], [resizedHeight, resizedWidth],\n
[[padding.top, padding.bottom], [padding.left, padding.right]],\n    APPLY_SIGMOID_ACTIVATION);\n\n
const scaledPartHeatmapScore = scaleAndCropToInputTensorShape(\n    partHeatmapLogits, [height, width],
[resizedHeight, resizedWidth],\n    [[padding.top, padding.bottom], [padding.left, padding.right]],\n
APPLY_SIGMOID_ACTIVATION);\n  const segmentation =\n
toMaskTensor(tf.squeeze(scaledSegmentScores), segmentationThreshold);\n  return {\n    partSegmentation:\n
decodePartSegmentation(segmentation, scaledPartHeatmapScore),\n    heatmapScores,\n    offsets,\n
displacementFwd,\n    displacementBwd,\n  }; \n });\n  resized.dispose();\n  return {\n
partSegmentation,\n  heatmapScores,\n  offsets,\n  displacementFwd,\n  displacementBwd,\n
padding,\n  internalResolutionHeightAndWidth\n
}; \n })\n\n /**\n * Given an image with many people, returns a PartSegmentation dictionary that\n * contains
the body part segmentation mask for all people and a single pose.\n * \n * Note: The body part segmentation mask
returned by this method covers all\n * people but the pose works well when there is one person. If you want to\n *
estimate instance-level multiple person body part segmentation & pose for\n * each person, use
`segmentMultiPersonParts` instead.\n * \n * @param input
ImageData|HTMLImageElement|HTMLCanvasElement|HTMLVideoElement)\n * The input image to feed
through the network.\n * \n * @param config PersonInferenceConfig object that contains\n * parameters for the
BodyPix inference using single person decoding.\n * \n * @return A SemanticPartSegmentation dictionary that
contains height, width,\n * the flattened binary segmentation mask and the pose for the person. The\n * width and
height correspond to
the same dimensions of the input image.\n * - `height`: The height of the person part segmentation data in pixel
unit.\n * - `width`: The width of the person part segmentation data in pixel unit.\n * - `data`: The flattened
Int32Array of person part segmentation data with a\n * part id from 0-24 for the pixels that are part of a
corresponding body\n * part, and -1 otherwise. The size of the array is equal to `height` x\n * `width` in row-
major order.\n * - `allPoses`: The 2d poses of all people.\n */\n\n ^\n async segmentPersonParts(\n  input:
BodyPixInput,\n  config: PersonInferenceConfig = PERSON_INFERENCE_CONFIG):\n
Promise<SemanticPartSegmentation> {\n  config = {...PERSON_INFERENCE_CONFIG, ...config};\n\n
validatePersonInferenceConfig(config);\n  const {\n    partSegmentation,\n    heatmapScores,\n    offsets,\n
displacementFwd,\n    displacementBwd,\n    padding,\n    internalResolutionHeightAndWidth\n } =\n
this.segmentPersonPartsActivation(\n
input, config.internalResolution, config.segmentationThreshold);\n\n  const [height, width] =
partSegmentation.shape;\n  const data = await partSegmentation.data() as Int32Array;\n
partSegmentation.dispose();\n\n  const tensorBuffers = await toTensorBuffers3D(\n    [heatmapScores, offsets,
displacementFwd, displacementBwd]);\n  const [scoresBuf, offsetsBuf, displacementsFwdBuf,
displacementsBwdBuf] =\n    tensorBuffers;\n\n  let poses = decodeMultiplePoses(\n    scoresBuf, offsetsBuf,
displacementsFwdBuf, displacementsBwdBuf,\n    this.baseModel.outputStride, config.maxDetections,\n
config.scoreThreshold, config.nmsRadius);\n\n  poses = scaleAndFlipPoses(\n    poses, [height, width],
internalResolutionHeightAndWidth, padding,\n    FLIP_POSES_AFTER_SCALING);\n\n  heatmapScores.dispose();\n  offsets.dispose();\n  displacementFwd.dispose();\n  displacementBwd.dispose();\n\n
return {height, width, data,

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allPoses: poses};\n }\n\n /**\n * Given an image with multiple people, returns an *array* of PartSegmentation\n * object. Each element in the array corresponding to one\n * of the people in the input image. In other words, it\n predicts\n * instance-level multiple person body part segmentation & pose for each\n * person.\n *\n * This\n does standard ImageNet pre-processing before inferring through\n * the model. The image pixels should have\n values [0-255].\n *\n * @param input\n * ImageData|HTMLImageElement|HTMLCanvasElement|HTMLVideoElement) The input\n * image to feed\n through the network.\n *\n * @param config MultiPersonInferenceConfig object that contains\n * parameters for\n the BodyPix inference using multi-person decoding.\n *\n * @return An array of PartSegmentation object, each\n containing a width,\n * height, a flattened array (with part id from 0-24 for the pixels that are\n * part of a\n corresponding body part, and -1 otherwise) and 2D pose.\n\n The width\n * and height correspond to the dimensions of the image. Each flattened part\n * segmentation array\n size is equal to `height` x `width`.\n */\n\n async segmentMultiPersonParts(\n  input: BodyPixInput,\n  config: MultiPersonInstanceInferenceConfig =\n    MULTI_PERSON_INSTANCE_INFERENCE_CONFIG): Promise<PartSegmentation[]> {\n  config = {...MULTI_PERSON_INSTANCE_INFERENCE_CONFIG,\n    ...config};\n\n  validateMultiPersonInstanceInferenceConfig(config);\n  const [height, width] =\n    getInputSize(input);\n  const internalResolutionHeightAndWidth = toInputResolutionHeightAndWidth(\n    config.internalResolution, this.baseModel.outputStride,\n    [height, width]);\n  const {resized, padding} =\n    padAndResizeTo(input, internalResolutionHeightAndWidth);\n  const {\n    segmentation,\n    longOffsets,\n    heatmapScoresRaw,\n    offsetsRaw,\n    displacementFwdRaw,\n    displacementBwdRaw,\n    partSegmentation,\n  } = tf.tidy(()\n    => {\n      const {\n        segmentLogits,\n        longOffsets,\n        heatmapScores,\n        offsets,\n        displacementFwd,\n        displacementBwd,\n        partHeatmaps\n      } =\n        this.predictForMultiPersonInstanceSegmentationAndPart(resized);\n\n      // decoding with scaling.\n      const scaledSegmentScores = scaleAndCropToInputTensorShape(\n        segmentLogits, [height, width],\n        internalResolutionHeightAndWidth,\n        [[padding.top, padding.bottom], [padding.left, padding.right]],\n        APPLY_SIGMOID_ACTIVATION);\n\n      // decoding with scaling.\n      const scaledPartSegmentationScores =\n        scaleAndCropToInputTensorShape(\n          partHeatmaps, [height, width], internalResolutionHeightAndWidth,\n          [[padding.top, padding.bottom], [padding.left, padding.right]],\n          APPLY_SIGMOID_ACTIVATION);\n\n      const scaledLongOffsets = longOffsets;\n      const segmentation = toMaskTensor(\n        tf.squeeze(scaledSegmentScores), config.segmentationThreshold);\n\n      const partSegmentation =\n        decodeOnlyPartSegmentation(scaledPartSegmentationScores);\n      return {\n        segmentation,\n        longOffsets: scaledLongOffsets,\n        heatmapScoresRaw: heatmapScores,\n        offsetsRaw: offsets,\n        displacementFwdRaw: displacementFwd,\n        displacementBwdRaw: displacementBwd,\n        partSegmentation\n      };\n    });\n\n  const tensorBuffers = await toTensorBuffers3D(\n    [heatmapScoresRaw, offsetsRaw, displacementFwdRaw, displacementBwdRaw]);\n  const [scoresBuf,\n    offsetsBuf, displacementsFwdBuf, displacementsBwdBuf] =\n    tensorBuffers;\n\n  let poses =\n    decodeMultiplePoses(\n      scoresBuf, offsetsBuf, displacementsFwdBuf, displacementsBwdBuf,\n      this.baseModel.outputStride, config.maxDetections,\n      config.scoreThreshold, config.nmsRadius);\n\n  poses =\n    scaleAndFlipPoses(\n      poses, [height, width], internalResolutionHeightAndWidth, padding,\n      FLIP_POSES_AFTER_SCALING);\n\n  const instanceMasks = await decodePersonInstancePartMasks(\n    segmentation, longOffsets,\n    partSegmentation, poses, height, width,\n    this.baseModel.outputStride, internalResolutionHeightAndWidth,\n    padding,\n    config.scoreThreshold, config.refineSteps, config.minKeypointScore,\n    config.maxDetections);\n\n  resized.dispose();\n  segmentation.dispose();\n  longOffsets.dispose();\n  heatmapScoresRaw.dispose();\n  offsetsRaw.dispose();\n  displacementFwdRaw.dispose();\n  displacementBwdRaw.dispose();\n  partSegmentation.dispose();\n\n  return instanceMasks;\n }\n\n public\n dispose() {\n  this.baseModel.dispose();\n }\n\n /**\n * Loads the MobileNet BodyPix model.\n */\n\n async\n function loadMobileNet(config: ModelConfig): Promise<BodyPix> {\n  const outputStride = config.outputStride;\n
```

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const quantBytes = config.quantBytes;\n const multiplier = config.multiplier;\n if (tf == null) {\n throw new
Error(\n     `Cannot
  find TensorFlow.js. If you are using a <script> tag, please ` +\n     `also include @tensorflow/tfjs on the page
  before using this\n     model.`);\n }
\n\n const url = mobileNetSavedModel(outputStride, multiplier,
  quantBytes);\n const graphModel = await tfconv.loadGraphModel(config.modelUrl || url);\n const mobilenet = new
  MobileNet(graphModel, outputStride);\n return new BodyPix(mobilenet);\n }
\n\n **\n * Loads the ResNet BodyPix
  model.\n */
\n\n ^/async function loadResNet(config: ModelConfig): Promise<BodyPix> {\n const outputStride =
  config.outputStride;\n const quantBytes = config.quantBytes;\n if (tf == null) {\n throw new Error(\n
  `Cannot find TensorFlow.js. If you are using a <script> tag, please ` +\n     `also include @tensorflow/tfjs on the
  page before using this\n     model.`);\n }
\n\n const url = resNet50SavedModel(outputStride, quantBytes);\n const
  graphModel = await tfconv.loadGraphModel(config.modelUrl || url);\n const resnet = new ResNet(graphModel,
  outputStride);\n return new BodyPix(resnet);\n }
\n\n **\n * Loads the BodyPix model instance from a checkpoint,
  with the ResNet\n * or MobileNet architecture. The model to be loaded is configurable using the\n * config
  dictionary ModelConfig. Please find more details in the\n * documentation of the ModelConfig.\n *
\n * @param
  config ModelConfig dictionary that contains parameters for\n * the BodyPix loading process. Please find more
  details of each parameters\n * in the documentation of the ModelConfig interface. The predefined\n *
  `MOBILENET_V1_CONFIG` and `RESNET_CONFIG` can also be used as references\n * for defining your
  customized config.\n */
\n\n ^/export async function load(config: ModelConfig = MOBILENET_V1_CONFIG):\n Promise<BodyPix> {\n config =
  validateModelConfig(config);\n if (config.architecture === `ResNet50`) {\n return
  loadResNet(config);\n } else if (config.architecture === `MobileNetV1`) {\n return
  loadMobileNet(config);\n } else {\n return null;\n
  }\n}\n\n", **\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache
  License, Version 2.0 (the `License`);\n * you may not use this file except in compliance with the License.\n *
  You may obtain a copy of the License at\n *
  http://www.apache.org/licenses/LICENSE-2.0\n *
  Unless required by applicable law or agreed to in writing, software\n * distributed under the License is
  distributed on an `AS IS`\n BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the
  specific language governing permissions and\n * limitations under the License.\n *
  =====\n
  *\n\n// method copied from bGlur in https://codepen.io/zhaojun/pen/zZmRQe\n\n^/export function cpuBlur(\n
  canvas: HTMLCanvasElement|OffscreenCanvas,\n image:
  HTMLImageElement|HTMLVideoElement|HTMLCanvasElement|OffscreenCanvas,\n blur: number) {\n const
  ctx = canvas.getContext(`2d`);\n\n
  let sum = 0;\n const delta = 5;\n const alphaLeft = 1 / (2 * Math.PI * delta * delta);\n const step =
  blur < 3 ? 1 :
  2;\n for (let y = -blur; y <= blur; y += step) {\n for (let x = -blur; x <= blur; x += step) {\n const
  weight =\n alphaLeft * Math.exp(-(x * x + y * y) / (2 * delta * delta));\n sum += weight;\n }
  }\n for (let y = -blur; y <=
  blur; y += step) {\n for (let x = -blur; x <= blur; x += step) {\n ctx.globalAlpha = alphaLeft *\n
  Math.exp(-(x * x + y * y) / (2 * delta * delta)) / sum * blur;\n ctx.drawImage(image, x, y);\n }
  }\n
  ctx.globalAlpha = 1;\n}\n\n", **\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed
  under the Apache License, Version 2.0 (the `License`);\n * you may not use this file except in compliance with
  the License.\n * You may obtain a copy of the License at\n *
  http://www.apache.org/licenses/LICENSE-2.0\n *
  Unless required by applicable
  law or agreed to in writing, software\n * distributed under the License is distributed on an `AS IS` BASIS,\n
  * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the
  specific language governing permissions and\n * limitations under the License.\n *
  =====\n
  *\n\nimport {cpuBlur} from './blur';\nimport {Color, PartSegmentation, PersonSegmentation} from
  './types';\nimport {SemanticPartSegmentation, SemanticPersonSegmentation} from './types';\nimport {getInputSize}
  from './util';\n\n^/export type Canvas = HTMLCanvasElement | OffscreenCanvas;\n\nconst offScreenCanvases:

```



```

{[name: string]: Canvas} = {};\n\ntype ImageType = HTMLImageElement|HTMLVideoElement|Canvas;\ntype
HasDimensions = {\n width: number,\n height: number\n};\n\nfunction isSafari() {\n return
/(^((?!chrome|android).)*safari/i.test(navigator.userAgent));\n}\n\nfunction assertSameDimensions(\n {width:
widthA,
height: heightA}: HasDimensions,\n {width: widthB, height: heightB}: HasDimensions, nameA: string,\n
nameB: string) {\n if (widthA !== widthB || heightA !== heightB) {\n throw new Error(`error: dimensions must
match. ${nameA} has dimensions ${\n widthA}x${heightA}, ${nameB} has dimensions
${widthB}x${heightB}`);\n }\n}\n\nfunction flipCanvasHorizontal(canvas: Canvas) {\n const ctx =
canvas.getContext('2d');\n ctx.scale(-1, 1);\n ctx.translate(-canvas.width, 0);\n}\n\nfunction
drawWithCompositing(\n ctx: CanvasRenderingContext2D|OffscreenCanvasRenderingContext2D,\n image:
Canvas|ImageType,\n compositeOperation: string) {\n ctx.globalCompositeOperation = compositeOperation;\n
ctx.drawImage(image, 0, 0);\n}\n\nfunction createOffScreenCanvas(): Canvas {\n if (typeof document !==
'undefined') {\n return document.createElement('canvas');\n } else if (typeof OffscreenCanvas !== 'undefined')
{\n return new OffscreenCanvas(0, 0);\n } else {\n throw
new Error('Cannot create a canvas in this context');\n }\n}\n\nfunction ensureOffscreenCanvasCreated(id: string):
Canvas {\n if (!offScreenCanvases[id]) {\n offScreenCanvases[id] = createOffScreenCanvas();\n }\n return
offScreenCanvases[id];\n}\n\nfunction drawAndBlurImageOnCanvas(\n image: ImageType, blurAmount:
number, canvas: Canvas) {\n const {height, width} = image;\n const ctx = canvas.getContext('2d');\n canvas.width
= width;\n canvas.height = height;\n ctx.clearRect(0, 0, width, height);\n ctx.save();\n if (isSafari()) {\n
cpuBlur(canvas, image, blurAmount);\n } else {\n // tslint:disable:no-any\n (ctx as any).filter =
`blur(${blurAmount}px)`;\n ctx.drawImage(image, 0, 0, width, height);\n }\n ctx.restore();\n}\n\nfunction
drawAndBlurImageOnOffScreenCanvas(\n image: ImageType, blurAmount: number,\n offscreenCanvasName:
string): Canvas {\n const canvas = ensureOffscreenCanvasCreated(offscreenCanvasName);\n if (blurAmount ===
0) {\n renderImageToCanvas(image,
canvas);\n } else {\n drawAndBlurImageOnCanvas(image, blurAmount, canvas);\n }\n return
canvas;\n}\n\nfunction renderImageToCanvas(image: ImageType, canvas: Canvas) {\n const {width, height} =
image;\n canvas.width = width;\n canvas.height = height;\n const ctx = canvas.getContext('2d');\n ctx
.drawImage(image, 0, 0, width, height);\n}\n\n/**\n * Draw an image on a canvas\n */\n\nfunction
renderImageDataToCanvas(image: ImageData, canvas: Canvas) {\n canvas.width = image.width;\n canvas.height
= image.height;\n const ctx = canvas.getContext('2d');\n ctx.putImageData(image, 0, 0);\n}\n\nfunction
renderImageDataToOffScreenCanvas(\n image: ImageData, canvasName: string): Canvas {\n const canvas =
ensureOffscreenCanvasCreated(canvasName);\n renderImageDataToCanvas(image, canvas);\n return
canvas;\n}\n\n/**\n * Given the output from estimating multi-person segmentation, generates an\n * image with
foreground and background color at each pixel determined
by the\n * corresponding binary segmentation value at the pixel from the output. In\n * other words, pixels where
there is a person will be colored with foreground\n * color and where there is not a person will be colored with
background color.\n */\n * @param personOrPartSegmentation The output from\n * `segmentPerson`,
`segmentMultiPerson`,\n * `segmentPersonParts` or `segmentMultiPersonParts`. They can\n * be
SemanticPersonSegmentation object, an array of PersonSegmentation object,\n * SemanticPartSegmentation object,
or an array of PartSegmentation object.\n */\n * @param foreground Default to {r:0, g:0, b:0, a: 0}. The foreground
color\n * (r,g,b,a) for visualizing pixels that belong to people.\n */\n * @param background Default to {r:0, g:0, b:0,
a: 255}. The background color\n * (r,g,b,a) for visualizing pixels that don't belong to people.\n */\n * @param
drawContour Default to false. Whether to draw the contour around each\n * person's segmentation mask or body
part mask.\n */\n * @param foregroundIds Default to [1]. The integer values that represent\n * foreground. For person
segmentation, 1 is the foreground. For body part\n * segmentation, it can be a subset of all body parts ids.\n */\n *
@returns An ImageData with the same width and height of\n * all the PersonSegmentation in
multiPersonSegmentation, with opacity and\n * transparency at each pixel determined by the corresponding binary\n

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* segmentation value at the pixel from the output.\n */
export function toMask(\n  personOrPartSegmentation:
SemanticPersonSegmentation|\n SemanticPartSegmentation|PersonSegmentation[]|PartSegmentation[],\n
foreground: Color = {\n  r: 0,\n  g: 0,\n  b: 0,\n  a: 0\n },\n background: Color = {\n  r: 0,\n  g: 0,\n
b: 0,\n  a: 255\n },\n drawContour = false, foregroundIds: number[] = [1]): ImageData {\n  if
(Array.isArray(personOrPartSegmentation) &&\n  personOrPartSegmentation.length === 0) {\n  return null;\n
}\n\n  let multiPersonOrPartSegmentation:\n  Array<SemanticPersonSegmentation|SemanticPartSegmentation|\n
PersonSegmentation|PartSegmentation>;\n\n  if (!Array.isArray(personOrPartSegmentation)) {\n
multiPersonOrPartSegmentation = [personOrPartSegmentation];\n  } else {\n  multiPersonOrPartSegmentation =
personOrPartSegmentation;\n  }\n\n  const {width, height} = multiPersonOrPartSegmentation[0];\n  const bytes =
new Uint8ClampedArray(width * height * 4);\n\n  function drawStroke(\n  bytes: Uint8ClampedArray, row:
number, column: number, width: number,\n  radius: number, color: Color = {r: 0, g: 255, b: 255, a: 255}) {\n
for (let i = -radius; i <= radius; i++) {\n  for (let j = -radius; j <= radius; j++) {\n  if (i !== 0 && j !== 0) {\n
const n = (row + i) * width + (column + j);\n  bytes[4 * n + 0] = color.r;\n  bytes[4 * n + 1] = color.g;\n
bytes[4 * n + 2] = color.b;\n  bytes[4 * n + 3] = color.a;\n
}\n  }\n  }\n\n  function isSegmentationBoundary(\n  segmentationData: Uint8Array|Int32Array,\n
row: number,\n  column: number,\n  width: number,\n  foregroundIds: number[] = [1],\n  radius = 1,\n
): boolean {\n  let numberBackgroundPixels = 0;\n  for (let i = -radius; i <= radius; i++) {\n  for (let j = -radius;
j <= radius; j++) {\n  if (i !== 0 && j !== 0) {\n  const n = (row + i) * width + (column + j);\n  if
(!foregroundIds.some(id => id === segmentationData[n])) {\n  numberBackgroundPixels += 1;\n  }\n
}\n  }\n  }\n  return numberBackgroundPixels > 0;\n  }\n\n  for (let i = 0; i < height; i += 1) {\n  for (let j = 0; j
< width; j += 1) {\n  const n = i * width + j;\n  bytes[4 * n + 0] = background.r;\n  bytes[4 * n + 1] =
background.g;\n  bytes[4 * n + 2] = background.b;\n  bytes[4 * n + 3] = background.a;\n  for (let k = 0; k <
multiPersonOrPartSegmentation.length;\n  k++) {\n  if (foregroundIds.some(\n  id => id === multiPersonOrPartSegmentation[k].data[n])) {\n
bytes[4 * n] = foreground.r;\n  bytes[4 * n + 1] = foreground.g;\n  bytes[4 * n + 2] = foreground.b;\n
bytes[4 * n + 3] = foreground.a;\n  const isBoundary = isSegmentationBoundary(\n
multiPersonOrPartSegmentation[k].data, i, j, width,\n  foregroundIds);\n  if (drawContour && i - 1 >= 0
&& i + 1 < height && j - 1 >= 0 &&\n  j + 1 < width && isBoundary) {\n  drawStroke(bytes, i, j,
width, 1);\n  }\n  }\n  }\n  }\n\n  return new ImageData(bytes, width, height);\n  }\n\n  const
RAINBOW_PART_COLORS: Array<[number, number, number]> = [\n  [110, 64, 170], [143, 61, 178], [178, 60,
178], [210, 62, 167],\n  [238, 67, 149], [255, 78, 125], [255, 94, 99], [255, 115, 75],\n  [255, 140, 56], [239, 167,
47], [217, 194, 49], [194, 219, 64],\n
[175, 240, 91], [135, 245, 87], [96, 247, 96], [64, 243, 115],\n  [40, 234, 141], [28, 219, 169], [26, 199, 194], [33,
176, 213],\n  [47, 150, 224], [65, 125, 224], [84, 101, 214], [99, 81, 195]\n  ];\n  }\n\n  /**\n  * Given the output from
person body part segmentation (or multi-person\n  * instance body part segmentation) and an array of colors indexed
by part id,\n  * generates an image with the corresponding color for each part at each pixel,\n  * and white pixels
where there is no part.\n  * @param partSegmentation The output from segmentPersonParts\n  * or
segmentMultiPersonParts. The former is a SemanticPartSegmentation\n  * object and later is an array of
PartSegmentation object.\n  * @param partColors A multi-dimensional array of rgb colors indexed by\n  * part id.
Must have 24 colors, one for every part.\n  * @returns An ImageData with the same width and height of all the
element in\n  * multiPersonPartSegmentation, with the corresponding color for each part at\n  * each pixel, and
black pixels where there is no part.\n  */
export function toColoredPartMask(\n  partSegmentation:
SemanticPartSegmentation|PartSegmentation[],\n  partColors: Array<[number, number, number]> =\n
RAINBOW_PART_COLORS): ImageData {\n  if (Array.isArray(partSegmentation) && partSegmentation.length
=== 0) {\n  return null;\n  }\n\n  let multiPersonPartSegmentation;\n  if (!Array.isArray(partSegmentation)) {\n
multiPersonPartSegmentation = [partSegmentation];\n  } else {\n  multiPersonPartSegmentation =
partSegmentation;\n  }\n\n  const {width, height} = multiPersonPartSegmentation[0];\n  const bytes = new
Uint8ClampedArray(width * height * 4);\n\n  for (let i = 0; i < height * width; ++i) {\n  // invert mask. Invert the

```

```

segmentation mask.\n  const j = i * 4;\n  bytes[j + 0] = 255;\n  bytes[j + 1] = 255;\n  bytes[j + 2] = 255;\n  bytes[j + 3] = 255;\n  for (let k = 0; k < multiPersonPartSegmentation.length; k++) {\n    const partId =
multiPersonPartSegmentation[k].data[i];\n
    if (partId !== -1) {\n      const color = partColors[partId];\n      if (!color) {\n        throw new Error(`No color
could be found for part id ${partId}`);\n      }\n      bytes[j + 0] = color[0];\n      bytes[j + 1] = color[1];\n
bytes[j + 2] = color[2];\n      bytes[j + 3] = 255;\n    }\n  }\n  return new ImageData(bytes, width,
height);\n}\n\nconst CANVAS_NAMES = {\n  blurred: 'blurred',\n  blurredMask: 'blurred-mask',\n  mask: 'mask',\n
lowresPartMask: 'lowres-part-mask',\n};\n\n/**\n * Given an image and a maskImage of type ImageData, draws the
image with the\n * mask on top of it onto a canvas.\n * @param canvas The canvas to be drawn onto.\n * @param image The original image to apply the mask to.\n * @param maskImage An ImageData containing the
mask. Ideally this should be\n * generated by toMask or toColoredPartMask.\n * @param maskOpacity The
opacity of the mask when drawing it on top of the\n * image. Defaults
to 0.7. Should be a float between 0 and 1.\n * @param maskBlurAmount How many pixels to blur the mask by.
Defaults to 0.\n * Should be an integer between 0 and 20.\n * @param flipHorizontal If the result should be
flipped horizontally. Defaults\n * to false.\n */\nexport function drawMask(\n  canvas: Canvas, image: ImageType,
maskImage: ImageData|null,\n  maskOpacity = 0.7, maskBlurAmount = 0, flipHorizontal = false) {\n  const
[height, width] = getInputSize(image);\n  canvas.width = width;\n  canvas.height = height;\n\n  const ctx =
canvas.getContext('2d');\n  ctx.save();\n  if (flipHorizontal) {\n    flipCanvasHorizontal(canvas);\n  }\n\n  ctx.drawImage(image, 0, 0);\n\n  ctx.globalAlpha = maskOpacity;\n  if (maskImage) {\n
assertSameDimensions({ width, height }, maskImage, 'image', 'mask');\n\n  const mask =
renderImageDataToOffScreenCanvas(maskImage, CANVAS_NAMES.mask);\n\n  const blurredMask =
drawAndBlurImageOnOffScreenCanvas(\n    mask, maskBlurAmount,
CANVAS_NAMES.blurredMask);\n  ctx.drawImage(blurredMask, 0, 0, width, height);\n  }\n\n  ctx.restore();\n}\n\n/**\n * Given an image and a maskImage of type ImageData, draws the image with the\n *
pixelated mask on top of it onto a canvas.\n * @param canvas The canvas to be drawn onto.\n * @param image The original image to apply the mask to.\n * @param maskImage An ImageData containing the mask.
Ideally this should be\n * generated by toColoredPartMask.\n * @param maskOpacity The opacity of the mask
when drawing it on top of the\n * image. Defaults to 0.7. Should be a float between 0 and 1.\n * @param
maskBlurAmount How many pixels to blur the mask by. Defaults to 0.\n * Should be an integer between 0 and 20.\n
* @param flipHorizontal If the result should be flipped horizontally. Defaults\n * to false.\n * @param
pixelCellWidth The width of each pixel cell. Default to 10 px.\n */\nexport function drawPixelatedMask(\n
canvas: Canvas, image: ImageType,
maskImage: ImageData,\n  maskOpacity = 0.7, maskBlurAmount = 0, flipHorizontal = false,\n  pixelCellWidth =
10.0) {\n  const [height, width] = getInputSize(image);\n  assertSameDimensions({ width, height }, maskImage,
'image', 'mask');\n\n  const mask = renderImageDataToOffScreenCanvas(maskImage, CANVAS_NAMES.mask);\n
const blurredMask = drawAndBlurImageOnOffScreenCanvas(\n    mask, maskBlurAmount,
CANVAS_NAMES.blurredMask);\n\n  canvas.width = blurredMask.width;\n  canvas.height =
blurredMask.height;\n\n  const ctx = canvas.getContext('2d');\n  ctx.save();\n  if (flipHorizontal) {\n
flipCanvasHorizontal(canvas);\n  }\n\n  const offscreenCanvas =\nensureOffscreenCanvasCreated(CANVAS_NAMES.lowresPartMask);\n  const offscreenCanvasCtx =
offscreenCanvas.getContext('2d');\n  offscreenCanvas.width = blurredMask.width * (1.0 / pixelCellWidth);\n
offscreenCanvas.height = blurredMask.height * (1.0 / pixelCellWidth);\n  offscreenCanvasCtx.drawImage(\n
blurredMask, 0, 0, blurredMask.width,
blurredMask.height, 0, 0,\n  offscreenCanvas.width, offscreenCanvas.height);\n  ctx.imageSmoothingEnabled =
false;\n  ctx.drawImage(\n    offscreenCanvas, 0, 0, offscreenCanvas.width, offscreenCanvas.height, 0,\n    0,
canvas.width, canvas.height);\n\n  // Draws vertical grid lines that are `pixelCellWidth` apart from each other.\n  for
(let i = 0; i < offscreenCanvas.width; i++) {\n    ctx.beginPath();\n    ctx.strokeStyle = '#ffffff';\n
ctx.moveTo(pixelCellWidth * i, 0);\n    ctx.lineTo(pixelCellWidth * i, canvas.height);\n    ctx.stroke();\n  }\n\n  //

```

```

Draws horizontal grid lines that are `pixelCellWidth` apart from each
// other.
for (let i = 0; i <
offscreenCanvas.height; i++) {
  ctx.beginPath();
  ctx.strokeStyle = '#ffffff';
  ctx.moveTo(0, pixelCellWidth
* i);
  ctx.lineTo(canvas.width, pixelCellWidth * i);
  ctx.stroke();
}
ctx.globalAlpha = 1.0 -
maskOpacity;
ctx.drawImage(image, 0, 0, blurredMask.width, blurredMask.height);
ctx.restore();
}
function createPersonMask(
  multiPersonSegmentation:
PersonSegmentation[]|SemanticPersonSegmentation,
  edgeBlurAmount: number): Canvas {
  const
backgroundMaskImage = toMask(
  multiPersonSegmentation, {r: 0, g: 0, b: 0, a: 255},
  {r: 0, g: 0, b: 0, a:
0});
  const backgroundMask =
  renderImageDataToOffScreenCanvas(backgroundMaskImage,
CANVAS_NAMES.mask);
  if (edgeBlurAmount === 0) {
    return backgroundMask;
  } else {
    return
drawAndBlurImageOnOffScreenCanvas(
  backgroundMask, edgeBlurAmount,
CANVAS_NAMES.blurredMask);
  }
}
/**
 * Given a personSegmentation and an image, draws the image
with its background
 * blurred onto the canvas.
 * @param canvas The canvas to draw the background-blurred
image onto.
 * @param image The image to blur the background of and draw.
 * @param
personSegmentation A SemanticPersonSegmentation or an array of
 * PersonSegmentation object.
 * @param
backgroundBlurAmount
  How many pixels in the background blend into each
 * other. Defaults to 3. Should be an integer between 1 and
20.
 * @param edgeBlurAmount How many pixels to blur on the edge between the person
 * and the
background by. Defaults to 3. Should be an integer between 0 and 20.
 * @param flipHorizontal If the output
should be flipped horizontally. Defaults
 * to false.
 */
export function drawBokehEffect(
  canvas: Canvas,
image: ImageType,
  multiPersonSegmentation: SemanticPersonSegmentation|PersonSegmentation[],
backgroundBlurAmount = 3, edgeBlurAmount = 3, flipHorizontal = false) {
  const blurredImage =
drawAndBlurImageOnOffScreenCanvas(
  image, backgroundBlurAmount, CANVAS_NAMES.blurred);
  canvas.width = blurredImage.width;
  canvas.height = blurredImage.height;
  const ctx =
canvas.getContext('2d');
  if (Array.isArray(multiPersonSegmentation) &&
  multiPersonSegmentation.length
=== 0) {
    ctx.drawImage(blurredImage,
0, 0);
    return;
  }
  const personMask = createPersonMask(multiPersonSegmentation, edgeBlurAmount);
  ctx.save();
  if (flipHorizontal) {
    flipCanvasHorizontal(canvas);
  }
  // draw the original image on the final
canvas
  const [height, width] = getInputSize(image);
  ctx.drawImage(image, 0, 0, width, height);
  //
"destination-in" - "The existing canvas content is kept where both the
// new shape and existing canvas content
overlap. Everything else is made
// transparent."
  // crop what's not the person using the mask from the original
image
  drawWithCompositing(ctx, personMask, 'destination-in');
  //
"destination-over" - "The existing canvas
content is kept where both the
// new shape and existing canvas content
overlap. Everything else is made
//
transparent."
  // draw the blurred background on top of the original image where it doesn't
// overlap.
  drawWithCompositing(ctx, blurredImage, 'destination-over');
  ctx.restore();
}
function
createBodyPartMask(
  multiPersonPartSegmentation: SemanticPartSegmentation|PartSegmentation[],
bodyPartIdsToMask: number[], edgeBlurAmount: number): Canvas {
  const backgroundMaskImage = toMask(
  multiPersonPartSegmentation, {r: 0, g: 0, b: 0, a: 0},
  {r: 0, g: 0, b: 0, a: 255}, true, bodyPartIdsToMask);
  const backgroundMask =
  renderImageDataToOffScreenCanvas(backgroundMaskImage,
CANVAS_NAMES.mask);
  if (edgeBlurAmount === 0) {
    return backgroundMask;
  } else {
    return
drawAndBlurImageOnOffScreenCanvas(
  backgroundMask, edgeBlurAmount,
CANVAS_NAMES.blurredMask);
  }
}
/**
 * Given a personSegmentation and an image, draws the image
with its background
 * blurred onto the canvas.
 * @param canvas The canvas to draw the background-blurred
image onto.
 * @param image The image to blur the background of and draw.
 * @param
partSegmentation A SemanticPartSegmentation or an array of
 * PartSegmentation
object.
 * @param bodyPartIdsToBlur Default to [0, 1] (left-face and right-face). An
 * array of body part ids
to blur. Each must be one of the 24 body part ids.
 * @param backgroundBlurAmount How many pixels in the
background blend into each
 * other. Defaults to 3. Should be an integer between 1 and 20.
 * @param
edgeBlurAmount How many pixels to blur on the edge between the person
 * and the background by. Defaults to

```

```

3. Should be an integer between 0 and 20.\n * \n * @param flipHorizontal If the output should be flipped
horizontally. Defaults\n * to false.\n * /\nexport function blurBodyPart(\n  canvas: Canvas, image: ImageType,\n  partSegmentation: SemanticPartSegmentation|PartSegmentation[],\n  bodyPartIdsToBlur = [0, 1],
backgroundBlurAmount = 3, edgeBlurAmount = 3,\n  flipHorizontal = false) {\n  const blurredImage =
drawAndBlurImageOnOffScreenCanvas(\n    image, backgroundBlurAmount, CANVAS_NAMES.blurred);\n  canvas.width = blurredImage.width;\n
  canvas.height = blurredImage.height;\n\n  const ctx = canvas.getContext('2d');\n\n  if
(Array.isArray(partSegmentation) && partSegmentation.length === 0) {\n    ctx.drawImage(blurredImage, 0, 0);\n
  return;\n  }\n  const bodyPartMask =\n    createBodyPartMask(partSegmentation, bodyPartIdsToBlur,
edgeBlurAmount);\n\n  ctx.save();\n  if (flipHorizontal) {\n    flipCanvasHorizontal(canvas);\n  }\n  // draw the
original image on the final canvas\n  const [height, width] = getInputSize(image);\n  ctx.drawImage(image, 0, 0,
width, height);\n\n  // "destination-in" - "The existing canvas content is kept where both the\n  // new shape and
existing canvas content overlap. Everything else is made\n  // transparent.\n\n  // crop what's not the person using the
mask from the original image\n  drawWithCompositing(ctx, bodyPartMask, 'destination-in');\n\n  // "destination-
over" - "The existing canvas content is kept where both the\n  // new shape and existing canvas content overlap.
Everything else is made\n  // transparent.\n\n  // draw the blurred background on top of the original image where it
doesn't\n  // overlap.\n  drawWithCompositing(ctx, blurredImage, 'destination-over');\n  ctx.restore();\n}\n\n"/**\n *
@license\n * Copyright 2020 Google Inc. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0
(the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of
the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n * \n *
===== \n
*/\n\nexport const PART_CHANNELS: string[] = [\n
  'left_face',\n  'right_face',\n  'left_upper_arm_front',\n  'left_upper_arm_back',\n  'right_upper_arm_front',\n
  'right_upper_arm_back',\n  'left_lower_arm_front',\n  'left_lower_arm_back',\n  'right_lower_arm_front',\n
  'right_lower_arm_back',\n  'left_hand',\n  'right_hand',\n  'torso_front',\n  'torso_back',\n  'left_upper_leg_front',\n
  'left_upper_leg_back',\n  'right_upper_leg_front',\n  'right_upper_leg_back',\n  'left_lower_leg_front',\n
  'left_lower_leg_back',\n  'right_lower_leg_front',\n  'right_lower_leg_back',\n  'left_feet',\n  'right_feet'];\n\n"/**
@license See the LICENSE file. *\n\n// This code is auto-generated, do not modify this file!\nconst version =
'2.2.0';\nexport
{version};\n\n], "names": ["toFlattenedOneHotPartMap", "partHeatmapScores", "numParts", "shape", "partMapLocation
s", "tf.argmax", "partMapFlattened", "tf.reshape", "tf.oneHot", "clipByMask2d", "image", "mask", "tf.mul", "toMaskTens
or", "segmentScores", "threshold", "tf.tidy", "tf.cast", "tf.greater", "tf.scalar", "decodePartSegmentation", "segmentation
Mask", "_a", "partMapHeight", "partMapWidth", "flattenedMap", "partNumbers", "tf.expandDims", "tf.range", "tf.matM
ul", "partMap", "partMapShiftedUpForClipping", "tf.add", "tf.sub", "decodeOnlyPartSegmentation", "model", "outputStr
ide", "this", "inputShape", "inputs", "tf.util", "assert", "BaseModel", "input", "asFloat", "_this", "preprocessInput", "asBatc
h", "results3d", "predict", "map", "y", "tf.squeeze", "namedResults", "nameOutputResults", "heatmapScores", "tf.sigmoid",
"heatmap", "offsets", "displacementFwd", "displacementBwd", "segmentation", "partHeatmaps", "longOffsets", "partOf
fssets", "dispose", "__extends", "MobileNet", "tf.div", "results", "PART_NAMES", "NUM_KEYPOINTS", "length", "PA
RT_IDS", "reduce", "result", "jointName", "i", "CONNECTED_PART_NAMES", "POSE_CHAIN", "CONNECTED_P
ART_INDICES", "jointNameA", "jointNameB", "getScale", "_b", "padding", "height", "width", "inputResolutionY", "inp
utResolutionX", "padT", "padB", "getOffsetPoint", "x", "keypoint", "get", "getImageCoords", "part", "heatmapX", "heatm
apY", "clamp", "a", "min", "max", "squaredDistance", "y1", "x1", "y2", "x2", "dy", "dx", "addVectors", "b", "computeDistan
ce", "embedding", "pose", "minPartScore", "distance", "numKpt", "p", "keypoints", "score", "Math", "position", "Infinity",
"convertToPositionInOuput", "stride", "padL", "scaleX", "scaleY", "round", "getEmbedding", "location", "keypointIndex",
"convertToPosition", "outputResolutionX", "refineSteps", "newLocation", "nn", "t", "newPos", "nn_1", "matchEmbeddin

```

gToInstance", "poses", "numKptForMatching", "_c", "embed", "pair", "keypointsIndex", "push", "kMin", "kMinDist", "k", "dist", "getOutputResolution", "decodeMultipleMasksCPU", "posesAboveScore", "inHeight", "inWidth", "dataArray", "Uint8Array", "fill", "j", "n", "decodeMultiplePartMasksCPU", "partSegmentaion", "Int32Array", "decodeMultipleMask sWebGl", "minKptScore", "maxNumPeople", "origHeight", "origWidth", "slice", "outHeight", "outWidth", "shapedLong Offsets", "poseVals", "Float32Array", "poseOffset", "kp", "offset", "_d", "posesTensor", "tf.tensor", "program", "variable Names", "outputShape", "userCode", "tf.backend", "compileAndRun", "toPersonKSegmentation", "tf.equal", "toPersonK PartSegmentation", "bodyParts", "isWebGIBackend", "getBackend", "decodePersonInstanceMasks", "minPoseScore", " minKeypointScore", "filter", "personSegmentations", "masksTensorInfo", "masksTensor", "tf.engine", "makeTensorFrom mDataId", "dataId", "dtype", "_", "Promise", "all", "data", "personSegmentationsData", "forEach", "segmentationsData", " longOffsetsData", "decodePersonInstancePartMasks", "partSegmentation", "partSegmentations", "partSegmentationsB yPersonData", "partSegmentaionData", "half", "floor", "maxSize", "getElementValue", "priorityQueue", "Array", "numb erOfElements", "MaxHeap", "swim", "exchange", "sink", "less", "getValueAt", "scoreIsMaximumInLocalWindow", "key pointId", "localMaximumRadius", "scores", "localMaximum", "yStart", "yEnd", "yCurrent", "xStart", "xEnd", "xCurrent", "buildPartWithScoreQueue", "scoreThreshold", "numKeypoints", "queue", "enqueue", "id", "parentChildrenTuples", "pa rentJoinName", "childJoinName", "parentToChildEdges", "childToParentEdges", "getDisplacement", "edgeId", "point", "displacements", "numEdges", "getStridedIndexNearPoint", "traverseToTargetKeypoint", "sourceKeypoint", "targetKe ypointId", "scoresBuffer", "offsetRefineStep", "displacement", "targetKeypoint", "targetKeypointIndices", "offsetPoint", "targetKeyPointIndices", "decodePose", "root", "displacementsFwd", "displacementsBwd", "instanceKeypoints", "root Part", "rootScore", "rootPoint", "edge", "sourceKeypointId", "withinNmsRadiusOfCorrespondingPoint", "squaredNmsR adius", "some", "correspondingKeypoint", "getInstanceScore", "existingPoses", "kLocalMaximumRadius", "decodeMul tiplePoses", "offsetsBuffer", "displacementsFwdBuffer", "displacementsBwdBuffer", "maxPoseDetections", "nmsRadi us", "empty", "dequeue", "imageNetMean", "ResNet", "RESNET50_BASE_URL", "MOBILENET_BASE_URL", "res Net50SavedModel", "quantBytes", "graphJson", "mobileNetSavedModel", "multiplier", "toStr", "1", "0.75", "0.5", "getSi zeFromImageLikeElement", "offsetHeight", "offsetWidth", "Error", "getSizeFromVideoElement", "hasAttribute", "vide oHeight", "videoWidth", "getInputSize", "HTMLCanvasElement", "OffscreenCanvas", "HTMLImageElement", "Image Data", "HTMLVideoElement", "tf.Tensor", "isValidInputResolution", "resolution", "toValidInputResolution", "inputRe solution", "INTERNAL_RESOLUTION_STRING_OPTIONS", "low", "medium", "high", "full", "INTERNAL_RESO LUTION_PERCENTAGES", "MIN_INTERNAL_RESOLUTION", "MAX_INTERNAL_RESOLUTION", "toIntern alResolutionPercentage", "internalResolution", "Object", "values", "join", "toInputResolutionHeightAndWidth", "input Height", "inputWidth", "internalResolutionPercentage", "toInputTensor", "tf.browser", "fromPixels", "resizeAndPadTo", "imageTensor", "flipHorizontal", "targetH", "targetW", "resizeW", "resizeH", "padR", "aspect", "padHeight", "ceil", "pad Width", "resizedAndPadded", "resized", "tf.image", "resizeBilinear", "tf.reverse", "tf.pad3d", "paddedBy", "scaleAndCro pToInputTensorShape", "tensor", "applySigmoidActivation", "inputTensorHeight", "inputTensorWidth", "resizedAndP addedHeight", "resizedAndPaddedWidth", "_e", "inResizedAndPadded", "removePaddingAndResizeBack", "originalH eight", "originalWidth", "batchedImage", "cropAndResize", "padAndResizeTo", "targetAspect", "top", "left", 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"displacementsBwdBuf", "allPoses", "scaledLongOffsets", "predictForMultiPersonInstanceSegmentation AndPart", "heatmapScoresRaw", "offsetsRaw", "displacementFwdRaw", "displacementBwdRaw", "instanceMasks", "pr edictForPersonSegmentationAndPart", "scaledPartHeatmapScore", "segmentPersonPartsActivation", "scaledPartSegm entationScores", "loadMobileNet", "tf", "url", "tfconv.loadGraphModel", "modelUrl", "graphModel", "mobilenet", "load

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in path(s):

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No license file was found, but licenses were detected in source scan.

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ndering_util.ts", "./src/part_channels.ts", "./src/version.ts", "./src/index.ts"], "sourcesContent": ["/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You\n * may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required\n * by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\"\n * BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the\n * License for the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport * as tf from '@tensorflow/tfjs-core';\n\n/**\n * Takes the sigmoid of the part heatmap output and\n * generates a 2d one-hot\n * tensor with ones where the part's score has the maximum value.\n * \n * @param\n * partHeatmapScores\n * \nfunction toFlattenedOneHotPartMap(partHeatmapScores: tf.Tensor3D): tf.Tensor2D {\n  const numParts = partHeatmapScores.shape[2];\n  const partMapLocations = tf.argmax(partHeatmapScores, 2);\n  const partMapFlattened = tf.reshape(partMapLocations, [-1]);\n  \n  return tf.oneHot(partMapFlattened, numParts) as tf.Tensor2D;\n}\n\nfunction clipByMask2d(image: tf.Tensor2D,\n  mask: tf.Tensor2D): tf.Tensor2D {\n  return tf.mul(image, mask);\n}\n\n/**\n * Takes the sigmoid of the\n * segmentation output, and generates a segmentation\n * mask with a 1 or 0 at each pixel where there is a person or\n * not a person. The\n * segmentation threshold determines the threshold of a score for a pixel for it\n * to be\n * considered part of a person.\n * \n * @param segmentScores A 3d-tensor of the sigmoid of the segmentation output.\n * \n * @param segmentationThreshold The minimum that segmentation values must have\n * to be considered part of the\n * person. Affects the generation of the\n * segmentation mask and the clipping of the colored part image.\n * \n * \n * @returns A segmentation mask with a 1 or 0 at each pixel where there is a\n * person or not a person.\n * \nfunction toMaskTensor(\n  segmentScores: tf.Tensor2D, threshold: number): tf.Tensor2D {\n  return tf.tidy(\n    () =>\n      (tf.cast(tf.greater(\n        segmentScores, tf.scalar(threshold)), 'int32') as\n        tf.Tensor2D));\n  }\n\n/**\n * Takes the sigmoid of the person and part map output, and returns a 2d tensor\n * of an\n * image with the corresponding value at each pixel corresponding to the\n * part with the highest value. These part ids\n * are clipped by the segmentation\n * mask. Wherever the a pixel is clipped by the segmentation mask, its value\n * will set to -1, indicating that there is no part in that pixel.\n * \n * @param segmentScores A 3d-tensor of the sigmoid of the segmentation output.\n * \n * @param partHeatmapScores A 3d-tensor of the sigmoid of the part heatmap\n * output.\n * The third dimension corresponds to the part.\n * \n * @returns A 2d tensor of an image with the corresponding value\n * at each pixel\n * corresponding to the part with the highest value. These part ids are clipped\n * by the segmentation\n * mask. It will have values of -1 for pixels that are\n * outside of the body\n * and do not have a corresponding part.\n * \nfunction decodePartSegmentation(\n  segmentationMask:\n  tf.Tensor2D,\n  partHeatmapScores: tf.Tensor3D): tf.Tensor2D {\n  const [partMapHeight, partMapWidth,\n  numParts] = partHeatmapScores.shape;\n  return tf.tidy(() => {\n    const flattenedMap =\n    toFlattenedOneHotPartMap(partHeatmapScores);\n    const partNumbers = tf.expandDims(tf.range(0, numParts, 1,\n    'int32'), 1);\n    const partMapFlattened =\n      tf.cast(tf.matmul(flattenedMap, partNumbers as tf.Tensor2D),\n    'int32');\n    const partMap = tf.reshape(partMapFlattened, [partMapHeight, partMapWidth]);\n    const\n    partMapShiftedUpForClipping = tf.add(partMap, tf.scalar(1, 'int32'));\n    return tf.sub(clipByMask2d(\n    partMapShiftedUpForClipping as tf.Tensor2D, segmentationMask)\n      , tf.scalar(1, 'int32'));\n  });\n}\n\nfunction decodeOnlyPartSegmentation(partHeatmapScores: tf.Tensor3D):\n  tf.Tensor2D {\n  const\n  [partMapHeight, partMapWidth, numParts]\n  = partHeatmapScores.shape;\n  return tf.tidy(() => {\n    const flattenedMap =\n    toFlattenedOneHotPartMap(partHeatmapScores);\n    const partNumbers = tf.expandDims(tf.range(0, numParts, 1,\n    'int32'), 1);\n    const partMapFlattened =\n      tf.cast(tf.matmul(flattenedMap, partNumbers as tf.Tensor2D),\n    'int32');\n    return tf.reshape(partMapFlattened, [partMapHeight, partMapWidth]);\n  });\n}\n\n", "\n**\n * @license\n * Copyright 2019 Google Inc. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0\n * (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of\n * the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or

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*\n\nimport * as tfconv from '@tensorflow/tfjs-converter';\nimport * as tf from '@tensorflow/tfjs-core';\nimport {BodyPixOutputStride} from './types';\n\n/**\n * BodyPix supports using various convolution neural network models\n * (e.g. ResNet and MobileNetV1) as its underlying base model.\n * The following BaseModel interface defines a unified interface for\n * creating such BodyPix base models. Currently both MobileNet (in\n * ./mobilenet.ts) and ResNet (in ./resnet.ts) implements the BaseModel\n * interface. New base models that conform to the BaseModel interface can be\n * added to BodyPix.\n */\nexport abstract class BaseModel {\n  constructor(\n    protected readonly model: tfconv.GraphModel,\n    public readonly outputStride: BodyPixOutputStride) {\n    const inputShape =\n      this.model.inputs[0].shape as [number, number, number, number];\n    tf.util.assert(\n      (inputShape[1] === -1) && (inputShape[2] === -1),\n      () => `Input shape [${inputShape[1]}, ${inputShape[2]}]` +\n        ` must both be equal to or -1`);\n  }\n\n  abstract preprocessInput(input: tf.Tensor3D): tf.Tensor3D;\n\n  /**\n   * Predicts intermediate Tensor representations.\n   * @param input The input RGB image of the base model.\n   * A Tensor of shape: [inputResolution,\n   * inputResolution, 3].\n   * @return A dictionary of base model's intermediate predictions.\n   * The returned dictionary should contains the following elements:\n   * - heatmapScores: A Tensor3D that represents the keypoint heatmap scores.\n   * - offsets: A Tensor3D that represents the offsets.\n   * - displacementFwd: A Tensor3D that represents the forward displacement.\n   * - displacementBwd: A Tensor3D that represents the backward displacement.\n   * - segmentation: A Tensor3D that represents the segmentation of all\n   * people.\n   * - longOffsets: A Tensor3D that represents the long offsets used for\n   * instance grouping.\n   * - partHeatmaps: A Tensor3D that represents the body part segmentation.\n   */\n  predict(input: tf.Tensor3D): {\n    heatmapScores: tf.Tensor3D,\n    offsets: tf.Tensor3D,\n    displacementFwd: tf.Tensor3D,\n    displacementBwd: tf.Tensor3D,\n    segmentation: tf.Tensor3D,\n    partHeatmaps: tf.Tensor3D,\n    longOffsets: tf.Tensor3D,\n    partOffsets: tf.Tensor3D\n  } {\n    return tf.tidy(() => {\n      const asFloat = this.preprocessInput(tf.cast(input, 'float32'));\n      const asBatch = tf.expandDims(asFloat, 0);\n      const results = this.model.predict(asBatch) as tf.Tensor4D[];\n      const results3d: tf.Tensor3D[] = results.map(y => tf.squeeze(y, [0]));\n      const namedResults =\n        this.nameOutputResults(results3d);\n      return {\n        heatmapScores: tf.sigmoid(namedResults.heatmap),\n        offsets: namedResults.offsets,\n        displacementFwd: namedResults.displacementFwd,\n        displacementBwd: namedResults.displacementBwd,\n        segmentation: namedResults.segmentation,\n        partHeatmaps: namedResults.partHeatmaps,\n        longOffsets: namedResults.longOffsets,\n        partOffsets: namedResults.partOffsets\n      };\n    });\n  }\n\n  /**\n   * Releases the CPU and GPU memory allocated by the model.\n   */\n  dispose() {\n    this.model.dispose();\n  }\n}\n\n/**\n * @license\n * Copyright 2019 Google Inc. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n=====
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*\n\nimport * as tf from '@tensorflow/tfjs-core';\n\nimport { BaseModel } from './base_model';\n\nexport class
MobileNet extends BaseModel {\n  preprocessInput(input: tf.Tensor3D): tf.Tensor3D {\n    // Normalize the pixels
[0, 255] to be between [-1, 1].\n    return tf.tidy(() => tf.sub(tf.div(input, 127.5), 1.0));\n  }\n\n  nameOutputResults(results: tf.Tensor3D[]) {\n    const [\n      offsets,\n      segmentation,\n      partHeatmaps,\n      longOffsets,\n      heatmap,\n      displacementFwd,\n      displacementBwd,\n      partOffsets,\n    ] = results;\n    return {\n      offsets,\n      segmentation,\n      partHeatmaps,\n      longOffsets,\n      heatmap,\n      displacementFwd,\n      displacementBwd,\n      partOffsets\n    };\n  }\n}\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache
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License for the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nexport type Tuple<T> = [T, T];\nexport type StringTuple = Tuple<string>;\nexport type NumberTuple =
Tuple<number>;\n\nexport const PART_NAMES = [\n  'nose', 'leftEye', 'rightEye', 'leftEar', 'rightEar',
'leftShoulder',\n  'rightShoulder', 'leftElbow', 'rightElbow', 'leftWrist', 'rightWrist',\n  'leftHip', 'rightHip', 'leftKnee',
'rightKnee', 'leftAnkle', 'rightAnkle'\n];\n\nexport const NUM_KEYPOINTS = PART_NAMES.length;\n\nexport
interface NumberDict {\n  [jointName: string]: number;\n}\n\nexport const PART_IDS =\nPART_NAMES.reduce((result: NumberDict, jointName, i): NumberDict => {\n  result[jointName] = i;\n
return result;\n  }, {});\n\nconst CONNECTED_PART_NAMES: StringTuple[] = [\n  ['leftHip', 'leftShoulder'],
['leftElbow', 'leftShoulder'],\n  ['leftElbow', 'leftWrist'], ['leftHip', 'leftKnee'],\n  ['leftKnee', 'leftAnkle'],
['rightHip', 'rightShoulder'],\n  ['rightElbow', 'rightShoulder'],\n  ['rightElbow', 'rightWrist'],\n  ['rightHip', 'rightKnee'],
['rightKnee', 'rightAnkle'],\n  ['leftShoulder', 'rightShoulder'],\n  ['leftHip', 'rightHip']\n];\n\n/*\n * Define the skeleton. This defines the parent->child relationships of our\n * tree.
Arbitrarily this defines the nose as the root of the tree, however\n * since we will infer the displacement for both
parent->child and\n * child->parent, we can define the tree root as any node.\n */\n\nexport const POSE_CHAIN:
StringTuple[] = [\n  ['nose', 'leftEye'], ['leftEye', 'leftEar'], ['nose', 'rightEye'],\n  ['rightEye', 'rightEar'],
['nose', 'leftShoulder'],\n  ['leftShoulder', 'leftElbow'], ['leftElbow', 'leftWrist'],\n  ['leftShoulder', 'leftHip'],
['leftHip', 'leftKnee'],\n  ['leftKnee', 'leftAnkle'], ['nose', 'rightShoulder'],\n  ['rightShoulder', 'rightElbow'],
['rightElbow', 'rightWrist'],\n  ['rightShoulder', 'rightHip'], ['rightHip', 'rightKnee'],\n  ['rightKnee', 'rightAnkle']\n];\n\nexport const
CONNECTED_PART_INDICES = CONNECTED_PART_NAMES.map(\n  ([jointNameA, jointNameB]) =>\n    ([PART_IDS[jointNameA], PART_IDS[jointNameB]]);\n  );\n", "/*\n *
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport { NUM_KEYPOINTS } from './keypoints';\nimport { Padding, Part, TensorBuffer3D, Vector2D } from
'./types';\n\nexport function getScale(\n  height,\n  width): [number, number],\n  [inputResolutionY, inputResolutionX]: [number, number],\n  padding: Padding):
[number, number] {\n  const {top: padT, bottom: padB, left: padL, right: padR} = padding;\n  const scaleY =
inputResolutionY / (padT + padB + height);\n  const scaleX = inputResolutionX / (padL + padR + width);\n  return
[scaleX, scaleY];\n}\n\nexport function getOffsetPoint(\n  y: number, x: number, keypoint: number, offsets:
TensorBuffer3D): Vector2D {\n  return {\n    y: offsets.get(y, x, keypoint),\n    x: offsets.get(y, x, keypoint +
NUM_KEYPOINTS)\n  };\n}\n\nexport function getImageCoords(\n  part: Part, outputStride: number, offsets:

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TensorBuffer3D): Vector2D {\n const {heatmapY, heatmapX, id: keypoint} = part;\n const {y, x} =
getOffsetPoint(heatmapY, heatmapX, keypoint, offsets);\n return {\n x: part.heatmapX * outputStride + x,\n y:
part.heatmapY * outputStride + y\n };}\n\nexport function fillArray<T>(element: T, size: number): T[] {\n const
result:
```

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T[] = new Array(size);\n\n for (let i = 0; i < size; i++) {\n result[i] = element;\n }\n\n return result;\n}\n\nexport
function clamp(a: number, min: number, max: number): number {\n if (a < min) {\n return min;\n }\n if (a >
max) {\n return max;\n }\n return a;\n}\n\nexport function squaredDistance(\n y1: number, x1: number, y2:
number, x2: number): number {\n const dy = y2 - y1;\n const dx = x2 - x1;\n return dy * dy + dx *
dx;\n}\n\nexport function addVectors(a: Vector2D, b: Vector2D): Vector2D {\n return {x: a.x + b.x, y: a.y +
b.y};}\n\nexport function clampVector(a: Vector2D, min: number, max: number): Vector2D {\n return {y:
clamp(a.y, min, max), x: clamp(a.x, min, max)};\n}\n\n"/**\n * @license\n * Copyright 2019 Google Inc. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
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distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *
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=====\n
*/\n\nimport {NUM_KEYPOINTS} from './keypoints';\nimport {Padding, Pose} from './types';\nimport
{getScale} from './util';\n\ninterface Pair {\n x: number;\n y: number;\n}\n\nfunction computeDistance(embedding:
Pair[], pose: Pose, minPartScore = 0.3) {\n let distance = 0.0;\n let numKpt = 0;\n for (let p = 0; p <
embedding.length; p++) {\n if (pose.keypoints[p].score > minPartScore) {\n numKpt += 1;\n distance +=
(embedding[p].x - pose.keypoints[p].position.x) ** 2 +\n (embedding[p].y - pose.keypoints[p].position.y) **
2;\n }\n }\n if (numKpt === 0) {\n distance = Infinity;\n } else {\n distance = distance / numKpt;\n }\n
return distance;\n}\n\nfunction convertToPositionInOutput(\n position: Pair, [padT, padL]: [number, number],\n
[scaleX, scaleY]: [number, number], stride: number): Pair {\n const y = Math.round(((padT + position.y + 1.0) *
scaleY - 1.0) / stride);\n const x = Math.round(((padL + position.x + 1.0) * scaleX - 1.0) / stride);\n
return {x,
y};}\n\nfunction getEmbedding(\n location: Pair, keypointIndex: number,\n convertToPosition: (pair: Pair) =>
Pair, outputResolutionX: number,\n longOffsets: Float32Array, refineSteps: number,\n [height, width]: [number,
number]): Pair {\n const newLocation = convertToPosition(location);\n const nn = newLocation.y *
outputResolutionX + newLocation.x;\n let dy = longOffsets[NUM_KEYPOINTS * (2 * nn) + keypointIndex];\n let
dx = longOffsets[NUM_KEYPOINTS * (2 * nn + 1) + keypointIndex];\n let y = location.y + dy;\n
let x = location.x + dx;\n for (let t = 0; t < refineSteps; t++) {\n y = Math.min(y, height - 1);\n x =
Math.min(x, width - 1);\n const newPos = convertToPosition({x, y});\n const nn = newPos.y * outputResolutionX +
newPos.x;\n dy = longOffsets[NUM_KEYPOINTS * (2 * nn) + keypointIndex];\n dx =
longOffsets[NUM_KEYPOINTS * (2 * nn + 1) + keypointIndex];\n y = y + dy;\n x = x + dx;\n }\n\n return {x,
y};}\n\nfunction matchEmbeddingToInstance(\n location: Pair, longOffsets: Float32Array, poses: Pose[],\n numKptForMatching: number, [padT, padL]: [number, number],\n [scaleX, scaleY]: [number, number],
outputResolutionX: number,\n [height, width]: [number, number], stride: number,\n refineSteps: number):
number {\n const embed: Pair[] = [];\n const convertToPosition = (pair: Pair) =>\n
convertToPositionInOutput(pair, [padT, padL], [scaleX, scaleY], stride);\n\n for (let keypointsIndex = 0;
keypointsIndex < numKptForMatching;\n keypointsIndex++)\n {\n const embedding = getEmbedding(\n
location, keypointsIndex, convertToPosition, outputResolutionX,\n
longOffsets, refineSteps, [height, width]);\n embed.push(embedding);\n }\n\n let kMin = -1;\n let kMinDist
= Infinity;\n for (let k = 0; k < poses.length; k++) {\n const dist = computeDistance(embed, poses[k]);\n if
(dist < kMinDist) {\n kMin = k;\n kMinDist = dist;\n }\n }\n return kMin;\n}\n\nfunction
getOutputResolution(\n [inputResolutionY, inputResolutionX]: [number, number],\n stride: number): [number,
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number] {\n  const outputResolutionX = Math.round((inputResolutionX - 1.0) / stride + 1.0);\n  const
outputResolutionY = Math.round((inputResolutionY - 1.0) / stride + 1.0);\n  return [outputResolutionX,
outputResolutionY];\n}\n\nexport function decodeMultipleMasksCPU(\n  segmentation: Uint8Array, longOffsets:
Float32Array,\n  posesAboveScore: Pose[], height: number, width: number, stride: number,\n  [inHeight,
inWidth]: [number, number], padding: Padding,\n  refineSteps: number, numKptForMatching = 5): Uint8Array[]
{\n  const dataArrays =\n  posesAboveScore.map(x => new Uint8Array(height * width).fill(0));\n  const {top:
padT, left: padL} = padding;\n  const [scaleX, scaleY] =\n  getScale([height, width], [inHeight, inWidth],
padding);\n  const [outputResolutionX, ] =\n  getOutputResolution([inHeight, inWidth], stride);\n  for (let i = 0; i <
height; i += 1) {\n    for (let j = 0; j < width; j += 1) {\n      const n = i * width + j;\n      const prob =
segmentation[n];\n      if (prob === 1) {\n        const kMin = matchEmbeddingToInstance(\n          {x: j, y: i},
longOffsets, posesAboveScore, numKptForMatching,\n          [padT, padL], [scaleX, scaleY], outputResolutionX,
[height, width],\n          stride, refineSteps);\n        if (kMin >= 0) {\n          dataArrays[kMin][n] = 1;\n        }\n      }\n    }\n  }\n  return dataArrays;\n}\n\nexport function decodeMultiplePartMasksCPU(\n
segmentation: Uint8Array, longOffsets: Float32Array,\n  partSegmentaion: Uint8Array, posesAboveScore:
Pose[], height: number,\n  width: number, stride: number, [inHeight, inWidth]: [number, number],\n  padding:
Padding, refineSteps: number,\n  numKptForMatching = 5): Int32Array[] {\n  const dataArrays =\n  posesAboveScore.map(x => new Int32Array(height * width).fill(-1));\n  const {top: padT, left: padL} =
padding;\n  const [scaleX, scaleY] =\n  getScale([height, width], [inHeight, inWidth], padding);\n  const
[outputResolutionX, ] =\n  getOutputResolution([inHeight, inWidth], stride);\n  for (let i = 0; i < height; i += 1)
{\n    for (let j = 0; j < width; j += 1) {\n      const n = i * width + j;\n      const prob = segmentation[n];\n      if (prob
=== 1) {\n        const kMin = matchEmbeddingToInstance(\n          {x: j, y: i}, longOffsets, posesAboveScore,
numKptForMatching,\n          [padT, padL], [scaleX, scaleY], outputResolutionX,
[height, width],\n          stride, refineSteps);\n        if (kMin >= 0) {\n          dataArrays[kMin][n] =
partSegmentaion[n];\n        }\n      }\n    }\n  }\n  return dataArrays;\n}\n"}\n\n", "/*\n * @license\n * Copyright 2019
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software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport * as tf from '@tensorflow/tfjs-core';\nimport * as tf_webgl from
 '@tensorflow/tfjs-backend-webgl';\n\nimport {NUM_KEYPOINTS} from './keypoints';\nimport {Padding, Pose}
from './types';\nimport {getScale} from './util';\n\nexport function decodeMultipleMasksWebGL(\n  segmentation:
tf.Tensor2D, longOffsets: tf.Tensor3D,\n  posesAboveScore: Pose[], height: number, width: number, stride:
number,\n  [inHeight, inWidth]: [number, number], padding: Padding,\n  refineSteps: number, minKptScore:
number,\n  maxNumPeople: number): tf.TensorInfo {\n  // The height/width of the image/canvas itself.\n  const
[origHeight, origWidth] = segmentation.shape;\n  // The height/width of the output of the model.\n  const
[outHeight, outWidth] = longOffsets.shape.slice(0, 2);\n  const shapedLongOffsets: tf.Tensor4D =\n  tf.reshape(longOffsets, [outHeight, outWidth, 2, NUM_KEYPOINTS]);\n  // Make pose tensor of shape
[MAX_NUM_PEOPLE, NUM_KEYPOINTS, 3] where\n  // the last 3 coordinates correspond to the score, h and w
coordinate of that\n  // keypoint.\n
  const poseVals = new Float32Array(maxNumPeople * NUM_KEYPOINTS * 3).fill(0.0);\n  for (let i = 0; i <
posesAboveScore.length; i++) {\n    const poseOffset = i * NUM_KEYPOINTS * 3;\n    const pose =
posesAboveScore[i];\n    for (let kp = 0; kp < NUM_KEYPOINTS; kp++) {\n      const keypoint =
pose.keypoints[kp];\n      const offset = poseOffset + kp * 3;\n      poseVals[offset] = keypoint.score;\n
      poseVals[offset + 1] = keypoint.position.y;\n      poseVals[offset + 2] = keypoint.position.x;\n    }\n  }\n  const
[scaleX, scaleY] =\n  getScale([height, width], [inHeight, inWidth], padding);\n  const posesTensor =

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tf.tensor(poseVals, [maxNumPeople, NUM_KEYPOINTS, 3]);\n\n const {top: padT, left: padL} = padding;\n\n const program: tf_webgl.GPGPUProgram = {\n  variableNames: ['segmentation', 'longOffsets', 'poses'],\n  outputShape: [origHeight, origWidth],\n  userCode: `\n  int convertToPositionInOut(int pos, int pad, float\n  scale, int stride) {\n    return round(((float(pos\n  + pad) + 1.0) * scale - 1.0) / float(stride));\n  }\n\n  float convertToPositionInOutFloat(\n    int pos, int pad,\n  float scale, int stride) {\n    return ((float(pos + pad) + 1.0) * scale - 1.0) / float(stride);\n  }\n\n  float dist(float\n  x1, float y1, float x2, float y2) {\n    return pow(x1 - x2, 2.0) + pow(y1 - y2, 2.0);\n  }\n\n  float\n  sampleLongOffsets(float h, float w, int d, int k) {\n    float fh = fract(h);\n    float fw = fract(w);\n    int clH =\n  int(ceil(h));\n    int clW = int(ceil(w));\n    int flH = int(floor(h));\n    int flW = int(floor(w));\n    float o11 =\n  getLongOffsets(flH, flW, d, k);\n    float o12 = getLongOffsets(flH, clW, d, k);\n    float o21 =\n  getLongOffsets(clH, flW, d, k);\n    float o22 = getLongOffsets(clH, clW, d, k);\n    float o1 = mix(o11, o12,\n  fw);\n    float o2 = mix(o21, o22, fw);\n    return mix(o1, o2, fh);\n  }\n\n  int findNearestPose(int h, int w) {\n    float prob = getSegmentation(h,\n  w);\n    if (prob < 1.0) {\n      return -1;\n    }\n\n    // Done(Tyler): convert from output space h/w to strided\n  space.\n    float stridedH = convertToPositionInOutFloat(\n      h, ${padT}, ${scaleY}, ${stride});\n    float\n  stridedW = convertToPositionInOutFloat(\n      w, ${padL}, ${scaleX}, ${stride});\n\n    float minDist =\n  1000000.0;\n    int iMin = -1;\n    for (int i = 0; i < ${maxNumPeople}; i++) {\n      float curDistSum = 0.0;\n      int numKpt = 0;\n      for (int k = 0; k < ${NUM_KEYPOINTS}; k++) {\n        float dy =\n  sampleLongOffsets(stridedH, stridedW, 0, k);\n        float dx = sampleLongOffsets(stridedH, stridedW, 1, k);\n\n        float y = float(h) + dy;\n        float x = float(w) + dx;\n\n        for (int s = 0; s < ${refineSteps}; s++) {\n          int yRounded = round(min(y, float(${height} - 1.0)));\n          int xRounded = round(min(x, float(${width} -\n  1.0)));\n          float yStrided = convertToPositionInOutFloat(\n            yRounded, ${padT}, ${scaleY}, ${stride});\n          float xStrided = convertToPositionInOutFloat(\n            xRounded, ${padL}, ${scaleX}, ${stride});\n\n          float dy = sampleLongOffsets(yStrided, xStrided, 0,\n  k);\n          float dx = sampleLongOffsets(yStrided, xStrided, 1, k);\n          y = y + dy;\n          x = x + dx;\n        }\n        float poseScore = getPoses(i, k, 0);\n        float poseY = getPoses(i, k, 1);\n        float poseX =\n  getPoses(i, k, 2);\n        if (poseScore > ${minKptScore}) {\n          numKpt = numKpt + 1;\n          curDistSum\n  = curDistSum + dist(x, y, poseX, poseY);\n        }\n      }\n      if (numKpt > 0 && curDistSum / float(numKpt) <\n  minDist) {\n        minDist = curDistSum / float(numKpt);\n        iMin = i;\n      }\n    }\n    return iMin;\n  }\n\n  void main() {\n    ivec2 coords = getOutputCoords();\n    int nearestPose = findNearestPose(coords[0],\n  coords[1]);\n    setOutput(float(nearestPose));\n  }\n\n  };\n  const webglBackend = tf.backend() as\n  tf_webgl.MathBackendWebGL;\n  return webglBackend.compileAndRun(\n    program, [segmentation,\n  shapedLongOffsets, posesTensor]);\n  }\n  }`;\n  /**\n  * @license\n  * Copyright 2019 Google Inc. All Rights Reserved.\n  * Licensed under the Apache License, Version 2.0 (the "License");\n  * you may not use this file except in\n  compliance with the License.\n  * You may obtain a copy of the License at\n  *  

http://www.apache.org/licenses/LICENSE-2.0\n  * Unless required by applicable law or agreed to in writing,\n  software\n  * distributed under the License is distributed on an "AS IS" BASIS,\n  * WITHOUT WARRANTIES\n  OR CONDITIONS OF ANY KIND, either express or implied.\n  * See the License for the specific language\n  governing permissions and\n  * limitations under the License.\n  */\n  =====\n  *\n  *\n  import * as tf\n  from '@tensorflow/tfjs-core';\n  import {getBackend} from '@tensorflow/tfjs-core';\n  import {Padding,\n  PartSegmentation, PersonSegmentation, Pose} from './types';\n  import {decodeMultipleMasksCPU,\n  decodeMultiplePartMasksCPU} from './decode_multiple_masks_cpu';\n  import {decodeMultipleMasksWebGL} from\n  './decode_multiple_masks_webgl';\n  export function toPersonKSegmentation(\n    segmentation: tf.Tensor2D, k:\n  number): tf.Tensor2D {\n    return tf.tidy(() => (tf.cast(tf.equal(\n    segmentation, tf.scalar(k)), 'int32') as\n  tf.Tensor2D));\n  }\n  export function toPersonKPartSegmentation(\n    segmentation: tf.Tensor2D, bodyParts:\n  tf.Tensor2D, k: number): tf.Tensor2D {\n    return tf.tidy(() => tf.sub(tf.mul(tf.cast(tf.equal(\n
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segmentation, tf.scalar(k)), 'int32'), tf.add(bodyParts, 1)), 1));\n\nfunction isWebGIBackend() {\n  return
getBackend() === 'webgl';\n}\n\nexport async function decodePersonInstanceMasks(\n  segmentation:
tf.Tensor2D, longOffsets: tf.Tensor3D,
  poses: Pose[],\n  height: number, width: number, stride: number,\n  [inHeight, inWidth]: [number, number],
padding: Padding, minPoseScore = 0.2,\n  refineSteps = 8, minKeypointScore = 0.3,\n  maxNumPeople = 10):
Promise<PersonSegmentation[]> {\n  // Filter out poses with smaller score.\n  const posesAboveScore =
poses.filter(pose => pose.score >= minPoseScore);\n  let personSegmentationsData: Uint8Array[];\n  if
(isWebGIBackend()) {\n    const personSegmentations = tf.tidy(() => {\n      const masksTensorInfo =
decodeMultipleMasksWebGL(\n        segmentation, longOffsets, posesAboveScore, height, width, stride,\n        [inHeight, inWidth], padding, refineSteps, minKeypointScore,\n        maxNumPeople);\n      const masksTensor =
tf.engine().makeTensorFromDataId(\n        masksTensorInfo.dataId, masksTensorInfo.shape,\n        masksTensorInfo.dtype) as tf.Tensor2D;\n      return posesAboveScore.map(\n        (_, k) =>
toPersonKSegmentation(masksTensor,
k));\n    });\n  }\n  personSegmentationsData =\n    (await Promise.all(personSegmentations.map(mask =>
mask.data()))) as\n    Uint8Array[];\n  personSegmentations.forEach(x => x.dispose());\n  } else {\n    const
segmentationsData = await segmentation.data() as Uint8Array;\n    const longOffsetsData = await longOffsets.data()
as Float32Array;\n    personSegmentationsData = decodeMultipleMasksCPU(\n      segmentationsData,
longOffsetsData, posesAboveScore, height, width,\n      stride, [inHeight, inWidth], padding, refineSteps);\n  }\n  return personSegmentationsData.map(\n    (data, i) => ({data, pose: posesAboveScore[i], width,
height}));\n}\n\nexport async function decodePersonInstancePartMasks(\n  segmentation: tf.Tensor2D,
longOffsets: tf.Tensor3D,\n  partSegmentation: tf.Tensor2D, poses: Pose[], height: number, width: number,\n  stride: number, [inHeight, inWidth]: [number, number], padding: Padding,\n  minPoseScore = 0.2, refineSteps = 8,
minKeypointScore
= 0.3,\n  maxNumPeople = 10): Promise<PartSegmentation[]> {\n  const posesAboveScore = poses.filter(pose =>
pose.score >= minPoseScore);\n  let partSegmentationsByPersonData: Int32Array[];\n  if (isWebGIBackend())
{\n    const partSegmentations = tf.tidy(() => {\n      const masksTensorInfo = decodeMultipleMasksWebGL(\n        segmentation, longOffsets, posesAboveScore, height, width, stride,\n        [inHeight, inWidth], padding,
refineSteps, minKeypointScore,\n        maxNumPeople);\n      const masksTensor =
tf.engine().makeTensorFromDataId(\n        masksTensorInfo.dataId, masksTensorInfo.shape,\n        masksTensorInfo.dtype) as tf.Tensor2D;\n      return posesAboveScore.map(\n        (_, k) =>\n        toPersonKPartSegmentation(masksTensor, partSegmentation, k));\n    });\n  }\n  partSegmentationsByPersonData =\n    (await Promise.all(partSegmentations.map(x => x.data()))) as\n    Int32Array[];\n  partSegmentations.forEach(x => x.dispose());\n  } else {\n    const segmentationsData = await segmentation.data() as Uint8Array;\n    const longOffsetsData =
await longOffsets.data() as Float32Array;\n    const partSegmentaionData = await partSegmentation.data() as
Uint8Array;\n    partSegmentationsByPersonData = decodeMultiplePartMasksCPU(\n      segmentationsData,
longOffsetsData, partSegmentaionData,\n      posesAboveScore, height, width, stride, [inHeight, inWidth],
padding,\n      refineSteps);\n  }\n  return partSegmentationsByPersonData.map(\n    (data, k) => ({pose:
posesAboveScore[k], data, height, width}));\n}\n\n", "/*\n * @license\n * Copyright 2019 Google Inc. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
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http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
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the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY
KIND, either express or implied.\n * See the License for the specific language governing permissions and\n *
limitations under the License.\n *
=====\n
*/\n\n// algorithm based on Coursera Lecture from Algorithms, Part 1:\n\n

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https://www.coursera.org/learn/algorithms-part1/lecture/ZjoSM/heapsort\n\nfunction half(k: number) {\n return
Math.floor(k / 2);\n}\n\nexport class MaxHeap<T> {\n private priorityQueue: T[];\n private numberOfElements:
number;\n private getElementValue: (element: T) => number;\n\n constructor(maxSize: number, getElementValue:
(element: T) => number) {\n this.priorityQueue = new Array(maxSize);\n this.numberOfElements = -1;\n
this.getElementValue = getElementValue;\n }\n\n public enqueue(x: T): void {\n
this.priorityQueue[++this.numberOfElements] = x;\n this.swim(this.numberOfElements);\n
}\n\n public dequeue(): T {\n const max = this.priorityQueue[0];\n this.exchange(0, this.numberOfElements--
);\n this.sink(0);\n this.priorityQueue[this.numberOfElements + 1] = null;\n return max;\n }\n\n public
empty(): boolean {\n return this.numberOfElements === -1;\n }\n\n public size(): number {\n return
this.numberOfElements + 1;\n }\n\n public all(): T[] {\n return this.priorityQueue.slice(0, this.numberOfElements
+ 1);\n }\n\n public max(): T {\n return this.priorityQueue[0];\n }\n\n private swim(k: number): void {\n while
(k > 0 && this.less(half(k), k)) {\n this.exchange(k, half(k));\n k = half(k);\n }\n }\n\n private sink(k:
number): void {\n while (2 * k <= this.numberOfElements) {\n let j = 2 * k;\n if (j < this.numberOfElements
&& this.less(j, j + 1)) {\n j++;\n }\n if (!this.less(k, j)) {\n break;\n }\n this.exchange(k, j);\n
k = j;\n }\n }\n\n private
getValueAt(i: number): number {\n return this.getElementValue(this.priorityQueue[i]);\n }\n\n private less(i:
number, j: number): boolean {\n return this.getValueAt(i) < this.getValueAt(j);\n }\n\n private exchange(i:
number, j: number): void {\n const t = this.priorityQueue[i];\n this.priorityQueue[i] = this.priorityQueue[j];\n
this.priorityQueue[j] = t;\n }\n}\n\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n *
Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations
under the License.\n *
=====
\n
*/\n\nimport {PartWithScore, TensorBuffer3D} from '../types';\n\nimport {MaxHeap} from
'/max_heap';\n\nfunction scoreIsMaximumInLocalWindow(\n keypointId: number, score: number, heatmapY:
number, heatmapX: number,\n localMaximumRadius: number, scores: TensorBuffer3D): boolean {\n const
[height, width] = scores.shape;\n\n let localMaximum = true;\n const yStart = Math.max(heatmapY -
localMaximumRadius, 0);\n const yEnd = Math.min(heatmapY + localMaximumRadius + 1, height);\n for (let
yCurrent = yStart; yCurrent < yEnd; ++yCurrent) {\n const xStart = Math.max(heatmapX - localMaximumRadius,
0);\n const xEnd = Math.min(heatmapX + localMaximumRadius + 1, width);\n for (let xCurrent = xStart;
xCurrent < xEnd; ++xCurrent) {\n if (scores.get(yCurrent, xCurrent, keypointId) > score) {\n localMaximum
= false;\n break;\n }\n }\n if (!localMaximum)
{\n break;\n }\n }\n\n return localMaximum;\n}\n\n/*\n * Builds a priority queue with part candidate
positions for a specific image in\n * the batch. For this we find all local maxima in the score maps with score\n *
values above a threshold. We create a single priority queue across all parts.\n */\n\nexport function
buildPartWithScoreQueue(\n scoreThreshold: number, localMaximumRadius: number,\n scores:
TensorBuffer3D): MaxHeap<PartWithScore> {\n const [height, width, numKeypoints] = scores.shape;\n\n const
queue = new MaxHeap<PartWithScore>(\n height * width * numKeypoints, ({score}) => score);\n\n for (let
heatmapY = 0; heatmapY < height; ++heatmapY) {\n for (let heatmapX = 0; heatmapX < width; ++heatmapX) {\n
for (let keypointId = 0; keypointId < numKeypoints; ++keypointId) {\n const score = scores.get(heatmapY,
heatmapX, keypointId);\n\n // Only consider parts with score greater or equal to threshold as\n // root
candidates.\n\n if (score < scoreThreshold) {\n continue;\n }\n\n // Only consider keypoints whose score is
maximum in a local window.\n if (scoreIsMaximumInLocalWindow(\n keypointId, score, heatmapY,

```

```
heatmapX, localMaximumRadius,\n        scores)) {\n    queue.enqueue({score, part: {heatmapY, heatmapX,\nid: keypointId}});\n    }\n}\n}\n}\n}\n}\n\nreturn queue;\n}\n}\n}\n\n"/**\n * @license\n * Copyright 2019 Google\n * LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not\n * use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the\n * specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n\n*/\n\nimport {NumberTuple, PART_IDS, PART_NAMES, POSE_CHAIN} from './keypoints';\nimport {Keypoint,\nPartWithScore, TensorBuffer3D, Vector2D} from './types';\nimport {clamp, getOffsetPoint} from './util';\nimport {\naddVectors, getImageCoords} from './util';\n\nconst parentChildrenTuples: NumberTuple[] =\nPOSE_CHAIN.map((\n    [parentJoinName, childJoinName]): NumberTuple =>\n    ([PART_IDS[parentJoinName], PART_IDS[childJoinName]]));\n\nconst parentToChildEdges: number[] =\nparentChildrenTuples.map(([, childJointId]) => childJointId);\n\nconst childToParentEdges: number[] =\nparentChildrenTuples.map(([\n    parentJointId,\n    parentJointId,\n]) =>\nparentJointId);\n\nfunction getDisplacement(\n    edgeId: number, point: Vector2D, displacements:\nTensorBuffer3D): Vector2D {\n    const\n        numEdges = displacements.shape[2] / 2;\n    return {\n        y: displacements.get(point.y, point.x, edgeId),\n        x:\n        displacements.get(point.y, point.x, numEdges + edgeId)\n    };\n}\n\nfunction getStridedIndexNearPoint(\n    point:\nVector2D, outputStride: number, height: number,\n    width: number): Vector2D {\n    return {\n        y:\n        clamp(Math.round(point.y / outputStride), 0, height - 1),\n        x: clamp(Math.round(point.x / outputStride), 0, width -\n1)\n    };\n}\n\n/**\n * We get a new keypoint along the `edgeId` for the pose instance, assuming\n * that the position\n * of the `idSource` part is already known. For this, we\n * follow the displacement vector from the source to target\n * part (stored in\n * the `i`-t channel of the displacement tensor). The displaced keypoint\n * vector is refined using\n * the offset vector by `offsetRefineStep` times.\n */\nfunction traverseToTargetKeypoint(\n    edgeId: number,\n    sourceKeypoint: Keypoint, targetKeypointId: number,\n    scoresBuffer: TensorBuffer3D, offsets:\nTensorBuffer3D, outputStride: number,\n    displacements: TensorBuffer3D, offsetRefineStep = 2): Keypoint {\n    const [height, width] = scoresBuffer.shape;\n    // Nearest neighbor interpolation for the source->target\n    displacements.\n    const sourceKeypointIndices = getStridedIndexNearPoint(\n        sourceKeypoint.position,\n        outputStride, height, width);\n    const displacement =\n        getDisplacement(edgeId, sourceKeypointIndices,\n        displacements);\n    const displacedPoint = addVectors(sourceKeypoint.position, displacement);\n    let\n        targetKeypoint = displacedPoint;\n    for (let i = 0; i < offsetRefineStep; i++) {\n        const targetKeypointIndices =\n        getStridedIndexNearPoint(targetKeypoint, outputStride, height, width);\n        const offsetPoint = getOffsetPoint(\n            targetKeypointIndices.y, targetKeypointIndices.x,\n            targetKeypointId,\n            offsets);\n        targetKeypoint =\n        addVectors(\n            {\n                x: targetKeypointIndices.x * outputStride,\n                y: targetKeypointIndices.y\n            },\n            {x: offsetPoint.x, y: offsetPoint.y});\n    }\n    const targetKeypointIndices =\n        getStridedIndexNearPoint(targetKeypoint, outputStride, height, width);\n    const score = scoresBuffer.get(\n        targetKeypointIndices.y, targetKeypointIndices.x,\n        targetKeypointId);\n    return {position: targetKeypoint, part:\n        PART_NAMES[targetKeypointId], score};\n}\n\n/**\n * Follows the displacement fields to decode the full pose of\n * the object\n * instance given the position of a part that acts as root.\n */\n@return An array of decoded keypoints\nand their scores for a single pose\n\nexport function decodePose(\n    root: PartWithScore, scores:\nTensorBuffer3D, offsets: TensorBuffer3D,\n    outputStride: number, displacementsFwd: TensorBuffer3D,\n    displacementsBwd: TensorBuffer3D): Keypoint[] {\n    const numParts = scores.shape[2];\n    const numEdges =\n        parentToChildEdges.length;\n    const instanceKeypoints: Keypoint[] = new Array(numParts);\n    //\n    Start a new detection instance at the position of the root.\n    const {part: rootPart, score: rootScore} = root;\n    const\n        rootPoint = getImageCoords(rootPart, outputStride, offsets);\n    instanceKeypoints[rootPart.id] = {\n        score:\n        rootScore,\n        part: PART_NAMES[rootPart.id],\n        position: rootPoint\n    };\n    // Decode the part positions
```

```

upwards in the tree, following the backward\n // displacements.\n for (let edge = numEdges - 1; edge >= 0; --edge)
{\n  const sourceKeypointId = parentToChildEdges[edge];\n  const targetKeypointId =
childToParentEdges[edge];\n  if (instanceKeypoints[sourceKeypointId] &&\n
!instanceKeypoints[targetKeypointId]) {\n    instanceKeypoints[targetKeypointId] = traverseToTargetKeypoint(\n
    edge, instanceKeypoints[sourceKeypointId], targetKeypointId, scores,\n    offsets, outputStride,
displacementsBwd);\n  }\n }\n\n // Decode the part positions downwards in the tree, following the forward\n //
displacements.\n for (let
edge = 0; edge < numEdges; ++edge) {\n  const sourceKeypointId = childToParentEdges[edge];\n  const
targetKeypointId = parentToChildEdges[edge];\n  if (instanceKeypoints[sourceKeypointId] &&\n
!instanceKeypoints[targetKeypointId]) {\n    instanceKeypoints[targetKeypointId] = traverseToTargetKeypoint(\n
    edge, instanceKeypoints[sourceKeypointId], targetKeypointId, scores,\n    offsets, outputStride,
displacementsFwd);\n  }\n }\n\n return instanceKeypoints;\n}\n\n",/**\n * @license\n * Copyright 2019 Google
Inc. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND,
either express or implied.\n * See the License for the specific language governing permissions and\n * limitations
under the License.\n *
=====
*\n\nimport { Keypoint, Pose, TensorBuffer3D } from './types';\n\nimport { buildPartWithScoreQueue } from
'/build_part_with_score_queue';\n\nimport { decodePose } from './decode_pose';\n\nimport { getImageCoords,
squaredDistance } from './util';\n\nfunction withinNmsRadiusOfCorrespondingPoint(\n  poses: Pose[],
squaredNmsRadius: number, {x, y}: {x: number, y: number},\n  keypointId: number): boolean {\n  return
poses.some(({ keypoints }) => {\n    const correspondingKeypoint = keypoints[keypointId].position;\n    return
squaredDistance(\n      y, x, correspondingKeypoint.y, correspondingKeypoint.x) <= \n
squaredNmsRadius;\n  });\n}\n\n/* Score the newly proposed object instance without taking into account\n * the
scores of the parts that overlap with any previously
detected\n * instance.\n */\nfunction getInstanceScore(\n  existingPoses: Pose[], squaredNmsRadius: number,\n  instanceKeypoints: Keypoint[]): number {\n  let notOverlappedKeypointScores = instanceKeypoints.reduce(\n
(result, { position, score }, keypointId): number => {\n    if (!withinNmsRadiusOfCorrespondingPoint(\n
existingPoses, squaredNmsRadius, position, keypointId)) {\n      result += score;\n    }\n    return result;\n
}, 0.0);\n\n  return notOverlappedKeypointScores /= instanceKeypoints.length;\n}\n\n// A point (y, x) is considered
as root part candidate if its score is a\n// maximum in a window |y - y'| <= kLocalMaximumRadius, |x - x'| <= \n//
kLocalMaximumRadius.\nconst kLocalMaximumRadius = 1;\n\n/**\n * Detects multiple poses and finds their parts
from part scores and\n * displacement vectors. It returns up to `maxDetections` object instance\n * detections in
decreasing root score order. It works as follows: We first\n * create
a priority queue with local part score maxima above\n * `scoreThreshold`, considering all parts at the same time.
Then we\n * iteratively pull the top element of the queue (in decreasing score order)\n * and treat it as a root
candidate for a new object instance. To avoid\n * duplicate detections, we reject the root candidate if it is within a
disk\n * of `nmsRadius` pixels from the corresponding part of a previously detected\n * instance, which is a form of
part-based non-maximum suppression (NMS). If\n * the root candidate passes the NMS check, we start a new object
instance\n * detection, treating the corresponding part as root and finding the\n * positions of the remaining parts by
following the displacement vectors\n * along the tree-structured part graph. We assign to the newly detected\n *
instance a score equal to the sum of scores of its parts which have not\n * been claimed by a previous instance (i.e.,
those at least `nmsRadius`\n * pixels away from the corresponding part
of all previously detected\n * instances), divided by the total number of parts `numParts`.\n *\n * @param
heatmapScores 3-D tensor with shape `[height, width, numParts]`.\n *\n * The value of heatmapScores[y, x, k] is the

```

score of placing the k -th object part at position (y, x) . The value of $\text{offsets}[y, x, k]$, $\text{offsets}[y, x, k + \text{numParts}]$ is the short range offset vector of the k -th object part at heatmap position (y, x) . DisplacementsFwd 3-D tensor of shape $[\text{height}, \text{width}, 2 * \text{num_edges}]$, where $\text{num_edges} = \text{num_parts} - 1$ is the number of edges (parent-child pairs) in the tree. It contains the forward displacements between consecutive part from the root towards the leaves. DisplacementsBwd 3-D tensor of shape $[\text{height}, \text{width}, 2 * \text{num_edges}]$, where $\text{num_edges} = \text{num_parts} - 1$ is the number of edges (parent-child pairs) in the tree.

It contains the backward displacements between consecutive part from the root towards the leaves. OutputStride The output stride that was used when feed-forwarding through the PoseNet model. Must be 32, 16, or 8. maxPoseDetections Maximum number of returned instance detections per image. scoreThreshold Only return instance detections that have root part score greater or equal to this value. Defaults to 0.5. nmsRadius Non-maximum suppression part distance. It needs to be strictly positive. Two parts suppress each other if they are less than nmsRadius pixels away. Defaults to 20. return An array of poses and their scores, each containing keypoints and the corresponding keypoint scores. decodeMultiplePoses(scoresBuffer: TensorBuffer3D, offsetsBuffer: TensorBuffer3D, displacementsFwdBuffer: TensorBuffer3D, displacementsBwdBuffer: TensorBuffer3D, outputStride:

```
number, maxPoseDetections: number, scoreThreshold = 0.5, nmsRadius = 20): Pose[] {
  const poses: Pose[] = [];
  const queue = buildPartWithScoreQueue(scoreThreshold, kLocalMaximumRadius, scoresBuffer);
  const squaredNmsRadius = nmsRadius * nmsRadius;
  // Generate at most maxDetections object instances per image
  // decreasing root part score order
  while (poses.length < maxPoseDetections && !queue.empty()) {
    // The top element in the queue is the next root candidate
    const root = queue.dequeue();
    // Part-based non-maximum suppression: We reject a root candidate if it
    // is within a disk of nmsRadius pixels from the corresponding part of
    // a previously detected instance
    const rootImageCoords = getImageCoords(root.part, outputStride, offsetsBuffer);
    if (withinNmsRadiusOfCorrespondingPoint(poses, squaredNmsRadius, rootImageCoords, root.part.id))
      continue;
    // Start a new detection instance at the position of the root
    const keypoints = decodePose(root, scoresBuffer, offsetsBuffer, outputStride, displacementsFwdBuffer, displacementsBwdBuffer);
    const score = getInstanceScore(poses, squaredNmsRadius, keypoints);
    poses.push({keypoints, score});
  }
  return poses;
}
/**
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```

```

=====
import * as tf from '@tensorflow/tfjs-core';
import { BaseModel } from './base_model';
const imageNetMean = [-123.15, -115.90, -103.06];
export class ResNet extends BaseModel {
  preprocessInput(input: tf.Tensor3D): tf.Tensor3D {
    return tf.add(input, imageNetMean);
  }
  nameOutputResults(results: tf.Tensor3D[]) {
    const [displacementBwd, displacementFwd, heatmap, longOffsets, offsets, partHeatmaps, segmentation, partOffsets] = results;
    return [offsets, segmentation, partHeatmaps, longOffsets, heatmap, displacementFwd, displacementBwd, partOffsets];
  }
}
/**
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```

```

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* limitations under the License.
=====
const RESNET50_BASE_URL = 'https://storage.googleapis.com/tfjs-
models/savedmodel/bodypix/resnet50';
const MOBILENET_BASE_URL = 'https://storage.googleapis.com/tfjs-
models/savedmodel/bodypix/mobilenet/';
// The BodyPix 2.0 ResNet50
models use the latest TensorFlow.js 1.0 model
// format.
export function resNet50SavedModel(stride: number,
quantBytes: number): string {
  const graphJson = `model-stride${stride}.json`;
  // quantBytes=4 corresponding
to the
  non-quantized full-precision SavedModel.
  if (quantBytes === 4) {
    return RESNET50_BASE_URL + `float^
+ graphJson`;
  } else {
    return RESNET50_BASE_URL + `quant${quantBytes}^
+ graphJson`;
  }
}
// The BodyPix 2.0 MobileNetV1 models use the latest TensorFlow.js 1.0 model
// format.
export function
mobileNetSavedModel(stride: number, multiplier: number, quantBytes: number): string {
  const toStr: {[key:
number]: string} = {1.0: '100', 0.75: '075', 0.50: '050'};
  const graphJson = `model-stride${stride}.json`;
  //
quantBytes=4 corresponding to the non-quantized full-precision SavedModel.
  if (quantBytes === 4) {
    return
MOBILENET_BASE_URL + `float/${toStr[multiplier]}^
+ graphJson`;
  } else {
    return
MOBILENET_BASE_URL + `quant${quantBytes}/${toStr[multiplier]}^
+
graphJson`;
  }
}
}
/*
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* WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.
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* limitations under the License.
=====
import * as tf from '@tensorflow/tfjs-core';
import {BodyPixInput, BodyPixOutputStride, Padding} from
'./types';
import {Pose, TensorBuffer3D} from './types';
import {BodyPixInternalResolution} from
'./types';
function getSizeFromImageLikeElement(input: HTMLImageElement|
HTMLCanvasElement|
  OffscreenCanvas): [number, number] {
  if ('offsetHeight'
in input && input.offsetHeight !== 0 && 'offsetWidth' in input &&
input.offsetWidth !== 0) {
    return
[input.offsetHeight, input.offsetWidth];
  } else if (input.height != null && input.width != null) {
    return
[input.height, input.width];
  } else {
    throw new Error(`HTMLImageElement must have height and
width attributes set.`);
  }
}
function getSizeFromVideoElement(input: HTMLVideoElement): [number,
number] {
  if (input.hasAttribute('height') && input.hasAttribute('width')) {
    // Prioritizes user specified height
and width.
    // We can't test the .height and .width properties directly,
    // because they evaluate to 0 if unset.
    return [input.height, input.width];
  } else {
    return [input.videoHeight, input.videoWidth];
  }
}
export
function getInputSize(input: BodyPixInput): [number, number] {
  if ((typeof (HTMLCanvasElement) !==
'undefined' &&
input instanceof HTMLCanvasElement) || (typeof
(OffscreenCanvas) !== 'undefined' &&
input instanceof OffscreenCanvas) || (typeof
(HTMLImageElement) !== 'undefined' &&
input instanceof HTMLImageElement)) {
    return
getSizeFromImageLikeElement(input);
  } else if (typeof (ImageData) !== 'undefined' && input instanceof
ImageData) {
    return [input.height, input.width];
  } else if (typeof (HTMLVideoElement) !== 'undefined'
&&
input instanceof HTMLVideoElement) {
    return getSizeFromVideoElement(input);
  } else if (input
instanceof tf.Tensor) {
    return [input.shape[0], input.shape[1]];
  } else {
    throw new Error(`error: Unknown
input type: ${input}`);
  }
}
function isValidInputResolution(resolution: number, outputStride: number):
boolean {
  return (resolution - 1) % outputStride === 0;
}
export function toValidInputResolution(inputResolution: number, outputStride: BodyPixOutputStride): number {
  if
(isValidInputResolution(inputResolution, outputStride))

```

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    {\n  return inputResolution;\n }\n\n  return Math.floor(inputResolution / outputStride) * outputStride +
  1;\n}\n\nconst INTERNAL_RESOLUTION_STRING_OPTIONS = {\n  low: 'low',\n  medium: 'medium',\n  high:
  'high',\n  full: 'full'\n};\n\nconst INTERNAL_RESOLUTION_PERCENTAGES = {\n
  [INTERNAL_RESOLUTION_STRING_OPTIONS.low]: 0.25,\n
  [INTERNAL_RESOLUTION_STRING_OPTIONS.medium]: 0.5,\n
  [INTERNAL_RESOLUTION_STRING_OPTIONS.high]: 0.75,\n
  [INTERNAL_RESOLUTION_STRING_OPTIONS.full]: 1.0\n};\n\nconst MIN_INTERNAL_RESOLUTION =
  0.1;\nconst MAX_INTERNAL_RESOLUTION = 2.0;\n\nfunction toInternalResolutionPercentage(\n
  internalResolution: BodyPixInternalResolution): number {\n  if (typeof internalResolution === 'string') {\n    const
  result = INTERNAL_RESOLUTION_PERCENTAGES[internalResolution];\n\n    tf.util.assert(\n      typeof result
  === 'number',\n      () => `string value of inputResolution must be one of ${\n
  Object.values(INTERNAL_RESOLUTION_STRING_OPTIONS)\n
    .join(',')\n    } but was ${internalResolution}.`);\n    return result;\n  } else {\n    tf.util.assert(\n      typeof
  internalResolution === 'number' &&\n      internalResolution <= MAX_INTERNAL_RESOLUTION &&\n
  internalResolution >= MIN_INTERNAL_RESOLUTION,\n      () =>\n        `inputResolution must be a string
  or number between ${\n          MIN_INTERNAL_RESOLUTION\n        } and ${MAX_INTERNAL_RESOLUTION},\n
  but ` +\n      `was ${internalResolution}`);\n    return internalResolution;\n  }\n}\n\n\nexport function
  toInputResolutionHeightAndWidth(\n  internalResolution: BodyPixInternalResolution,\n  outputStride:
  BodyPixOutputStride,\n  [inputHeight, inputWidth]: [number, number]): [number, number] {\n  const
  internalResolutionPercentage =\n    toInternalResolutionPercentage(internalResolution);\n\n  return [\n
  toValidInputResolution(\n    inputHeight * internalResolutionPercentage, outputStride),\n
  toValidInputResolution(\n    inputWidth
    * internalResolutionPercentage, outputStride)\n  ];\n}\n\n\nexport function toInputTensor(input: BodyPixInput) {\n //
  TODO: tf.browser.fromPixels types to support OffscreenCanvas\n // @ts-ignore\n  return input instanceof tf.Tensor
  ? input : tf.browser.fromPixels(input);\n}\n\n\nexport function resizeAndPadTo(\n  imageTensor: tf.Tensor3D,\n
  [targetH, targetW]: [number, number],\n  flipHorizontal = false): {\n  resizedAndPadded: tf.Tensor3D,\n
  paddedBy: [[number, number], [number, number]]\n} {\n  const [height, width] = imageTensor.shape;\n\n  const
  targetAspect = targetW / targetH;\n  const aspect = width / height;\n\n  let resizeW: number;\n  let resizeH:
  number;\n  let padL: number;\n  let padR: number;\n  let padT: number;\n  let padB: number;\n\n  if (aspect >
  targetAspect) {\n    // resize to have the larger dimension match the shape.\n    resizeW = targetW;\n    resizeH =
  Math.ceil(resizeW / aspect);\n\n    const padHeight = targetH - resizeH;\n    padL = 0;\n    padR = 0;\n
    padT = Math.floor(padHeight / 2);\n    padB = targetH - (resizeH + padT);\n  } else {\n    resizeH = targetH;\n
    resizeW = Math.ceil(targetH * aspect);\n\n    const padWidth = targetW - resizeW;\n    padL = Math.floor(padWidth
  / 2);\n    padR = targetW - (resizeW + padL);\n    padT = 0;\n    padB = 0;\n  }\n\n  const resizedAndPadded =
  tf.tidy(() => {\n    // resize to have largest dimension match image\n    let resized: tf.Tensor3D;\n    if
  (flipHorizontal) {\n      resized = tf.image.resizeBilinear(\n        tf.reverse(imageTensor, 1), [resizeH, resizeW]);\n
    } else {\n      resized = tf.image.resizeBilinear(imageTensor, [resizeH, resizeW]);\n    }\n\n    const padded =
  tf.pad3d(resized, [[padT, padB], [padL, padR], [0, 0]]);\n\n    return padded;\n  });\n\n  return {\n    resizedAndPadded,
  paddedBy: [[padT, padB], [padL, padR]]\n};\n}\n\n\nexport function scaleAndCropToInputTensorShape(\n  tensor:
  tf.Tensor3D,\n  [inputTensorHeight, inputTensorWidth]: [number, number],\n  [resizedAndPaddedHeight,
  resizedAndPaddedWidth]: [number, number],\n  [[padT, padB], [padL, padR]]: [[number, number], [number,
  number]],\n  applySigmoidActivation = false): tf.Tensor3D {\n  return tf.tidy(() => {\n    let inResizedAndPadded:
  tf.Tensor3D = tf.image.resizeBilinear(tensor,\n      [resizedAndPaddedHeight, resizedAndPaddedWidth], true);\n\n
  if (applySigmoidActivation) {\n    inResizedAndPadded = tf.sigmoid(inResizedAndPadded);\n  }\n\n  return
  removePaddingAndResizeBack(\n    inResizedAndPadded, [inputTensorHeight, inputTensorWidth],\n
  [[padT, padB], [padL, padR]]);\n  });\n}\n\n\nexport function removePaddingAndResizeBack(\n  resizedAndPadded:
  tf.Tensor3D,\n  [originalHeight, originalWidth]: [number, number],\n  [[padT, padB], [padL, padR]]: [[number,
  number], [number, number]]): tf.Tensor3D {\n  return tf.tidy(() => {\n    const batchedImage: tf.Tensor4D =

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tf.expandDims(resizedAndPadded);\n return tf.squeeze(tf.image\n      .cropAndResize(\n
        batchedImage, [[\n          padT / (originalHeight + padT + padB - 1.0),\n          padL / (originalWidth +\n          padL + padR - 1.0),\n          (padT + originalHeight - 1.0) ^\n          (originalHeight + padT + padB - 1.0),\n          (padL + originalWidth - 1.0) / (originalWidth + padL + padR - 1.0)\n          ]],\n          [0], [originalHeight,\n          originalWidth]), [0]);\n });\n}\n\nexport function resize2d(\n  tensor: tf.Tensor2D, resolution: [number, number],\n  nearestNeighbor?: boolean): tf.Tensor2D {\n  return tf.tidy(() => {\n    const batchedImage: tf.Tensor4D =\n      tf.expandDims(tensor, 2);\n    return tf.squeeze(\n      tf.image.resizeBilinear(batchedImage, resolution,\n      nearestNeighbor));\n  });\n}\n\nexport function padAndResizeTo(\n  input: BodyPixInput, [targetH, targetW]:\n  [number, number]):\n  {resized: tf.Tensor3D, padding: Padding} {\n  const [height, width] = getInputSize(input);\n  const targetAspect = targetW / targetH;\n\n  const aspect = width / height;\n  let [padT, padB, padL, padR] = [0, 0, 0, 0];\n  if (aspect < targetAspect) {\n    //\n    pads the width\n    padT = 0;\n    padB = 0;\n    padL = Math.round(0.5 * (targetAspect * height - width));\n    padR =\n      Math.round(0.5 * (targetAspect * height - width));\n  } else {\n    // pads the height\n    padT = Math.round(0.5 *\n      ((1.0 / targetAspect) * width - height));\n    padB = Math.round(0.5 *\n      ((1.0 / targetAspect) * width - height));\n    padL = 0;\n    padR = 0;\n  }\n\n  const resized: tf.Tensor3D = tf.tidy(() => {\n    let imageTensor =\n      toInputTensor(input);\n    imageTensor = tf.pad3d(imageTensor, [[padT, padB], [padL, padR], [0, 0]]);\n\n    return\n      tf.image.resizeBilinear(imageTensor, [targetH, targetW]);\n  });\n\n  return {resized, padding: {top: padT, left: padL,\n    right: padR, bottom: padB}};\n}\n\nexport async function toTensorBuffers3D(tensors: tf.Tensor3D[]):\n  Promise<TensorBuffer3D[]> {\n  return Promise.all(tensors.map(tensor => tensor.buffer()));\n}\n\nexport\n  function scalePose(\n    pose: Pose, scaleY: number, scaleX: number, offsetY = 0,\n    offsetX = 0): Pose {\n  return\n    {\n      score: pose.score,\n      keypoints: pose.keypoints.map(({score, part, position}) => ({\n        score,\n        part,\n        position: {\n          x: position.x *\n          scaleX + offsetX,\n          y: position.y * scaleY + offsetY\n        }\n      })))\n    };\n}\n\nexport function scalePoses(\n  poses: Pose[], scaleY: number, scaleX: number, offsetY = 0,\n  offsetX = 0) {\n  if (scaleX === 1 && scaleY === 1 && offsetY === 0 && offsetX === 0) {\n    return poses;\n  }\n  return poses.map(pose => scalePose(pose, scaleY, scaleX, offsetY, offsetX));\n}\n\nexport function\n  flipPoseHorizontal(pose: Pose, imageWidth: number): Pose {\n  return {\n    score: pose.score,\n    keypoints: pose.keypoints.map(\n      ({score, part, position}) => ({\n        score,\n        part,\n        position:\n        {x: imageWidth - 1 - position.x, y: position.y}\n      })))\n  };\n}\n\nexport function flipPosesHorizontal(poses:\n  Pose[], imageWidth: number) {\n  if (imageWidth <= 0) {\n    return poses;\n  }\n  return poses.map(pose =>\n    flipPoseHorizontal(pose, imageWidth));\n}\n\nexport function scaleAndFlipPoses(\n  poses: Pose[], [height,\n  width]: [number, number],\n  [inputResolutionHeight, inputResolutionWidth]: [number, number],\n  padding:\n  Padding, flipHorizontal: boolean): Pose[] {\n  const scaleY =\n    (height + padding.top + padding.bottom) /\n    (inputResolutionHeight);\n  const scaleX =\n    (width + padding.left + padding.right) /\n    (inputResolutionWidth);\n\n  const scaledPoses =\n    scalePoses(poses, scaleY, scaleX, -padding.top, -\n    padding.left);\n\n  if (flipHorizontal) {\n    return flipPosesHorizontal(scaledPoses, width);\n  } else {\n    return scaledPoses;\n  }\n}\n\n", "\n**\n * @license\n * Copyright 2019 Google Inc. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in\n  compliance with the License.\n * You may obtain a copy of the License at\n * \n *  

http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n  software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n  OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n  governing permissions and\n * limitations under the License.\n *  

=====\n\n\nimport * as tfconv from '@tensorflow/tfjs-converter';\nimport * as tf from '@tensorflow/tfjs-core';\nimport\n  {BaseModel} from './base_model';\nimport {decodeOnlyPartSegmentation, decodePartSegmentation,\n  toMaskTensor} from './decode_part_map';\nimport

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{MobileNet} from './mobilenet';\nimport {decodePersonInstanceMasks, decodePersonInstancePartMasks} from
'/multi_person/decode_instance_masks';\nimport {decodeMultiplePoses} from
'/multi_person/decode_multiple_poses';\nimport {ResNet} from './resnet';\nimport {mobileNetSavedModel,
resNet50SavedModel} from './saved_models';\nimport {BodyPixArchitecture, BodyPixInput,
BodyPixInternalResolution, BodyPixMultiplier, BodyPixOutputStride, BodyPixQuantBytes, Padding} from
'/types';\nimport {PartSegmentation, PersonSegmentation, SemanticPartSegmentation,
SemanticPersonSegmentation} from './types';\nimport {getInputSize, padAndResizeTo,
scaleAndCropToInputTensorShape, scaleAndFlipPoses, toInputResolutionHeightAndWidth, toTensorBuffers3D}
from './util';\n\nconst APPLY_SIGMOID_ACTIVATION = true;\nconst FLIP_POSES_AFTER_SCALING =
false;\n\n**\n * BodyPix model loading is configurable using the following config dictionary.\n *\n *
`architecture`: BodyPixArchitecture. It determines
which BodyPix architecture\n * to load. The supported architectures are: MobileNetV1 and ResNet50.\n *\n *
`outputStride`: Specifies the output stride of the BodyPix model.\n * The smaller the value, the larger the output
resolution, and more accurate\n * the model at the cost of speed. Set this to a larger value to increase speed\n * at the
cost of accuracy. Stride 32 is supported for ResNet and\n * stride 8,16,32 are supported for various MobileNetV1
models.\n *\n * `multiplier`: An optional number with values: 1.01, 1.0, 0.75, or\n * 0.50. The value is used only by
MobileNet architecture. It is the float\n * multiplier for the depth (number of channels) for all convolution ops.\n *
The larger the value, the larger the size of the layers, and more accurate\n * the model at the cost of speed. Set this to
a smaller value to increase speed\n * at the cost of accuracy.\n *\n * `modelUrl`: An optional string that specifies
custom url of the model. This\n * is useful for area/countries that
don't have access to the model hosted on\n * GCP.\n *\n * `quantBytes`: An optional number with values: 1, 2, or 4.
This parameter\n * affects weight quantization in the models. The available options are\n * 1 byte, 2 bytes, and 4
bytes. The higher the value, the larger the model size\n * and thus the longer the loading time, the lower the value,
the shorter the\n * loading time but lower the accuracy.\n */\n\nexport interface ModelConfig {\n  architecture:
BodyPixArchitecture;\n  outputStride: BodyPixOutputStride;\n  multiplier?: BodyPixMultiplier;\n  modelUrl?:
string;\n  quantBytes?: BodyPixQuantBytes;\n}\n\n// The default configuration for loading MobileNetV1 based
BodyPix.\n// (And for references, the default configuration for loading ResNet\n// based PoseNet is also
included).\n//\n// const RESNET_CONFIG = {\n//   architecture: 'ResNet50',\n//   outputStride: 32,\n//   quantBytes: 4,\n// } as ModelConfig;\n//\n// const MOBILENET_V1_CONFIG = {\n  architecture:
'MobileNetV1',\n  outputStride: 16,\n  quantBytes: 4,\n  multiplier: 0.75,\n} as ModelConfig;\n\nconst VALID_ARCHITECTURE:
BodyPixArchitecture[] = ['MobileNetV1', 'ResNet50'];\nconst VALID_STRIDE: {[id: string]:
BodyPixOutputStride[]} = {\n  'MobileNetV1': [8, 16, 32],\n  'ResNet50': [32, 16]\n};\nconst
VALID_MULTIPLIER: {[id: string]: BodyPixMultiplier[]} = {\n  'MobileNetV1': [0.50, 0.75, 1.0],\n  'ResNet50':
[1.0]\n};\nconst VALID_QUANT_BYTES: BodyPixQuantBytes[] = [1, 2, 4];\n\nfunction
validateModelConfig(config: ModelConfig): ModelConfig {\n  config = config || MOBILENET_V1_CONFIG;\n  if (config.architecture == null) {\n    config.architecture = 'MobileNetV1';\n  }\n  if (VALID_ARCHITECTURE.indexOf(config.architecture) < 0) {\n    throw new Error(\n    `Invalid architecture
${config.architecture}.` +\n    `Should be one of ${VALID_ARCHITECTURE}`);\n  }\n  if (config.outputStride
== null) {\n    config.outputStride = 16;\n  }\n  if (VALID_STRIDE[config.architecture].indexOf(config.outputStride)
< 0) {\n    throw new Error(\n    `Invalid outputStride ${config.outputStride}.` +\n    `Should be one of
${VALID_STRIDE[config.architecture]}` +\n    `for architecture ${config.architecture}.`);\n  }\n  if (config.multiplier == null) {\n    config.multiplier = 1.0;\n  }\n  if (VALID_MULTIPLIER[config.architecture].indexOf(config.multiplier) < 0) {\n    throw new Error(\n    `Invalid
multiplier ${config.multiplier}.` +\n    `Should be one of ${VALID_MULTIPLIER[config.architecture]}` +\n    `for
architecture ${config.architecture}.`);\n  }\n  if (config.quantBytes == null) {\n    config.quantBytes = 4;\n  }\n  if (VALID_QUANT_BYTES.indexOf(config.quantBytes) < 0) {\n    throw new Error(\n    `Invalid

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`quantBytes ${config.quantBytes}.` +n `Should be one of ${VALID_QUANT_BYTES}` +n `for architecture ${config.architecture}.`);n }n\n return config;n}\n\n**n * BodyPix inference is configurable using the following`

`config dictionary.\n *\n * `flipHorizontal`: If the left-right keypoint of poses/part segmentation\n * should be flipped/mirrored horizontally. This should be set to true for\n * videos where the video is by default flipped horizontally (i.e. a webcam),\n * and you want the person & body part segmentation to be returned in the proper\n * orientation.\n *\n * `internalResolution`: Defaults to 'medium'. The internal resolution\n * percentage that the input is resized to before inference. The larger the\n * internalResolution the more accurate the model at the cost of slower\n * prediction times. Available values are 'low', 'medium', 'high', 'full', or a\n * percentage value between 0 and 1. The values 'low', 'medium', 'high', and\n * 'full' map to 0.25, 0.5, 0.75, and 1.0 correspondingly.\n *\n * `segmentationThreshold`: The minimum that segmentation values must\n * have to be considered part of the person. Affects the generation of the\n * segmentation mask. More specifically, it is the threshold used to binarize\n * the intermediate person segmentation probability. The probability of each\n * pixel belongs to a person is in range [0, 1]. If the probability is greater\n * than the `segmentationThreshold`, it will be set to 1 otherwise 0.\n *\n * ^\n * export interface InferenceConfig {\n flipHorizontal?: boolean;n\n internalResolution?: BodyPixInternalResolution;n\n segmentationThreshold?: number;n}\n\n**n * Person Inference Config\n *\n * `maxDetections`: Defaults to 10. Maximum number of person pose detections per\n * image.\n *\n * `scoreThreshold`: Defaults to 0.4. Only return person pose that have root\n * part score greater or equal to this value.\n *\n * `nmsRadius`: Defaults to 20. Non-maximum suppression part distance in pixels.\n * It needs to be strictly positive. Two pose keypoints suppress each other if\n * they are less than `nmsRadius` pixels away.\n *\n * ^\n * export interface PersonInferenceConfig extends InferenceConfig {\n maxDetections?: number;n\n scoreThreshold?: number;n\n nmsRadius?: number;n}\n\n**n * Multiple Person Instance Inference Config\n *\n * `maxDetections`: Defaults to 10. Maximum number of returned instance\n * segmentation and pose detections per image.\n *\n * `scoreThreshold`: Defaults to 0.4. Only returns and uses person\n * poses for instance segmentation assignment when the pose has root part score\n * greater or equal to this value.\n *\n * `nmsRadius`: Defaults to 20. Non-maximum suppression part distance in pixels.\n * It needs to be strictly positive. Two parts suppress each other if they are\n * less than `nmsRadius` pixels away.\n *\n * `minKeypointScore`: Default to 0.3. Keypoints above the score are used\n * for matching and assigning segmentation mask to each person.\n *\n * `refineSteps`: Default to 10. The number of refinement steps used when\n * assigning the instance segmentation. It needs to be strictly positive. The\n * larger the higher the accuracy and slower the inference.\n *\n * ^\n * export interface MultiPersonInstanceInferenceConfig extends InferenceConfig {\n maxDetections?: number;n\n scoreThreshold?: number;n\n nmsRadius?: number;n\n minKeypointScore?: number;n\n refineSteps?: number;n}\n\n**n * export const PERSON_INFERENCE_CONFIG: PersonInferenceConfig = {\n flipHorizontal: false,\n internalResolution: 'medium',\n segmentationThreshold: 0.7,\n maxDetections: 10,\n scoreThreshold: 0.4,\n nmsRadius: 20,\n};\n\n**n * export const MULTI_PERSON_INSTANCE_INFERENCE_CONFIG:\n MultiPersonInstanceInferenceConfig = {\n flipHorizontal: false,\n internalResolution: 'medium',\n segmentationThreshold: 0.7,\n maxDetections: 10,\n scoreThreshold: 0.4,\n nmsRadius: 20,\n minKeypointScore: 0.3,\n refineSteps: 10,\n};\n\nfunction validatePersonInferenceConfig(config: PersonInferenceConfig) {\n const {segmentationThreshold, maxDetections, scoreThreshold, nmsRadius} =\n config;n\n if (segmentationThreshold < 0.0 || segmentationThreshold > 1.0) {\n throw new Error(\n `segmentationThreshold ${segmentationThreshold}.` +n `Should be in range [0.0, 1.0]`);n }\n\n if (maxDetections <= 0) {\n throw new Error(\n `Invalid maxDetections ${maxDetections}.` +n `Should be > 0`);n }\n\n if (scoreThreshold < 0.0 || scoreThreshold > 1.0) {\n throw new Error(\n `Invalid scoreThreshold ${scoreThreshold}.` +n `Should be in range [0.0, 1.0]`);n }\n\n if (nmsRadius <= 0) {\n throw new Error(`Invalid nmsRadius ${nmsRadius}.`);n }\n}\n\nfunction validateMultiPersonInstanceInferenceConfig(\n config: MultiPersonInstanceInferenceConfig) {\n const {\n segmentationThreshold,\n maxDetections,\n scoreThreshold,\n nmsRadius,\n minKeypointScore,\n`

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refineSteps\n } = config;\n\n if (segmentationThreshold < 0.0 || segmentationThreshold > 1.0) {\n  throw new
Error(\n    `segmentationThreshold ${segmentationThreshold}.` +\n    `Should be in range [0.0,
1.0]`);\n }\n\n if (maxDetections <= 0) {\n  throw new Error(\n    `Invalid maxDetections ${maxDetections}.`
+\n    `Should be > 0`);\n }\n\n if (scoreThreshold < 0.0 || scoreThreshold > 1.0) {\n  throw new Error(\n
`Invalid scoreThreshold ${scoreThreshold}.` +\n    `Should be in range [0.0, 1.0]`);\n }\n\n if (nmsRadius <= 0)
{\n  throw new Error(`Invalid nmsRadius ${nmsRadius}.`);\n }\n\n if (minKeypointScore < 0 ||
minKeypointScore > 1) {\n  throw new Error(\n    `Invalid minKeypointScore ${minKeypointScore}.` +\n
`Should be in range [0.0, 1.0]`);\n }\n\n if (refineSteps <= 0 || refineSteps > 20) {\n  throw new Error(\n
`Invalid refineSteps ${refineSteps}.` +\n    `Should be in range [1, 20]`);\n }\n}\n\nexport class BodyPix {\n
baseModel: BaseModel;\n\n constructor(net: BaseModel) {\n  this.baseModel = net;\n }\n\n private
predictForPersonSegmentation(input: tf.Tensor3D): {\n  segmentLogits: tf.Tensor3D,\n
heatmapScores: tf.Tensor3D,\n  offsets: tf.Tensor3D,\n  displacementFwd: tf.Tensor3D,\n  displacementBwd:
tf.Tensor3D,\n } {\n  const {\n    segmentation,\n    heatmapScores,\n    offsets,\n    displacementFwd,\n
displacementBwd,\n  } = this.baseModel.predict(input);\n  return {\n    segmentLogits: segmentation,\n
heatmapScores,\n    offsets,\n    displacementFwd,\n    displacementBwd,\n  };}\n\n private
predictForPersonSegmentationAndPart(input: tf.Tensor3D): {\n  segmentLogits: tf.Tensor3D,\n
partHeatmapLogits: tf.Tensor3D,\n  heatmapScores: tf.Tensor3D,\n  offsets: tf.Tensor3D,\n  displacementFwd:
tf.Tensor3D,\n  displacementBwd: tf.Tensor3D,\n } {\n  const {\n    segmentation,\n    partHeatmaps,\n
heatmapScores,\n    offsets,\n    displacementFwd,\n    displacementBwd\n  } = this.baseModel.predict(input);\n
return {\n    segmentLogits: segmentation,\n    partHeatmapLogits: partHeatmaps,\n
heatmapScores,\n    offsets,\n    displacementFwd,\n    displacementBwd,\n  };}\n\n private
predictForMultiPersonInstanceSegmentationAndPart(input: tf.Tensor3D):\n  {\n    segmentLogits:
tf.Tensor3D,\n    longOffsets: tf.Tensor3D,\n    heatmapScores: tf.Tensor3D,\n    offsets: tf.Tensor3D,\n
displacementFwd: tf.Tensor3D,\n    displacementBwd: tf.Tensor3D,\n    partHeatmaps: tf.Tensor3D\n  } {\n
const {\n    segmentation,\n    longOffsets,\n    heatmapScores,\n    offsets,\n    displacementFwd,\n
displacementBwd,\n    partHeatmaps,\n  } = this.baseModel.predict(input);\n  return {\n    segmentLogits:
segmentation,\n    longOffsets,\n    heatmapScores,\n    offsets,\n    displacementFwd,\n    displacementBwd,\n
partHeatmaps\n  };}\n\n /**\n * Given an image with people, returns a dictionary of all intermediate\n *
tensors including: 1) a binary array with 1 for the pixels that are part
of\n * the person, and 0 otherwise, 2) heatmapScores, 3) offsets, and 4) paddings.\n * @param input
ImageData|HTMLImageElement|HTMLCanvasElement|HTMLVideoElement)\n * The input image to feed
through the network.\n * @param internalResolution Defaults to 'medium'. The internal resolution\n * that
the input is resized to before inference. The larger the\n * internalResolution the more accurate the model at the
cost of slower\n * prediction times. Available values are 'low', 'medium', 'high', 'full', or\n * a percentage value
between 0 and 1. The values 'low', 'medium', 'high', and\n * 'full' map to 0.25, 0.5, 0.75, and 1.0 correspondingly.\n
*\n * @param segmentationThreshold The minimum that segmentation values must have\n * to be considered
part of the person. Affects the generation of the\n * segmentation mask.\n * @return A dictionary containing
`segmentation`, `heatmapScores`, `offsets`,\n * and `padding`:\n * - `segmentation`: A 2d
Tensor with 1 for the pixels that are part of the\n * person, and 0 otherwise. The width and height correspond to
the same\n * dimensions of the input image.\n * - `heatmapScores`: A 3d Tensor of the keypoint heatmaps used
by\n * pose estimation decoding.\n * - `offsets`: A 3d Tensor of the keypoint offsets used by pose\n * estimation
decoding.\n * - `displacementFwd`: A 3d Tensor of the keypoint forward displacement used\n * by pose
estimation decoding.\n * - `displacementBwd`: A 3d Tensor of the keypoint backward displacement used\n * by
pose estimation decoding.\n * - `padding`: The padding (unit pixels) being applied to the input image\n * before it
is fed into the model.\n */\n segmentPersonActivation(\n  input: BodyPixInput, internalResolution:
BodyPixInternalResolution,\n  segmentationThreshold = 0.5): {\n  segmentation: tf.Tensor2D,\n
heatmapScores: tf.Tensor3D,\n  offsets: tf.Tensor3D,\n  displacementFwd: tf.Tensor3D,\n  displacementBwd:

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tf.Tensor3D,\n padding: Padding,\n internalResolutionHeightAndWidth: [number, number]\n } {\n const
[height, width] = getInputSize(input);\n const internalResolutionHeightAndWidth =
toInputResolutionHeightAndWidth(\n internalResolution, this.baseModel.outputStride, [height, width]);\n
const {resized, padding} =\n padAndResizeTo(input, internalResolutionHeightAndWidth);\n\n const {\n
segmentation,\n heatmapScores,\n offsets,\n displacementFwd,\n displacementBwd\n } = tf.tidy(() =>
{\n const {\n segmentLogits,\n heatmapScores,\n offsets,\n displacementFwd,\n
displacementBwd\n } = this.predictForPersonSegmentation(resized);\n\n const [resizedHeight, resizedWidth]
= resized.shape;\n\n const scaledSegmentScores = scaleAndCropToInputTensorShape(\n segmentLogits,
[height, width], [resizedHeight, resizedWidth],\n [[padding.top, padding.bottom], [padding.left,
padding.right]],\n APPLY_SIGMOID_ACTIVATION);\n\n return {\n segmentation: toMaskTensor(\n
tf.squeeze(scaledSegmentScores), segmentationThreshold),\n heatmapScores,\n offsets,\n
displacementFwd,\n displacementBwd,\n });\n });\n resized.dispose();\n return {\n segmentation,\n
heatmapScores,\n offsets,\n displacementFwd,\n displacementBwd,\n padding,\n
internalResolutionHeightAndWidth\n });\n }\n\n /**\n * Given an image with many people, returns a
PersonSegmentation dictionary\n * that contains the segmentation mask for all people and a single pose.\n *
Note: The segmentation mask returned by this method covers all people but\n * the pose works well for one
person. If you want to estimate instance-level\n * multiple person segmentation & pose for each person, use\n *
`segmentMultiPerson` instead.\n * @param input
ImageData|HTMLImageElement|HTMLCanvasElement|HTMLVideoElement)\n
* The input image to feed through the network.\n * @param config PersonInferenceConfig object that
contains\n * parameters for the BodyPix inference using person decoding.\n * @return A
SemanticPersonSegmentation dictionary that contains height,\n * width, the flattened binary segmentation mask
and the poses for all people.\n * The width and height correspond to the same dimensions of the input image.\n * -
`height`: The height of the segmentation data in pixel unit.\n * - `width`: The width of the segmentation data in
pixel unit.\n * - `data`: The flattened Uint8Array of segmentation data. 1 means the pixel\n * belongs to a person
and 0 means the pixel doesn't belong to a person. The\n * size of the array is equal to `height` x `width` in row-
major order.\n * - `allPoses`: The 2d poses of all people.\n */\n async segmentPerson(\n input:
BodyPixInput,\n config: PersonInferenceConfig = PERSON_INFERENCE_CONFIG):\n
Promise<SemanticPersonSegmentation> {\n config = {...PERSON_INFERENCE_CONFIG, ...config};\n\n
validatePersonInferenceConfig(config);\n\n const {\n segmentation,\n heatmapScores,\n offsets,\n
displacementFwd,\n displacementBwd,\n padding,\n internalResolutionHeightAndWidth\n } =\n
this.segmentPersonActivation(\n input, config.internalResolution, config.segmentationThreshold);\n\n
const [height, width] = segmentation.shape;\n\n const result = await segmentation.data() as Uint8Array;\n
segmentation.dispose();\n\n const tensorBuffers = await toTensorBuffers3D(\n [heatmapScores, offsets,
displacementFwd, displacementBwd]);\n const [scoresBuf, offsetsBuf, displacementsFwdBuf,
displacementsBwdBuf] =\n tensorBuffers;\n\n let poses = decodeMultiplePoses(\n scoresBuf, offsetsBuf,
displacementsFwdBuf, displacementsBwdBuf,\n this.baseModel.outputStride, config.maxDetections,\n
config.scoreThreshold, config.nmsRadius);\n\n poses = scaleAndFlipPoses(\n poses, [height, width],
internalResolutionHeightAndWidth, padding,\n FLIP_POSES_AFTER_SCALING);\n\n
heatmapScores.dispose();\n offsets.dispose();\n displacementFwd.dispose();\n displacementBwd.dispose();\n\n
return {height, width, data: result, allPoses: poses};\n }\n\n /**\n * Given an image with multiple people, returns
an *array* of\n * PersonSegmentation object. Each element in the array corresponding to one\n * of the people in
the input image. In other words, it predicts\n * instance-level multiple person segmentation & pose for each
person.\n * The model does standard ImageNet pre-processing before inferring through\n * the model. The
image pixels should have values [0-255].\n * @param input\n *
ImageData|HTMLImageElement|HTMLCanvasElement|HTMLVideoElement) The input\n * image to feed
through the network.\n * @param config MultiPersonInferenceConfig

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object that contains
 * parameters for the BodyPix inference using multi-person decoding.
 * @return An array of PersonSegmentation object, each containing a width,
 * height, a binary array (1 for the pixels that are part of the
 * person, and 0 otherwise) and 2D pose. The array size corresponds to the
 * number of pixels in the image. The width and height correspond to the
 * dimensions of the image the binary array is shaped to, which are
the same
 * dimensions of the input image.
 */
async segmentMultiPerson(
  input: BodyPixInput,
  config: MultiPersonInstanceInferenceConfig = MULTI_PERSON_INSTANCE_INFERENCE_CONFIG):
  Promise<PersonSegmentation[]> {
  config = {...MULTI_PERSON_INSTANCE_INFERENCE_CONFIG, ...config};
  validateMultiPersonInstanceInferenceConfig(config);
  const [height, width] = getInputSize(input);
  const internalResolutionHeightAndWidth = toInputResolutionHeightAndWidth(
    config.internalResolution, this.baseModel.outputStride, [height, width]);
  const {resized, padding} = padAndResizeTo(input, internalResolutionHeightAndWidth);
  const {
    segmentation,
    longOffsets,
    heatmapScoresRaw,
    offsetsRaw,
    displacementFwdRaw,
    displacementBwdRaw,
  } = tf.tidy(() => {
    const {
      segmentLogits,
      longOffsets,
      heatmapScores,
      offsets,
      displacementFwd,
      displacementBwd,
    } = this.predictForMultiPersonInstanceSegmentationAndPart(resized);
    const scaledSegmentScores = scaleAndCropToInputTensorShape(
      segmentLogits, [height, width], internalResolutionHeightAndWidth,
      [[padding.top, padding.bottom], [padding.left, padding.right]],
      APPLY_SIGMOID_ACTIVATION);
    const longOffsetsResized = false;
    let scaledLongOffsets;
    if (longOffsetsResized) {
      scaledLongOffsets = scaleAndCropToInputTensorShape(
        longOffsets, [height, width], internalResolutionHeightAndWidth,
        [[padding.top, padding.bottom], [padding.left, padding.right]],
        APPLY_SIGMOID_ACTIVATION);
    } else {
      scaledLongOffsets = longOffsets;
    }
    const segmentation = toMaskTensor(
      tf.squeeze(scaledSegmentScores), config.segmentationThreshold);
    return {
      segmentation,
      longOffsets: scaledLongOffsets,
      heatmapScoresRaw: heatmapScores,
      offsetsRaw: offsets,
      displacementFwdRaw: displacementFwd,
      displacementBwdRaw: displacementBwd,
    };
  });
  const tensorBuffers = await toTensorBuffers3D(
    [heatmapScoresRaw, offsetsRaw, displacementFwdRaw, displacementBwdRaw]);
  const [scoresBuf, offsetsBuf, displacementsFwdBuf, displacementsBwdBuf] =
    tensorBuffers;
  let poses = decodeMultiplePoses(
    scoresBuf, offsetsBuf, displacementsFwdBuf, displacementsBwdBuf,
    this.baseModel.outputStride, config.maxDetections, config.scoreThreshold,
    config.nmsRadius);
  poses = scaleAndFlipPoses(
    poses, [height, width], internalResolutionHeightAndWidth, padding,
    FLIP_POSES_AFTER_SCALING);
  const instanceMasks = await decodePersonInstanceMasks(
    segmentation, longOffsets, poses, height, width, this.baseModel.outputStride,
    internalResolutionHeightAndWidth, padding, config.scoreThreshold,
    config.refineSteps, config.minKeypointScore, config.maxDetections);
  resized.dispose();
  segmentation.dispose();
  longOffsets.dispose();
  heatmapScoresRaw.dispose();
  offsetsRaw.dispose();
  displacementFwdRaw.dispose();
  displacementBwdRaw.dispose();
  return instanceMasks;
}

/**
 * Given an image with many people, returns a dictionary containing: height,
 * width, a tensor with a part id from 0-24 for the pixels that are
 * part of a corresponding body part, and -1 otherwise. This does standard
 * ImageNet pre-processing before inferring through the model. The image
 * should have values [0-255].
 * @param input ImageData|HTMLImageElement|HTMLCanvasElement|HTMLVideoElement
 * The input image to feed through the network.
 * @param internalResolution Defaults to 'medium'. The internal resolution
 * percentage that the input is resized to before inference. The larger the
 * internalResolution the more accurate the model at the cost of slower
 * prediction times. Available values are 'low', 'medium', 'high', 'full', or
 * a percentage value between 0 and 1. The values 'low', 'medium', 'high', and
 * 'full' map to 0.25, 0.5, 0.75, and 1.0 correspondingly.
 * @param segmentationThreshold The minimum that segmentation values must have
 * to be considered part of the person. Affects the clipping of the colored
 * part image.

```

```

@return A dictionary containing `partSegmentation`, `heatmapScores`,\n * `offsets`, and `padding`:\n * -
`partSegmentation`: A 2d Tensor with a part id from 0-24 for\n * the pixels that are part of a corresponding body
part, and -1 otherwise.\n * - `heatmapScores`: A 3d Tensor of the keypoint heatmaps used by\n * single-person
pose estimation decoding.\n * - `offsets`: A 3d Tensor of the keypoint offsets used by single-person pose\n *
estimation decoding.\n * - `displacementFwd`: A 3d Tensor of the keypoint forward displacement\n * used by
pose estimation decoding.\n * - `displacementBwd`: A 3d Tensor of the keypoint backward displacement used\n *
by pose estimation decoding.\n * - `padding`: The padding (unit pixels) being applied to the input image\n *
before it is fed into the model.\n */\n segmentPersonPartsActivation(\n    input: BodyPixInput,\n    internalResolution: BodyPixInternalResolution,\n    segmentationThreshold = 0.5): {\n    partSegmentation:\n    tf.Tensor2D,\n    heatmapScores: tf.Tensor3D,\n    offsets: tf.Tensor3D,\n    displacementFwd: tf.Tensor3D,\n    displacementBwd: tf.Tensor3D,\n    padding: Padding,\n    internalResolutionHeightAndWidth: [number, number]\n  } {\n    const [height, width] = getInputSize(input);\n    const internalResolutionHeightAndWidth =\n    toInputResolutionHeightAndWidth(\n      internalResolution, this.baseModel.outputStride, [height, width]);\n    const {\n      resized,\n      padding,\n    } = padAndResizeTo(input, internalResolutionHeightAndWidth);\n    const {\n      partSegmentation,\n      heatmapScores,\n      offsets,\n      displacementFwd,\n      displacementBwd\n    } =\n    tf.tidy(() => {\n      const {\n        segmentLogits,\n        partHeatmapLogits,\n        heatmapScores,\n        offsets,\n        displacementFwd,\n        displacementBwd\n      } = this.predictForPersonSegmentationAndPart(resized);\n      const [resizedHeight, resizedWidth] = resized.shape;\n      const scaledSegmentScores\n      = scaleAndCropToInputTensorShape(\n        segmentLogits, [height, width], [resizedHeight, resizedWidth],\n        [[padding.top, padding.bottom], [padding.left, padding.right]],\n        APPLY_SIGMOID_ACTIVATION);\n      const scaledPartHeatmapScore = scaleAndCropToInputTensorShape(\n        partHeatmapLogits, [height, width],\n        [resizedHeight, resizedWidth],\n        [[padding.top, padding.bottom], [padding.left, padding.right]],\n        APPLY_SIGMOID_ACTIVATION);\n      const segmentation =\n      toMaskTensor(tf.squeeze(scaledSegmentScores), segmentationThreshold);\n      return {\n        partSegmentation:\n        decodePartSegmentation(segmentation, scaledPartHeatmapScore),\n        heatmapScores,\n        offsets,\n        displacementFwd,\n        displacementBwd,\n      }; \n    });\n    resized.dispose();\n    return {\n      partSegmentation,\n      heatmapScores,\n      offsets,\n      displacementFwd,\n      displacementBwd,\n      padding,\n      internalResolutionHeightAndWidth\n    }; \n  }\n} /**\n * Given an image with many people, returns a
PartSegmentation dictionary that\n * contains the body part segmentation mask for all people and a single pose.\n
*\n * Note: The body part segmentation mask returned by this method covers all\n * people but the pose works
well when there is one person. If you want to\n * estimate instance-level multiple person body part segmentation &
pose for\n * each person, use `segmentMultiPersonParts` instead.\n *\n * @param input
ImageData|HTMLImageElement|HTMLCanvasElement|HTMLVideoElement)\n * The input image to feed
through the network.\n *\n * @param config PersonInferenceConfig object that contains\n * parameters for the
BodyPix inference using single person decoding.\n *\n * @return A SemanticPartSegmentation dictionary that
contains height, width,\n * the flattened binary segmentation mask and the pose for the person. The\n * width and
height\n * correspond to the same dimensions of the input image.\n * - `height`: The height of the person part segmentation
data in pixel unit.\n * - `width`: The width of the person part segmentation data in pixel unit.\n * - `data`: The
flattened Int32Array of person part segmentation data with a\n * part id from 0-24 for the pixels that are part of a
corresponding body\n * part, and -1 otherwise. The size of the array is equal to `height` x\n * `width` in row-
major order.\n * - `allPoses`: The 2d poses of all people.\n */\n async segmentPersonParts(\n    input:\n    BodyPixInput,\n    config: PersonInferenceConfig = PERSON_INFERENCE_CONFIG): \n    Promise<SemanticPartSegmentation> {\n    config = {...PERSON_INFERENCE_CONFIG, ...config};\n    validatePersonInferenceConfig(config);\n    const {\n      partSegmentation,\n      heatmapScores,\n      offsets,\n      displacementFwd,\n      displacementBwd,\n      padding,\n      internalResolutionHeightAndWidth\n    } =\n
```

```

    this.segmentPersonPartsActivation(\n      input, config.internalResolution, config.segmentationThreshold);\n\n    const [height, width] = partSegmentation.shape;\n    const data = await partSegmentation.data() as Int32Array;\n    partSegmentation.dispose();\n\n    const tensorBuffers = await toTensorBuffers3D(\n      [heatmapScores, offsets,\n      displacementFwd, displacementBwd]);\n    const [scoresBuf, offsetsBuf, displacementsFwdBuf,\n      displacementsBwdBuf] =\n      tensorBuffers;\n\n    let poses = decodeMultiplePoses(\n      scoresBuf, offsetsBuf,\n      displacementsFwdBuf, displacementsBwdBuf,\n      this.baseModel.outputStride, config.maxDetections,\n      config.scoreThreshold, config.nmsRadius);\n\n    poses = scaleAndFlipPoses(\n      poses, [height, width],\n      internalResolutionHeightAndWidth, padding,\n      FLIP_POSES_AFTER_SCALING);\n\n    heatmapScores.dispose();\n    offsets.dispose();\n    displacementFwd.dispose();\n    displacementBwd.dispose();\n\n    return {height,\n      width, data, allPoses: poses};\n  }\n\n  /**\n   * Given an image with multiple people, returns an *array* of\n   * PartSegmentation\n   * object. Each element in the array corresponding to one\n   * of the people in the input image.\n   * In other words, it predicts\n   * instance-level multiple person body part segmentation & pose for each\n   * person.\n   * This does standard ImageNet pre-processing before inferring through\n   * the model. The image\n   * pixels should have values [0-255].\n   * @param input\n   * ImageData|HTMLImageElement|HTMLCanvasElement|HTMLVideoElement) The input\n   * image to feed\n   * through the network.\n   * @param config MultiPersonInferenceConfig object that contains\n   * parameters for\n   * the BodyPix inference using multi-person decoding.\n   * @return An array of PartSegmentation object, each\n   * containing a width,\n   * height, a flattened array (with part id from 0-24 for the pixels that are\n   * part of a\n   * corresponding body part, and -1 otherwise)\n   * and 2D pose. The width\n   * and height correspond to the dimensions of the image. Each flattened part\n   * segmentation array size is equal to `height` x `width`.\n   */\n  async segmentMultiPersonParts(\n    input:\n      BodyPixInput,\n    config: MultiPersonInstanceInferenceConfig =\n      MULTI_PERSON_INSTANCE_INFERENCE_CONFIG): Promise<PartSegmentation[]> {\n    config =\n      {...MULTI_PERSON_INSTANCE_INFERENCE_CONFIG, ...config};\n\n    validateMultiPersonInstanceInferenceConfig(config);\n    const [height, width] = getInputSize(input);\n    const\n      internalResolutionHeightAndWidth = toInputResolutionHeightAndWidth(\n        config.internalResolution,\n        this.baseModel.outputStride,\n        [height, width]);\n    const {resized, padding} =\n      padAndResizeTo(input,\n        internalResolutionHeightAndWidth);\n    const {\n      segmentation,\n      longOffsets,\n      heatmapScoresRaw,\n      offsetsRaw,\n      displacementFwdRaw,\n      displacementBwdRaw,\n      partSegmentation,\n    } = tf.tidy(() => {\n      const {\n        segmentLogits,\n        longOffsets,\n        heatmapScores,\n        offsets,\n        displacementFwd,\n        displacementBwd,\n        partHeatmaps\n      } =\n        this.predictForMultiPersonInstanceSegmentationAndPart(resized);\n      // decoding with scaling.\n      const\n        scaledSegmentScores = scaleAndCropToInputTensorShape(\n          segmentLogits, [height, width],\n          internalResolutionHeightAndWidth,\n          [[padding.top, padding.bottom], [padding.left, padding.right]],\n          APPLY_SIGMOID_ACTIVATION);\n      // decoding with scaling.\n      const scaledPartSegmentationScores =\n        scaleAndCropToInputTensorShape(\n          partHeatmaps, [height, width], internalResolutionHeightAndWidth,\n          [[padding.top, padding.bottom], [padding.left, padding.right]],\n          APPLY_SIGMOID_ACTIVATION);\n      const scaledLongOffsets = longOffsets;\n      const segmentation = toMaskTensor(\n        tf.squeeze(scaledSegmentScores),\n        config.segmentationThreshold);\n      const partSegmentation =\n        decodeOnlyPartSegmentation(scaledPartSegmentationScores);\n      return {\n        segmentation,\n        longOffsets:\n          scaledLongOffsets,\n        heatmapScoresRaw: heatmapScores,\n        offsetsRaw: offsets,\n        displacementFwdRaw: displacementFwd,\n        displacementBwdRaw: displacementBwd,\n        partSegmentation\n      };\n    });\n\n    const tensorBuffers = await toTensorBuffers3D(\n      [heatmapScoresRaw,\n      offsetsRaw, displacementFwdRaw, displacementBwdRaw]);\n    const [scoresBuf, offsetsBuf,\n      displacementsFwdBuf, displacementsBwdBuf] =\n      tensorBuffers;\n\n    let poses = decodeMultiplePoses(\n      scoresBuf, offsetsBuf, displacementsFwdBuf, displacementsBwdBuf,\n      this.baseModel.outputStride,\n
```

```

config.maxDetections,\n      config.scoreThreshold, config.nmsRadius);\n\n poses = scaleAndFlipPoses(\n
poses, [height, width], internalResolutionHeightAndWidth, padding,\n
  FLIP_POSES_AFTER_SCALING);\n\n const instanceMasks = await decodePersonInstancePartMasks(\n
segmentation, longOffsets, partSegmentation, poses, height, width,\n      this.baseModel.outputStride,\n
internalResolutionHeightAndWidth, padding,\n      config.scoreThreshold, config.refineSteps,\n
config.minKeypointScore,\n      config.maxDetections);\n\n resized.dispose();\n segmentation.dispose();\n
longOffsets.dispose();\n heatmapScoresRaw.dispose();\n offsetsRaw.dispose();\n
displacementFwdRaw.dispose();\n displacementBwdRaw.dispose();\n partSegmentation.dispose();\n\n return
instanceMasks;\n }\n\n public dispose() {\n      this.baseModel.dispose();\n }\n}\n\n/**\n * Loads the MobileNet
BodyPix model.\n */\n\nexport async function loadMobileNet(config: ModelConfig): Promise<BodyPix> {\n const
outputStride = config.outputStride;\n const quantBytes = config.quantBytes;\n const multiplier =
config.multiplier;\n if (tf == null) {\n      throw new Error(\n
`Cannot find TensorFlow.js. If you are using a <script> tag, please ` +\n
`also include @tensorflow/tfjs on
the page before using this\n      model.`);\n }\n\n const url = mobileNetSavedModel(outputStride, multiplier,
quantBytes);\n const graphModel = await tfconv.loadGraphModel(config.modelUrl || url);\n const mobilenet = new
MobileNet(graphModel, outputStride);\n return new BodyPix(mobilenet);\n }\n\n/**\n * Loads the ResNet BodyPix
model.\n */\n\nexport async function loadResNet(config: ModelConfig): Promise<BodyPix> {\n const outputStride =
config.outputStride;\n const quantBytes = config.quantBytes;\n if (tf == null) {\n      throw new Error(\n
`Cannot find TensorFlow.js. If you are using a <script> tag, please ` +\n
`also include @tensorflow/tfjs on the
page before using this\n      model.`);\n }\n\n const url = resNet50SavedModel(outputStride, quantBytes);\n const
graphModel = await tfconv.loadGraphModel(config.modelUrl || url);\n const resnet = new
ResNet(graphModel, outputStride);\n return new BodyPix(resnet);\n }\n\n/**\n * Loads the BodyPix model
instance from a checkpoint, with the ResNet\n * or MobileNet architecture. The model to be loaded is configurable
using the\n * config dictionary ModelConfig. Please find more details in the\n * documentation of the
ModelConfig.\n */\n\nexport async function load(config: ModelConfig =
MOBILENET_V1_CONFIG): Promise<BodyPix> {\n config = validateModelConfig(config);\n if
(config.architecture === 'ResNet50') {\n      return loadResNet(config);\n } else if (config.architecture ===
'MobileNetV1') {\n      return loadMobileNet(config);\n } else {\n
return null;\n }\n}\n\n",/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under
the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * \n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n */\n\n
=====)\n
*/\n\n// method copied from bGluR in https://codepen.io/zhaojun/pen/zZmRQe\n\nexport function cpuBlur(\n
canvas: HTMLCanvasElement|OffscreenCanvas,\n      image:
HTMLImageElement|HTMLVideoElement|HTMLCanvasElement|OffscreenCanvas,\n      blur: number) {\n const
ctx = canvas.getContext('2d');\n let sum = 0;\n const delta = 5;\n const alphaLeft = 1 / (2 * Math.PI * delta *
delta);\n const step = blur < 3 ? 1 : 2;\n for (let y = -blur; y <= blur; y += step) {\n      for (let x =
-blur; x <= blur; x += step) {\n          const weight =\n              alphaLeft * Math.exp(-(x * x + y * y) / (2 * delta * delta));\n          sum +=
weight;\n      }\n }\n for (let y = -blur; y <= blur; y += step) {\n      for (let x = -blur; x <= blur; x +=
step) {\n          ctx.globalAlpha = alphaLeft *\n              Math.exp(-(x * x + y * y) / (2 * delta * delta)) / sum * blur;\n          ctx.drawImage(image, x,
y);\n      }\n }\n ctx.globalAlpha = 1;\n }\n\n",/**\n * @license\n * Copyright 2019 Google

```

LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```
=====\n*\n\nimport {cpuBlur} from './blur';\nimport {Color, PartSegmentation, PersonSegmentation} from\n './types';\nimport {SemanticPartSegmentation, SemanticPersonSegmentation} from './types';\nimport {getInputSize} from './util';\n\nexport type Canvas = HTMLCanvasElement | OffscreenCanvas;\n\nconst offScreenCanvases:\n { [name: string]: Canvas } = {};\n\ntype ImageType = HTMLImageElement|HTMLVideoElement|Canvas;\ntype\n HasDimensions = {\n width: number,\n height: number\n};\n\nfunction isSafari() {\n return\n /^(?!chrome|android).*safari/i.test(navigator.userAgent);\n}\n\nfunction assertSameDimensions(\n {width: widthA, height: heightA}: HasDimensions,\n {width: widthB, height: heightB}: HasDimensions,\n nameA: string,\n nameB: string) {\n if (widthA !== widthB || heightA !== heightB) {\n throw new Error(`error:\n dimensions must match. ${nameA} has dimensions ${\n widthA}x${heightA}, ${nameB} has dimensions\n ${widthB}x${heightB}`);\n }\n}\n\nfunction flipCanvasHorizontal(canvas: Canvas) {\n const ctx =\n canvas.getContext('2d');\n ctx.scale(-1, 1);\n ctx.translate(-canvas.width, 0);\n}\n\nfunction\n drawWithCompositing(\n ctx: CanvasRenderingContext2D|OffscreenCanvasRenderingContext2D,\n image:\n Canvas|ImageType,\n compositeOperation: string) {\n ctx.globalCompositeOperation = compositeOperation;\n ctx.drawImage(image, 0, 0);\n}\n\nfunction createOffScreenCanvas(): Canvas {\n if (typeof document !==\n 'undefined') {\n return document.createElement('canvas');\n } else if (typeof OffscreenCanvas !== 'undefined')\n {\n return new OffscreenCanvas(0, 0);\n } else\n {\n throw new Error('Cannot create a canvas in this context');\n }\n}\n\nfunction\n ensureOffscreenCanvasCreated(id: string): Canvas {\n if (!offScreenCanvases[id]) {\n offScreenCanvases[id] =\n createOffScreenCanvas();\n }\n return offScreenCanvases[id];\n}\n\nfunction drawAndBlurImageOnCanvas(\n image: ImageType, blurAmount: number, canvas: Canvas) {\n const {height, width} = image;\n const ctx =\n canvas.getContext('2d');\n canvas.width = width;\n canvas.height = height;\n ctx.clearRect(0, 0, width, height);\n ctx.save();\n if (isSafari()) {\n cpuBlur(canvas, image, blurAmount);\n } else {\n // tslint:disable:no-any\n (ctx as any).filter = `blur(${blurAmount}px)`;\n ctx.drawImage(image, 0, 0, width, height);\n }\n ctx.restore();\n}\n\nfunction drawAndBlurImageOnOffScreenCanvas(\n image: ImageType, blurAmount:\n number,\n offscreenCanvasName: string): Canvas {\n const canvas =\n ensureOffscreenCanvasCreated(offscreenCanvasName);\n if (blurAmount ===\n 0) {\n renderImageToCanvas(image, canvas);\n } else {\n drawAndBlurImageOnCanvas(image, blurAmount,\n canvas);\n }\n return canvas;\n}\n\nfunction renderImageToCanvas(image: ImageType, canvas: Canvas) {\n const\n {width, height} = image;\n canvas.width = width;\n canvas.height = height;\n const ctx =\n canvas.getContext('2d');\n ctx.drawImage(image, 0, 0, width, height);\n}\n\n/* Draw an image on a canvas\n *\n */\n\nfunction renderImageDataToCanvas(image: ImageData, canvas: Canvas) {\n canvas.width = image.width;\n canvas.height = image.height;\n const ctx = canvas.getContext('2d');\n ctx.putImageData(image, 0,\n 0);\n}\n\nfunction renderImageDataToOffScreenCanvas(\n image: ImageData, canvasName: string): Canvas {\n const canvas = ensureOffscreenCanvasCreated(canvasName);\n renderImageDataToCanvas(image, canvas);\n return canvas;\n}\n\n/* Given the output from estimating multi-person segmentation, generates an\n * image with foreground and background color at\n * each pixel determined by the\n * corresponding binary segmentation value at the pixel from the output. In\n * other words, pixels where there is a person will be colored with foreground\n * color and where there is not a person will be colored with background color.\n * @param personOrPartSegmentation The output from\n * `segmentPerson`, `segmentMultiPerson`,\n * `segmentPersonParts` or `segmentMultiPersonParts`. They can\n * be SemanticPersonSegmentation object, an array of PersonSegmentation object,\n * SemanticPartSegmentation object,
```


or an array of PartSegmentation object.

`@param foreground` Default to {r:0, g:0, b:0, a: 0}. The foreground color (r,g,b,a) for visualizing pixels that belong to people.

`@param background` Default to {r:0, g:0, b:0, a: 255}. The background color (r,g,b,a) for visualizing pixels that don't belong to people.

`@param drawContour` Default to false. Whether to draw the contour around each person's segmentation mask or body part mask.

`@param foregroundIds` Default to [1]. The integer values that represent foreground. For person segmentation, 1 is the foreground. For body part segmentation, it can be a subset of all body parts ids.

`@returns` An ImageData with the same width and height of all the PersonSegmentation in multiPersonSegmentation, with opacity and transparency at each pixel determined by the corresponding binary segmentation value at the pixel from the output.

```

function toMask(personOrPartSegmentation: SemanticPersonSegmentation | SemanticPartSegmentation | PersonSegmentation[] | PartSegmentation[], foreground: Color = {r: 0, g: 0, b: 0, a: 0}, background: Color = {r: 0, g: 0, b: 0, a: 255}, drawContour = false, foregroundIds: number[] = [1]): ImageData {
  if (Array.isArray(personOrPartSegmentation) && personOrPartSegmentation.length === 0) {
    return null;
  }
  let multiPersonOrPartSegmentation: Array<SemanticPersonSegmentation | SemanticPartSegmentation | PersonSegmentation | PartSegmentation>;
  if (!Array.isArray(personOrPartSegmentation)) {
    multiPersonOrPartSegmentation = [personOrPartSegmentation];
  } else {
    multiPersonOrPartSegmentation = personOrPartSegmentation;
  }
  const {width, height} = multiPersonOrPartSegmentation[0];
  const bytes = new Uint8ClampedArray(width * height * 4);
  function drawStroke(bytes: Uint8ClampedArray, row: number, column: number, width: number, radius: number, color: Color = {r: 0, g: 255, b: 255, a: 255}) {
    for (let i = -radius; i <= radius; i++) {
      for (let j = -radius; j <= radius; j++) {
        if (i !== 0 && j !== 0) {
          const n = (row + i) * width + (column + j);
          bytes[4 * n + 0] = color.r;
          bytes[4 * n + 1] = color.g;
          bytes[4 * n + 2] = color.b;
          bytes[4 * n + 3] = color.a;
        }
      }
    }
  }
  function isSegmentationBoundary(segmentationData: Uint8Array | Int32Array, row: number, column: number, width: number, foregroundIds: number[] = [1], radius = 1): boolean {
    let numberBackgroundPixels = 0;
    for (let i = -radius; i <= radius; i++) {
      for (let j = -radius; j <= radius; j++) {
        if (i !== 0 && j !== 0) {
          const n = (row + i) * width + (column + j);
          if (!foregroundIds.some(id => id === segmentationData[n])) {
            numberBackgroundPixels += 1;
          }
        }
      }
    }
    return numberBackgroundPixels > 0;
  }
  for (let i = 0; i < height; i += 1) {
    for (let j = 0; j < width; j += 1) {
      const n = i * width + j;
      bytes[4 * n + 0] = background.r;
      bytes[4 * n + 1] = background.g;
      bytes[4 * n + 2] = background.b;
      bytes[4 * n + 3] = background.a;
      for (let k = 0; k < multiPersonOrPartSegmentation.length; k++) {
        if (foregroundIds.some(id => id === multiPersonOrPartSegmentation[k].data[n])) {
          bytes[4 * n] = foreground.r;
          bytes[4 * n + 1] = foreground.g;
          bytes[4 * n + 2] = foreground.b;
          bytes[4 * n + 3] = foreground.a;
          const isBoundary = isSegmentationBoundary(multiPersonOrPartSegmentation[k].data, i, j, width, foregroundIds);
          if (drawContour && i - 1 >= 0 && i + 1 < height && j - 1 >= 0 && j + 1 < width && isBoundary) {
            drawStroke(bytes, i, j, width, 1);
          }
        }
      }
    }
  }
  return new ImageData(bytes, width, height);
}
const RAINBOW_PART_COLORS: Array<[number, number, number]> = [
  [110, 64, 170], [143, 61, 178], [178, 60, 178], [210, 62, 167], [238, 67, 149], [255, 78, 125], [255, 94, 99], [255, 115, 75], [255, 140, 56], [239, 167, 47], [217, 194, 49], [194, 219, 64], [175, 240, 91], [135, 245, 87], [96, 247, 96], [64, 243, 115], [40, 234, 141], [28, 219, 169], [26, 199, 194], [33, 176, 213], [47, 150, 224], [65, 125, 224], [84, 101, 214], [99, 81, 195]
];

```

`@param partSegmentation` The output from segmentPersonParts or segmentMultiPersonParts. The former is a SemanticPartSegmentation object and later is an array of PartSegmentation object.

`@param partColors` A multi-dimensional array of rgb colors indexed by part id.

```

Must have 24 colors, one for every part.\n * @returns An ImageData with the same width and height of all the
element in\n * multiPersonPartSegmentation, with the corresponding color for each part at\n * each
pixel, and black pixels where there is no part.\n */\nexport function toColoredPartMask(\n partSegmentation:
SemanticPartSegmentation|PartSegmentation[],\n partColors: Array<[number, number, number]> =\n
RAINBOW_PART_COLORS): ImageData {\n if (Array.isArray(partSegmentation) && partSegmentation.length
=== 0) {\n return null;\n }\n\n let multiPersonPartSegmentation;\n if (!Array.isArray(partSegmentation)) {\n
multiPersonPartSegmentation = [partSegmentation];\n } else {\n multiPersonPartSegmentation =
partSegmentation;\n }\n\n const {width, height} = multiPersonPartSegmentation[0];\n const bytes = new
Uint8ClampedArray(width * height * 4);\n\n for (let i = 0; i < height * width; ++i) {\n // invert mask. Invert the
segmentation mask.\n const j = i * 4;\n bytes[j + 0] = 255;\n bytes[j + 1] = 255;\n bytes[j + 2] = 255;\n
bytes[j + 3] = 255;\n for (let k = 0; k < multiPersonPartSegmentation.length; k++) {\n const partId =
multiPersonPartSegmentation[k].data[i];\n\n if (partId !== -1) {\n const color = partColors[partId];\n if (!color) {\n
throw new Error(`No color
could be found for part id ${partId}`);\n }\n bytes[j + 0] = color[0];\n bytes[j + 1] = color[1];\n
bytes[j + 2] = color[2];\n bytes[j + 3] = 255;\n }\n }\n }\n\n return new ImageData(bytes, width,
height);\n}\n\nconst CANVAS_NAMES = {\n blurred: 'blurred',\n blurredMask: 'blurred-mask',\n mask: 'mask',\n
lowresPartMask: 'lowres-part-mask',\n};\n\n/**\n * Given an image and a maskImage of type ImageData, draws the
image with the\n * mask on top of it onto a canvas.\n *\n * @param canvas The canvas to be drawn onto.\n *\n *
@param image The original image to apply the mask to.\n *\n * @param maskImage An ImageData containing the
mask. Ideally this should be\n * generated by toMask or toColoredPartMask.\n *\n * @param maskOpacity The
opacity of the mask when drawing it on top of the\n
* image. Defaults to 0.7. Should be a float between 0 and 1.\n *\n * @param maskBlurAmount How many pixels to
blur the mask by. Defaults to 0.\n *\n * Should be an integer between 0 and 20.\n *\n * @param flipHorizontal If
the result should be flipped horizontally. Defaults\n * to false.\n */\nexport function drawMask(\n canvas: Canvas,
image: ImageType, maskImage: ImageData|null,\n maskOpacity = 0.7, maskBlurAmount = 0, flipHorizontal =
false) {\n const [height, width] = getInputSize(image);\n canvas.width = width;\n canvas.height = height;\n\n
const ctx = canvas.getContext('2d');\n ctx.save();\n if (flipHorizontal) {\n flipCanvasHorizontal(canvas);\n }\n\n
ctx.drawImage(image, 0, 0);\n\n ctx.globalAlpha = maskOpacity;\n if (maskImage) {\n
assertSameDimensions({width, height}, maskImage, 'image', 'mask');\n\n const mask =
renderImageDataToOffScreenCanvas(maskImage, CANVAS_NAMES.mask);\n\n const blurredMask =
drawAndBlurImageOnOffScreenCanvas(\n mask,\n
maskBlurAmount, CANVAS_NAMES.blurredMask);\n ctx.drawImage(blurredMask, 0, 0, width, height);\n }\n\n
ctx.restore();\n}\n\n/**\n * Given an image and a maskImage of type ImageData, draws the image with the\n *
pixelated mask on top of it onto a canvas.\n *\n * @param canvas The canvas to be drawn onto.\n *\n * @param
image The original image to apply the mask to.\n *\n * @param maskImage An ImageData containing the mask.
Ideally this should be\n * generated by toColoredPartMask.\n *\n * @param maskOpacity The opacity of the mask
when drawing it on top of the\n * image. Defaults to 0.7. Should be a float between 0 and 1.\n *\n * @param
maskBlurAmount How many pixels to blur the mask by. Defaults to 0.\n *\n * Should be an integer between 0 and 20.\n
*\n * @param flipHorizontal If the result should be flipped horizontally. Defaults\n * to false.\n *\n * @param
pixelCellWidth The width of each pixel cell. Default to 10 px.\n */\nexport function drawPixelatedMask(\n
canvas: Canvas, image:
ImageType, maskImage: ImageData,\n maskOpacity = 0.7, maskBlurAmount = 0, flipHorizontal = false,\n
pixelCellWidth = 10.0) {\n const [height, width] = getInputSize(image);\n assertSameDimensions({width, height},
maskImage, 'image', 'mask');\n\n const mask = renderImageDataToOffScreenCanvas(maskImage,
CANVAS_NAMES.mask);\n\n const blurredMask = drawAndBlurImageOnOffScreenCanvas(\n mask,\n
maskBlurAmount, CANVAS_NAMES.blurredMask);\n\n canvas.width = blurredMask.width;\n canvas.height =
blurredMask.height;\n\n const ctx = canvas.getContext('2d');\n ctx.save();\n if (flipHorizontal) {\n
flipCanvasHorizontal(canvas);\n }\n\n const offscreenCanvas =\n

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ensureOffscreenCanvasCreated(CANVAS_NAMES.lowresPartMask);\n const offscreenCanvasCtx =
offscreenCanvas.getContext('2d');\n offscreenCanvas.width = blurredMask.width * (1.0 / pixelCellWidth);\n
offscreenCanvas.height = blurredMask.height * (1.0 / pixelCellWidth);\n offscreenCanvasCtx.drawImage(\n
blurredMask,
0, 0, blurredMask.width, blurredMask.height, 0, 0,\n offscreenCanvas.width, offscreenCanvas.height);\n
ctx.imageSmoothingEnabled = false;\n ctx.drawImage(\n offscreenCanvas, 0, 0, offscreenCanvas.width,
offscreenCanvas.height, 0,\n 0, canvas.width, canvas.height);\n\n // Draws vertical grid lines that are
`pixelCellWidth` apart from each other.\n for (let i = 0; i < offscreenCanvas.width; i++) {\n ctx.beginPath();\n
ctx.strokeStyle = '#ffffff';\n ctx.moveTo(pixelCellWidth * i, 0);\n ctx.lineTo(pixelCellWidth * i,
canvas.height);\n ctx.stroke();\n }\n\n // Draws horizontal grid lines that are `pixelCellWidth` apart from each\n
// other.\n for (let i = 0; i < offscreenCanvas.height; i++) {\n ctx.beginPath();\n ctx.strokeStyle = '#ffffff';\n
ctx.moveTo(0, pixelCellWidth * i);\n ctx.lineTo(canvas.width, pixelCellWidth * i);\n ctx.stroke();\n }\n\n
ctx.globalAlpha = 1.0 - maskOpacity;\n ctx.drawImage(image, 0, 0, blurredMask.width,
blurredMask.height);\n ctx.restore();\n }\n\nfunction createPersonMask(\n multiPersonSegmentation:
PersonSegmentation[]|SemanticPersonSegmentation,\n edgeBlurAmount: number): Canvas {\n const
backgroundMaskImage = toMask(\n multiPersonSegmentation, {r: 0, g: 0, b: 0, a: 255},\n {r: 0, g: 0, b: 0, a:
0});\n const backgroundMask =\n renderImageDataToOffScreenCanvas(backgroundMaskImage,
CANVAS_NAMES.mask);\n if (edgeBlurAmount === 0) {\n return backgroundMask;\n } else {\n return
drawAndBlurImageOnOffScreenCanvas(\n backgroundMask, edgeBlurAmount,
CANVAS_NAMES.blurredMask);\n }\n}\n\n/**\n * Given a personSegmentation and an image, draws the image
with its background\n * blurred onto the canvas.\n *\n * @param canvas The canvas to draw the background-blurred
image onto.\n *\n * @param image The image to blur the background of and draw.\n *\n * @param
personSegmentation A SemanticPersonSegmentation or an array of\n * PersonSegmentation object.\n *\n * @param backgroundBlurAmount How many pixels in the background blend into each\n * other. Defaults to
3. Should be an integer between 1 and 20.\n *\n * @param edgeBlurAmount How many pixels to blur on the edge
between the person\n * and the background by. Defaults to 3. Should be an integer between 0 and 20.\n *\n *
@param flipHorizontal If the output should be flipped horizontally. Defaults\n * to false.\n */\n\nexport function
drawBokehEffect(\n canvas: Canvas, image: ImageType,\n multiPersonSegmentation:
SemanticPersonSegmentation|PersonSegmentation[],\n backgroundBlurAmount = 3, edgeBlurAmount = 3,
flipHorizontal = false) {\n const blurredImage = drawAndBlurImageOnOffScreenCanvas(\n image,
backgroundBlurAmount, CANVAS_NAMES.blurred);\n canvas.width = blurredImage.width;\n canvas.height =
blurredImage.height;\n const ctx = canvas.getContext('2d');\n\n if (Array.isArray(multiPersonSegmentation)
&&\n multiPersonSegmentation.length === 0) {\n ctx.drawImage(blurredImage,
0, 0);\n return;\n }\n\n const personMask = createPersonMask(multiPersonSegmentation, edgeBlurAmount);\n\n
ctx.save();\n if (flipHorizontal) {\n flipCanvasHorizontal(canvas);\n }\n\n // draw the original image on the final
canvas\n const [height, width] = getInputSize(image);\n ctx.drawImage(image, 0, 0, width, height);\n\n //
`destination-in` - `The existing canvas content is kept where both the\n // new shape and existing canvas content
overlap. Everything else is made\n // transparent.`\n // crop what's not the person using the mask from the original
image\n drawWithCompositing(ctx, personMask, 'destination-in');\n // `destination-over` - `The existing canvas
content is kept where both the\n // new shape and existing canvas content overlap. Everything else is made\n //
transparent.`\n // draw the blurred background on top of the original image where it doesn't\n // overlap.\n
drawWithCompositing(ctx, blurredImage, 'destination-over');\n
ctx.restore();\n }\n\nfunction createBodyPartMask(\n multiPersonPartSegmentation:
SemanticPartSegmentation|PartSegmentation[],\n bodyPartIdsToMask: number[], edgeBlurAmount: number):
Canvas {\n const backgroundMaskImage = toMask(\n multiPersonPartSegmentation, {r: 0, g: 0, b: 0, a: 0},\n
{r: 0, g: 0, b: 0, a: 255}, true, bodyPartIdsToMask);\n const backgroundMask =\n
renderImageDataToOffScreenCanvas(backgroundMaskImage, CANVAS_NAMES.mask);\n if (edgeBlurAmount
=== 0) {\n return backgroundMask;\n } else {\n return drawAndBlurImageOnOffScreenCanvas(\n

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backgroundMask, edgeBlurAmount, CANVAS_NAMES.blurredMask);\n }
}

/**
 * Given a personSegmentation and an image, draws the image with its background
 * blurred onto the canvas.
 *
 * @param canvas The canvas to draw the background-blurred image onto.
 * @param image The image to blur the background of and draw.
 * @param partSegmentation A SemanticPartSegmentation or an array of
 * PartSegmentation object.
 * @param bodyPartIdsToBlur Default to [0, 1] (left-face and right-face). An
 * array of body part ids to blur. Each must be one of the 24 body part ids.
 * @param backgroundBlurAmount How many pixels in the background blend into each
 * other. Defaults to 3. Should be an integer between 1 and 20.
 * @param edgeBlurAmount How many pixels to blur on the edge between the person
 * and the background by. Defaults to 3. Should be an integer between 0 and 20.
 * @param flipHorizontal If the output should be flipped horizontally. Defaults
 * to false.
 */
export function blurBodyPart(
  canvas: Canvas,
  image: ImageType,
  partSegmentation: SemanticPartSegmentation|PartSegmentation[],
  bodyPartIdsToBlur = [0, 1],
  backgroundBlurAmount = 3,
  edgeBlurAmount = 3,
  flipHorizontal = false) {
  const blurredImage = drawAndBlurImageOnOffScreenCanvas(
    image, backgroundBlurAmount, CANVAS_NAMES.blurred);
  canvas.width = blurredImage.width;
  canvas.height = blurredImage.height;
  const ctx = canvas.getContext('2d');
  if (Array.isArray(partSegmentation) && partSegmentation.length === 0) {
    ctx.drawImage(blurredImage, 0, 0);
    return;
  }
  const bodyPartMask = createBodyPartMask(partSegmentation, bodyPartIdsToBlur,
    edgeBlurAmount);
  ctx.save();
  if (flipHorizontal) {
    flipCanvasHorizontal(canvas);
  }
  // draw the original image on the final canvas
  const [height, width] = getInputSize(image);
  ctx.drawImage(image, 0, 0, width, height);
  // "destination-in" - "The existing canvas content is kept where both the
  // new shape and existing canvas content overlap. Everything else is made
  // transparent."
  // crop what's not the person using the mask from the original image
  drawWithCompositing(ctx, bodyPartMask, 'destination-in');
  // "destination-over" - "The existing canvas content is kept where both the
  // new shape and existing canvas content overlap. Everything else is made
  // transparent."
  // draw the blurred background on top of the original image where it doesn't
  // overlap.
  drawWithCompositing(ctx, blurredImage, 'destination-over');
  ctx.restore();
}

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 */

=====
export const PART_CHANNELS: string[]
= [
  'left_face',
  'right_face',
  'left_upper_arm_front',
  'left_upper_arm_back',
  'right_upper_arm_front',
  'right_upper_arm_back',
  'left_lower_arm_front',
  'left_lower_arm_back',
  'right_lower_arm_front',
  'right_lower_arm_back',
  'left_hand',
  'right_hand',
  'torso_front',
  'torso_back',
  'left_upper_leg_front',
  'left_upper_leg_back',
  'right_upper_leg_front',
  'right_upper_leg_back',
  'left_lower_leg_front',
  'left_lower_leg_back',
  'right_lower_leg_front',
  'right_lower_leg_back',
  'left_feet',
  'right_feet'];

/**
 * @license See the LICENSE file.
 */
// This code is auto-generated, do not modify this file!
const version = '2.2.0';
export { version };

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 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
 * See the License for the specific language governing permissions and
 * limitations under the License.
 */

=====

```

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*/\n\nexport {BodyPix, load} from './body_pix_model';\nexport {blurBodyPart, drawBokehEffect, drawMask, drawPixelatedMask, toColoredPartMask, toMask} from './output_rendering_util';\nexport {PART_CHANNELS} from './part_channels';\nexport {PartSegmentation, PersonSegmentation, SemanticPartSegmentation, SemanticPersonSegmentation} from './types';\nexport {flipPoseHorizontal, resizeAndPadTo, scaleAndCropToInputTensorShape} from './util';\nexport {version} from './version';\n\n", "names": ["tf.argmax", "tf.reshape", "tf.oneHot", "tf.mul", "tf.tidy", "tf.cast", "tf.greater", "tf.scalar", "tf.expandDims", "tf.range", "tf.matmul", "tf.add", "tf.sub", "tf.util", "tf.squeeze", "tf.sigmoid", "tf.div", "tf.tensor", "tf.backend", "tf.equal", "getBackend", "tf.engine", "tf.Tensor", "tf.browser", "tf.image", "tf.reverse", "tf.pad3d", "tfconv.loadGraphModel"], "mappings": ";;;;;;IAAA;;;;;;AAiBA,IAEA;;;;;IAMA,SAAS,wBAAwB,CAAC,iBAA8B;QAC9D,IAAM,QAAQ,GAAG,iBAAiB,CAAC,KAAC,CAAC,CAAC,CAAC,CAAC;QAC5C,IAAM,gBAAgB,GAAGA,SAAS,CAAC,iBAAiB,EAAE,CAAC,CAAC,CAAC;QAEzD,IAAM,gBAAgB,GAAGC,UAAU,CAAC,gBAAgB,EAAE,CAAC,CAAC,CAAC,CAAC,CAAC,CAAC;QAE5D,OAAOC,SAAS,CAAC,gBAAgB,EAAE,QAAQ,CAAQ,CAAC;IAC9D,CAAC;IAED,SAAS,YAAI,CAAC,KAkB,EAAE,IAAiB;QACzD,OAAOC,MAAM,CAAC,KAAC,EAAE,IAAI,CAAC,CAAC;IAC7B,CAAC;IAED;;;;;AAAA,aAAgB,YAAI,CACxB,AAA0B,EAAE,SAAiB;QAC/C,OAAOC,OAAO,CACV;YACI,OAAOC,OAAO,CAACC,UAAU,CACf,AAaA,EAAEC,SAAS,CAAC,SAAS,CAAC,CAAC,EAAE,OAAO,CAAiB;SAAA,CAAC,CAAC;IAC9E,CAAC;IAED;;;;;;AAeA,aAAgB,sBAAsB,CACIC,gBAA6B,EAC7B,iBAA8B;QAC1B,IAAA,KAA0C,iBAAiB,CAAC,KAAC,EAAhE,AAaA,QAAA,EAAE,YAAI,QAAA,EAAE,QAAQ,QAA2B,CAAC;QACxE,OAAOH,OAAO,CAAC;YACb,IAAM,YAAI,GAAG,wBAAwB,CAAC,iBAAiB,CAAC,CAAC;YACjE,IAAM,WAAW,GAAGI,AAaA,CAACC,QAAQ,CAAC,CAAC,EAAE,QAAQ,EAAE,CAAC,EAAE,OAAO,CAAC,EAAE,CAAC,CAAC,CAAC;YAExE,IAAM,gBAAgB,GACIBJ,OAAO,CAACK,SAAS,CAAC,YAAI,EAAE,WAA0B,CAAC,EAAE,OAAO,CAAC,CAAC;YAE1E,IAAM,OAAO,GAAGT,UAAU,CAAC,gBAAgB,EAAE,CAAC,AAaA,EAAE,YAAI,CAAC,CAAC,CAAC;YAE5E,IAAM,2BAA2B,GAAGU,MAAM,CAAC,OAAO,EAAEJ,SAAS,CAAC,CAAC,EAAE,OAAO,CAAC,CAAC,CAAC;YAE3E,OAAOK,MAAM,CAAC,YAAI,CACf,2BAA0C,EAAE,gBAAgB,CAAC,EACIEL,SAAS,CAAC,CAAC,EAAE,OAAO,CAAC,CAAC,CAAC;SAC9B,CAAC,CAAC;IACL,CAAC;AAED,AAAgB,0BAA0B,CAAC,iBAA8B;QAEjE,IAAA,KAA0C,iBAAiB,CAAC,KAAC,EAAhE,AAaA,QAAA,EAAE,YAAI,QAAA,EAAE,QAAQ,QAA2B,CAAC;QACxE,OAAOH,OAAO,CAAC;YACb,IAAM,YAAI,GAAG,wBAAwB,CAAC,iBAAiB,CAAC,CAAC;YACjE,IAAM,WAAW,GAAGI,AAaA,CAACC,QAAQ,CAAC,CAAC,EAAE,QAAQ,EAAE,CAAC,EAAE,OAAO,CAAC,EAAE,CAAC,CAAC,CAAC;YAExE,IAAM,gBAAgB,GACIBJ,OAAO,CAACK,SAAS,CAAC,YAAI,EAAE,WAA0B,CAAC,EAAE,OAAO,CAAC,CAAC;YAE1E,OAAOT,UAAU,CAAC,gBAAgB,EAAE,CAAC,AAaA,EAAE,YAAI,CAAC,CAAC,CAAC;SACpE,CAAC,CAAC;IACL,CAAC;;IC1GD;;;;;;AAkBA,IAGA;;;;;;IASA;QACE,mBACuB,KAAwB,EAC3B,YAAiC;YAD9B,UAAK,GAAL,KAAC,CAAmB;YAC3B,iBAAI,GAAG,YAAI,CAAqB;YACnD,IAAM,UAAU,GACZ,IAAI,CAAC,KAAC,CAAC,MAAM,CAAC,CAAC,CAAC,CAAC,KAAY,CAAC;YACnEY,OAAO,CAAC,MAAM,CACV,CAAC,UAAU,CAAC,CAAC,CAAC,KAAC,CAAC,MAAM,UAAU,CAAC,CAAC,CAAC,KAAC,CAAC,CAAC,CAAC,EACHD,cAAM,OAAA,kBAAgB,UAAU,CAAC,CAAC,CAAC,UAAK,UAAU,CAAC,CAAC,CAAC,OAAI;gBACrD,6BAA6B,GAAA,CAAC,CAAC;SACxC;;;;;;QAsBD,2BAAO,GAAP,UAAQ,KAakB;YAA1B,iBA4BC;YAIbc,OAAOT,OAAO,CAAC;gBACb,IAAM,OAAO,GAAG,KAAL,CAAC,eAAe,CAACC,OAAO,CAAC,KAAC,EAAE,SAAS,CAAC,CAAC,CAAC;gBAChE,IAAM,OAAO,GAAGG,AAaA,CAAC,OAAO,EAAE,CAAC,CAAC,CAAC;gBAC1C,IAAM,OAAO,GAAG,KAAL,CAAC,KAAC,CAAC,OAAO,CAAC,OAAO,CAakB,CAAC;gBAC7D,IAAM,SAAS,GAakB,OAAO,CAAC,GAAG,CAAC,UAAA,CAAC,IAAI,OAAAM,UAAU,CAAC,CAAC,EAAE,CAAC,CAAC,CAAC,CAAC,GAAA,CAAC,CAAC;gBACtE,IAAM,YAAI,GAAG,KAAL,CAAC,iBAAiB,CAAC,SAAS,CAAC,CAAC;gBAEvD,OAAO;oBACL,AAaA,EAAEC,UAAU,CAAC,YAAI,CAAC,OAAO,CAAC;oBAC/C,OAAO,EAAE,YAAI,CAAC,OAAO;oBAC7B,eAAe,EAAE,YAAI,CAAC,eAAe;oBAC7C,eAAe,EAAE,YAAI,CAAC,eAAe;oBAC7C,YAAI,EAAE,YAAI,CAAC,YAAI;oBACvC,YAAI,EAAE,YAAI,CAAC,YAAI;oBACvC,WAAW,EAAE,YAAI,CAAC,WAAW;oBACrC,WAAW,EAAE,YAAI,CAAC,WAAW;iBACtC,CAAC;aACH,CAAC,CAAC;SACJ;;;QakBD,2BAAO,GAAP;YACE,IAAI,CAAC,KAAC,CAAC,OAAO,EAAE,CAAC;SACtB;QACH,gBAAC;IAAD,CAAC,IAAA;;IChHD;;;;;;IAqBA;QAA+B,6BAAS;QAAxC;;S
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No license file was found, but licenses were detected in source scan.

```
/**
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tX","drawOffsetVectors","offsetPoints","singlePose","heatmapData","offsetPointsData","rainbow","warm","spectral","stats","Stats","state","video","stream","net","videoConstraints","changingArchitecture","changingMultiplier","changingStride","changingResolution","changingQuantBytes","getVideoInputs","mediaDevices","enumerateDevices","console","videoDevices","filter","device","kind","stopExistingVideoCapture","srcObject","getTracks","track","stop","getDeviceIdForLabel","cameraLabel","videoInputs","videoInput","deviceId","getFacingMode","toLowerCase","includes","getConstraints","facingMode","setupCamera","getUserMedia","videoElement","resolve","onloadedmetadata","videoWidth","videoHeight","loadVideo","info","play","defaultQuantBytes","defaultMobileNetMultiplier","defaultMobileNetStride","defaultMobileNetInternalResolution","defaultResNetMultiplier","defaultResNetStride","defaultResNetInternalResolution","guiState","algorithm","estimate","camera","input","internalResolution","multiPersonDecoding","numKeypointForMatching","refineSteps","segmentation","segmentationThreshold","effect","maskBackground","backgroundBlurAmount","maskBlurAmount","edgeBlurAmount","partMap","colorScale","blurBodyPartAmount","bodyPartEdgeBlurAmount","showFps","toCameraOptions","cameras","default","setupGui","dat","architectureController","changingCamera","algorithmController","addFolder","outputStrideController","updateGuiOutputStride","outputStrideArray","internalResolutionController","updateGuiInternalResolution","internalResolutionArray","multiplierController","updateGuiMultiplier","multiplierArray","quantBytesController","updateGuiInputSection","updateGuiQuantBytes","quantBytesArray","open","estimateController","segmentationEffectController","darknessLevel","bokehBlurAmount","close","singlePersonDecoding","effectType","partColorScales","setShownPartColorScales","estimationType","colors","partColors","bodyPix","PART_CHANNELS","partColor","child","setupFPS","showPanel","estimateSegmentation","segmentMultiPerson","segmentPerson","multiPersonSegmentation","estimatePartSegmentation","segmentMultiPersonParts","segmentPersonParts","multiPersonPartSegmentation","drawPoses","personOrPersonPartSegmentation","flipHorizontally","personSegmentation","pose","allPoses","loadBodyPix","segmentBodyInRealTime","bodySegmentationFrame","begin","foregroundColor","backgroundColor","mask","toMask","drawMask","drawBokehEffect","coloredPartImageData","toColoredPartMask","pixelCellWidth","drawPixelatedMask","blurBodyPartIds","blurBodyPart","end","bindPage","webkitGetUserMedia","mozGetUserMedia"],"mappings": "AyDGA,aAAA,OAAA,eAAA,QAAA,aAAA,CAAA,OAAA,IAAA,QAAA,aAAA,EAAA,MAAM,EAU,QAAhB,QAAA,QAAgB;AzDoJf,aAAA,OAAA,eAAA,QAAA,aAAA,CAAA,OAAA,IAAA,QAAA,cAAA,QAAA,YAAA,QAAA,gBAAA,QAAA,qBAAA,EAnIM,MAAM,EAakB,KAmI9B,QAAA,gBAAA,EAIIM,MAAM,EAakB,KAKI9B,QAAA,gBAAA,EA1GK,MAAO,EAIX,YAAoB,EAAGC,GAAhC,KAAA,QAAA,EAAGC,KAAA,UAAA,EAH5C,KAAA,KAAO,IAAI,QACX,KAAA,aAAe,EAIvB,IAAI,GAIK,OAHF,KAAK,KAAK,IAAI,IACZ,KAAA,UAAU,SAAS,KAAK,QAAS,GAejC,KAAK,KAAK,IAAI,GAGvB,IAAI,EAAGB,GACb,KAAA,eACA,KAAA,KAAK,IAAI,EAQ,GAGxB,IAAI,GACK,OAAA,KAAK,KAAK,IAAI,GAGvB,OAAO,GAEE,OADF,KAAA,eACE,KAAK,KAAK,OAAO,GAG1B,aACS,OAAA,KAAK,cA8Ef,QAAA,YAAA,EArdK,MAAO,EACX,SAAS,GACA,OAAA,EAakB,YAE3B,OAAO,GACE,OAAA,EAakB,UAE3B,iBACS,OAAA,EAET,KAAK,GACI,OAAA,EAakB,QAE3B,KAAK,GACI,OAAA,EAakB,QAE3B,SAAS,GACA,OAAA,EAakB,YAE3B,aACS,OAAA,EAakB,cAE3B,YAAY,EAAGB,GACnB,OAAA,EAakB,eAE3B,MAAM,EAauB,EAaiB,GACrC,OAAA,EAakB,SAE3B,KACI,EAAGB,EAauB,EAaiB,EACxD,GACK,OAAA,EAakB,QAE3B,SACS,OAAA,EAakB,UAG3B,iBACS,OAAA,EAakB,kBAG3B,UACS,OAA0B,KAA1B,KAAK,iBAA0B,EAakB,EAE1D,UACS,OAAA,EAakB,YAI7B,SAAS,EAakB,GACnB,MAAA,IAAI,UACF,wDACJ,wEACL,QAAA,cAAA;;ACKlBA,aAxSBK,SAAU,EAQ,GAElB,IAAA,EAU,EAAM,OChB,EAAO,EACP,EAQ,EAEL,KAAA,EAU,GAef,EAAS,KAAK,SAAW,EAAW,EAIpC,EAAO,IAFP,GAGA,EAAM,GAAW,EAAM,GACvB,EAAM,GAAS,EAqBb,SAAU,EAaa,EAEP,GAehB,GA AA,EAAM,SAAW,EAAO,OACpB,MAAA,MACJ,4EAC0B,EAAM,oCACL,EAAO,UAEIC,IACA,EAAM,EADN,EA AU,EAAM,OAehB,EAQ,EAEL,KAAA,EAU,GAef,EAAS,KAAK,SAAW,EAAW,EAIpC,EAAO,IAFP,GA GA,EAQ,EA AO,GACf,EAAM,GAAW,EAAM,GACvB,EAAO,GAAW,EAAO,GACzB,EAAM,GAAS,EACf,EA AO,GAAS,EAKd,SAAU,EAAM,EAaa,EA AW,GACrC,OAAA,KAAK,IAAI,EA AK,KAAK,IAAI,EAAG,IAG7B,SAAU,EAakB,GACzB,OAAA,EAAM,GAAM,EA AI,EAAM,EAAM,EAG/B,SAAU,EA AI,GACd,IAAA,EAAM,EA CL,IAAA,IAAI,EA AI,EAAG,EA AI,EA AI,OAAQ,IAC9B,GAAO,EA AI,GAEN,OAAA,EAUH,SAAU,EAAY,EA AW,GAC/B,MAAA,EA AI,KAAK,SACP,OAAA,EA AI,GAAM,EA AI,GA AK,EAIvB,SAAU,EAAY,EA Ae,GAC rC,IAAA,EAAS,EACR,IAAA,IAAI,EA AI,EAAG,EA AI,EA AE,OAAQ,IA AK,CAC3B,MAAA,EAAO,OAAO,EA

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D,GAFa,EAaK,EAAY,EAAA,eAAiB,EAaI,GAAM,GAG5C,GAFa,EAaK,EAAY,EAAA,eAAiB,EAaI,EAaK,GAaK,GAKID,MAAO,CAAC,EAAC,EAaE,EAAC,GAGd,SAAS,EAcl,EAaGB,EAa2B,EAC3C,EAa2B,EAC3B,EAa0C,EACpC,EAaM,C,EAACn,C,GAKF,QAR8B,EAAA,EAAA,GAAM,EAAA,EAAA,GACjC,EAAA,EAAA,GAAQ,EAAA,EAAA,GACR,EAAA,EAAA,GAAQ,EAAA,EAAA,GAEL,EAaGB,GACbB,EAa0B,SAAC,GACvB,OAAA,EAAYB,EAAM,CAAC,EAAM,GAaO,CAAC,EAaQ,GAAS,IAE1D,EAaIb,EAAG,EAaIb,EACzC,IAAkB,CACrB,IAAM,EAAY,EACd,EAaU,EAaGB,EAaMB,EAC7C,EAaA,EAaA,CAAC,EAaQ,IAEvC,EAAM,KAaK,GAKb,IAFA,IAAI,GAAQ,EACR,EAaW,EAAA,EACN,EAaI,EAAG,EAaI,EAAM,OAAQ,IAAK,CACrC,IAAM,EAaO,EAaGB,EAaO,EAAM,IACtC,EAaO,IACt,EAAO,EACP,EAaW,GAGf,OAAO,EAGT,SAAS,EACL,EACA,OADC,EAAA,EAAA,GAaKB,EAAA,EAAA,GAIrB,MAAO,CAFMb,KAaK,OAAO,EAaMB,GAaO,EAAS,GAC/C,KAaK,OAAO,EAaMB,GAaO,EAAS,IAI3E,SAaGB,EACZ,EAa0B,EAC1B,EAAYB,EAaGB,EAae,EACxD,EAaUc,EACvC,EAaQB,OADpB,EAAA,EAAA,GAaU,EAAA,EAAA,QACU,IAAA,IAAA,EAAA,GAUvB,IATA,IAAM,EACF,EAaGB,IAAI,SAAA,GAaK,OAAA,IAAI,WAAW,EAAS,GAaO,KAaK,KAElD,EAaA,EAAA,IAAW,EAAA,EAAA,KAeZ,EAAA,EAAA,SAAA,CAAA,EAAA,GAAA,CAAA,EAAA,GAAA,GAAC,EAAA,EAAA,GAAQ,EAAA,EAAA,GAER,EAAA,EAAA,CAAA,EAAA,GAAA,GAAA,GAEE,EAaI,EAAG,EAaI,EAaQ,GAaK,EAC/B,IAAK,IAAI,EAaI,EAAG,EAaI,EAaO,GAaK,EAAG,CACjC,IAAM,EAaI,EAaI,EAaQ,EAETb,GAaA,IADA,EAaA,GACV,CACd,IAAM,EAaO,EACT,CAAC,EAAG,EAAG,EAAG,GAaI,EAaA,EAaIb,EAC5C,CAAC,EAAM,GAaO,CAAC,EAaQ,GAAS,EAaMB,CAAC,EAaQ,GAC5D,EAaQ,GACR,GAaQ,IAcV,EAaW,GAAM,GAaK,IAM9B,OAAO,EAGT,SAaGB,EACZ,EAa0B,EAC1B,EAa6B,EAAYB,EACtD,EAaE,EAaGB,EAC/B,EAaKB,EACIB,OAFgC,EAAA,EAAA,GAaU,EAAA,EAAA,QAE1C,IAAA,IAAA,EAAA,GAWF,IAVA,IAAM,EACF,EAaGB,IAAI,SAAA,GAaK,OAAA,IAAI,WAAW,EAAS,GAaO,MAAM,KAe3D,EAaA,EAAA,IAAW,EAAA,EAAA,KAeZ,EAAA,EAAA,SAAA,CAAA,EAAA,GAAA,CAAA,EAAA,GAAA,GAAC,EAAA,EAAA,GAAQ,EAAA,EAAA,GAER,EAAA,EAAA,CAAA,EAAA,GAAA,GAAA,GAGE,EAaI,EAAG,EAaI,EAaQ,GAaK,EAC/B,IAAK,IAAI,EAaI,EAAG,EAaI,EAaO,GAaK,EAAG,CACjC,IAAM,EAaI,EAaI,EAaQ,EAETb,GAaA,IADA,EAaA,GACV,CACd,IAAM,EAaO,EACT,CAAC,EAAG,EAAG,EAAG,GAaI,EAaA,EAaIb,EAC5C,CAAC,EAAM,GAaO,CAAC,EAaQ,GAAS,EAaMB,CAAC,EAaQ,GAC5D,EAaQ,GACR,GAaQ,IAcV,EAaW,GAAM,GAaK,EAaGB,KAM9C,OAAO,EAjET,QAAA,uBAAA,EAiCA,QAAA,2BAAA;;oECiA,IAAA,EAAA,QAAA,yBAGA,EAAA,QAAA,gBAEA,EAAA,QAAA,UAEA,SAaGB,EACZ,EAa2B,EAC3B,EAAYB,EAaGB,EAaE,EACxD,EAaUc,EACvC,EAaQB,EACrB,GAaF,QAFg,EAAA,EAAA,GAaU,EAAA,EAAA,GAIP,EAAA,EAAA,MAAC,EAAA,EAAA,GAAY,EAAA,EAAA,GAEB,EAAA,EAAA,MAAA,MAAA,EAAA,GAAC,EAAA,EAAA,GAaW,EAAA,EAAA,GAeZ,EACF,EAAG,QAAQ,EAaA,CAAC,EAaW,EAaU,EAAG,EAaA,gBAK/C,EAaW,IAAI,aAAa,EAaE,EAAA,cAAgB,GAAG,KAaK,GACHE,EAaI,EAAG,EAaI,EAaGB,OAAQ,IAG1C,IAFA,IAAM,EAaA,EAaI,EAAA,cAAgB,EACjC,EAaO,EAaGB,GACpB,EAaK,EAAG,EAaK,EAAA,cAAE,IAAM,CACzC,IAAM,EAaW,EAaK,UAAU,GAC1B,EAAS,EAaKB,EAAL,EAC5B,EAAS,GAaU,EAAS,MAC5B,EAAS,EAAS,GAaK,EAAS,SAAS,EACzC,EAAS,EAAS,GAaK,EAAS,SAAS,EAIVc,IAAA,EAAA,EAaA,SAAA,CAAA,EAAA,GAAA,CAAA,EAAA,GAAA,GAAC,EAAA,EAAA,GAAQ,EAAA,EAAA,GAGT,EAac,EAAG,OAAO,EAaU,CAAC,EAaC,EAAA,cAAE,IAE/D,EAAA,EAAA,IAAW,EAAA,EAAA,KAeZ,EAaIC,CACrC,cAAE,CAAC,eAAgB,cAAE,SAC/C,YAAa,CAAC,EAAY,GAC1B,SAaU,gyCAcSd,EAaI,KAaK,EAAM,KAaK,EAAM,0EAElB,EAaI,KAaK,EAAM,KAaK,EAAM,2FAIX,EAAY,mGAGV,EAAA,cAAa,6PAOX,EAaW,4DACK,EAAS,GAAG,wDACZ,EAaQ,GAAG,iGAGjC,EAaI,KAaK,EAAM,KAaK,EAAM,6FAElB,EAaI,KAaK,EAAM,KAaK,EAAM,wXAYxB,EAaW,ifAqBrC,OADqB,EAAG,UACJ,cAChB,EAAS,CAAC,EAaC,EAaMB,IAvIjD,QAAA,yBAAA;;k6CCPA,IAAA,EAAA,QAAA,yBACA,EAAA,QAAA,yBAIA,EAAA,QAAA,+BACA,EAAA,QAAA,iCAEA,SAaGB,EACZ,EAa2B,GAC7B,OAAO,EAAG,KACN,WAAM,OAAO,EAAG,KAaK,EAAG,MACd,EAaC,EAAG,OAAO,IAAK,WAGvC,SAaGB,EACZ,EAa2B,EAawB,GACrD,OAAO,EAAG,KACN,WAAM,OAAA,EAAG,IAAI,EAAG,IAAI,EAAG,KAaK,EAAG,MAC3B,EAaC,EAAG,OAAO,IAAK,SAaU,EAAG,IAAI,EAaW,IAAK,KAGxE,SAAS,IACP,MAawB,UAAjB,EAAA,aAGT,SAASB,EACIB,EAa2B,EAa0B,EACrD,EAaGB,EAaE,EAC/B,EAaUc,EAaKB,EACzD,EAaIb,EACjB,OAFc,EAAA,EAAA,GAaU,EAAA,EAaA,eAA8C,IAAA,IAAA,EAAA,SACzD,IAAA,IAAA,EAAA,QAAIb,IAAA,IAAA,EAAA,SACjB,IAAA,IAAA,EAaA,0GAEl,EAaKB,EAAM,OAAO,SAAA,GAAQ,OAAA,EAaK,OAAS,IAIVd,KACI,EAASB,EAAG,KAaK,WA

CIC,IAAM,EAakB,EAAA,yBACpB,EAac,EAAa,EAAiB,EAAQ,EAAO,EAC3D,CAAC,EAAU,GAAU,EAAS,EAAa,EAC3C,GACE,EAac,EAAG,SAAS,qBAC5B,EAagB,OAAQ,EAagB,MACxC,EAagB,OAEpB,OAAO,EAagB,IACnB,SAAC,EAAG,GAAM,OAAA,EAAsB,EAAa,OAI9C,CAAA,EAAM,QAAQ,IAAI,EAAoB,IAAI,SAAA,GAAQ,OAAA,EAak,YAf1D,CAAA,EAAA,iBacF,EACK,EAAA,OAGL,EAAoB,QAAQ,SAAA,GAak,OAAA,EAAE,yBAET,MAAA,CAAA,EAAM,EAAa,eACrB,OADIB,EAAoB,EAAA,OACF,CAAA,EAAM,EAAY,eAApC,EAakB,EAAA,OAExB,EAA0B,EAAA,uBACtB,EAAMB,EAAiB,EAAiB,EAAQ,EAC7D,EAAQ,CAAC,EAAU,GAAU,EAAS,oBAG5C,MAAA,CAAA,EAAO,EAAwB,IAC3B,SAAC,EAAM,GAAM,MAAA,CAAE,KAAI,EA AE,KAAM,EAagB,GAAL,MAAK,EAAE,OAAM,WAGIE,SAAsB,EACIB,EAA2B,EAC3B,EAA+B,EAAe,EAagB,EAC9D,EAagB,EAauC,EACvD,EAAoB,EAAiB,EACrC,OAFiB,EAAA,EAAA,GAAU,EAAA,EAAA,eAC3B,IAAA,IAAA,EAAA,SAAoB,IAAA,IAAA,EAAA,QAAiB,IAAA,IAAA,EAAA,SACrC,IAAA,IAAA,EAAA,4GACI,EAakB,EAAM,OAAO,SAAA,GAAQ,OAAA,EAak,OAAS,IAIvD,KACI,EAAoB,EAAG,KAAK,WACHC,IAAM,EAakB,EAAA,yBACpB,EAac,EAAa,EAAiB,EAAQ,EAAO,EAC3D,CAAC,EAAU,GAAU,EAAS,EAAa,EAC3C,GACE,EAac,EAAG,SAAS,qBAC9B,EAagB,OAAQ,EAagB,MACxC,EAagB,OAEIB,OAAO,EAagB,IACnB,SAAC,EAAG,GACA,OAAA,EAA0B,EAAa,EAakB,OAI9D,CAAA,EAAM,QAAQ,IAAI,EAakB,IAAI,SAAA,GAAK,OAAA,EAAE,YAhBID,CAAA,EAAA,iBAeF,EACK,EAAA,OAGL,EAakB,QAAQ,SAAA,GAak,OA AA,EAAE,yBAEP,MAAA,CAAA,EAAM,EAAa,eACrB,OADIB,EAAoB,EAAA,OACF,CAAA,EAAM,EAAY,eACd,OADtB,EAakB,EAAA,OACI,CAAA,EAAM,EAAiB,eAA7C,EAAsB,EAAA,OAE5B,EAagC,EAAA,2BAC5B,EAAMB,EAAiB,EACpC,EAAiB,EAAQ,EAAO,EAAQ,CAAC,EAAU,GAAU,EAC7D,oBAGN,MAAA,CAAA,EAAO,EAA8B,IACjC,SAAC,EAAM,GAAM,MAAA,CAAE,KAAM,EAagB,GAAL,KAAI,EA AE,OAAM,EA AE,MAAK,WAvGIE,QAAA,sBAAA,EAOA,QAAA,0BAAA,EAWA,QAAA,0BAAA,EA2CA,QAAA,8BAAA;;aCIEA,SAAS,EAak,GACZ,OAAO,KAAK,MAAM,EAAL,0DAGxB,IAAA,EAAA,WAKE,SAAA,EAAY,EAAiB,GAC3B,KAAK,cAAgB,IAAI,MAAM,GAC/B,KAAK,kBAAoB,EACzB,KAAK,gBAakB,EAkE3B,OA/DS,EAAA,UAAA,QAAP,SAAe,GACb,KAAK,gBAagB,KAAK,kBAAoB,EAC9C,KAAK,KAAK,KAAK,mBAGV,EAAA,UAAA,QAAP,WACE,IAAM,EAAM,KAAK,cAAc,GAI/B,OAHA,KAAK,SAAS,EAAG,KAAK,oBACtB,KAAK,KAAK,GACV,KAAK,cAAc,KAAK,iBAAMB,GAak,KACzC,GAGF,EAAA,UAAA,MAAP,WACE,OAAkC,IAA3B,KAAK,kBAGP,EAAA,UAAA,KAAP,WACE,OAAO,KAAK,iBAAMB,GAG1B,EAAA,UAAA,IAAP,WACE,OAAO,KAAK,cAAc,MAAM,EAAG,KAAK,iBAAMB,IAGtD,EAAA,UAAA,IAAP,WACE,OAAO,KAAK,cAAc,IAGpB,EAAA,UAAA,KAAR,SAAa,GACX,KAAO,EAAL,GAak,KAAK,KAAK,EAak,GAAL,IACjC,KAAK,SAAS,EAAG,EAak,IACtB,EAAL,EAak,IAIL,EAAA,UAAA,KAAR,SAAa,GACX,KAAO,EAAL,GAak,KAAK,kBAakB,CACrC,IAAL,EAAL,EAAL,EAIZ,GAHI,EAAL,KAAK,kBAAoB,KAAK,KAAK,EAAG,EAAL,IACHD,KAEG,KAAK,KAAK,EAAG,GACHb,MAEF,KAAK,SAAS,EAAG,GACjB,EAAL,IAIA,EAAA,UAAA,WAAR,SAAMb,GACjB,OAAO,KAAK,gBAagB,KAAK,cAAc,KAGzC,EAAA,UAAA,KAAR,SAAa,EA AW,GACTb,OAAO,KAAK,WA AW,GAak,KAAK,WA AW,IAGtC,EAAA,UAAA,SAAR,SAAiB,EA AW,GAC1B,IAAM,EAAL,KAAK,cAAc,GAC7B,KAAK,cAAc,GAak,KAAK,cAAc,GAC3C,KAAK,cAAc.GAAK,GAE5B,EA1EA,GAAa,QAAA,QAAA;;oECLb,IAAA,EAAA,QAAA,cAEA,SAAS,EA CL,EAAoB,EAAe,EAakB,EACrD,EAA4B,GAM9B,IALM,IAAA,EAAA,EAAA,MAAC,EAAA,EAAA,GAAQ,EAAA,EAAA,GAEX,GAAe,EACb,EAAS,KAAK,IAAI,EA AW,EA AoB,GACjD,EAAO,KAAK,IAAI,EA AW,EAaqB,EAAG,GACHd,EA AW,EA AQ,EA AW,IAAQ,EA AU,CAGvD,IAFA,IAAM,EAAS,KAAK,IAAI,EA AW,EA AoB,GACjD,EAAO,KAAK,IAAI,EA AW,EAaqB,EAAG,GACHd,EA AW,EA AQ,EA AW,IAAQ,EAC7C,GAAL,EAAO,IAAI,EA AU,EA AU,GAAC,EAAO,CACtD,GAAe,EACf,MAGJ,IAAK,EACH,MAIJ,OAAO,EAQT,SAAGB,EACZ,EA AWB,EACxB,GAMF,IALM,IAAA,EAAA,EAAA,MAAC,EA AA,EAAA,GAAQ,EAAA,EAAA,GA AO,EAAA,EAAA,GAehB,EA AQ,IAAI,EAAA,QACd,EAAS,EA AQ,EAAC,SAAC,GAAY,OAAX,EAAA,QA E5B,EA AW,EA AG,EA AW,IAAU,EAC1C,IAAK,IAAI,EA AW,EA AG,EA AW,IAAS,EACzC,IAAK,IAAI,EAAa,EAAG,EAAa,IAAgB,EAAY,CACH,E,IAAM,EA AQ,EAAO,IAAI,EA AU,EA AU,GAIZc,EA AQ,GAKR,EACI,EAAY,EAAO,EA AU,EA AU,EACvC,IACN,EAAM,QAAQ,CAAC,MAAK,EAAE,KAAAM,CAAC,SAAQ,EAAE,SAAQ,EAAE,GAAL,KAM7D,OAAO,EA7BT,QAAA,wBAAA;;oECICA,IAAA,EA AA,QAAA,gBAGA,EAAA,QAAA,UACA,EAAA,QAAA,UAEM,EAAsC,EAAA,WA AW,IACnD,SAAC,OAAC,EA AA,EAAA,GAAGB,EAAA,EAAA,GACd,MAAA,CAAE,EAAA,SAAS,GAAiB,EAAA,SAAS,MAEvC,EACF,EA AqB,IAAI,SAAC,GAaqB,OAALB,EAAA,KAE3B,EACF,EAaqB,IAAI,SAAC,GAEK,OADJ,EAAA,KAG/B,SAA

S,EA CL,EAAGB,EA AiB,GACnC,IAAM,EA AW,EA Ac,MAAM,GA AK,EAC1C,MAAO,CACL,EAAG,EA Ac,IAA I,EAAM,EAAG,EAAM,EAAG,GACvC,EAAG,EA Ac,IAAI,EAAM,EAAG,EAAM,EAAG,EA AW,IAItD,SAAS,E ACL,EA AiB,EAAsB,EACvC,GACF,MAAO,CACL,EAAG,EAAA,MAAM,KAAK,MAAM,EAAM,EA AI,GAAe, EAAG,EAAS,GACzD,EAAG,EAAA,MAAM,KAAK,MAAM,EAAM,EA AI,GAAe,EAAG,EAAQ,IAW5D,SAAS, EA CL,EAAGB,EA A0B,EAC1C,EA A8B,EA AyB,EACvD,EA A+B,QAAA,IAAA,IAAA,EAAA,GAYjC,IAXM,IA AA,EAAA,EAAA,MAAC,EAAA,EAAA,GAAQ,EAAA,EAAA,GAMT,EACF,EAAGB,EAJU,EAC1B,EA Ae,SAA U,EA Ac,EAAQ,GAGA,GAG/C,EADmB,EAAA,WAAW,EA Ae,SAAU,GAEID,EA AI,EAAG,EA AI,EA AkB,IAA K,CACzC,IAAM,EACF,EA AyB,EAAGB,EA Ac,EAAQ,GAE7D,EA Ac,EAAA,eAChB,EAAsB,EAAG,EAAsB,EA AG,EACID,GAEJ,EA AiB,EAAA,WACb,CACE,EAAG,EAAsB,EA AI,EAC7B,EAAG,EAAsB,EA AI,GAE/B,CAA C,EAAG,EAAY,EAAG,EAAG,EAAY,IAExC,IAAM,EACF,EA AyB,EAAGB,EA Ac,EAAQ,GAC7D,EAAQ,EA Aa ,IACvB,EAAsB,EAAG,EAAsB,EAAG,GAEtD,MAAO,CAAC,SAAU,EAAGB,KAAM,EAAA,WAAW,GAAmB, MA AK,GAS7E,SAAGB,EACZ,EA AqB,EA AwB,EAC7C,EAAsB,EACtB,GACF,IAAM,EA AW,EA AO,MAAM,G ACxB,EA AW,EA AmB,OAE9B,EA AgC,IAAI,MAAM,GAEzC,EAAA,EAAA,KAAgB,EAAA,EAAA,MACjB,EA AY,EAAA,eAAe,EAAU,EA Ac,GAEzD,EA AkB,EAAS,IAAM,CAC/B,MAAO,EACP,KAAM,EAAA,WAAW,EA AS,IAC1B,SAAU,GAKZ,IAAK,IAAI,EAAO,EA AW,EAAG,GAAQ,IAAK,EAAM,CAC/C,IAAM,EA AmB,EA mB,GACtC,EA AmB,EA AmB,GACxC,EA AkB,KACjB,EA AkB,KACrB,EA AkB,GAAoB,EACIC,EAAM,EA AkB, GAAmB,EA AkB,EAC7D,EAAS,EA Ac,IAM/B,IAAS,EAAO,EAAG,EAAO,IAAY,EAAM,CACpC,EA AmB,EA mB,GACtC,EA AmB,EA AmB,GACxC,EA AkB,KACjB,EA AkB,KACrB,EA AkB,GAAoB,EACIC,EAAM,EA AkB, GAAmB,EA AkB,EAC7D,EAAS,EA Ac,IAI/B,OAAO,EA5CT,QAAA,WAAA;;oECrFA,IAAA,EAAA,QAAA,iCA CA,EAAA,QAAA,iBACA,EAAA,QAAA,UAEA,SAAS,EA CL,EA Ae,EA A0B,EACzC,OAD0C,EAAA,EAAA,EA AG,EAAA,EAAA,EAE/C,OAAO,EAAM,KAAK,SAAC,OACX,EADY,EAAA,UACsB,GAAY,SACpD,OAAO,E AAA,gBACI,EAAG,EAAG,EAAsB,EAAG,EAAsB,IAC5D,IAQR,SAAS,EA CL,EA AuB,EACvB,GAUF,OATkC, EA AkB,OACHD,SAAC,EAAQ,EA AmB,OAI/B,EAAA,EAAA,SAAU,EAAA,EAAA,MAKIB,OAJK,EACG,EA Ae,EA AkB,EAAU,KACjD,GAAU,GAEL,GACN,GAE+B,EA AkB,OAM1D,IAAM,EAAsB,EAyD5B,SAAGB,EACZ ,EA A8B,EAC9B,EACA,EA AwC,EACxC,EA A2B,EAAsB,QAAtB,IAAA,IAAA,EAAA,SAAsB,IAAA,IAAA,EA A A,IAUnD,IATA,IAAM,EAAGB,GA EhB,EAAQ,EAAA,wBACV,EAAGB,EA AqB,GAEnC,EA AmB,EAAY,EAI9B, EAAM,OAAS,IAAsB,EAAM,SAAS,CAEzD,IAAM,EAAO,EAAM,UAOnB,IAAI,EACI,EAAO,EAFX,EAAA,eA Ae,EA AK,KAAM,EA Ac,GAEM,EA AK,KAAK,IAD5D,CAMA,IAAM,EAAY,EAAA,WACd,EAAM,EA Ac,EA Ae,EA Ac,EACjD,GAEE,EAAQ,EA AiB,EAAO,EA AkB,GAExD,EAAM,KAAK,CAAC,UAAS,EA AE,MAAK,KAG 9B,OAAO,EA tCT,QAAA,oBAAA;;yaChGA,IAAA,EAAA,QAAA,yBAEA,EAAA,QAAA,gBAEM,EA Ae,EA AE, QAAS,OAAS,QAEzC,EAAA,SAAA,GAAA,SAAA,mDA2BA,OA3B4B,EAAA,EAAA,GAC1B,EAAA,UAAA,gB AAA,SAAGB,GACd,OAAO,EAAG,IAAI,EAAO,IAGvB,EAAA,UAAA,kBAAA,SAAKB,GAEd,IAAA,EAAA,EA AA,GACA,EAAA,EAAA,GACA,EAAA,EAAA,GACA,EAAA,EAAA,GACA,EAAA,EAAA,GACA,EAAA,EA A A,GAIF,MAAO,CACL,QAAO,EACP,aALA,EAAA,GAMA,aAAY,EACZ,YAAW,EACX,QAAO,EACP,gBAAe,E ACf,gBAAe,EACf,YAVA,EAAA,KAA N,EA3BA,CAA4B,EAAA,WAAf,QAAA,OAAA;;oECNb,IAAM,EACF,OE ACE,EACF,2EAIJ,SAAGB,EA AmB,EAAGB,GACjD,IAAM,EAAY,eAAe,EAAM,QA EvC,OA AmB,IAAf,EACK, EA AoB,SAAW,EA E/B,EA AoB,QAAQ,EA AU,IAAM,EAMvD,SAAGB,EACZ,EAAGB,EA AoB,GACtC,IAAM,EA AiC,CAAC,EA AK,MAAO,IAAM,MAAO,GAAM,OACjE,EAAY,eAAe,EAAM,QA EvC,OA AmB,IAAf,EACK, EA AqB,SAAS,EAAM,GA AW,IAAM,EA ErD,EA AqB,QAAQ,EA AU,IAAI,EAAM,GA AW,IAC/D,EA rBR,QAAA ,mBAAA,EA YA,QAAA,oBAAA;;o6C3oBIBA,IAAA,EAAA,QAAA,yBAMA,SAAS,EA A4B,GAEnC,GAA2B,IA AvB,EAAM,cAA4C,IAAtB,EAAM,YACpC,MAAO,CAAC,EAAM,aAAc,EAAM,aAC7B,GAAoB,MAAhB,EA A M,QAAiC,MAAf,EAAM,MACvC,MAAO,CAAC,EAAM,OAAQ,EAAM,OAE5B,MAAM,IAAI,MACN,+DAIR,S AAS,EA AwB,GAC/B,OAAI,EAAM,aAAa,WAAa,EAAM,aAAa,SAI9C,CAAC,EAAM,OAAQ,EAAM,OA ErB,C AAC,EAAM,YAAa,EAAM,YAIrC,SAAGB,EAAa,GAC3B,GAAoC,oBAAxB,mBACP,aAAiB,mBACa,oBAAvB,k BACP,aAAiB,iBACpB,OAAO,EA A4B,GAC9B,GAA2B,oBAAhB,WAA+B,aAAiB,UChE,MAAO,CAAC,EA A M,OAAQ,EAAM,OACvB,GAC2B,oBAAvB,kBACP,aAAiB,iBACnB,OAAO,EA AwB,GAC1B,GAAI,aAAiB,EA AG,OAC7B,MAAO,CAAC,EAAM,MAAM,GAAI,EAAM,MAAM,IAEpC,MAAM,IAAI,MAAM,8BAA8B,EA A K,KAIvD,SAAS,EA CL,EA AoB,GACtB,OAAQ,EAAA,GA AK,GAAiB,EAG7C,SAAGB,EACZ,EA AyB,GAC3B,O

AAI,EAuB,EAiB,GACnC,EAGF,KAAK,MAAM,EAakB,GAAgB,EAae,EA9BrE,QAAA,aAAA,EAwBA,QA
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=====\n*/\n\nimport {Backend, DataId} from './tensor';\nimport {BackendValues, DataType} from './types';\n\nexport const EPSILON_FLOAT32 = 1e-7;\nexport const EPSILON_FLOAT16 = 1e-4;\n\nRequired information for all backends.\nexport interface BackendTimingInfo {\n  kernelMs: number | {error:  
string};\n  getExtraProfileInfo?(): string; // a field for additional timing information // e.g.  
packing / unpacking for WebGL backend\n}\n\nexport interface TensorStorage {\n  read(dataId: DataId):  
Promise<BackendValues>;\n  readSync(dataId: DataId): BackendValues;\n  disposeData(dataId: DataId, force?:  
boolean): boolean;\n  write(values: BackendValues, shape: number[], dtype: DataType): DataId;\n  move(\n  dataId: DataId, values: BackendValues, shape: number[], dtype: DataType,\n  refCount: number): void;\n  memory(): {unreliable: boolean}; // Backend-specific information.\n  /** Returns number of data ids currently in
```

```

the storage. */
 numDataIds(): number;
 refCount(dataId: DataId): number;
}

/** Convenient class for
storing tensor-related data. */
export class DataStorage<T> {
  private data = new WeakMap<DataId, T>();
  private dataIdsCount = 0;
  constructor(private backend: KernelBackend, private dataMover: DataMover) {}
  get(dataId: DataId) {
    if (!this.data.has(dataId)) {
      this.dataMover.moveData(this.backend, dataId);
    }
    return this.data.get(dataId);
  }
  set(dataId: DataId, value: T): void {
    this.dataIdsCount++;
    this.data.set(dataId, value);
  }
  has(dataId: DataId): boolean {
    return this.data.has(dataId);
  }
  delete(dataId: DataId): boolean {
    this.dataIdsCount--;
    return this.data.delete(dataId);
  }
  numDataIds():
  number {
    return this.dataIdsCount;
  }
}

export interface DataMover {
  /**
   * To be called by
backends whenever they see a dataId that they don't own.
   * Upon calling this method, the mover will fetch the
tensor from another
   * backend and register it with the current active backend.
   */
  moveData(backend:
  KernelBackend, dataId: DataId): void;
}

export interface BackendTimer {
  // check if backend timer is available
  timerAvailable(): boolean;
  time(f: () => void):
  Promise<BackendTimingInfo>;
}

/** The interface that defines the kernels that should be implemented
when
 * adding a new backend. New backends don't need to implement every one of the
 * methods, this can be
done gradually (throw an error for unimplemented
 * methods). */
export class KernelBackend implements
  TensorStorage, Backend, BackendTimer {
  refCount(dataId: DataId): number {
    return
  notYetImplemented('refCount');
  }
  incRef(dataId: DataId): void {
    return notYetImplemented('incRef');
  }
  timerAvailable(): boolean {
    return true;
  }
  time(f: () => void): Promise<BackendTimingInfo> {
    return notYetImplemented('time');
  }
  read(dataId: object): Promise<BackendValues> {
    return
  notYetImplemented('read');
  }
  readSync(dataId: object): BackendValues {
    return
  notYetImplemented('readSync');
  }
  numDataIds(): number {
    return notYetImplemented('numDataIds');
  }
  disposeData(dataId: object, force?: boolean): boolean {
    return notYetImplemented('disposeData');
  }
  write(values: BackendValues, shape: number[], dtype: DataType): DataId {
    return
  notYetImplemented('write');
  }
  move(
    dataId: DataId, values: BackendValues, shape: number[], dtype:
  DataType,
    refCount: number): void {
    return notYetImplemented('move');
  }
  memory(): {unreliable:
  boolean; reasons?: string[]} {
    return notYetImplemented('memory');
  }
  /** Returns the highest precision for
floats in bits (e.g. 16 or 32) */
  floatPrecision(): 16|32 {
    return notYetImplemented('floatPrecision');
  }
  /** Returns the smallest representable number.
   */
  epsilon(): number {
    return this.floatPrecision() === 32 ?
  EPSILON_FLOAT32 : EPSILON_FLOAT16;
  }
  dispose(): void {
    return notYetImplemented('dispose');
  }
}

function notYetImplemented(kernelName: string): never {
  throw new Error(
    ` ${kernelName} ' not yet implemented or not found in the registry. ` +
    ` This kernel may not be supported
by the tfjs backend you have chosen`);
}

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 */
=====
import {DataType, DataTypeMap, FlatVector, NumericDataType, RecursiveArray, TensorLike, TypedArray}
from
  './types';

/** Shuffles the array in-place using Fisher-Yates algorithm.
   */
const a = [1, 2, 3, 4,
5];
tf.util.shuffle(a);
console.log(a);

@param array The array to shuffle in-place.
@doc
{heading: 'Util', namespace: 'util'}
tslint:disable-next-line:no-any
export function shuffle(array:
any[]|Uint32Array|Int32Array|
Float32Array): void {
  let counter = array.length;
  let temp = 0;
  let index = 0;
  // While there are elements in the array
  while (counter > 0) {
    // Pick a random index
    index = (Math.random() * counter) | 0;
    // Decrease counter by 1
    counter--;
    // And swap the last element with
it
    temp = array[counter];
    array[counter] = array[index];
    array[index] = temp;
  }
}

/** Shuffles

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two arrays in-place the same way using Fisher-Yates algorithm.\n *`js\n * const a = [1,2,3,4,5];\n * const b =
[11,22,33,44,55];\n * tf.util.shuffleCombo(a,
b);\n * console.log(a, b);\n *```\n *\n * @param array The first array to shuffle in-place.\n * @param array2 The
second array to shuffle in-place with the same permutation\n * as the first array.\n *\n * @doc {heading: 'Util',
namespace: 'util'}\n *\n // tslint:disable-next-line:no-any\nexport function shuffleCombo(array:
any[]|Uint32Array|Int32Array|Float32Array,\n // tslint:disable-next-line:no-any\n array2:
any[]|Uint32Array|Int32Array|Float32Array): void {\n\n if (array.length !== array2.length) {\n throw Error(\n
`Array sizes must match to be shuffled together` +\n `First array length was ${array.length}` +\n `Second
array length was ${array2.length}`);\n }\n let counter = array.length;\n let temp, temp2;\n let index = 0;\n //
While there are elements in the array\n while (counter > 0) {\n // Pick a random index\n index = (Math.random()
* counter) | 0;\n // Decrease counter by 1\n counter--;\n // And swap the
last element of each array with it\n temp = array[counter];\n temp2 = array2[counter];\n array[counter] =
array[index];\n array2[counter] = array2[index];\n array[index] = temp;\n array2[index] = temp2;\n
}\n}\n\n/** Clamps a value to a specified range. *\nexport function clamp(min: number, x: number, max: number):
number {\n return Math.max(min, Math.min(x, max));\n}\n\nexport function nearestLargerEven(val: number):
number {\n return val % 2 === 0 ? val : val + 1;\n}\n\nexport function sum(arr: number[]): number {\n let sum =
0;\n for (let i = 0; i < arr.length; i++) {\n sum += arr[i];\n }\n return sum;\n}\n\n/**\n * Returns a sample from a
uniform [a, b) distribution.\n *\n * @param a The minimum support (inclusive).\n * @param b The maximum
support (exclusive).\n *\n * @return A pseudorandom number on the half-open interval [a,b).\n *\nexport function
randUniform(a: number, b: number) {\n const r = Math.random();\n return (b * r) + (1 - r) * a;\n}\n\n/**
Returns the squared Euclidean distance between two vectors. *\nexport function distSquared(a: FlatVector, b:
FlatVector): number {\n let result = 0;\n for (let i = 0; i < a.length; i++) {\n const diff = Number(a[i]) -
Number(b[i]);\n result += diff * diff;\n }\n return result;\n}\n\n/**\n * Asserts that the expression is true.
Otherwise throws an error with the\n * provided message.\n *\n *`js\n * const x = 2;\n * tf.util.assert(x === 2, 'x is
not 2');\n *```\n *\n * @param expr The expression to assert (as a boolean).\n * @param msg A function that returns
the message to report when throwing an\n * error. We use a function for performance reasons.\n *\n * @doc
{heading: 'Util', namespace: 'util'}\n *\nexport function assert(expr: boolean, msg: () => string) {\n if (!expr) {\n
throw new Error(typeof msg === 'string' ? msg : msg());\n }\n}\n\nexport function assertShapesMatch(\n shapeA:
number[], shapeB: number[], errorMessagePrefix = ''): void {\n assert(\n
arraysEqual(shapeA, shapeB),\n () => errorMessagePrefix + `Shapes ${shapeA} and ${shapeB} must
match`);\n}\n\nexport function assertNonNull(a: TensorLike): void {\n assert(\n a != null,\n () => `The input
to the tensor constructor must be a non-null value.`);\n}\n\n// NOTE: We explicitly type out what T extends instead
of any so that\n// util.flatten on a nested array of number doesn't try to infer T as a\n// number[][], causing us to
explicitly type util.flatten<number>().\n\n/**\n * Flattens an arbitrarily nested array.\n *\n *`js\n * const a = [[1, 2],
[3, 4], [5, [6, [7]]]];\n * const flat = tf.util.flatten(a);\n * console.log(flat);\n *```\n *\n * @param arr The nested
array to flatten.\n * @param result The destination array which holds the elements.\n * @param skipTypedArray If
true, avoids flattening the typed arrays. Defaults\n * to false.\n *\n * @doc {heading: 'Util', namespace: 'util'}\n
*\nexport function\nflatten<T extends number|boolean|string|Promise<number>|TypedArray>(\n
arr: T|RecursiveArray<T>, result: T[] = [], skipTypedArray = false): T[] {\n if (result == null) {\n result = [];\n
}\n if (Array.isArray(arr) || isTypedArray(arr) && !skipTypedArray) {\n for (let i = 0; i < arr.length; ++i) {\n
flatten(arr[i], result, skipTypedArray);\n }\n } else {\n result.push(arr as T);\n }\n return result;\n}\n\n/**\n *
Returns the size (number of elements) of the tensor given its shape.\n *\n *`js\n * const shape = [3, 4, 2];\n * const
size = tf.util.sizeFromShape(shape);\n * console.log(size);\n *```\n *\n * @doc {heading: 'Util', namespace: 'util'}\n
*\nexport function sizeFromShape(shape: number[]): number {\n if (shape.length === 0) {\n // Scalar.\n return
1;\n }\n let size = shape[0];\n for (let i = 1; i < shape.length; i++) {\n size *= shape[i];\n }\n return
size;\n}\n\nexport function isScalarShape(shape: number[]): boolean {\n return shape.length === 0;\n}\n\nexport
function

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arraysEqual(n1: FlatVector, n2: FlatVector) {\n if (n1 === n2) {\n return true;\n }\n if (n1 == null || n2 == null) {\n return false;\n }\n if (n1.length !== n2.length) {\n return false;\n }\n for (let i = 0; i < n1.length; i++) {\n if (n1[i] !== n2[i]) {\n return false;\n }\n }\n return true;\n}\n\nexport function isInt(a: number): boolean {\n return a % 1 === 0;\n}\n\nexport function tanh(x: number): number {\n // tslint:disable-next-line:no-any\n if ((Math as any).tanh != null) {\n // tslint:disable-next-line:no-any\n return (Math as any).tanh(x);\n }\n if (x === Infinity) {\n return 1;\n } else if (x === -Infinity) {\n return -1;\n } else {\n const e2x = Math.exp(2 * x);\n return (e2x - 1) / (e2x + 1);\n }\n}\n\nexport function sizeToSquarishShape(size: number): [number, number] {\n const width = Math.ceil(Math.sqrt(size));\n return [width, Math.ceil(size / width)];\n}\n\n/**\n * Creates a new array with randomized indices to a given quantity.\n * @param quantity Quantity of how many shuffled indices to create.\n * @param number Quantity of how many shuffled indices to create.\n * @doc {heading: 'Util', namespace: 'util'}\n */\nexport function createShuffledIndices(n: number): Uint32Array {\n const shuffledIndices = new Uint32Array(n);\n for (let i = 0; i < n; ++i) {\n shuffledIndices[i] = i;\n }\n shuffle(shuffledIndices);\n return shuffledIndices;\n}\n\nexport function rightPad(a: string, size: number): string {\n if (size <= a.length) {\n return a;\n }\n return a + '.repeat(size - a.length);\n}\n\nexport function repeatedTry(\n checkFn: () => boolean, delayFn = (counter: number) => 0, maxCounter?: number): Promise<void> {\n return new Promise<void>((resolve, reject) => {\n let tryCount = 0;\n const tryFn = () => {\n if (checkFn()) {\n resolve();\n return;\n }\n tryCount++;\n const\n nextBackoff = delayFn(tryCount);\n if (maxCounter != null && tryCount >= maxCounter) {\n reject();\n return;\n }\n setTimeout(tryFn, nextBackoff);\n });\n tryFn();\n });\n}\n\n/**\n * Given the full size of the array and a shape that may contain -1 as the\n * implicit dimension, returns the inferred shape where -1 is replaced.\n * E.g. For shape=[2, -1, 3] and size=24, it will return [2, 4, 3].\n * @param shape The shape, which may contain -1 in some dimension.\n * @param size The full size (number of elements) of the array.\n * @return The inferred shape where -1 is replaced with the inferred size.\n */\nexport function inferFromImplicitShape(\n shape: number[], size: number): number[] {\n let shapeProd = 1;\n let implicitIdx = -1;\n for (let i = 0; i < shape.length; ++i) {\n if (shape[i] >= 0) {\n shapeProd *= shape[i];\n } else if (shape[i] === -1) {\n if (implicitIdx !== -1) {\n throw Error(\n `Shapes can only have 1 implicit size. ` +\n `Found -1 at dim ${implicitIdx} and dim ${i}`);\n }\n implicitIdx = i;\n } else if (shape[i] < 0) {\n throw Error(`Shapes can not be < 0. Found ${shape[i]} at dim ${i}`);\n }\n }\n\n if (implicitIdx === -1) {\n if (size > 0 && size !== shapeProd) {\n throw Error(`Size(${size}) must match the product of shape ${shape}`);\n }\n return shape;\n }\n\n if (shapeProd === 0) {\n throw Error(\n `Cannot infer the missing size in [${shape}] when ` +\n `there are 0 elements`);\n }\n\n if (size % shapeProd !== 0) {\n throw Error(\n `The implicit shape can't be a fractional number. ` +\n `Got ${size} / ${shapeProd}`);\n }\n\n const newShape = shape.slice();\n newShape[implicitIdx] = size / shapeProd;\n return newShape;\n}\n\nexport function parseAxisParam(\n axis: number|number[], shape: number[]): number[] {\n const rank = shape.length;\n // Normalize input\n axis = axis == null ? shape.map((s, i) => i) : [].concat(axis);\n // Check for valid range\n assert(\n axis.every(ax => ax >= -rank && ax < rank),\n () => `All values in axis param must be in range [-${rank}, ${rank}] but ` +\n `got axis ${axis}`);\n // Check for only integers\n assert(\n axis.every(ax => isInt(ax)),\n () => `All values in axis param must be integers but ` +\n `got axis ${axis}`);\n // Handle negative axis.\n return axis.map(a => a < 0 ? rank + a : a);\n}\n\n/**\n * Reduces the shape by removing all dimensions of shape 1.\n */\nexport function squeezeShape(shape: number[], axis?: number[]): {newShape: number[], keptDims: number[]} {\n const newShape: number[] = [];\n const keptDims: number[] = [];\n const isEmptyArray = axis != null && Array.isArray(axis) && axis.length === 0;\n const axes = (axis == null || isEmptyArray) ?\n null :\n parseAxisParam(axis, shape).sort();\n let j = 0;\n for (let i = 0; i < shape.length; ++i) {\n if (axes != null) {\n if (axes[j] === i && shape[i] !== 1) {\n throw new Error(\n `Can't squeeze axis ${i} since its dim '${shape[i]}' is not 1`);\n }\n if ((axes[j] == null || axes[j] > i) && shape[i] === 1) {\n newShape.push(shape[i]);\n keptDims.push(i);\n }\n if (axes[j] <= i) {\n

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    j++;
  }
}
if (shape[i] !== 1) {
  newShape.push(shape[i]);
  keptDims.push(i);
}
return {newShape, keptDims};
}
export function getTypedArrayFromDType<D extends NumericDataType>(
  dtype: D, size: number): DataTypeMap[D] {
  let values = null;
  if (dtype === null || dtype === 'float32') {
    values = new Float32Array(size);
  } else if (dtype === 'int32') {
    values = new Int32Array(size);
  } else if (dtype === 'bool') {
    values = new Uint8Array(size);
  } else {
    throw new Error(`Unknown data type ${dtype}`);
  }
  return values as DataTypeMap[D];
}
export function getArrayFromDType<D extends DataType>(
  dtype: D, size: number): DataTypeMap[D] {
  let values = null;
  if (dtype === null || dtype === 'float32') {
    values = new Float32Array(size);
  } else if (dtype === 'int32') {
    values = new Int32Array(size);
  } else if (dtype === 'bool') {
    values = new Uint8Array(size);
  } else if (dtype === 'string') {
    values = new Array<'string'>(size);
  } else {
    throw new Error(`Unknown data type ${dtype}`);
  }
  return values as DataTypeMap[D];
}
export function checkConversionForErrors<D extends DataType>(
  vals: DataTypeMap[D]number[], dtype: D): void {
  for (let i = 0; i < vals.length; i++) {
    const num = vals[i] as number;
    if (isNaN(num) || !isFinite(num)) {
      throw Error(`A tensor of type ${dtype} being uploaded contains ${num}.`);
    }
  }
}
/** Returns true if the dtype is valid. */
export function isValidDtype(dtype: DataType): boolean {
  return
    dtype === 'bool' || dtype === 'complex64' || dtype === 'float32' ||
    dtype === 'int32' || dtype === 'string';
}
/** Returns true if the new type can't encode the old type without loss of precision. */
export function hasEncodingLoss(oldType: DataType, newType: DataType): boolean {
  if (newType === 'complex64') {
    return false;
  }
  if (newType === 'float32' && oldType !== 'complex64') {
    return false;
  }
  if (newType === 'int32' && oldType !== 'float32' && oldType !== 'complex64') {
    return false;
  }
  if (newType === 'bool' && oldType === 'bool') {
    return false;
  }
  return true;
}
export function isArray(a: {}): a is Float32Array | Int32Array | Uint8Array {
  return a instanceof Float32Array || a instanceof Int32Array ||
    a instanceof Uint8Array;
}
export function bytesPerElement(dtype: DataType): number {
  if (dtype === 'float32' || dtype === 'int32') {
    return 4;
  } else if (dtype === 'complex64') {
    return 8;
  } else if (dtype === 'bool') {
    return 1;
  } else {
    throw new Error(`Unknown dtype ${dtype}`);
  }
}
/** Returns the approximate number of bytes allocated in the string array - 2 * bytes per character. Computing the exact bytes for a native string in JS is not possible since it depends on the encoding of the html page that serves the website. */
export function bytesFromStringArray(arr: Uint8Array[]): number {
  if (arr === null) {
    return 0;
  }
  let bytes = 0;
  arr.forEach(x => bytes += x.length);
  return bytes;
}
/** Returns true if the value is a string. */
export function isString(value: {}): value is string {
  return typeof value === 'string' || value instanceof String;
}
export function isBoolean(value: {}): boolean {
  return typeof value === 'boolean';
}
export function isNumber(value: {}): boolean {
  return typeof value === 'number';
}
export function inferDtype(values: TensorLike): DataType {
  if (Array.isArray(values)) {
    return inferDtype(values[0]);
  }
  if (values instanceof Float32Array) {
    return 'float32';
  } else if (values instanceof Int32Array || values instanceof Uint8Array) {
    return 'int32';
  } else if (isNumber(values)) {
    return 'float32';
  } else if (isString(values)) {
    return 'string';
  } else if (isBoolean(values)) {
    return 'bool';
  }
  return 'float32';
}
export function isFunction(f: Function) {
  return !!f && f.constructor && f.call && f.apply;
}
export function nearestDivisor(size: number, start: number): number {
  for (let i = start; i < size; ++i) {
    if (size % i === 0) {
      return i;
    }
  }
  return size;
}
export function computeStrides(shape: number[]): number[] {
  const rank = shape.length;
  if (rank < 2) {
    return [];
  }
  // Last dimension has implicit stride of 1, thus having D-1 (instead of D) // strides.
  const strides = new Array(rank - 1);
  strides[rank - 2] = shape[rank - 1];
  for (let i = rank - 3; i >= 0; --i) {
    strides[i] = strides[i + 1] * shape[i + 1];
  }
  return strides;
}
function createNestedArray(offset: number, shape: number[], a: TypedArray) {
  const ret = new Array();
  if (shape.length === 1) {
    const d = shape[0];
    for (let i = 0; i < d; i++) {
      ret[i] = a[offset + i];
    }
  } else {
    const d = shape[0];
    const rest = shape.slice(1);
    const len = rest.reduce((acc, c) => acc * c);
    for (let i = 0; i < d; i++) {
      ret[i] = createNestedArray(offset + i * len, rest, a);
    }
  }
  return ret;
}
// Provide a nested array of TypedArray in given shape.
export function toNestedArray(shape: number[]),

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Promise<FlagValue>);\nexport type Flags = {\n [featureName: string]: FlagValue\n};\nexport type
FlagRegistryEntry = {\n evaluationFn: FlagEvaluationFn;\n setHook?: (value: FlagValue) => void;\n};\n\n/**\n *
The environment contains evaluated flags as well as the registered
platform.\n * This is always used as a global singleton and can be retrieved with\n * `tf.env()`. \n * \n * @doc
{heading: 'Environment'}\n */\nexport class Environment {\n private flags: Flags = {};\n private flagRegistry:
{[flagName: string]: FlagRegistryEntry} = {};\n\n private urlFlags: Flags = {};\n\n platformName: string;\n
platform: Platform;\n\n // tslint:disable-next-line: no-any\n constructor(public global: any) {\n
this.populateURLFlags();\n }\n\n setPlatform(platformName: string, platform: Platform) {\n if (this.platform !=
null) {\n console.warn(\n `Platform ${this.platformName} has already been set.` +\n `Overwriting the
platform with ${platform}.`);\n }\n this.platformName = platformName;\n this.platform = platform;\n }\n\n
registerFlag(\n flagName: string, evaluationFn: FlagEvaluationFn,\n setHook?: (value: FlagValue) => void)
{\n this.flagRegistry[flagName] = {evaluationFn, setHook};\n\n // Override
the flag value from the URL. This has to happen here because the\n // environment is initialized before flags get
registered.\n if (this.urlFlags[flagName] != null) {\n const flagValue = this.urlFlags[flagName];\n
console.warn(\n `Setting feature override from URL ${flagName}: ${flagValue}.`);\n this.set(flagName,
flagValue);\n }\n }\n\n async getAsync(flagName: string): Promise<FlagValue> {\n if (flagName in this.flags)
{\n return this.flags[flagName];\n }\n\n this.flags[flagName] = await this.evaluateFlag(flagName);\n return
this.flags[flagName];\n }\n\n get(flagName: string): FlagValue {\n if (flagName in this.flags) {\n return
this.flags[flagName];\n }\n\n const flagValue = this.evaluateFlag(flagName);\n if (isPromise(flagValue)) {\n
throw new Error(\n `Flag ${flagName} cannot be synchronously evaluated.` +\n `Please use getAsync()
instead.);\n }\n\n this.flags[flagName] = flagValue
as number | boolean;\n\n return this.flags[flagName];\n }\n\n getNumber(flagName: string): number {\n return
this.get(flagName) as number;\n }\n\n getBool(flagName: string): boolean {\n return this.get(flagName) as
boolean;\n }\n\n getFlags(): Flags {\n return this.flags;\n }\n\n // For backwards compatibility.\n get features():
Flags {\n return this.flags;\n }\n\n set(flagName: string, value: FlagValue): void {\n if
(this.flagRegistry[flagName] == null) {\n throw new Error(\n `Cannot set flag ${flagName} as it has not
been registered.);\n }\n\n this.flags[flagName] = value;\n if (this.flagRegistry[flagName].setHook != null) {\n
this.flagRegistry[flagName].setHook(value);\n }\n }\n\n private evaluateFlag(flagName: string):
FlagValue|Promise<FlagValue> {\n if (this.flagRegistry[flagName] == null) {\n throw new Error(\n
`Cannot evaluate flag '${flagName}': no evaluation function found.);\n }\n\n return
this.flagRegistry[flagName].evaluationFn);\n
}\n\n setFlags(flags: Flags) {\n this.flags = Object.assign({}, flags);\n }\n\n reset() {\n this.flags = {};\n
}\n\n this.urlFlags = {};\n this.populateURLFlags();\n }\n\n private populateURLFlags(): void {\n if (typeof
this.global === 'undefined' ||\n typeof this.global.location === 'undefined' ||\n typeof
this.global.location.search === 'undefined') {\n return;\n }\n\n const urlParams =
getQueryParams(this.global.location.search);\n if (TENSORFLOWJS_FLAGS_PREFIX in urlParams) {\n
const keyValues = urlParams[TENSORFLOWJS_FLAGS_PREFIX].split(',');\n keyValues.forEach(keyValue =>
{\n const [key, value] = keyValue.split(':') as [string, string];\n this.urlFlags[key] = parseValue(key,
value);\n });\n }\n }\n\n\nexport function getQueryParams(queryString: string): {[key: string]: string} {\n
const params = {};\n queryString.replace(/[?&][^=?&+](?=[^&*])?/g, (s, ...t)
=> {\n decodeParam(params, t[0], t[1]);\n return t.join('=);\n });\n return params;\n }\n\nfunction
decodeParam(\n params: {[key: string]: string}, name: string, value?: string) {\n
params[decodeURIComponent(name)] = decodeURIComponent(value || "");\n\n\nfunction parseValue(flagName:
string, value: string): FlagValue {\n value = value.toLowerCase();\n if (value === 'true' || value === 'false') {\n
return value === 'true';\n } else if (`${+value}` === value) {\n return +value;\n }\n\n throw new Error(\n
`Could not parse value flag value ${value} for flag ${flagName}.`);\n }\n\n\n/**\n * Returns the current environment
(a global singleton).\n * \n * The environment object contains the evaluated feature values as well as the\n * active
platform.\n * \n * @doc {heading: 'Environment'}\n */\nexport function env() {\n return ENV;\n }\n\nexport let

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ENV: Environment = null;\nexport function setEnvironmentGlobal(environment: Environment) {\n  ENV =
environment;\n}\n", "//
  shim for using process in browser\nvar process = module.exports = {};\n\n// cached from whatever global is present
so that test runners that stub it\n// don't break things. But we need to wrap it in a try catch in case it is\n// wrapped in
strict mode code which doesn't define any globals. It's inside a\n// function because try/catches deoptimize in certain
engines.\n\nvar cachedSetTimeout;\nvar cachedClearTimeout;\n\nfunction defaultSetTimeout() {\n  throw new
Error('setTimeout has not been defined');\n}\nfunction defaultClearTimeout () {\n  throw new Error('clearTimeout
has not been defined');\n}\n(function () {\n  try {\n    if (typeof setTimeout === 'function') {\n
cachedSetTimeout = setTimeout;\n    } else {\n      cachedSetTimeout = defaultSetTimeout;\n    } catch
(e) {\n      cachedSetTimeout = defaultSetTimeout;\n    } try {\n      if (typeof clearTimeout === 'function') {\n
cachedClearTimeout = clearTimeout;\n      } else {\n        cachedClearTimeout = defaultClearTimeout;\n      } catch (e) {\n
cachedClearTimeout = defaultClearTimeout;\n      }\n    })\nfunction runTimeout(fun) {\n  if (cachedSetTimeout
=== setTimeout) {\n    //normal environments in sane situations\n    return setTimeout(fun, 0);\n  } // if
setTimeout wasn't available but was latter defined\n  if ((cachedSetTimeout === defaultSetTimeout ||
!cachedSetTimeout) && setTimeout) {\n    cachedSetTimeout = setTimeout;\n    return setTimeout(fun, 0);\n  }
\n  try {\n    // when when somebody has screwed with setTimeout but no I.E. maddness\n    return
cachedSetTimeout(fun, 0);\n  } catch(e){\n    try {\n      // When we are in I.E. but the script has been eveled
so I.E. doesn't trust the global object when called normally\n      return cachedSetTimeout.call(null, fun, 0);\n
    } catch(e){\n      // same as above but when it's a version of I.E. that must
have the global object for 'this', hopfully our context correct otherwise it will throw a global error\n      return
cachedSetTimeout.call(this, fun, 0);\n    } }\n\n\nfunction runClearTimeout(marker) {\n  if
(cachedClearTimeout === clearTimeout) {\n    //normal environments in sane situations\n    return
clearTimeout(marker);\n  } // if clearTimeout wasn't available but was latter defined\n  if
((cachedClearTimeout === defaultClearTimeout || !cachedClearTimeout) && clearTimeout) {\n
cachedClearTimeout = clearTimeout;\n    return clearTimeout(marker);\n  } try {\n    // when when
somebody has screwed with setTimeout but no I.E. maddness\n    return cachedClearTimeout(marker);\n  }
catch (e){\n    try {\n      // When we are in I.E. but the script has been eveled so I.E. doesn't trust the global
object when called normally\n      return cachedClearTimeout.call(null, marker);\n    } catch (e){\n
      // same as above but when it's a version of I.E. that must have the global object for 'this', hopfully our context
correct otherwise it will throw a global error.\n      // Some versions of I.E. have different rules for clearTimeout
vs setTimeout\n      return cachedClearTimeout.call(this, marker);\n    } }\n\n\n\n\n\nvar queue = [];\nvar
draining = false;\nvar currentQueue;\nvar queueIndex = -1;\n\nfunction cleanUpNextTick() {\n  if (!draining ||
!currentQueue) {\n    return;\n  }\n  draining = false;\n  if (currentQueue.length) {\n    queue =
currentQueue.concat(queue);\n  } else {\n    queueIndex = -1;\n  }\n  if (queue.length) {\n    drainQueue();\n  }
}\n\nfunction drainQueue() {\n  if (draining) {\n    return;\n  }\n  var timeout =
runTimeout(cleanUpNextTick);\n  draining = true;\n\n  var len = queue.length;\n  while(len) {\n
currentQueue = queue;\n    queue = [];\n    while (++queueIndex <
len) {\n      if (currentQueue) {\n        currentQueue[queueIndex].run();\n      }\n    }\n    queueIndex = -1;\n    len = queue.length;\n  }\n  currentQueue = null;\n  draining = false;\n
runClearTimeout(timeout);\n}\n\nprocess.nextTick = function (fun) {\n  var args = new Array(arguments.length -
1);\n  if (arguments.length > 1) {\n    for (var i = 1; i < arguments.length; i++) {\n      args[i - 1] =
arguments[i];\n    }\n  }\n  queue.push(new Item(fun, args));\n  if (queue.length === 1 && !draining) {\n
runTimeout(drainQueue);\n  }\n};\n\n// v8 likes predictable objects\nfunction Item(fun, array) {\n  this.fun =
fun;\n  this.array = array;\n}\nItem.prototype.run = function () {\n  this.fun.apply(null,
this.array);\n};\nprocess.title = 'browser';\nprocess.browser = true;\nprocess.env = {};\nprocess.argv =
[];\nprocess.version = ""; // empty string to avoid regexp issues\nprocess.versions = {};\n\nfunction

```



```

noop() {}
process.on = noop;
process.addListener = noop;
process.once = noop;
process.off =
noop;
process.removeListener = noop;
process.removeAllListeners = noop;
process.emit =
noop;
process.prependListener = noop;
process.prependOnceListener = noop;
process.listeners = function
(name) { return [] }
process.binding = function (name) {
  throw new Error('process.binding is not
supported');
};
process.cwd = function () { return '/' };
process.chdir = function (dir) {
  throw new
Error('process.chdir is not supported');
};
process.umask = function() { return 0; };
"/**
 * @license
 * Copyright 2020 Google LLC. All Rights Reserved.
 * Licensed under the Apache License, Version 2.0 (the
 * "License");
 * you may not use this file except in compliance with the License.
 * You may obtain a copy of the
 * License at
 * http://www.apache.org/licenses/LICENSE-2.0
 * Unless required by applicable law or
 * agreed to in writing, software
 * distributed
 * under the License is distributed on an "AS IS" BASIS,
 * WITHOUT WARRANTIES OR CONDITIONS OF
 * ANY KIND, either express or implied.
 * See the License for the specific language governing permissions and
 * limitations under the License.
 */
=====
*/
// Note that the identifier globalNameSpace is scoped to this module, but will
// always resolve to the same
// global object regardless of how the module is
// resolved.
// tslint:disable-next-line:no-any
let globalNameSpace:
{[_tfGlobals: Map<string, any>];}
// tslint:disable-next-line:no-any
export function getGlobalNameSpace():
{[_tfGlobals: Map<string, any>]} {
  if (globalNameSpace == null) {
    // tslint:disable-next-line:no-any
    let ns:
any;
    if (typeof (window) !== 'undefined') {
      ns = window;
    } else if (typeof (global) !== 'undefined') {
      ns = global;
    } else if (typeof (process) !== 'undefined') {
      ns = process;
    }
    } else if (typeof (self) !== 'undefined') {
      ns = self;
    } else {
      throw new Error('Could not find a global
object');
    }
    globalNameSpace = ns;
  }
  return globalNameSpace;
}
// tslint:disable-next-line:no-
any
function getGlobalMap(): Map<string, any> {
  const ns = getGlobalNameSpace();
  if (ns._tfGlobals ==
null) {
    ns._tfGlobals = new Map();
  }
  return ns._tfGlobals;
}
/**
 * Returns a globally accessible
 * 'singleton' object.
 * @param key the name of the object
 * @param init a function to initialize to initialize
 * this object
 * the first time it is fetched.
 */
export function getGlobal<T>(key: string, init: () => T): T {
  const globalMap = getGlobalMap();
  if (globalMap.has(key)) {
    return globalMap.get(key);
  } else {
    const singleton = init();
    globalMap.set(key, singleton);
    return globalMap.get(key);
  }
}
"/**
 * @license
 * Copyright 2020 Google LLC. All Rights Reserved.
 * Licensed under the Apache License, Version 2.0 (the "License");
 * you may not use this file except in
 * compliance with the License.
 * You may obtain a copy of the License at
 * http://www.apache.org/licenses/LICENSE-2.0
 * Unless required by applicable law or agreed to in writing,
 * software
 * distributed under the License is distributed on an "AS IS" BASIS,
 * WITHOUT WARRANTIES
 * OR CONDITIONS OF ANY KIND, either express or implied.
 * See the License for the specific language
 * governing permissions and
 * limitations under the License.
 */
=====
*/
// Allow UpperCamelCase variable names
// tslint:disable: variable-name
// Unfortunately just enabling PascalCase
// per file (tslint:enable:
// allow-pascal-case) doesn't work.
import {NamedTensorInfoMap, TensorInfo} from
 './kernel_registry';
import {ExplicitPadding} from './ops/conv_util';
import {Activation} from
 './ops/fused_types';
import
 {DataType, PixelData} from './types';
export const Abs = 'Abs';
export type AbsInputs =
UnaryInputs;
export const Acos = 'Acos';
export type AcosInputs = UnaryInputs;
export const Acosh =
'Acosh';
export type AcoshInputs = UnaryInputs;
export const Add = 'Add';
export type AddInputs =
BinaryInputs;
export const AddN = 'AddN';
export type AddNInputs = TensorInfo[];
export const All =
'All';
export type AllInputs = Pick<NamedTensorInfoMap, 'x'>;
export interface AllAttrs {
  axis:
number|number[];
  keepDims: boolean;
}
export const Any = 'Any';
export type AnyInputs =
Pick<NamedTensorInfoMap, 'x'>;
export interface AnyAttrs {
  axis: number|number[];
  keepDims:
boolean;
}
export const ArgMax = 'ArgMax';
export type ArgMaxInputs = Pick<NamedTensorInfoMap,

```

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'x';\nexport interface ArgMaxAttrs {\n  axis: number;\n}\n\nexport const ArgMin = 'ArgMin';\nexport type ArgMinInputs = Pick<NamedTensorInfoMap, 'x';>\nexport interface ArgMinAttrs {\n  axis: number;\n}\n\nexport const Asin = 'Asin';\nexport type AsinInputs = UnaryInputs;\n\nexport const Asinh = 'Asinh';\nexport type AsinhInputs = UnaryInputs;\n\nexport const Atan = 'Atan';\nexport type AtanInputs = UnaryInputs;\n\nexport const Atanh = 'Atanh';\nexport type AtanhInputs = UnaryInputs;\n\nexport const Atan2 = 'Atan2';\nexport type Atan2Inputs = BinaryInputs;\n\nexport const AvgPool = 'AvgPool';\nexport type AvgPoolInputs = Pick<NamedTensorInfoMap, 'x';>\nexport interface AvgPoolAttrs {\n  filterSize: [number, number]|number;\n  strides: [number, number]|number;\n  pad: 'valid'|'same'|number;\n  dimRoundingMode?: 'floor'|'round'|'ceil';\n}\n\nexport const AvgPoolGrad = 'AvgPoolGrad';\nexport type AvgPoolGradInputs = Pick<NamedTensorInfoMap, 'dy'|'input';>\nexport interface AvgPoolGradAttrs {\n  filterSize: [number, number]|number;\n  strides: [number, number]|number;\n  pad: 'valid'|'same'|number;\n}\n\nexport const AvgPool3D = 'AvgPool3D';\nexport type AvgPool3DInputs = Pick<NamedTensorInfoMap, 'x';>\nexport interface AvgPool3DAttrs {\n  filterSize: [number, number, number]|number;\n  strides: [number, number, number]|number;\n  pad: 'valid'|'same'|number;\n  dimRoundingMode?: 'floor'|'round'|'ceil';\n  dataFormat: 'NDHWC'|'NCDHW';\n}\n\nexport const AvgPool3DGrad = 'AvgPool3DGrad';\nexport type AvgPool3DGradInputs = Pick<NamedTensorInfoMap, 'dy'|'input';>\nexport interface AvgPool3DGradAttrs {\n  filterSize: [number, number, number]|number;\n  strides: [number, number, number]|number;\n  pad: 'valid'|'same'|number;\n  dimRoundingMode?: 'floor'|'round'|'ceil';\n}\n\nexport const BatchMatMul = 'BatchMatMul';\nexport type BatchMatMulInputs = Pick<NamedTensorInfoMap, 'a'|'b';>\nexport interface BatchMatMulAttrs {\n  transposeA: boolean;\n  transposeB: boolean;\n}\n\nexport const BatchToSpaceND = 'BatchToSpaceND';\nexport type BatchToSpaceNDInputs = Pick<NamedTensorInfoMap, 'x';>\nexport interface BatchToSpaceNDAttrs {\n  blockShape: number[];\n  crops: number[][];\n}\n\nexport type BinaryInputs = Pick<NamedTensorInfoMap, 'a'|'b';>\n\nexport const Bincount = 'Bincount';\nexport type BincountInputs = Pick<NamedTensorInfoMap, 'x'|'weights';>\nexport interface BincountAttrs {\n  size: number;\n}\n\nexport const BroadcastTo = 'BroadcastTo';\nexport type BroadcastToInputs = Pick<NamedTensorInfoMap, 'x';>\nexport interface BroadCastToAttrs {\n  shape: number[];\n  inputShape: number[]; // for gradient\n}\n\nexport const Cast = 'Cast';\nexport type CastInputs = UnaryInputs;\nexport interface CastAttrs {\n  dtype: DataType;\n}\n\nexport const Ceil = 'Ceil';\nexport type CeilInputs = UnaryInputs;\n\nexport const ClipByValue = 'ClipByValue';\nexport type ClipByValueInputs = UnaryInputs;\nexport interface ClipByValueAttrs {\n  clipValueMin: number;\n  clipValueMax: number;\n}\n\nexport const Complex = 'Complex';\nexport type ComplexInputs = Pick<NamedTensorInfoMap, 'real'|'imag';>\n\nexport const ComplexAbs = 'ComplexAbs';\nexport type ComplexAbsInputs = UnaryInputs;\n\nexport const Concat = 'Concat';\nexport type ConcatInputs = TensorInfo[];\nexport interface ConcatAttrs {\n  axis: number;\n}\n\nexport const Conv2D = 'Conv2D';\nexport type Conv2DInputs = Pick<NamedTensorInfoMap, 'x'|'filter';>\nexport interface Conv2DAttrs {\n  strides: [number, number]|number;\n  pad: 'valid'|'same'|number|ExplicitPadding;\n  dataFormat: 'NHWC'|'NCHW';\n  dilations: [number, number]|number;\n  dimRoundingMode?: 'floor'|'round'|'ceil';\n}\n\nexport const Conv2DBackpropFilter = 'Conv2DBackpropFilter';\nexport type Conv2DBackpropFilterInputs = Pick<NamedTensorInfoMap, 'x'|'dy';>\nexport interface Conv2DBackpropFilterAttrs {\n  strides: [number, number]|number;\n  pad: 'valid'|'same'|number|ExplicitPadding;\n  dataFormat: 'NHWC'|'NCHW';\n  dimRoundingMode?: 'floor'|'round'|'ceil';\n  filterShape: [number, number, number, number];\n}\n\nexport const Conv2DBackpropInput = 'Conv2DBackpropInput';\nexport type Conv2DBackpropInputInputs = Pick<NamedTensorInfoMap, 'dy'|'filter';>\nexport interface Conv2DBackpropInputAttrs {\n  strides: [number, number]|number;\n  pad: 'valid'|'same'|number|ExplicitPadding;\n  dataFormat: 'NHWC'|'NCHW';\n  dimRoundingMode?: 'floor'|'round'|'ceil';\n  inputShape: [number, number, number, number];\n}\n\nexport const Conv3D = 'Conv3D';\nexport type Conv3DInputs = Pick<NamedTensorInfoMap, 'x'|'filter';>\nexport interface Conv3DAttrs {\n  strides: [number, number, number]|number;\n  pad: 'valid'|'same';\n  dataFormat: 'NDHWC'|'NCDHW';\n  dilations: [number, number, number]|number;\n}\n\nexport const Conv3DBackpropFilterV2 =

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'Conv3DBackpropFilterV2';\nexport type Conv3DBackpropFilterV2Inputs = Pick<NamedTensorInfoMap,
'x'|'dy'>;\n\nexport interface Conv3DBackpropFilterV2Attrs {\n  strides: [number, number, number]|number;\n  pad:
'valid'|'same';\n  filterShape: [number, number, number, number, number];\n}\n\nexport const
Conv3DBackpropInputV2 = 'Conv3DBackpropInputV2';\nexport type Conv3DBackpropInputV2Inputs
=\n  Pick<NamedTensorInfoMap, 'dy'|'filter'>;\nexport interface Conv3DBackpropInputV2Attrs {\n  strides:
[number, number, number]|number;\n  pad: 'valid'|'same';\n  inputShape: [number, number, number, number,
number];\n}\n\nexport const Cos = 'Cos';\nexport type CosInputs = UnaryInputs;\n\nexport const Cosh =
'Cosh';\nexport type CoshInputs = UnaryInputs;\n\nexport const Cumsum = 'Cumsum';\nexport type CumsumInputs
= Pick<NamedTensorInfoMap, 'x'>;\nexport interface CumsumAttrs {\n  axis: number;\n  exclusive: boolean;\n  reverse: boolean;\n}\n\nexport const CropAndResize = 'CropAndResize';\nexport type CropAndResizeInputs =\n  Pick<NamedTensorInfoMap, 'image'|'boxes'|'boxInd'>;\nexport interface CropAndResizeAttrs {\n  cropSize:
[number, number];\n  method: 'bilinear'|'nearest';\n  extrapolationValue: number;\n}\n\nexport const DenseBincount
= 'DenseBincount';\nexport type DenseBincountInputs = Pick<NamedTensorInfoMap, 'x'|'weights'>;\nexport
interface DenseBincountAttrs {\n  size:
number;\n  binaryOutput?: boolean;\n}\n\nexport const DepthToSpace = 'DepthToSpace';\nexport type
DepthToSpaceInputs = Pick<NamedTensorInfoMap, 'x'>;\nexport interface DepthToSpaceAttrs {\n  blockSize:
number;\n  dataFormat: 'NHWC'|'NCHW';\n}\n\nexport const DepthwiseConv2dNative =
'DepthwiseConv2dNative';\nexport type DepthwiseConv2dNativeInputs =\n  Pick<NamedTensorInfoMap,
'x'|'filter'>;\nexport interface DepthwiseConv2dNativeAttrs {\n  strides: [number, number]|number;\n  pad:
'valid'|'same'|number;\n  dataFormat: 'NHWC'|'NCHW';\n  dilations: [number, number]|number;\n  dimRoundingMode?:
'floor'|'round'|'ceil';\n}\n\nexport const DepthwiseConv2dNativeBackpropFilter =\n  'DepthwiseConv2dNativeBackpropFilter';\nexport type DepthwiseConv2dNativeBackpropFilterInputs =\n  Pick<NamedTensorInfoMap, 'x'|'dy'>;\nexport interface DepthwiseConv2dNativeBackpropFilterAttrs {\n  strides:
[number, number]|number;\n  dilations: [number, number]|number;\n  pad: 'valid'|'same'|number;\n  dimRoundingMode?:
'floor'|'round'|'ceil';\n  filterShape: [number, number, number, number];\n}\n\nexport const
DepthwiseConv2dNativeBackpropInput =\n  'DepthwiseConv2dNativeBackpropInput';\nexport type
DepthwiseConv2dNativeBackpropInputInputs =\n  Pick<NamedTensorInfoMap, 'dy'|'filter'>;\nexport interface
DepthwiseConv2dNativeBackpropInputAttrs {\n  strides: [number, number]|number;\n  dilations: [number,
number]|number;\n  pad: 'valid'|'same'|number;\n  dimRoundingMode?: 'floor'|'round'|'ceil';\n  inputShape: [number,
number, number, number];\n}\n\nexport const Diag = 'Diag';\nexport type DiagInputs =
Pick<NamedTensorInfoMap, 'x'>;\n\nexport const Dilation2D = 'Dilation2D';\nexport type Dilation2DInputs =
Pick<NamedTensorInfoMap, 'x'|'filter'>;\nexport interface Dilation2DAttrs {\n  strides: [number, number]|number;\n  pad:
'valid'|'same'|number;\n  dilations: [number, number]|number;\n}\n\nexport const Dilation2DBackpropInput =
'Dilation2DBackpropInput';\nexport type Dilation2DBackpropInputInputs
=\n  Pick<NamedTensorInfoMap, 'x'|'filter'|'dy'>;\n\nexport const Dilation2DBackpropFilter =
'Dilation2DBackpropFilter';\nexport type Dilation2DBackpropFilterInputs =\n  Pick<NamedTensorInfoMap,
'x'|'filter'|'dy'>;\n\nexport const RealDiv = 'RealDiv';\nexport type RealDivInputs = BinaryInputs;\n\nexport const
Elu = 'Elu';\nexport type EluInputs = Pick<NamedTensorInfoMap, 'x'>;\n\nexport const EluGrad =
'EluGrad';\nexport type EluGradInputs = Pick<NamedTensorInfoMap, 'dy'|'y'>;\n\nexport const Erf = 'Erf';\nexport
type ErfInputs = UnaryInputs;\n\nexport const Equal = 'Equal';\nexport type EqualInputs = BinaryInputs;\n\nexport
const Exp = 'Exp';\nexport type ExpInputs = UnaryInputs;\n\nexport const ExpandDims = 'ExpandDims';\nexport
type ExpandDimsInputs = Pick<NamedTensorInfoMap, 'input'>;\nexport interface ExpandDimsAttrs {\n  dim:
number;\n}\n\nexport const Expm1 = 'Expm1';\nexport type Expm1Inputs = UnaryInputs;\n\nexport const FFT =
'FFT';\nexport type FFTInputs =
Pick<NamedTensorInfoMap, 'input'>;\n\nexport const Fill = 'Fill';\nexport interface FillAttrs {\n  shape:
number[];\n  value: number|string;\n  dtype: DataType;\n}\n\nexport const FlipLeftRight = 'FlipLeftRight';\nexport
type FlipLeftRightInputs = Pick<NamedTensorInfoMap, 'image'>;\n\nexport const Floor = 'Floor';\nexport type

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FloorInputs = UnaryInputs;\n\nexport const FloorDiv = 'FloorDiv';\nexport type FloorDivInputs =
BinaryInputs;\n\nexport const FusedBatchNorm = 'FusedBatchNorm';\nexport type FusedBatchNormInputs =\nPick<NamedTensorInfoMap, 'x'|'scale'|'offset'|'mean'|'variance'>;\nexport interface FusedBatchNormAttrs {\n
varianceEpsilon: number;\n}\n\nexport const GatherV2 = 'GatherV2';\nexport type GatherV2Inputs =
Pick<NamedTensorInfoMap, 'x'|'indices'>;\nexport interface GatherV2Attrs {\n axis: number;\n batchDims:
number;\n}\n\nexport const GatherNd = 'GatherNd';\nexport type GatherNdInputs = Pick<NamedTensorInfoMap,
'params'|'indices'>;\n\nexport const Greater = 'Greater';\nexport
type GreaterInputs = BinaryInputs;\n\nexport const GreaterEqual = 'GreaterEqual';\nexport type GreaterEqualInputs
= BinaryInputs;\n\nexport const Identity = 'Identity';\nexport type IdentityInputs = Pick<NamedTensorInfoMap,
'x'>;\n\nexport const IFFT = 'IFFT';\nexport type IFFTInputs = Pick<NamedTensorInfoMap, 'input'>;\n\nexport
const Imag = 'Imag';\nexport type ImagInputs = Pick<NamedTensorInfoMap, 'input'>;\n\nexport const IsFinite =
'IsFinite';\nexport type IsFiniteInputs = UnaryInputs;\n\nexport const IsInf = 'IsInf';\nexport type IsInfInputs =
UnaryInputs;\n\nexport const IsNan = 'IsNan';\nexport type IsNanInputs = UnaryInputs;\n\nexport const LeakyRelu
= 'LeakyRelu';\nexport type LeakyReluInputs = Pick<NamedTensorInfoMap, 'x'>;\nexport interface LeakyReluAttrs
{\n alpha: number;\n}\n\nexport const Less = 'Less';\nexport type LessInputs = BinaryInputs;\n\nexport const
LessEqual = 'LessEqual';\nexport type LessEqualInputs = BinaryInputs;\n\nexport const LinSpace =
'LinSpace';\nexport interface LinSpaceAttrs {\n start: number;\n stop: number;\n num: number;\n}\n\nexport const
Log = 'Log';\nexport type LogInputs = UnaryInputs;\n\nexport const Log1p = 'Log1p';\nexport type Log1pInputs =
UnaryInputs;\n\nexport const LogicalAnd = 'LogicalAnd';\nexport type LogicalAndInputs = BinaryInputs;\n\nexport
const LogicalNot = 'LogicalNot';\nexport type LogicalNotInputs = Pick<NamedTensorInfoMap, 'x'>;\n\nexport
const LogicalOr = 'LogicalOr';\nexport type LogicalOrInputs = BinaryInputs;\n\nexport const LogSoftmax =
'LogSoftmax';\nexport type LogSoftmaxInputs = Pick<NamedTensorInfoMap, 'logits'>;\nexport interface
LogSoftmaxAttrs {\n axis: number;\n}\n\nexport const LRN = 'LRN';\nexport type LRNInputs =
Pick<NamedTensorInfoMap, 'x'>;\nexport interface LRNAttrs {\n depthRadius: number;\n bias: number;\n alpha:
number;\n beta: number;\n}\n\nexport const LRNGrad = 'LRNGrad';\nexport type LRNGradInputs =
Pick<NamedTensorInfoMap, 'x'|'y'|'dy'>;\nexport interface
LRNGradAttrs {\n depthRadius: number;\n bias: number;\n alpha: number;\n beta: number;\n}\n\nexport const
Max = 'Max';\nexport type MaxInputs = Pick<NamedTensorInfoMap, 'x'>;\nexport interface MaxAttrs {\n
reductionIndices: number|number[];\n keepDims: boolean;\n}\n\nexport const Maximum = 'Maximum';\nexport
type MaximumInputs = BinaryInputs;\n\nexport const MaxPool = 'MaxPool';\nexport type MaxPoolInputs =
Pick<NamedTensorInfoMap, 'x'>;\nexport interface MaxPoolAttrs {\n filterSize: [number, number]|number;\n
strides: [number, number]|number;\n pad: 'valid'|'same'|number;\n dimRoundingMode?:
'floor'|'round'|'ceil';\n}\n\nexport const MaxPoolGrad = 'MaxPoolGrad';\nexport type MaxPoolGradInputs =
Pick<NamedTensorInfoMap, 'dy'|'input'|'output'>;\nexport interface MaxPoolGradAttrs {\n filterSize: [number,
number]|number;\n strides: [number, number]|number;\n pad: 'valid'|'same'|number;\n dimRoundingMode?:
'floor'|'round'|'ceil';\n}\n\nexport const MaxPool3D = 'MaxPool3D';\nexport
type MaxPool3DInputs = Pick<NamedTensorInfoMap, 'x'>;\nexport interface MaxPool3DAttrs {\n filterSize:
[number, number, number]|number;\n strides: [number, number, number]|number;\n pad: 'valid'|'same'|number;\n
dataFormat: 'NDHWC'|'NCDHW';\n dimRoundingMode?: 'floor'|'round'|'ceil';\n}\n\nexport const MaxPool3DGrad
= 'MaxPool3DGrad';\nexport type MaxPool3DGradInputs =\n Pick<NamedTensorInfoMap,
'dy'|'input'|'output'>;\nexport interface MaxPool3DGradAttrs {\n filterSize: [number, number, number]|number;\n
strides: [number, number, number]|number;\n pad: 'valid'|'same'|number;\n dimRoundingMode?:
'floor'|'round'|'ceil';\n}\n\nexport const MaxPoolWithArgmax = 'MaxPoolWithArgmax';\nexport type
MaxPoolWithArgmaxInputs = Pick<NamedTensorInfoMap, 'x'>;\nexport interface MaxPoolWithArgmaxAttrs {\n
filterSize: [number, number]|number;\n strides: [number, number]|number;\n pad: 'valid'|'same'|number;\n
includeBatchInIndex: boolean;\n}\n\nexport const Mean = 'Mean';\nexport
type MeanInputs = Pick<NamedTensorInfoMap, 'x'>;\nexport interface MeanAttrs {\n axis: number|number[];\n
keepDims: boolean;\n}\n\nexport const Min = 'Min';\nexport type MinInputs = Pick<NamedTensorInfoMap,

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'x';\nexport interface MinAttrs {\n  axis: number|number[];\n  keepDims: boolean;\n}\n\n\nexport const Minimum =
'Minimum';\nexport type MinimumInputs = BinaryInputs;\n\nexport const MirrorPad = 'MirrorPad';\nexport type
MirrorPadInputs = Pick<NamedTensorInfoMap, 'x'>;\nexport interface MirrorPadAttrs {\n  paddings:
Array<[number, number]>;\n  mode: 'reflect'|'symmetric';\n}\n\n\nexport const Mod = 'Mod';\nexport type ModInputs
= BinaryInputs;\n\nexport const Multinomial = 'Multinomial';\nexport type MultinomialInputs =
Pick<NamedTensorInfoMap, 'logits'>;\nexport interface MultinomialAttrs {\n  numSamples: number;\n  seed:
number;\n  normalized: boolean;\n}\n\n\nexport const Multiply = 'Multiply';\nexport type MultiplyInputs =
BinaryInputs;\n\nexport const Neg = 'Neg';\nexport type
NegInputs = UnaryInputs;\n\nexport const NotEqual = 'NotEqual';\nexport type NotEqualInputs =
BinaryInputs;\n\nexport const NonMaxSuppressionV3 = 'NonMaxSuppressionV3';\nexport type
NonMaxSuppressionV3Inputs =\n  Pick<NamedTensorInfoMap, 'boxes'|'scores'>;\nexport interface
NonMaxSuppressionV3Attrs {\n  maxOutputSize: number;\n  iouThreshold: number;\n  scoreThreshold:
number;\n}\n\n\nexport const NonMaxSuppressionV4 = 'NonMaxSuppressionV4';\nexport type
NonMaxSuppressionV4Inputs =\n  Pick<NamedTensorInfoMap, 'boxes'|'scores'>;\nexport interface
NonMaxSuppressionV4Attrs {\n  maxOutputSize: number;\n  iouThreshold: number;\n  scoreThreshold: number;\n  padToMaxOutputSize: boolean;\n}\n\n\nexport const NonMaxSuppressionV5 = 'NonMaxSuppressionV5';\nexport
type NonMaxSuppressionV5Inputs =\n  Pick<NamedTensorInfoMap, 'boxes'|'scores'>;\nexport interface
NonMaxSuppressionV5Attrs {\n  maxOutputSize: number;\n  iouThreshold: number;\n  scoreThreshold: number;\n  softNmsSigma: number;\n}\n\n\nexport
const OnesLike = 'OnesLike';\nexport type OnesLikeInputs = UnaryInputs;\n\n\nexport const OneHot =
'OneHot';\nexport type OneHotInputs = Pick<NamedTensorInfoMap, 'indices'>;\nexport interface OneHotAttrs {\n
depth: number;\n  onValue: number;\n  offValue: number;\n}\n\n\nexport const Pack = 'Pack';\nexport type
PackInputs = TensorInfo[];\nexport interface PackAttrs {\n  axis: number;\n}\n\n\nexport const PadV2 =
'PadV2';\nexport type PadV2Inputs = Pick<NamedTensorInfoMap, 'x'>;\nexport interface PadV2Attrs {\n
paddings: Array<[number, number]>;\n  constantValue: number;\n}\n\n\nexport const Pool = 'Pool';\nexport type
PoolInputs = Pick<NamedTensorInfoMap, 'input'>;\n\nexport const Pow = 'Pow';\nexport type PowInputs =
BinaryInputs;\n\nexport const Prelu = 'Prelu';\nexport type PreluInputs = Pick<NamedTensorInfoMap,
'x'|'alpha'>;\n\nexport const Prod = 'Prod';\nexport type ProdInputs = Pick<NamedTensorInfoMap, 'x'>;\nexport
interface ProdAttrs {\n  axis: number|number[];\n  keepDims: boolean;\n}\n\n\nexport
const Range = 'Range';\nexport interface RangeAttrs {\n  start: number;\n  stop: number;\n  step: number;\n  dtype:
'float32'|'int32';\n}\n\n\nexport const Real = 'Real';\nexport type RealInputs = Pick<NamedTensorInfoMap,
'input'>;\n\nexport const Reciprocal = 'Reciprocal';\nexport type ReciprocalInputs = UnaryInputs;\n\n\nexport
const Relu = 'Relu';\nexport type ReluInputs = Pick<NamedTensorInfoMap, 'x'>;\n\nexport const Reshape =
'Reshape';\nexport type ReshapeInputs = Pick<NamedTensorInfoMap, 'x'>;\nexport interface ReshapeAttrs {\n
shape: number[];\n}\n\n\nexport const ResizeNearestNeighbor = 'ResizeNearestNeighbor';\nexport type
ResizeNearestNeighborInputs = Pick<NamedTensorInfoMap, 'images'>;\nexport interface
ResizeNearestNeighborAttrs {\n  alignCorners: boolean;\n  halfPixelCenters: boolean;\n  size: [number,
number];\n}\n\n\nexport const ResizeNearestNeighborGrad = 'ResizeNearestNeighborGrad';\nexport type
ResizeNearestNeighborGradInputs =\n  Pick<NamedTensorInfoMap,
'images'|'dy'>;\nexport type ResizeNearestNeighborGradAttrs = ResizeNearestNeighborAttrs;\n\n\nexport const
ResizeBilinear = 'ResizeBilinear';\nexport type ResizeBilinearInputs = Pick<NamedTensorInfoMap,
'images'>;\nexport interface ResizeBilinearAttrs {\n  alignCorners: boolean;\n  halfPixelCenters: boolean;\n  size:
[number, number];\n}\n\n\nexport const ResizeBilinearGrad = 'ResizeBilinearGrad';\nexport type
ResizeBilinearGradInputs = Pick<NamedTensorInfoMap, 'images'|'dy'>;\nexport type ResizeBilinearGradAttrs =
ResizeBilinearAttrs;\n\nexport const Relu6 = 'Relu6';\nexport type Relu6Inputs = Pick<NamedTensorInfoMap,
'x'>;\n\nexport const Reverse = 'Reverse';\nexport type ReverseInputs = Pick<NamedTensorInfoMap, 'x'>;\nexport
interface ReverseAttrs {\n  dims: number|number[];\n}\n\n\nexport const Round = 'Round';\nexport type RoundInputs
= UnaryInputs;\n\nexport const Rsqrt = 'Rsqrt';\nexport type RsqrtInputs = UnaryInputs;\n\n\nexport const ScatterNd

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= 'ScatterNd';\nexport type ScatterNdInputs
= Pick<NamedTensorInfoMap, 'indices'|'updates'>;\nexport interface ScatterNdAttrs {\n shape:
number[];\n}\n\nexport const Select = 'Select';\nexport type SelectInputs = Pick<NamedTensorInfoMap,
'condition'|'t'|'e'>;\n\nexport const Selu = 'Selu';\nexport type SeluInputs = Pick<NamedTensorInfoMap,
'x'>;\n\nexport const Slice = 'Slice';\nexport type SliceInputs = Pick<NamedTensorInfoMap, 'x'>;\nexport interface
SliceAttrs {\n begin: number|number[];\n size: number|number[];\n}\n\nexport const Sin = 'Sin';\nexport type
SinInputs = UnaryInputs;\n\nexport const Sinh = 'Sinh';\nexport type SinhInputs = UnaryInputs;\n\nexport const
Sign = 'Sign';\nexport type SignInputs = UnaryInputs;\n\nexport const Sigmoid = 'Sigmoid';\nexport type
SigmoidInputs = UnaryInputs;\n\nexport const Softplus = 'Softplus';\nexport type SoftplusInputs =
UnaryInputs;\n\nexport const Sqrt = 'Sqrt';\nexport type SqrtInputs = UnaryInputs;\n\nexport const Sum =
'Sum';\nexport type SumInputs = Pick<NamedTensorInfoMap,
'x'>;\nexport interface SumAttrs {\n axis: number|number[];\n keepDims: boolean;\n}\n\nexport const
SpaceToBatchND = 'SpaceToBatchND';\nexport type SpaceToBatchNDInputs = Pick<NamedTensorInfoMap,
'x'>;\nexport interface SpaceToBatchNDAttrs {\n blockShape: number[];\n paddings: number[][];\n}\n\nexport
const SplitV = 'SplitV';\nexport type SplitVInputs = Pick<NamedTensorInfoMap, 'x'>;\nexport interface SplitVAttrs
{\n numOrSizeSplits: number[]|number;\n axis: number;\n}\n\nexport const Softmax = 'Softmax';\nexport type
SoftmaxInputs = Pick<NamedTensorInfoMap, 'logits'>;\nexport interface SoftmaxAttrs {\n dim:
number;\n}\n\nexport const SquaredDifference = 'SquaredDifference';\nexport type SquaredDifferenceInputs =
BinaryInputs;\n\nexport const Square = 'Square';\nexport type SquareInputs = Pick<NamedTensorInfoMap,
'x'>;\n\nexport const Sub = 'Sub';\nexport type SubInputs = BinaryInputs;\n\nexport const SparseToDense =
'SparseToDense';\nexport type SparseToDenseInputs =\n
Pick<NamedTensorInfoMap, 'sparseIndices'|'sparseValues'|'defaultValue'>;\nexport interface SparseToDenseAttrs
{\n outputShape: number[];\n}\n\nexport const StridedSlice = 'StridedSlice';\nexport type StridedSliceInputs =
Pick<NamedTensorInfoMap, 'x'>;\nexport interface StridedSliceAttrs {\n begin: number[];\n end: number[];\n
strides: number[];\n beginMask: number;\n endMask: number;\n ellipsisMask: number;\n newAxisMask:
number;\n shrinkAxisMask: number;\n}\n\nexport const Tan = 'Tan';\nexport type TanInputs =
UnaryInputs;\n\nexport const Tanh = 'Tanh';\nexport type TanhInputs = UnaryInputs;\n\nexport const Tile =
'Tile';\nexport type TileInputs = Pick<NamedTensorInfoMap, 'x'>;\nexport interface TileAttrs {\n reps:
number[];\n}\n\nexport const TopK = 'TopK';\nexport type TopKInputs = Pick<NamedTensorInfoMap,
'x'>;\nexport interface TopKAttrs {\n k: number;\n sorted: boolean;\n}\n\nexport const Transpose =
'Transpose';\nexport type TransposeInputs = Pick<NamedTensorInfoMap,
'x'>;\nexport interface TransposeAttrs {\n perm: number[];\n}\n\nexport const Unique = 'Unique';\nexport type
UniqueInputs = Pick<NamedTensorInfoMap, 'x'>;\nexport interface UniqueAttrs {\n axis: number;\n}\n\nexport
type UnaryInputs = Pick<NamedTensorInfoMap, 'x'>;\n\nexport const Unpack = 'Unpack';\nexport type
UnpackInputs = Pick<NamedTensorInfoMap, 'value'>;\nexport interface UnpackAttrs {\n axis:
number;\n}\n\nexport const UnsortedSegmentSum = 'UnsortedSegmentSum';\nexport type
UnsortedSegmentSumInputs =\n Pick<NamedTensorInfoMap, 'x'|'segmentIds'>;\nexport interface
UnsortedSegmentSumAttrs {\n numSegments: number;\n}\n\nexport const ZerosLike = 'ZerosLike';\nexport type
ZerosLikeInputs = UnaryInputs;\n\n\n**\n * TensorFlow.js-only kernels\n *\n\nexport const Step = 'Step';\nexport
type StepInputs = UnaryInputs;\nexport interface StepAttrs {\n alpha: number;\n}\n\nexport const FromPixels =
'FromPixels';\nexport interface FromPixelsInputs {\n pixels:
PixelData|ImageData|HTMLImageElement|HTMLCanvasElement|\n
HTMLVideoElement|ImageBitmap;\n}\n\nexport interface FromPixelsAttrs {\n numChannels:
number;\n}\n\nexport const RotateWithOffset = 'RotateWithOffset';\nexport type RotateWithOffsetInputs =
Pick<NamedTensorInfoMap, 'image'>;\nexport interface RotateWithOffsetAttrs {\n radians: number;\n fillValue:
number|[number, number, number];\n center: number|[number, number];\n}\n\nexport const _FusedMatMul =
'_FusedMatMul';\n\n// tslint:disable-next-line: class-name\nexport interface _FusedMatMulInputs extends
NamedTensorInfoMap {\n a: TensorInfo;\n b: TensorInfo;\n bias?: TensorInfo;\n preluActivationWeights?:

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TensorInfo;\n}\n// tslint:disable-next-line: class-name\nexport interface _FusedMatMulAttrs {\n transposeA:
boolean;\n transposeB: boolean;\n activation: Activation;\n leakyreluAlpha?: number;\n}\n\nexport const
FusedConv2D = 'FusedConv2D';\nexport interface FusedConv2DInputs extends NamedTensorInfoMap {\n x:
TensorInfo;\n filter: TensorInfo;\n
  bias?: TensorInfo;\n preluActivationWeights?: TensorInfo;\n}\n\nexport interface FusedConv2DAttrs {\n strides:
[number, number]|number;\n pad: 'valid'|'same'|number|ExplicitPadding;\n dataFormat: 'NHWC'|'NCHW';\n
  dilations: [number, number]|number;\n dimRoundingMode: 'floor'|'round'|'ceil';\n activation: Activation;\n
  leakyreluAlpha?: number;\n}\n\nexport const FusedDepthwiseConv2D = 'FusedDepthwiseConv2D';\nexport
interface FusedDepthwiseConv2DInputs extends NamedTensorInfoMap {\n x: TensorInfo;\n filter: TensorInfo;\n
  bias?: TensorInfo;\n preluActivationWeights?: TensorInfo;\n}\n\nexport interface FusedDepthwiseConv2DAttrs {\n
  strides: [number, number]|number;\n pad: 'valid'|'same'|number;\n dataFormat: 'NHWC'|'NCHW';\n dilations:
[number, number]|number;\n dimRoundingMode: 'floor'|'round'|'ceil';\n activation: Activation;\n leakyreluAlpha?:
number;\n}\n\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License,
Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may
obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by
applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS"
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
=====
*\nimport {env} from './environment';\nimport {getGlobal} from './global_util';\nimport {NamedGradientMap}
from './tape';\nimport {Tensor} from './tensor';\nimport {DataType, RecursiveArray} from './types';\n\nconst
kernelRegistry =\n  getGlobal('kernelRegistry', () => new Map<string, KernelConfig>());\nconst gradRegistry =\n  getGlobal('gradRegistry', () => new Map<string,
  GradConfig>());\n\nexport type DataId = object;\n\nexport type AttributeValue =\n  number|number[]|boolean|boolean[]|string|string[]|NamedAttrMap;\n\n/** These are extra non-tensor/primitive
params passed to kernel functions. */\n\nexport type Attribute =
  AttributeValue|RecursiveArray<AttributeValue>;\n\n/** Specifies the code to run when executing a kernel.
*/\n\nexport type KernelFunc = (params: {\n inputs: NamedTensorInfoMap,\n backend: {},\n attrs?:
  NamedAttrMap,\n}) => TensorInfo|TensorInfo[];\n\n/** The function to run when computing a gradient during
backprop. */\n\nexport type GradFunc =\n  (dy: Tensor|Tensor[], saved: Tensor[], attrs: NamedAttrMap) =>\n  NamedGradientMap;\n\n/** Function that gets called after the backend initializes. */\n\nexport type KernelSetupFunc
= (backend: {}) => void;\n\n/** Function that gets called right before the backend is disposed. */\n\nexport type
KernelDisposeFunc = KernelSetupFunc;\n\n/** Config object for registering a kernel in the global registry.
*/\n\nexport interface KernelConfig {\n kernelName: string;\n backendName: string;\n kernelFunc: KernelFunc;\n
  setupFunc?: KernelSetupFunc;\n disposeFunc?: KernelDisposeFunc;\n}\n\n/** Config object for registering a
gradient in the global registry. */\n\nexport interface GradConfig {\n kernelName: string;\n inputsToSave?:
  string[];\n // When saveAllInputs is true, all inputs will be saved. Only use this flag\n // if inputs is an array of
Tensors.\n saveAllInputs?: boolean;\n outputsToSave?: boolean[];\n gradFunc: GradFunc;\n}\n\n/** Holds
metadata for a given tensor. */\n\nexport interface TensorInfo {\n dataId: DataId;\n shape: number[];\n dtype:
  DataType;\n}\n\nexport interface NamedTensorInfoMap {\n [name: string]: TensorInfo;\n}\n\nexport interface
NamedAttrMap {\n [name: string]: Attribute;\n}\n\n/**\n * Returns the kernel function (code) associated with the
provided names.\n * @param kernelName The official name of the kernel.\n * @param backendName The official
name of the backend.\n */\n\nexport function getKernel(\n  kernelName: string, backendName: string):
  KernelConfig {\n  const key = makeKey(kernelName, backendName);\n  return kernelRegistry.get(key);\n}\n\n/**\n * Returns the registered gradient info associated with the provided kernel.\n * @param kernelName The official TF
kernel name.\n */\n\nexport function getGradient(kernelName: string): GradConfig {\n  return

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gradRegistry.get(kernelName);\n}\n\nexport function getKernelsForBackend(backendName: string): KernelConfig[]
{\n  const it = kernelRegistry.entries();\n  const result: KernelConfig[] = [];\n\n  while (true) {\n    const {done,\n      value} = it.next();\n    if (done) {\n      break;\n    }\n    const [key, config] = value;\n    const [backend, ] =\n      key.split('_');\n    if (backend === backendName) {\n      result.push(config);\n    }\n  }\n  return result;\n}\n\n/**\n * Registers the function (forward pass) for the kernel in a global registry.\n * @param config A config object\n * with the following properties:\n * - `kernelName` The official name of the kernel.\n * - `backendName` The official\n * name of the backend.\n * - `kernelFunc` The function to run during the forward pass of the kernel.\n * - `setupFunc`\n * Optional. Gets called once, after the backend initializes.\n * - `disposeFunc` Optional. Gets called once, right before\n * the backend is\n * disposed.\n */\nexport function registerKernel(config: KernelConfig) {\n  const {kernelName,\n    backendName} = config;\n  const key = makeKey(kernelName, backendName);\n  if (kernelRegistry.has(key)) {\n    console.warn(\n      `The kernel '${kernelName}' for backend ` +\n      ` '${backendName}' is already\n      registered`);\n  }\n  kernelRegistry.set(key, config);\n}\n\n/**\n * Registers a gradient function for a given kernel in\n * the global registry,\n * to be used during the back-propagation of that kernel.\n * @param config An object with\n * the following properties:\n * - `kernelName` The name of the kernel that the gradient\n * function is for.\n * - `gradFunc` The function to run during back-propagation.\n */\nexport function\n  registerGradient(config: GradConfig) {\n  const {kernelName} = config;\n\n  if (gradRegistry.has(kernelName)) {\n    // TODO (yassogba) after 3.0 assess whether we need to keep this gated\n    // to debug mode.\n    if\n      (env().getBool('DEBUG')) {\n      console.warn(`Overriding the gradient for '${kernelName}'`);\n    }\n  }\n\n  gradRegistry.set(kernelName, config);\n}\n\n/**\n * Removes the kernel function from the registry.\n * @param\n * kernelName The official name of the kernel.\n * @param backendName The official name of the backend.\n */\nexport function unregisterKernel(\n  kernelName: string, backendName: string): void {\n  const key =\n    makeKey(kernelName, backendName);\n  if (!kernelRegistry.has(key)) {\n    throw new Error(\n      `The kernel\n      '${kernelName}' for backend ` +\n      ` '${backendName}' is not registered`);\n  }\n\n  kernelRegistry.delete(key);\n}\n\n/**\n * Removes the registered gradient from the global registry.\n */\nexport function unregisterGradient(kernelName:\n  string): void {\n  if (!gradRegistry.has(kernelName)) {\n    throw new Error(\n      `The gradient '${kernelName}'\n      for backend is not registered`);\n  }\n  gradRegistry.delete(kernelName);\n}\n\n/**\n * Finds kernels that have\n * already been registered to a backend and re-registers\n * them for a new backend. Useful for registering custom\n * backends.\n * @param registeredBackendName Already registered backend.\n * @param newBackendName New\n * backend.\n */\nexport function copyRegisteredKernels(\n  registeredBackendName: string, newBackendName:\n  string): void {\n  const kernels = getKernelsForBackend(registeredBackendName);\n  kernels.forEach(kernelConfig\n    => {\n      const newKernelConfig =\n        Object.assign({}, kernelConfig, {backendName: newBackendName});\n      registerKernel(newKernelConfig);\n    });\n}\n\nfunction makeKey(kernelName: string, backendName: string) {\n  return `${backendName}_${kernelName}`;\n}\n\n**\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n * 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a\n * copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable\n * law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS"\n * BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n */\n\n=====\n\nimport {env} from './environment';\nimport {BackendValues, DataType, TensorLike, TypedArray} from\n './types';\nimport * as base from './util_base';\nexport * from './util_base';\n\n/**\n * Create typed array for scalar\n * value. Used for storing\n * in `DataStorage`.\n */\nexport function createScalarValue(\n  value: DataType, dtype: DataType): BackendValues\n{\n  if (dtype === 'string') {\n    return encodeString(value);\n  }\n\n  return toTypedArray([value],\n    dtype);\n}\n\nfunction noConversionNeeded(a: TensorLike, dtype: DataType): boolean {\n  return (a instanceof\n    Float32Array && dtype === 'float32') ||\n    (a instanceof Int32Array && dtype === 'int32') ||\n    (a instanceof

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Uint8Array && dtype === 'bool');\n}\n\nexport function toTypedArray(a: TensorLike, dtype: DataType):  
TypedArray {\n  if (dtype === 'string') {\n    throw new Error('Cannot convert a string[] to a TypedArray');\n  }\n  if (Array.isArray(a)) {\n    a = base.flatten(a);\n  }\n  if (env().getBool('DEBUG')) {\n    base.checkConversionForErrors(a as number[], dtype);\n  }\n  if (noConversionNeeded(a, dtype)) {\n    return a as  
TypedArray;\n  }\n  if (dtype == null || dtype === 'float32' || dtype === 'complex64') {\n    return new  
Float32Array(a as number[]);\n  }\n  else if (dtype === 'int32') {\n    return new Int32Array(a as number[]);\n  }\n  else if (dtype === 'bool') {\n    const  
bool = new Uint8Array((a as number[]).length);\n    for (let i = 0; i < bool.length; ++i) {\n      if (Math.round((a as  
number[])[i]) !== 0) {\n        bool[i] = 1;\n      }\n    }\n    return bool;\n  }\n  else {\n    throw new Error('Unknown  
data type ${dtype}');\n  }\n}\n\n/**\n * Returns the current high-resolution time in milliseconds relative to an  
 * arbitrary time in the past. It works across different platforms (node.js,  
 * browsers).\n */\n * ` `js\n *  
 * console.log(tf.util.now());\n */\n * @doc {heading: 'Util', namespace: 'util'}\n */\n * export function now():  
 * number {\n *   return env().platform.now();\n * }\n\n/**\n * Returns a platform-specific implementation of  
 *  
 * [fetch](https://developer.mozilla.org/en-US/docs/Web/API/Fetch_API).\n * If `fetch` is defined on the global  
 * object (`window`, `process`, etc.),  
 * `tf.util.fetch` returns that  
 * function.\n * If not, `tf.util.fetch` returns a platform-specific solution.\n * ` `js\n *  
 * const resource = await  
 * tf.util.fetch('https://unpkg.com/@tensorflow/tfjs');\n * // handle response\n */\n * @doc {heading: 'Util'}\n */\n * export function fetch(\n *   path: string, requestInits?: RequestInit): Promise<Response> {\n *     return  
 *     env().platform.fetch(path, requestInits);\n * }\n\n/**\n * Encodes the provided string into bytes using the provided  
 * encoding scheme.\n */\n * @param s The string to encode.\n * @param encoding The encoding scheme. Defaults to  
 * utf-8.\n */\n * @doc {heading: 'Util'}\n */\n * export function encodeString(s: string, encoding = 'utf-8'): Uint8Array  
 * {\n *   encoding = encoding || 'utf-8';\n *   return env().platform.encode(s, encoding);\n * }\n\n/**\n * Decodes the provided  
 * bytes into a string using the provided encoding scheme.\n */\n * @param bytes The bytes to decode.\n * @param encoding The encoding scheme. Defaults to utf-8.\n */\n * @doc {heading: 'Util'}\n */\n * export  
 * function decodeString(bytes: Uint8Array, encoding = 'utf-8'): string {\n *   encoding = encoding || 'utf-8';\n *   return  
 *   env().platform.decode(bytes, encoding);\n * }\n\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights  
 * Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file  
 * except in compliance with the License.\n * You may obtain a copy of the License at  
 *  
 * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,  
 * software  
 * distributed under the License is distributed on an "AS IS" BASIS,  
 * WITHOUT WARRANTIES  
 * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language  
 * governing permissions and  
 * limitations under the License.\n */\n\n=====\n\n * export {BackendTimer, BackendTimingInfo} from './backends/backend';\n * import {env} from  
 * './environment';\n * import  
 * {Tensor} from './tensor';\n * import {NamedTensorMap} from './tensor_types';\n * import {DataType, DataTypeMap,  
 * TypedArray} from './types';\n * import * as util from './util';\n * export type KernelProfile = {\n *   kernelName: string,\n *   outputs: Tensor[],\n *   inputs: NamedTensorMap,\n *   timeMs: Promise<number|{error: string}>,\n *   extraInfo:  
 *   Promise<string>};\n * export class Profiler {\n *   constructor(private backendTimer: BackendTimer, private logger?:  
 *   Logger) {\n *     if (logger == null) {\n *       this.logger = new Logger();\n *     }\n *   }\n *   profileKernel(kernelName: string,  
 *   inputs: NamedTensorMap, f: () => Tensor[]):  
 *   KernelProfile {\n *     let outputs: Tensor[];\n *     const  
 *     holdResultWrapperFn = () => {\n *       outputs = f();\n *     };\n *     let timer: Promise<BackendTimingInfo>;\n *     const  
 *     start = util.now();\n *     if (this.backendTimer.timerAvailable()) {\n *       timer =  
 *       this.backendTimer.time(holdResultWrapperFn);\n *     } else {\n *       holdResultWrapperFn();\n *       outputs.map(output  
 * => output.dataSync());\n *     }\n *     timer = Promise.resolve({kernelMs: util.now() - start});\n *   }\n *   if  
 * (env().getBool('CHECK_COMPUTATION_FOR_ERRORS')) {\n *     for (let i = 0; i < outputs.length; i++) {\n *       const output = outputs[i];\n *       // Dangling promise here because we don't want to propagate up\n *       //
```

```

asynchronicity.\n    output.data().then(tensorVals => {\n        checkComputationForErrors(tensorVals,
output.dtype, kernelName);\n    });\n    }\n    }\n    }\n    const kernelProfile = {\n        kernelName,\n        outputs,\n        inputs,\n        timeMs: timer.then(timing => timing.kernelMs),\n        extraInfo: timer.then(\n            timing =>
timing.getExtraProfileInfo != null ?\n                timing.getExtraProfileInfo() :\n                "")\n        );\n    return
kernelProfile;\n    }\n    logKernelProfile(kernelProfile: KernelProfile): void {\n        const {kernelName, outputs,
timeMs, inputs, extraInfo} = kernelProfile;\n        outputs.forEach(result => {\n            Promise.all([result.data(),
timeMs, extraInfo]).then(valueContainer => {\n                this.logger.logKernelProfile(\n                    kernelName, result,
valueContainer[0], valueContainer[1], inputs,\n                    valueContainer[2]);\n            });\n        });\n    }\n    }\n    }\n    \nexport
function checkComputationForErrors<D extends DataType>(\n        vals: DataTypeMap[D], dtype: D, kernelName:
string): boolean {\n        if (dtype !== 'float32') {\n            // Only floating point computations will generate NaN values\n
return false;\n        }\n        for (let i = 0; i < vals.length; i++) {\n            const num = vals[i] as number;\n            if (isNaN(num) ||
!isFinite(num)) {\n                // Throwing custom exception so behavior is testable.\n                console.warn(`Found ${num} in
the result of '${kernelName}'`);\n                return true;\n            }\n        }\n        return false;\n    }\n    \nexport class Logger {\n
logKernelProfile(\n        name: string, result: Tensor, vals: TypedArray,\n        timeMs: number|{error: string}, inputs:
NamedTensorMap,\n        extraInfo?: string) {\n        const time
= typeof timeMs === 'number' ? util.rightPad(`${timeMs}ms`, 9) :\n            timeMs['error'];\n        const paddedName = util.rightPad(name, 25);\n        const rank = result.rank;\n        const size = result.size;\n        const
shape = util.rightPad(result.shape.toString(), 14);\n        let inputShapesDescription = ";\n        for (const name in
inputs) {\n            const input = inputs[name];\n            if (input != null) {\n                // The input might be a non-tensor (e.g
HTMLImageElement), in which case\n                // we claim the output shape as input shape.\n                const inputShape =
input.shape || result.shape;\n                const inputRank = inputShape.length;\n                inputShapesDescription +=\n                `${name}: ${inputRank}D ${inputRank > 0 ? inputShape : "}`;\n            }\n        }\n        console.log(\n
`${c}${paddedName} \\t${c}${time} \\t${c}${rank}D ${shape} \\t${c}${size} \\t${c}${\n
inputShapesDescription} \\t${c}${extraInfo}`,\n            'font-weight:bold', 'color:red',
'color:blue', 'color: orange',\n            'color: green', 'color: steelblue');\n        }\n    }\n    },/**\n * @license\n * Copyright 2017
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governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport * as util from
'/util';\n\nexport interface TapeNode {\n    id: number;\n    kernelName: string;\n
outputs: Tensor[];\n    inputs: NamedTensorMap;\n    // Optional params, defined only for ops with gradient impl.\n
gradient?: (dys: Tensor[]) => NamedGradientMap;\n    saved?: Tensor[];\n}\n\nexport type NamedGradientMap = {\n
[inputName: string]: () => Tensor;\n};\n\n/**\n * Computes a list of TapeNodes that connect x to y, filtering
everything else\n * out and preserving the order of the original tape elements.\n * @param tape The tape
elements to filter.\n * @param xs The input Tensors.\n * @param y The output Tensor.\n * \nexport function
getFilteredNodesXTToY(\n    tape: TapeNode[], xs: Tensor[], y: Tensor): TapeNode[] {\n    // Forward pass to
compute all the nodes and Tensors that are transitively a\n    // function of x.\n    const tensorsFromX: {[tensorId:
number]: boolean} = {};\n    const nodesFromX: {[nodeId: number]: boolean} = {};\n    for (let i = 0; i < xs.length;
i++) {\n        tensorsFromX[xs[i].id] = true;\n    }\n    for (let i = 0; i < tape.length; i++) {\n        const node = tape[i];\n
const nodeInputs = node.inputs;\n        for (const inputName in nodeInputs) {\n            const input =
nodeInputs[inputName];\n            let anyInputFromX = false;\n            for (let j = 0; j < xs.length; j++) {\n                if
(tensorsFromX[input.id]) {\n                    node.outputs.forEach(output => tensorsFromX[output.id] = true);\n
anyInputFromX = true;\n                    nodesFromX[node.id] = true;\n                    break;\n                }\n            }\n            if
(anyInputFromX) {\n                break;\n            }\n        }\n    }\n    // Backward pass to find all of the nodes and Tensors that

```

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lead to y.\n const tensorsLeadToY: {[tensorId: number]: boolean} = {};\n tensorsLeadToY[y.id] = true;\n const
nodesToY: {[nodeId: number]: boolean} = {};\n\n for (let i = tape.length - 1; i >= 0; i--) {\n const node =
tape[i];\n const nodeInputs = node.inputs;\n\n // If any of the outputs lead to y, mark all of the inputs as leading
to y.\n for (let j = 0; j < node.outputs.length; j++) {\n if (tensorsLeadToY[node.outputs[j].id])
{\n for (const inputName in nodeInputs) {\n tensorsLeadToY[nodeInputs[inputName].id] = true;\n
nodesToY[node.id] = true;\n } \n break;\n } \n } \n } \n\n // Return the paths that come from x and lead
to y.\n const filteredTape: TapeNode[] = [];\n for (let i = 0; i < tape.length; i++) {\n const node = tape[i];\n\n if
(nodesFromX[node.id] && nodesToY[node.id]) {\n // Prune the inputs from the node that aren't a function of
x.\n const prunedInputs: {[inputName: string]: Tensor} = {};\n for (const inputName in node.inputs) {\n
const nodeInput = node.inputs[inputName];\n if (tensorsFromX[nodeInput.id]) {\n
prunedInputs[inputName] = nodeInput;\n } \n } \n\n // Copy the node and overwrite inputsAndArgs to the
pruned version.\n const prunedNode = Object.assign({}, node);\n prunedNode.inputs = prunedInputs;\n
prunedNode.outputs = node.outputs;\n\n filteredTape.push(prunedNode);\n
} \n } \n\n return filteredTape;\n}\n\n/**\n * Backpropagate gradients through the filtered TapeNodes.\n *\n * @param tensorAccumulatedGradientMap A map of Tensor to its gradient. This map\n * is mutated by this
method.\n * @param filteredTape The filtered TapeNodes to backprop through.\n */\nexport function
backpropagateGradients(\n tensorAccumulatedGradientMap: {[tensorId: number]: Tensor},\n filteredTape:
TapeNode[], tidy: (f: Function) => Tensor,\n add: (a: Tensor, b: Tensor) => Tensor) {\n // Walk the tape
backward and keep a map of Tensor to its gradient.\n for (let i = filteredTape.length - 1; i >= 0; i--) {\n const node
= filteredTape[i];\n\n const dys: Tensor[] = [];\n node.outputs.forEach(o => {\n const gradTensor =
tensorAccumulatedGradientMap[o.id];\n if (gradTensor != null) {\n dys.push(gradTensor);\n } else {\n
// This particular output is not in the back-propagation subgraph, so it\n
// does not affect the final output, thus we put null for its dy.\n dys.push(null);\n } \n } \n\n if
(node.gradient == null) {\n throw new Error(\n `Cannot compute gradient: gradient function not found ` +\n
`for ${node.kernelName}.`);\n } \n\n // Backprop dy through this node and accumulate gradients over the
inputs.\n const inputGradients = node.gradient(dys);\n for (const inputName in node.inputs) {\n if
(!(inputName in inputGradients)) {\n throw new Error(\n `Cannot backprop through input
${inputName}. ` +\n `Available gradients found: ${Object.keys(inputGradients).}`);\n } \n\n // Call the
gradient function.\n const dx = tidy(() => inputGradients[inputName]());\n if (dx.dtype !== 'float32') {\n
throw new Error(\n `Error in gradient for op ${\n node.kernelName}. The gradient of input ` +\n
`${inputName} must have 'float32' dtype, but
has '${dx.dtype}'`);\n } \n\n const x = node.inputs[inputName];\n if (!util.arraysEqual(dx.shape, x.shape)) {\n
throw new Error(\n `Error in gradient for op ${\n node.kernelName}. The gradient of input ` +\n
`${inputName}' has shape '${dx.shape}', which does not match ` +\n
`the shape of the input
`${x.shape}``);\n } \n\n if (tensorAccumulatedGradientMap[x.id] == null) {\n
tensorAccumulatedGradientMap[x.id] = dx;\n } else {\n const curGradient =
tensorAccumulatedGradientMap[x.id];\n tensorAccumulatedGradientMap[x.id] = add(curGradient, dx);\n
curGradient.dispose();\n } \n } \n } \n}\n\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
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the License.\n *\n
===== \n
*/\n\nimport {DataType, TypedArray} from './types';\nimport {computeStrides, isString, rightPad, sizeFromShape}
from './util';\n\n// Maximum number of values before we decide to show ellipsis.\nconst

```

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FORMAT_LIMIT_NUM_VALS = 20;\n// Number of first and last values to show when displaying a, b,...,y,
z.\nconst FORMAT_NUM_FIRST_LAST_VALS = 3;\n// Number of significant digits to show.\nconst
FORMAT_NUM_SIG_DIGITS = 7;\n\nexport function tensorToString(\n  vals: TypedArray|string[], shape:
number[], dtype: DataType,\n  verbose: boolean) {\n  const strides = computeStrides(shape);\n
  const padPerCol = computeMaxSizePerColumn(vals, shape, dtype, strides);\n  const rank = shape.length;\n  const
valsLines = subTensorToString(vals, shape, dtype, strides, padPerCol);\n  const lines = ['Tensor'];\n  if (verbose) {\n
  lines.push(` dtype: ${dtype}`);\n  lines.push(` rank: ${rank}`);\n  lines.push(` shape: [${shape}]`);\n
  lines.push(` values:`);\n  }\n  lines.push(valsLines.map(l => ' ' + l).join('\n'));\n  return
lines.join('\n');\n}\n\nfunction computeMaxSizePerColumn(\n  vals: TypedArray|string[], shape: number[], dtype:
DataType,\n  strides: number[]): number[] {\n  const n = sizeFromShape(shape);\n  const numCols =
strides[strides.length - 1];\n  const padPerCol = new Array(numCols).fill(0);\n  const rank = shape.length;\n  const
valuesOrTuples =\n    dtype === 'complex64' ? createComplexTuples(vals) : vals;\n  if (rank > 1) {\n    for (let
row = 0; row < n / numCols; row++) {\n      const offset = row * numCols;\n      for
(let j = 0; j < numCols; j++) {\n        padPerCol[j] = Math.max(\n          padPerCol[j],\n
valToString(valuesOrTuples[offset + j], 0, dtype).length);\n      }\n    }\n  }\n  return padPerCol;\n}\n\nfunction
valToString(\n  val: number|string|[number, number], pad: number, dtype: DataType) {\n  let valStr: string;\n  if
(Array.isArray(val)) {\n    valStr = `${parseFloat(val[0].toFixed(FORMAT_NUM_SIG_DIGITS))} + ` +\n
`${parseFloat(val[1].toFixed(FORMAT_NUM_SIG_DIGITS))}j`;\n  } else if (isString(val)) {\n    valStr =
`${val}`;\n  } else if (dtype === 'bool') {\n    valStr = boolNumToString(val);\n  } else {\n    valStr =
parseFloat(val.toFixed(FORMAT_NUM_SIG_DIGITS)).toString();\n  }\n  return rightPad(valStr,
pad);\n}\n\nfunction boolNumToString(v: number): string {\n  return v === 0 ? 'false' : 'true';\n}\n\nfunction
subTensorToString(\n  vals: TypedArray|string[], shape: number[], dtype: DataType,\n  strides: number[],
padPerCol: number[], isLast = true):
string[] {\n  const storagePerElement = dtype === 'complex64' ? 2 : 1;\n  const size = shape[0];\n  const rank =
shape.length;\n  if (rank === 0) {\n    if (dtype === 'complex64') {\n      const complexTuple =
createComplexTuples(vals);\n      return [valToString(complexTuple[0], 0, dtype)];\n    }\n    if (dtype === 'bool')
{\n      return [boolNumToString(vals[0] as number)];\n    }\n    return [vals[0].toString()];\n  }\n  if (rank === 1)
{\n    if (size > FORMAT_LIMIT_NUM_VALS) {\n      const firstValsSize =
FORMAT_NUM_FIRST_LAST_VALS * storagePerElement;\n      let firstVals =
Array.from<number|string|[number, number]>(\n        vals.slice(0, firstValsSize));\n      let lastVals =
Array.from<number|string|[number, number]>(vals.slice(\n        (size - FORMAT_NUM_FIRST_LAST_VALS) *
storagePerElement,\n        size * storagePerElement));\n      if (dtype === 'complex64') {\n        firstVals =
createComplexTuples(firstVals);\n        lastVals = createComplexTuples(lastVals);\n
      }\n      return [\n        '[' +\n        firstVals.map((x, i) => valToString(x, padPerCol[i], dtype))\n
        .join(', ')\n        +\n        ', ..., ' +\n        lastVals\n        .map(\n          (x, i) => valToString(\n
            x, padPerCol[size -
FORMAT_NUM_FIRST_LAST_VALS + i], dtype))\n          .join(', ')\n        +\n        '']\n      ];\n    }\n    const
displayVals: Array<number|string|[number, number]> =\n      dtype === 'complex64' ? createComplexTuples(vals)
:\n      Array.from<number|string>(vals);\n    return [\n      '[' +\n      displayVals.map((x, i) =>
valToString(x, padPerCol[i], dtype))\n      .join(', ')\n      +\n      '']\n      ];\n  }\n  // The array is rank 2 or more.\n  const
subshape = shape.slice(1);\n  const substrides = strides.slice(1);\n  const stride = strides[0] * storagePerElement;\n
  const lines: string[] = [];\n  if (size > FORMAT_LIMIT_NUM_VALS) {\n    for (let i = 0; i <
FORMAT_NUM_FIRST_LAST_VALS;\n    i++) {\n      const start = i * stride;\n      const end = start + stride;\n      lines.push(...subTensorToString(\n
vals.slice(start, end), subshape, dtype, substrides, padPerCol,\n      false /* isLast */));\n    }\n    lines.push('...');\n
  }\n  for (let i = size - FORMAT_NUM_FIRST_LAST_VALS; i < size; i++) {\n    const start = i * stride;\n    const end
= start + stride;\n    lines.push(...subTensorToString(\n      vals.slice(start, end), subshape, dtype, substrides,
padPerCol,\n      i === size - 1 /* isLast */));\n  }\n  } else {\n    for (let i = 0; i < size; i++) {\n      const start = i *
stride;\n      const end = start + stride;\n      lines.push(...subTensorToString(\n        vals.slice(start, end), subshape,

```

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dtype, strides, padPerCol,
    i === size - 1 /* isLast */);
}
const sep = rank === 2 ? ',': '\n';
lines[0] = '[' + lines[0] + sep;
for (let i = 1; i < lines.length - 1; i++) {
  lines[i] = '[' + lines[i]
  + sep;
}
let newLineSep = '\n';
for (let i = 2; i < rank; i++) {
  newLineSep += '\n';
}
lines[lines.length - 1] = '[' + lines[lines.length - 1] + ']' + (isLast ? '\n' : newLineSep);
return lines;
}

function createComplexTuples(vals: Array<number, number>): TypedArray: Array<number, number> {
  const complexTuples: Array<number, number> = [];
  for (let i = 0; i < vals.length; i += 2) {
    complexTuples.push([vals[i], vals[i + 1]] as [number, number]);
  }
  return complexTuples;
}

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 */

```

```

=====
import {getGlobal} from './global_util';
import {tensorToString} from './tensor_format';
import {ArrayMap, BackendValues, DataType, DataTypeMap, DataValues, NumericDataType, Rank, ShapeMap, SingleValueMap, TypedArray} from './types';
import * as util from './util';
import {computeStrides, toNestedArray} from './util';

export interface TensorData<D> extends DataType {
  dataId?: DataId;
  values?: DataTypeMap[D];
}

// This interface mimics KernelBackend (in backend.ts), which would create a circular dependency if imported.
export interface Backend {
  /** A mutable object, similar to `tf.Tensor`, that allows users to set values at locations before converting to an immutable `tf.Tensor`.
   * See `tf.buffer` for creating a tensor buffer.
   * @doc {heading: 'Tensors', subheading: 'Classes'}
   */
  export class TensorBuffer<R> extends Rank, D extends DataType = 'float32' {
    size: number;
    shape: ShapeMap[R];
    strides: number[];
    values: DataTypeMap[D];
    constructor(shape: ShapeMap[R], public dtype: D, values?: DataTypeMap[D]) {
      this.shape = shape.slice() as ShapeMap[R];
      this.size = util.sizeFromShape(shape);
      if (values != null) {
        const n = values.length;
        util.assert(n === this.size, () => `Length of values '${n}' does not match the size ` + n `inferred by the shape '${this.size}'`);
        if (dtype === 'complex64') {
          throw new Error(`complex64 dtype TensorBuffers are not supported. Please create ` + n ` a TensorBuffer for the real and imaginary parts separately and ` + n ` call tf.complex(real, imag).`);
        }
        this.values = values || util.getArrayFromDType(dtype, this.size);
        this.strides = computeStrides(shape);
      }
      /** Sets a value in the buffer at a given location.
       * @param value The value to set.
       * @param locs The location indices.
       * @doc {heading: 'Tensors', subheading: 'Creation'}
       */
      set(value: SingleValueMap[D], ...locs: number[]): void {
        if (locs.length === 0) {
          locs = [0];
        }
        util.assert(locs.length === this.rank, () => `The number of provided coordinates (${locs.length}) must ` + n `match the rank (${this.rank})`);
        const index = this.locToIndex(locs);
        this.values[index] = value as number;
      }
      /** Returns the value in the buffer at the provided location.
       * @param locs The location indices.
       * @doc {heading: 'Tensors', subheading: 'Creation'}
       */
      get(...locs: number[]): SingleValueMap[D] {
        if (locs.length === 0) {
          locs = [0];
        }
        let i = 0;
        for (const loc of locs) {
          if (loc < 0 || loc >= this.shape[i]) {
            const msg = `Requested out of range element at ${locs}. ` + n ` Buffer shape=${this.shape}`;
            throw new Error(msg);
          }
          i++;
        }
        let index = locs[locs.length - 1];
        for (let i = 0; i < locs.length - 1; ++i) {
          index += this.strides[i] * locs[i];
        }
        return this.values[index] as SingleValueMap[D];
      }
      locToIndex(locs: number[]): number {
        if (this.rank === 0) {
          return 0;
        } else if (this.rank === 1) {
          return locs[0];
        }
        let index = locs[locs.length - 1];
        for (let i = 0; i < locs.length - 1; ++i) {
          index += this.strides[i] * locs[i];
        }
        return index;
      }
      indexToLoc(index: number): number[] {
        if (this.rank === 0) {
          return [];
        } else if (this.rank === 1) {
          return [index];
        }
        const locs: number[] = new Array(this.shape.length);
        for (let i = 0; i < locs.length

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- 1; ++i) {\n    locs[i] = Math.floor(index / this.strides[i]);\n    index -= locs[i] * this.strides[i];\n    }\n    locs[locs.length - 1] = index;\n    return locs;\n  }\n\n  get rank() {\n    return this.shape.length;\n  }\n\n  /**\n   * Creates an immutable `tf.Tensor` object from the buffer.\n   * \n   * @doc {heading: 'Tensors', subheading: 'Creation'}\n   * \n   * toTensor(): Tensor<R> {\n    return trackerFn().makeTensor(this.values, this.shape, this.dtype)\n  }\n\n  asTensor<R>(): Tensor<R> {\n    return trackerFn().makeTensor(this.values, this.shape, this.dtype)\n  }\n\n  export interface TensorTracker {\n    makeTensor(values: DataValues, shape: number[], dtype: DataType, backend?: Backend): Tensor;\n    makeVariable(initialValue: Tensor, trainable?: boolean, name?: string, dtype?: DataType): Variable;\n    incRef(a: Tensor, backend: Backend): void;\n    disposeTensor(t: Tensor): void;\n    disposeVariable(v: Variable): void;\n    read(dataId: DataId): Promise<BackendValues>;\n    readSync(dataId: DataId): BackendValues;\n  }\n\n  /**\n   * The Tensor class calls into this handler to delegate chaining operations.\n   * \n   * export interface OpHandler {\n    cast<T extends Tensor>(x: T, dtype: DataType): T;\n    buffer<R extends Rank, D extends DataType>(shape: ShapeMap[R], dtype: D, values?: DataTypeMap[D]): TensorBuffer<R, D>;\n    print<T extends Tensor>(x: T, verbose: boolean): void;\n    clone<T extends Tensor>(x: T): T;\n    // TODO(yassogba) bring reshape back?\n  }\n\n  // For tracking tensor creation and disposal.\n  let trackerFn: () => TensorTracker = null;\n  // Used by chaining methods to call into ops.\n  let opHandler: OpHandler = null;\n  // Used to warn about deprecated methods.\n  let deprecationWarningFn: (msg: string) => void = null;\n  // This here so that we can use this method on dev branches and keep the\n  // functionality at master.\n  // tslint:disable-next-line:no-unused-expression\n  [deprecationWarningFn];\n\n  /**\n   * An external consumer can register itself as the tensor tracker. This way\n   * the Tensor class can\n   * \n   * notify the tracker for every tensor created and\n   * \n   * disposed.\n   * \n   * export function setTensorTracker(fn: () => TensorTracker) {\n    trackerFn = fn;\n  }\n\n  /**\n   * An external consumer can register itself as the op handler. This way the\n   * \n   * Tensor class can have chaining methods that call into ops via the op\n   * \n   * handler.\n   * \n   * export function setOpHandler(handler: OpHandler) {\n    opHandler = handler;\n  }\n\n  /**\n   * Sets the deprecation warning function to be used by this file. This way the\n   * \n   * Tensor class can be a leaf but still use the environment.\n   * \n   * export function setDeprecationWarningFn(fn: (msg: string) => void) {\n    deprecationWarningFn = fn;\n  }\n\n  /**\n   * We wrap data id since we use weak map to avoid memory leaks.\n   * \n   * Since we have our own memory management, we have a reference counter\n   * \n   * mapping a tensor to its data, so there is always a pointer (even if that\n   * \n   * data is otherwise garbage collectable).\n   * \n   * See https://developer.mozilla.org/en-US/docs/Web/JavaScript/Reference/Global_Objects/WeakMap\n   * \n   * export type DataId = object; // object instead of {} to force non-primitive.\n\n  // Declare this namespace to make Tensor class augmentation work in google3.\n  export declare namespace Tensor {\n    /**\n     * A `tf.Tensor` object represents an immutable, multidimensional array of\n     * \n     * numbers that has a shape and a data type.\n     * \n     * See `tf.tensor` for details on how to create a `tf.Tensor`.\n     * \n     * @doc {heading: 'Tensors', subheading: 'Classes'}\n     * \n     * export class Tensor<R extends Rank = Rank> {\n     * /** Unique id of this tensor. *\n     * \n     * readonly id: number;\n     * /** *\n     * \n     * Id of the bucket holding the data for this tensor. Multiple arrays can\n     * \n     * point to the same bucket (e.g. when calling array.reshape()).\n     * \n     * dataId: DataId;\n     * /** *\n     * \n     * The shape of the tensor. *\n     * \n     * readonly shape: ShapeMap[R];\n     * /** *\n     * \n     * Number of elements in the tensor. *\n     * \n     * readonly size: number;\n     * /** *\n     * \n     * The data type for the array. *\n     * \n     * readonly dtype: DataType;\n     * /** *\n     * \n     * The rank type for the array (see `Rank` enum). *\n     * \n     * readonly rankType: R;\n     * /** *\n     * \n     * Whether this tensor has been globally kept. *\n     * \n     * kept = false;\n     * /** *\n     * \n     * The id of the scope this tensor is being tracked in. *\n     * \n     * scopeId: number;\n     * /** *\n     * \n     * Number of elements to skip in each dimension when indexing. See\n     * \n     * \n     * https://docs.scipy.org/doc/numpy/reference/generated/numpy.ndarray.strides.html\n     * \n     * \n     * readonly strides: number[];\n     * \n     * constructor(shape: ShapeMap[R], dtype: DataType, dataId: DataId, id: number) {\n     * \n     * \n     * this.shape = shape.slice() as ShapeMap[R];\n     * \n     * \n     * this.dtype = dtype || 'float32';\n     * \n     * \n     * this.size = util.sizeFromShape(shape);\n     * \n     * \n     * this.strides = computeStrides(shape);\n     * \n     * \n     * this.dataId = dataId;\n     * \n     * \n     * this.id = id;\n     * \n     * \n     * this.rankType = (this.rank < 5 ? this.rank.toString() : 'higher') as R;\n     * \n     * \n     * get rank(): number {\n     * \n     * \n     * return this.shape.length;\n     * \n     * \n     * }\n     * \n     * \n     * /**\n     * \n     * Returns a promise of `tf.TensorBuffer` that holds the underlying data.\n     * \n     * \n     * \n     * @doc {heading: 'Tensors', subheading:

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'Classes'})\n *^\n async buffer<D extends DataType = 'float32'>(): Promise<TensorBuffer<R, D>> {\n  const vals
= await this.data<D>();\n  return opHandler.buffer(this.shape, this.dtype as D, vals);\n }\n\n /**\n * Returns a
`tf.TensorBuffer` that holds the underlying data.\n * @doc {heading: 'Tensors', subheading: 'Classes'}\n *^\n
bufferSync<D extends DataType = 'float32'>(): TensorBuffer<R, D> {\n  return opHandler.buffer(this.shape,
this.dtype as D, this.dataSync());\n }\n\n /**\n * Returns the tensor data as a nested array. The transfer of data is
done\n * asynchronously.\n *^\n * @doc {heading: 'Tensors', subheading: 'Classes'}\n *^\n async array():
Promise<ArrayMap[R]> {\n  const vals = await this.data();\n  return toNestedArray(this.shape, vals) as
ArrayMap[R];\n }\n\n /**\n * Returns the tensor data as a nested array. The transfer of data is done\n *
synchronously.\n *^\n * @doc {heading: 'Tensors', subheading: 'Classes'}\n *^\n
arraySync(): ArrayMap[R] {\n  return toNestedArray(this.shape, this.dataSync()) as ArrayMap[R];\n }\n\n /**\n
* Asynchronously downloads the values from the `tf.Tensor`. Returns a\n * promise of `TypedArray` that resolves
when the computation has finished.\n *^\n * @doc {heading: 'Tensors', subheading: 'Classes'}\n *^\n async
data<D extends DataType = NumericDataType>(): Promise<DataTypeMap[D]> {\n  this.throwIfDisposed();\n  const
data = trackerFn().read(this.dataId);\n  if (this.dtype === 'string') {\n    const bytes = await data as
Uint8Array[];\n    try {\n      return bytes.map(b => util.decodeString(b)) as DataTypeMap[D];\n    } catch {\n
throw new Error(\n      'Failed to decode the string bytes into utf-8. ' +\n      'To get the original bytes, call
tensor.bytes().');\n    }\n  }\n  return data as Promise<DataTypeMap[D]>;\n }\n\n /**\n * Synchronously
downloads the values from the `tf.Tensor`. This blocks the\n * UI
thread until the values are ready, which can cause performance issues.\n *^\n * @doc {heading: 'Tensors',
subheading: 'Classes'}\n *^\n dataSync<D extends DataType = NumericDataType>(): DataTypeMap[D] {\n  this.throwIfDisposed();\n  const data = trackerFn().readSync(this.dataId);\n  if (this.dtype === 'string') {\n    try
{\n      return (data as Uint8Array[]).map(b => util.decodeString(b)) as\n      DataTypeMap[D];\n    } catch {\n
throw new Error(\n      'Failed to decode the string bytes into utf-8. ' +\n      'To get the original bytes, call
tensor.bytes().');\n    }\n  }\n  return data as DataTypeMap[D];\n }\n\n /** Returns the underlying bytes of the
tensor's data. *\n async bytes(): Promise<Uint8Array[]|Uint8Array> {\n  this.throwIfDisposed();\n  const data =
await trackerFn().read(this.dataId);\n  if (this.dtype === 'string') {\n    return data as Uint8Array[];\n  } else {\n
return new Uint8Array((data as TypedArray).buffer);\n  }\n }\n\n /**\n * Disposes `tf.Tensor` from memory.\n *^\n * @doc {heading: 'Tensors', subheading:
'Classes'}\n *^\n dispose(): void {\n  if (this.isDisposed) {\n    return;\n  }\n  trackerFn().disposeTensor(this);\n  this.isDisposedInternal = true;\n }\n\n protected isDisposedInternal = false;\n
get isDisposed(): boolean {\n  return this.isDisposedInternal;\n }\n\n throwIfDisposed() {\n  if (this.isDisposed)
{\n    throw new Error('Tensor is disposed.');

```



```

Float32Array|Int32Array|Uint8Array|Uint8Array[];\n\nexport enum Rank {\n R0 = 'R0',\n R1 = 'R1',\n R2 =
'R2',\n R3 = 'R3',\n R4 = 'R4',\n R5 = 'R5',\n R6 = 'R6'\n}\n\nexport type FlatVector =
boolean[]|number[]|TypedArray;\n\nexport type RegularArray<T> =\n
T[]|T[][]|T[][][]|T[][][][]|T[][][][][]|T[][][][][];\n\n// tslint:disable-next-line:no-any\n\nexport interface
RecursiveArray<T extends any> {\n [index: number]: T|RecursiveArray<T>;\n}\n\n// Looks for upcasting types.
Used, for example, in operations with mixed dtype\n\n// inputs.\n\nenum UpcastInt32AndMap {\n 'float32' = 'float32',\n
'int32' = 'int32',\n 'bool' = 'int32',\n 'complex64' = 'complex64'\n}\n\nenum
UpcastBoolAndMap {\n 'float32' = 'float32',\n 'int32' = 'int32',\n 'bool' = 'bool',\n 'complex64' =
'complex64'\n}\n\nenum UpcastFloat32AndMap {\n 'float32' = 'float32',\n 'int32' = 'float32',\n 'bool' = 'float32',\n
'complex64' = 'complex64'\n}\n\nenum UpcastComplex64AndMap {\n 'float32' = 'complex64',\n 'int32' =
'complex64',\n 'bool' = 'complex64',\n 'complex64' = 'complex64'\n}\n\nconst upcastTypeMap = {\n 'float32':
UpcastFloat32AndMap,\n 'int32': UpcastInt32AndMap,\n 'bool': UpcastBoolAndMap,\n 'complex64':
UpcastComplex64AndMap\n};\n\nexport function upcastType(typeA: DataType, typeB: DataType): DataType {\n
if (typeA === 'string' || typeB === 'string') {\n if (typeA === 'string' && typeB === 'string') {\n return
'string';\n }\n throw new Error(`Can not upcast ${typeA} with ${typeB}`);\n }\n return
upcastTypeMap[typeA][typeB];\n}\n\n/** Returns the output type after summation. */\n\nexport function
sumOutType(type: DataType): DataType {\n return
upcastType(type, 'int32');\n}\n\n/** @docalias TypedArray|Array */\n\nexport type TensorLike =\n
TypedArray|number|boolean|string|RecursiveArray<number|number[]|TypedArray>|\n
RecursiveArray<boolean>|RecursiveArray<string>|Uint8Array[];\n\nexport type ScalarLike =
number|boolean|string|Uint8Array;\n\n/** @docalias TypedArray|Array */\n\nexport type TensorLike1D =
TypedArray|number[]|boolean[]|string[]|Uint8Array[];\n\n/** @docalias TypedArray|Array */\n\nexport type
TensorLike2D = TypedArray|number[]|number[][]|boolean[]|boolean[][]|\n
string[]|string[][]|Uint8Array[]|Uint8Array[][];\n\n/** @docalias TypedArray|Array */\n\nexport type TensorLike3D =
TypedArray|number[]|number[][]|boolean[]|\n
boolean[][]|string[]|string[][]|Uint8Array[]|Uint8Array[][];\n\n/** @docalias TypedArray|Array */\n\nexport type
TensorLike4D = TypedArray|number[]|number[][]|boolean[]|\n
boolean[][]|string[]|string[][]|Uint8Array[]|Uint8Array[][];\n\n/** @docalias TypedArray|Array */\n\nexport
type TensorLike5D =\n TypedArray|number[]|number[][]|boolean[]|boolean[][]|string[]|\n
string[][]|Uint8Array[]|Uint8Array[][];\n\n/** @docalias TypedArray|Array */\n\nexport type TensorLike6D
=\n TypedArray|number[]|number[][]|boolean[]|boolean[][]|\n
string[]|string[][]|Uint8Array[]|Uint8Array[][];\n\n/** Type for representing image data in Uint8Array
type. */\n\nexport interface PixelData {\n width: number;\n height: number;\n data: Uint8Array;\n}\n\n"/**\n *
@license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR
CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing
permissions and\n * limitations under the License.\n *
=====
*/\n\nimport {Tensor} from './tensor';\nimport {TensorContainer, TensorContainerArray} from
'./tensor_types';\nimport {upcastType} from './types';\nimport {assert} from './util';\n\nexport function
makeTypesMatch<T extends Tensor>(a: T, b: T): [T, T] {\n if (a.dtype === b.dtype) {\n return [a, b];\n }\n
const dtype = upcastType(a.dtype, b.dtype);\n return [a.cast(dtype), b.cast(dtype)];\n}\n\nexport function
assertTypesMatch(a: Tensor, b: Tensor): void {\n assert(\n a.dtype === b.dtype,\n () => `The dtypes of the
first(${a.dtype}) and` +\n `second(${b.dtype}) input must match`);\n}\n\nexport function
isTensorInList(tensor: Tensor, tensorList: Tensor[]): boolean {\n return tensorList.some(x => x.id ===

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tensor.id);\n}\n\n/**\n
 * Extracts any `Tensor`s found within the provided object.\n * @param container an object that may be a
`Tensor` or may directly contain\n * `Tensor`s, such as a `Tensor[]` or `{key: Tensor, ...}`. In general it\n * is safe
to pass any object here, except that `Promise`s are not\n * supported.\n * @returns An array of `Tensors` found
within the passed object. If the\n * argument is simply a `Tensor`, a list containing that `Tensor` is\n * returned. If
the object is not a `Tensor` or does not\n * contain `Tensors`, an empty list is returned.\n */\n\nexport function
getTensorsInContainer(result: TensorContainer): Tensor[] {\n  const list: Tensor[] = [];\n  const seen = new
Set<{}|void>();\n  walkTensorContainer(result, list, seen);\n  return list;\n}\n\nfunction walkTensorContainer(\n
container: TensorContainer, list: Tensor[], seen: Set<{}|void>): void {\n  if (container == null) {\n    return;\n  }\n  if
(container instanceof Tensor) {\n    list.push(container);\n
    return;\n  }\n  if (!Iterable(container)) {\n    return;\n  }\n  // Iteration over keys works also for arrays.\n  const
iterable = container as TensorContainerArray;\n  for (const k in iterable) {\n    const val = iterable[k];\n    if
(!seen.has(val)) {\n      seen.add(val);\n      walkTensorContainer(val, list, seen);\n    }\n  }\n}\n\n// tslint:disable-
next-line:no-any\nfunction isIterable(obj: any): boolean {\n  return Array.isArray(obj) || typeof obj ===
'object';\n}\n\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless
required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express
or implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n */
=====
\n
*\n\nimport {BackendTimingInfo, DataMover, KernelBackend} from './backends/backend';\nimport {Environment,
setEnvironmentGlobal} from './environment';\nimport {getGlobalNamespace} from './global_util';\nimport {Add,
Cast, Identity} from './kernel_names';\nimport {getGradient, getKernel, getKernelsForBackend, GradFunc,
NamedAttrMap, TensorInfo} from './kernel_registry';\nimport {KernelProfile, Profiler} from './profiler';\nimport
{backpropagateGradients, getFilteredNodesXToY, TapeNode} from './tape';\nimport {DataId, setTensorTracker,
Tensor, TensorTracker, Variable} from './tensor';\nimport {GradSaveFunc, NamedTensorMap, NamedVariableMap,
TensorContainer} from './tensor_types';\nimport {getTensorsInContainer} from './tensor_util';\nimport
{BackendValues, DataType, DataValues} from './types';\nimport
* as util from './util';\nimport {bytesFromStringArray, makeOnesTypedArray, now, sizeFromShape} from
'./util';\n\n/**\n * A function that computes an output. The save function is for saving tensors\n * computed in the
forward pass, that we need in the backward pass.\n */\n\nexport type ForwardFunc<T> = (backend: KernelBackend,
save?: GradSaveFunc) => T;\n\n/**\n * @docalias (a: Tensor, b: Tensor, ..., save?: Function) => {\n *   value:
Tensor,\n *   gradFunc: (dy: Tensor, saved?: NamedTensorMap) => Tensor | Tensor[]\n * }\n */\n\nexport type
CustomGradientFunc<T extends Tensor> = (\n  ...inputs: Array<Tensor|GradSaveFunc>) => {\n    value: T;\n    gradFunc: (dy: T, saved: Tensor[]) => Tensor | Tensor[];\n  };\n\nexport type MemoryInfo = {\n  numTensors:
number;\n  numDataBuffers: number;\n  numBytes: number;\n  unreliable?: boolean;\n  reasons: string[];\n};\n\nexport
type KernelInfo = {\n  name: string;\n  bytesAdded: number;\n  totalBytesSnapshot: number;\n  tensorsAdded: number;\n
totalTensorsSnapshot:
number;\n  inputShapes: number[][];\n  outputShapes: number[][];\n  kernelTimeMs: number | {error: string} |
Promise<number> | {error: string};\n  extraInfo: string | Promise<string>;\n};\n\nexport type ProfileInfo = {\n
newBytes: number;\n  newTensors: number;\n  peakBytes: number;\n  kernels: KernelInfo[];\n  result:
TensorContainer;\n  kernelNames: string[];\n};\n\nexport interface TimingInfo extends BackendTimingInfo {\n  wallMs:
number;\n}\n\n/** @docalias Function */\n\nexport type ScopeFn<T extends TensorContainer> = () =>
T;\n\ninterface ScopeState {\n  track: Tensor[];\n  name: string;\n  id: number;\n}\n\ninterface
RegisteredKernelInvocation<I extends NamedTensorMap> {\n  kernelName: string;\n  inputs: I;\n  attrs?:
NamedAttrMap;\n}\n\ninterface CustomGradKernelInvocation<T extends Tensor|Tensor[],\n

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I extends NamedTensorMap> {\n forwardFunc: ForwardFunc<T>;\n backwardsFunc: (dy: T, saved: Tensor[])
=> {\n [P in keyof
I]: () => I[P]\n };\n inputs: I;\n attrs?: NamedAttrMap;\n}\n\nfunction isRegisteredKernelInvocation<T extends
Tensor|Tensor[],\n I extends NamedTensorMap>(\n kernelInvocation:
RegisteredKernelInvocation<I>|\n CustomGradKernelInvocation<T, I>):\n kernelInvocation is
RegisteredKernelInvocation<I> {\n return (kernelInvocation as RegisteredKernelInvocation<I>).kernelName !=
null;\n}\n\n\nclass EngineState {\n // Public since optimizers will use it.\n registeredVariables: NamedVariableMap
= {};\n\n nextTapeNodeId = 0;\n numBytes = 0;\n numTensors = 0;\n numStringTensors = 0;\n numDataBuffers
= 0;\n\n activeTape: TapeNode[];\n // Number of nested tf.grad() statements when computing higher-order\n //
gradients. E.g. `1` for first-order gradients and `2` for second-order\n // gradients. Used to track if the tape should be
removed after a backprop.\n gradientDepth = 0;\n // Number of nested kernel calls. When kernel depth
is greater than 1, we turn\n // off the tape.\n kernelDepth = 0;\n\n // Keep Tensors that parallel the tapes.\n
activeScope: ScopeState;\n scopeStack: ScopeState[] = [];\n /**\n * Keeps track of the number of data moves
during a kernel execution. We\n * maintain a stack since kernels can call other kernels, recursively.\n */\n
numDataMovesStack: number[] = [];\n nextScopeId = 0;\n\n tensorInfo = new WeakMap<DataId, {\n backend:
KernelBackend,\n bytes: number,\n dtype: DataType,\n shape: number[]\n }>();\n\n profiling = false;\n
activeProfile: ProfileInfo = {\n newBytes: 0,\n newTensors: 0,\n peakBytes: 0,\n kernels: [],\n result:
null,\n get kernelNames():\n string[] {\n return Array.from(new Set(this.kernels.map(k => k.name)));\n
}\n }\n\n dispose() {\n for (const variableName in this.registeredVariables) {\n
this.registeredVariables[variableName].dispose();\n }\n }\n}\n\nexport class Engine implements
TensorTracker, DataMover {\n state: EngineState;\n backendName: string;\n registry: {[id: string]:
KernelBackend} = {};\n registryFactory: {\n [id: string]: {\n factory: () => KernelBackend |
Promise<KernelBackend>,\n priority: number\n }\n } = {};\n\n private profiler: Profiler;\n private
backendInstance: KernelBackend;\n private pendingBackendInit: Promise<boolean>;\n private
pendingBackendInitId = 0;\n\n constructor(public ENV: Environment) {\n this.state = new EngineState();\n }\n\n
async ready(): Promise<void> {\n if (this.pendingBackendInit != null) {\n return
this.pendingBackendInit.then(() => {});\n }\n if (this.backendInstance != null) {\n return;\n }\n const
sortedBackends = this.getSortedBackends();\n for (let i = 0; i < sortedBackends.length; i++) {\n const
backendName = sortedBackends[i];\n const success = await this.initializeBackend(backendName).success;\n
if (success) {\n await this.setBackend(backendName);\n
return;\n }\n }\n\n throw new Error(\n `Could not initialize any backends, all backend initializations
`\n\n `failed.`);\n }\n\n get backend(): KernelBackend {\n if (this.pendingBackendInit != null) {\n throw
new Error(\n `Backend '${this.backendName}' has not yet been initialized. Make ` +\n\n `sure to await
tf.ready() or await tf.setBackend() before calling ` +\n\n `other methods`);\n }\n if (this.backendInstance ==
null) {\n const {name, asyncInit} = this.initializeBackendsAndReturnBest();\n if (asyncInit) {\n throw
new Error(\n `The highest priority backend '${name}' has not yet been ` +\n\n `initialized. Make sure to
await tf.ready() or ` +\n\n `await tf.setBackend() before calling other methods`);\n }\n
this.setBackend(name);\n }\n return this.backendInstance;\n }\n\n backendNames(): string[] {\n return
Object.keys(this.registryFactory);\n }\n\n findBackend(backendName: string): KernelBackend {\n if (!
(backendName in this.registry)) {\n // If
the backend hasn't been initialized but we have a registry entry for\n // it, initialize it and return it.\n
if (backendName in this.registryFactory) {\n const {asyncInit} = this.initializeBackend(backendName);\n
if (asyncInit) {\n // Backend is not ready yet.\n return null;\n }\n } else {\n return null;\n }\n
}\n return this.registry[backendName];\n }\n\n findBackendFactory(backendName: string):\n () =>
KernelBackend | Promise<KernelBackend> {\n if (!
(backendName in this.registryFactory)) {\n return null;\n
}\n return this.registryFactory[backendName].factory;\n }\n\n registerBackend(\n backendName: string,\n
factory: () => KernelBackend | Promise<KernelBackend>,\n priority = 1): boolean {\n if (backendName in
this.registryFactory) {\n

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    console.warn(`\${backendName} backend was already registered.` + `Reusing existing backend
factory.`);
    return false;
  }
  this.registryFactory[backendName] = {factory, priority};
  return true;
}

async setBackend(backendName: string): Promise<boolean> {
  if (this.registryFactory[backendName] === null) {
    throw new Error(`Backend name '\${backendName}' not found in registry`);
  }
  this.backendName = backendName;
  if (this.registry[backendName] === null) {
    this.backendInstance = null;
    const {success, asyncInit} = this.initializeBackend(backendName);
    const result = asyncInit ? await success : success;
    if (!result) {
      return false;
    }
    this.backendInstance = this.registry[backendName];
    this.setupRegisteredKernels();
    // Reset the profiler.
    this.profiler = new Profiler(this.backendInstance);
  }
  return true;
}

private setupRegisteredKernels(): void {
  const kernels = getKernelsForBackend(this.backendName);
  kernels.forEach(kernel => {
    if (kernel.setupFunc != null) {
      kernel.setupFunc(this.backendInstance);
    }
  });
}

private disposeRegisteredKernels(backendName: string): void {
  const kernels = getKernelsForBackend(backendName);
  kernels.forEach(kernel => {
    if (kernel.disposeFunc != null) {
      kernel.disposeFunc(this.registry[backendName]);
    }
  });
}

/**
 * Initializes a backend by looking up the backend name in the factory registry and calling the factory method. Returns a boolean representing whether the initialization of the backend succeeded. Throws an error if there is no backend in the factory registry.
 */
private initializeBackend(backendName: string): {success: boolean|Promise<boolean>, asyncInit: boolean} {
  const registryFactoryEntry = this.registryFactory[backendName];
  if (registryFactoryEntry === null) {
    throw new Error(`Cannot initialize backend \${backendName}, no registration found.`);
  }
  try {
    const backend = registryFactoryEntry.factory();
    /* Test if the factory returns a promise. Done in a more liberal way than previous 'Promise.resolve(backend)===backend' as we needed to account for custom Promise implementations (e.g. Angular)
    if (backend && !(backend instanceof KernelBackend) && typeof backend.then === 'function') {
      const promiseId = ++this.pendingBackendInitId;
      const success = backend.then(backendInstance => {
        // Outdated promise. Another backend was set in the meantime.
        if (promiseId < this.pendingBackendInitId) {
          return false;
        }
        this.registry[backendName] = backendInstance;
        this.pendingBackendInit = null;
        return true;
      }).catch(err => {
        // Outdated promise. Another backend was set in the meantime.
        if (promiseId < this.pendingBackendInitId) {
          return false;
        }
        this.pendingBackendInit = null;
        console.warn(`Initialization of backend \${backendName} failed`);
        console.warn(err.stack || err.message);
        return false;
      });
      this.pendingBackendInit = success;
      return {success, asyncInit: true};
    } else {
      this.registry[backendName] = backend as KernelBackend;
      return {success: true, asyncInit: false};
    }
  } catch (err) {
    console.warn(`Initialization of backend \${backendName} failed`);
    console.warn(err.stack || err.message);
    return {success: false, asyncInit: false};
  }
}

removeBackend(backendName: string): void {
  if (!(backendName in this.registryFactory)) {
    throw new Error(`\${backendName} backend not found in registry`);
  }
  if (this.backendName === backendName && this.pendingBackendInit != null) {
    // There is a pending promise of the backend we want to remove. Make it obsolete.
    this.pendingBackendInitId++;
  }
  if (backendName in this.registry) {
    this.disposeRegisteredKernels(backendName);
    this.registry[backendName].dispose();
    delete this.registry[backendName];
  }
  delete this.registryFactory[backendName];
  // Unset the backend if it is active.
  if (this.backendName === backendName) {
    this.pendingBackendInit = null;
    this.backendName = null;
    this.backendInstance = null;
  }
}

private getSortedBackends(): string[] {
  if (Object.keys(this.registryFactory).length === 0) {
    throw new Error('No backend found in registry.');
```

```

this.getSortedBackends();\n\n for (let i = 0; i < sortedBackends.length; i++) {\n  const backendName =
sortedBackends[i];\n  const {success, asyncInit} = this.initializeBackend(backendName);\n  if (asyncInit ||
success) {\n    return {name: backendName, asyncInit};\n  }\n  }\n  throw new Error(\n    `Could not
initialize any backends, all backend initializations `+\n    `failed.`);\n  }\n  }\n  moveData(backend: KernelBackend,
dataId: DataId) {\n    const info = this.state.tensorInfo.get(dataId);\n    const srcBackend = info.backend;\n    const
values = this.readSync(dataId);\n    const refCount = srcBackend.refCount(dataId);\n
    // Delete the tensor from the old backend and move it to the new\n    // backend.\n
srcBackend.disposeData(dataId, true);\n    info.backend = backend;\n    backend.move(dataId, values, info.shape,
info.dtype, refCount);\n    if (this.shouldCheckForMemLeaks()) {\n    // Track the number of moves during a kernel
execution to correctly\n    // detect memory leaks.\n
this.state.numDataMovesStack[this.state.numDataMovesStack.length - 1]++;\n    }\n  }\n  }\n  tidy<T extends
TensorContainer>(nameOrFn: string|ScopeFn<T>, fn?: ScopeFn<T>):\n  T {\n    let name: string = null;\n    if (fn
== null) {\n    // Called with only 1 argument.\n    if (typeof nameOrFn !== 'function') {\n    throw new
Error('Please provide a function to tidy()');\n    }\n    fn = nameOrFn;\n    } else {\n    // Called with 2
arguments.\n    if (typeof nameOrFn !== 'string' && !(nameOrFn instanceof String)) {\n    throw new Error(\n
    'When calling with two arguments,
the first argument ' +\n    'to tidy() must be a string');\n    }\n    if (typeof fn !== 'function') {\n    throw
new Error(\n    'When calling with two arguments, the 2nd argument ' +\n    'to tidy() must be a
function');\n    }\n    name = nameOrFn as string;\n    // TODO(nsthorat,smilkov): Do operation logging and
performance\n    // profiling.\n    }\n    let result: T;\n    return this.scopedRun(\n    () => this.startScope(name), ()
=> this.endScope(result), () => {\n    result = fn();\n    if (result instanceof Promise) {\n
console.error('Cannot return a Promise inside of tidy.);\n    }\n    return result;\n    });\n  }\n  }\n  private
scopedRun<T>(start: () => void, end: () => void, f: () => T): T {\n    start();\n    try {\n    const res = f();\n
end();\n    return res;\n    } catch (ex) {\n    end();\n    throw ex;\n    }\n  }\n  }\n  private static nextTensorId = 0;\n
private static nextTensorId():
number {\n    return Engine.nextTensorId++;\n  }\n  }\n  private static nextVariableId = 0;\n  private static
nextVariableId():
number {\n    return Engine.nextVariableId++;\n  }\n  }\n  /**\n   * This method is called instead of the public-facing
tensor.clone() when\n   * saving a tensor for backwards pass. It makes sure to add the clone\n   * operation to the
tape regardless of being called inside a kernel\n   * execution.\n   */\n  private clone(x: Tensor): Tensor {\n    const
y: Tensor = ENGINE.runKernel(Identity, {x} as {} as NamedTensorMap);\n    const inputs = {x};\n    const grad =
(dy: Tensor) => ({\n    x: () => {\n    const dtype = 'float32';\n    const gradInputs = {x: dy};\n    const attrs
= {dtype};\n    return ENGINE.runKernel(\n    Cast, gradInputs as {} as NamedTensorMap,\n
    // tslint:disable-next-line: no-unnecessary-type-assertion\n    attrs as {} as NamedAttrMap) as Tensor;\n
    }\n    });\n    const
saved: Tensor[] = [];\n    this.addTapeNode(this.state.activeScope.name, inputs, [y], grad, saved, {});\n    return y;\n
  }\n  }\n  /**\n   * Execute a kernel with the given name and return the output tensor.\n   */\n   * @param kernelName
The name of the kernel to execute.\n   * @param inputs A map of input names to tensors.\n   * @param attrs A map
of attribute names to their values. An attribute is a\n   * primitive (non-tensor) input to the kernel.\n   * @param
inputsToSave A list of tensors, inputs to save for the backprop\n   * computation.\n   * @param outputsToSave A
list of booleans, specifying which output to save\n   * for the backprop computation. These are booleans since the
output\n   * tensors are not visible to the user.\n   */\n  runKernel<T extends Tensor|Tensor[]>(kernelName:
string, inputs: NamedTensorMap, attrs?: NamedAttrMap): T {\n    const hasKernel = getKernel(kernelName,
this.backendName) != null;\n    if (!hasKernel) {\n    throw new Error(`Kernel
'${kernelName}' not registered for backend '${\n    this.backendName}'`);\n    }\n    return
this.runKernelFunc({kernelName, inputs, attrs});\n  }\n  }\n  private shouldCheckForMemLeaks(): boolean {\n
return this.ENV.getBool('IS_TEST');\n  }\n  }\n  private checkKernelForMemLeak(\n    kernelName: string,
numDataIdsBefore: number,\n    outInfos: TensorInfo[]): void {\n    const numDataIdsAfter =
this.backend.numDataIds();\n    // Count the number of data ids associated with the result of the kernel.\n    let

```

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numOutputDataIds = 0;\n  outInfos.forEach(info => {\n    // Complex numbers allocate 3 data ids, one for 'real',
one for\n    // 'imaginary', and one for the container that holds the former two.\n    numOutputDataIds +=
(info.dtype === 'complex64' ? 3 : 1);\n  });\n\n  // Account for the number of moves during kernel execution. A
"data move"\n  // can happen in the middle of a kernel execution, placing a new (key,value)\n  // pair in the data
storage.

```

```

Since data moves have net zero effect (we\n  // always remove the data from the old backend), we have to cancel
them out\n  // when detecting memory leaks.\n  const numMoves =\n

```

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this.state.numDataMovesStack[this.state.numDataMovesStack.length - 1];\n  const dataIdsLeaked =\nnumDataIdsAfter - numDataIdsBefore - numOutputDataIds - numMoves;\n  if (dataIdsLeaked > 0) {\n    throw
new Error(\n      `Backend '${this.backendName}' has an internal memory leak ` +\n      ` (${dataIdsLeaked}
data ids) after running '${kernelName}');\n  }\n\n  /**\n   * Internal helper method to execute a kernel Func\n
*\n   * Use `runKernel` to execute kernels from outside of engine.\n   */\n  private runKernelFunc<T extends
Tensor|Tensor[], I extends NamedTensorMap>(\n    kernelParams: RegisteredKernelInvocation<I>)\n  CustomGradKernelInvocation<T, I>: T {\n    let outputs: Tensor[];\n    let saved: Tensor[] = [];\n    const isTapeOn
= this.isTapeOn();\n

```

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const startingBytecount = this.state.numBytes;\n  const startingNumTensors = this.state.numTensors;\n\n  if
(this.shouldCheckForMemLeaks()) {\n    this.state.numDataMovesStack.push(0);\n  }\n\n  let kernelFunc: () =>
Tensor[];\n  if (this.backendName == null) {\n    // backend has not been initialized yet (backend initialization is
lazy\n    // can be deferred until an op/ kernel is run).\n    // The below getter has side effects that will try to
initialize the\n    // backend and set properties like this.backendName\n    // tslint:disable-next-line: no-unused-
expression\n    this.backend;\n  }\n\n  let out: TensorInfo|TensorInfo[];\n  const kernelOrScopeName =
isRegisteredKernelInvocation(kernelParams) ?\n    kernelParams.kernelName : \n    this.state.activeScope !=
null ? this.state.activeScope.name : ";\n\n  // Create the kernelFunc from either a registered kernel OR passed in\n
// forward/backward functions (used by custom grad). In

```

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this context a\n  // kernelFunc wraps a kernel implementation with some bookkeeping.\n\n  if
(isRegisteredKernelInvocation(kernelParams)) {\n    const {kernelName, inputs, attrs} = kernelParams;\n    if
(this.backendName == null) {\n      // backend has not been initialized yet (backend initialization is lazy\n      //
can be deferred until an op/ kernel is run).\n      // The below getter has side effects that will try to initialize the\n
// backend and set properties like this.backendName\n      // tslint:disable-next-line: no-unused-expression\n      this.backend;\n    }\n    const kernel = getKernel(kernelName, this.backendName);\n    util.assert(\n      kernel
!= null,\n      () => `Cannot find registered kernel '${kernelName}' for backend '${\n
this.backendName}');\n    kernelFunc = () => {\n      const numDataIdsBefore = this.backend.numDataIds();\n
      out = kernel.kernelFunc({inputs, attrs, backend: this.backend});\n

```

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const outInfos = Array.isArray(out) ? out : [out];\n    if (this.shouldCheckForMemLeaks()) {\n      this.checkKernelForMemLeak(kernelName, numDataIdsBefore, outInfos);\n    }\n\n    const outTensors =
outInfos.map((outInfo: TensorInfo|Tensor) => {\n      // todo (yassogba) remove this option (Tensor) when node
backend\n      // methods have been modularized and they all return tensorInfo.\n      // TensorInfos do not have
a rank attribute.\n      if ((outInfo as Tensor).rank != null) {\n        return outInfo as Tensor;\n      }\n
const {dataId, shape, dtype} = outInfo as TensorInfo;\n      return this.makeTensorFromDataId(dataId, shape,
dtype);\n    });\n\n    // Save any required inputs and outputs.\n    // Do not save unless we are recording to
the tape. Otherwise it would\n    // cause a mem leak since there would be no backprop for these tensors\n    //
(which would otherwise dispose them).\n

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if (isTapeOn) {\n      const tensorsToSave =\n        this.getTensorsForGradient(kernelName, inputs,
outTensors);\n      saved = this.saveTensorsForBackwardMode(tensorsToSave);\n    }\n    return
outTensors;\n  };\n  } else {\n    const {forwardFunc} = kernelParams;\n    // Running a customGrad op.\n    const saveFunc: GradSaveFunc = (tensors) => {\n      // Do not save unless we are recording to the tape. Otherwise
it would\n      // cause a mem leak since we would never run backprop, which disposes\n      // the kept tensors.\n      if (!isTapeOn) {\n        return;\n      }\n      saved = tensors.map(tensor => this.keep(this.clone(tensor)));
\n

```

```

};\n\n    kernelFunc = () => {\n        const numDataIdsBefore = this.backend.numDataIds();\n        out = this.tidy()\n        => forwardFunc(this.backend, saveFunc);\n        const outs = (Array.isArray(out) ? out : [out]) as Tensor[];\n        if\n        (this.shouldCheckForMemLeaks()) {\n            // Scope name is used to print a more helpful error message if needed.\n            this.checkKernelForMemLeak(kernelOrScopeName, numDataIdsBefore, outs);\n        }\n        return outs;\n    };\n}\n\n// Run the kernelFunc. Optionally profiling it.\nconst {inputs, attrs} = kernelParams;\nconst\nbackwardsFunc = isRegisteredKernelInvocation(kernelParams) ?\n    null :\n    kernelParams.backwardsFunc;\n\nlet kernelProfile: KernelProfile;\nthis.scopedRun(\n    // Stop recording to\n    a tape when running a kernel.\n    () => this.state.kernelDepth++, () => this.state.kernelDepth--, () => {\n        if\n        (!this.ENV.getBool('DEBUG') && !this.state.profiling) {\n            outputs = kernelFunc();\n        } else {\n            kernelProfile = this.profiler.profileKernel(\n                kernelOrScopeName, inputs, () => kernelFunc());\n            if\n            (this.ENV.getBool('DEBUG')) {\n                this.profiler.logKernelProfile(kernelProfile);\n            }\n            outputs = kernelProfile.outputs;\n        }\n    });\n\nif (isTapeOn) {\n    this.addTapeNode(\n        kernelOrScopeName, inputs, outputs, backwardsFunc, saved, attrs);\n}\n\nif\n(this.state.profiling) {\n    this.state.activeProfile.kernels.push({\n        name: kernelOrScopeName,\n        bytesAdded: this.state.numBytes - startingBytecount,\n        totalBytesSnapshot: this.state.numBytes,\n        tensorsAdded: this.state.numTensors - startingNumTensors,\n        totalTensorsSnapshot: this.state.numTensors,\n        inputShapes: Object.keys(inputs).map(\n            key => inputs[key] != null ? inputs[key].shape : null),\n        outputShapes: outputs.map(item => item.shape),\n        kernelTimeMs: kernelProfile.timeMs,\n        extraInfo:\n        kernelProfile.extraInfo\n    });\n}\n\nreturn (Array.isArray(out) ? outputs : outputs[0]) as T;\n}\n\n/**\n * Saves tensors used in forward mode for use in backward mode.\n *\n * @param tensors the list of tensors to save.\n */\nprivate saveTensorsForBackwardMode(tensors: Tensor[]):\nTensor[] {\n    const saved = tensors.map(tensor => this.keep(this.clone(tensor)));\n    return saved;\n}\n\n/**\n * Returns a list of tensors to save for a given gradient calculation.\n *\n * @param kernelName name of kernel to\n    look up gradient for.\n * @param inputs a map of input tensors.\n * @param outputs an array of output tensors\n    from forward mode of kernel.\n */\nprivate getTensorsForGradient(\n    kernelName: string, inputs:\n    NamedTensorMap,\n    outputs: Tensor[]): Tensor[]\n    | null {\n    const gradConfig = getGradient(kernelName);\n    if\n    (gradConfig != null) {\n        const inputsToSave: string[] = gradConfig.inputsToSave || [];\n        const outputsToSave:\n        boolean[] = gradConfig.outputsToSave || [];\n        // If saveAllInputs is true, all inputs will be saved. Otherwise,\n        inputs\n        // specified in inputsToSave will be saved.\n        let inputTensorsToSave:\n        Tensor[];\n        if (gradConfig.saveAllInputs) {\n            util.assert(\n                Array.isArray(inputs),\n                () =>\n                'saveAllInputs is true, expected inputs to be an array.);\n            inputTensorsToSave =\n            Object.keys(inputs).map((key) => inputs[key]);\n        } else {\n            inputTensorsToSave =\n            inputsToSave.map((inputName) => inputs[inputName]);\n        }\n        const outputTensorsToSave: Tensor[] =\n        outputs.filter((_, i) => outputsToSave[i]);\n        return inputTensorsToSave.concat(outputTensorsToSave);\n    }\n}\n\n// We return an empty list rather than throw an error because the kernel we\n// are looking up may not actually be\n// relevant to backproping through the\n// overall function.\n// See 'does not error if irrelevant (pruned) ops\n// are missing grads' test\n// in gradients_test.ts for an example.\nreturn [];\n}\n\n/**\n * Internal method used\n    by public APIs for tensor creation. Makes a new\n * tensor with\n    the provided shape, dtype and values. It always\n * creates a new data id and writes the values to the underlying\n    backend.\n */\nmakeTensor(\n    values: DataValues, shape: number[], dtype: DataType,\n    backend?:\n    KernelBackend): Tensor {\n    if (values == null) {\n        throw new Error('Values passed to engine.makeTensor() are\n        null');\n    }\n    dtype = dtype || 'float32';\n    backend = backend || this.backend;\n    let backendVals = values as\n    BackendValues;\n    if (dtype === 'string' && util.isString(values[0])) {\n        backendVals = (values as\n        string[]).map(d => util.encodeString(d));\n    }\n    const dataId = backend.write(backendVals, shape, dtype);\n    const t = new Tensor(shape, dtype, dataId, this.nextTensorId());\n    this.trackTensor(t, backend);\n}\n\n// Count\n// bytes for string tensors.\nif (dtype === 'string') {\n    const info = this.state.tensorInfo.get(dataId);\n    const\n    newBytes = bytesFromArray(backendVals as Uint8Array[]);\n    this.state.numBytes

```

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+= newBytes - info.bytes;\n    info.bytes = newBytes;\n    }\n    return t;\n    }\n\n /*\n * Internal method used by
backends. Makes a new tensor\n * that is a wrapper around an existing data id. It doesn't create\n * a new data id,
only increments the ref count used in memory tracking.\n */\n makeTensorFromDataId(\n    dataId: DataId,
shape: number[], dtype: DataType,\n    backend?: KernelBackend): Tensor {\n    dtype = dtype || 'float32';\n    const
t = new Tensor(shape, dtype, dataId, this.nextTensorId());\n    this.trackTensor(t, backend);\n    return t;\n    }\n\n
makeVariable(\n    initialValue: Tensor, trainable = true, name?: string,\n    dtype?: DataType): Variable {\n    name = name || this.nextVariableId().toString();\n    if (dtype != null && dtype !== initialValue.dtype) {\n
initialValue = initialValue.cast(dtype);\n    }\n    const v = new Variable(initialValue, trainable, name,
this.nextTensorId());\n    if (this.state.registeredVariables[v.name]
\n    != null) {\n        throw new Error(`Variable with name ${v.name} was already registered`);\n    }\n
this.state.registeredVariables[v.name] = v;\n    this.incRef(v, this.backend);\n    return v;\n    }\n\n trackTensor(a:
Tensor, backend: KernelBackend): void {\n    this.state.numTensors++;\n    if (a.dtype === 'string') {\n
this.state.numStringTensors++;\n    }\n    // Bytes for complex numbers are counted by their components. Bytes for\n
// string tensors are counted when writing values.\n    let bytes = 0;\n    if (a.dtype !== 'complex64' && a.dtype !==
'string') {\n        bytes = a.size * util.bytesPerElement(a.dtype);\n    }\n    this.state.numBytes += bytes;\n\n    if
(!this.state.tensorInfo.has(a.dataId)) {\n        this.state.numDataBuffers++;\n        this.state.tensorInfo.set(a.dataId, {\n
backend: backend || this.backend,\n        dtype: a.dtype,\n        shape: a.shape,\n        bytes\n    });\n    }\n    if
(!(a instanceof Variable)) {\n        this.track(a);\n    }\n    }\n\n // Track the tensor by dataId and increase the refCount for the dataId in the\n // backend.\n //
TODO(pyu10055): This is currently used by makeVariable method, to increase\n // refCount on the backend for the
dataId. It can potentially be replaced with\n // Identity op instead of calling backend directly.\n    incRef(a: Tensor,
backend: KernelBackend): void {\n        this.trackTensor(a, backend);\n        this.backend.incRef(a.dataId);\n    }\n\n
removeDataId(dataId: DataId, backend: KernelBackend) {\n    if (this.state.tensorInfo.has(dataId) &&\n    this.state.tensorInfo.get(dataId).backend === backend) {\n        this.state.tensorInfo.delete(dataId);\n
this.state.numDataBuffers--;\n    }\n    }\n\n disposeTensor(a: Tensor): void {\n    if
(!this.state.tensorInfo.has(a.dataId)) {\n        return;\n    }\n    const info = this.state.tensorInfo.get(a.dataId);\n\n
this.state.numTensors--;\n    if (a.dtype === 'string') {\n        this.state.numStringTensors--;\n
        this.state.numBytes -= info.bytes;\n    }\n    // Don't count bytes for complex numbers as they are counted by
their\n // components.\n    if (a.dtype !== 'complex64' && a.dtype !== 'string') {\n        const bytes = a.size *
util.bytesPerElement(a.dtype);\n        this.state.numBytes -= bytes;\n    }\n\n    // Remove the reference to dataId if
backend dispose the data successfully\n    if (info.backend.disposeData(a.dataId)) {\n        this.removeDataId(a.dataId, info.backend);\n    }\n\n    // TODO(nsthorat): Construct an error and save the stack
trace for\n // debugging when in debug mode. Creating a stack trace is too expensive\n // to do unconditionally.\n
}\n\n disposeVariables(): void {\n    for (const varName in this.state.registeredVariables) {\n        const v =
this.state.registeredVariables[varName];\n        this.disposeVariable(v);\n    }\n    }\n\n disposeVariable(v: Variable):
void {\n    this.disposeTensor(v);\n    if (this.state.registeredVariables[v.name] != null)\n    {\n        delete this.state.registeredVariables[v.name];\n    }\n    }\n\n memory(): MemoryInfo {\n    const info =
this.backend.memory() as MemoryInfo;\n    info.numTensors = this.state.numTensors;\n    info.numDataBuffers =
this.state.numDataBuffers;\n    info.numBytes = this.state.numBytes;\n    if (this.state.numStringTensors > 0) {\n
info.unreliable = true;\n    if (info.reasons == null) {\n        info.reasons = [];\n    }\n    info.reasons.push(\n
'Memory usage by string tensors is approximate ' +\n        '(2 bytes per character)');\n    }\n    return info;\n    }\n\n
async profile(query: () => (TensorContainer | Promise<TensorContainer>)): Promise<ProfileInfo> {\n
this.state.profiling = true;\n\n    const startBytes = this.state.numBytes;\n    const startNumTensors =
this.state.numTensors;\n\n    this.state.activeProfile.kernels = [];\n    this.state.activeProfile.result = await
query();\n\n    this.state.profiling = false;\n\n    this.state.activeProfile.peakBytes
= Math.max(\n        ...this.state.activeProfile.kernels.map(d => d.totalBytesSnapshot));\n
this.state.activeProfile.newBytes = this.state.numBytes - startBytes;\n    this.state.activeProfile.newTensors =\n    this.state.numTensors - startNumTensors;\n    for (const kernel of this.state.activeProfile.kernels) {\n

```



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kernel.kernelTimeMs = await kernel.kernelTimeMs;\n    kernel.extraInfo = await kernel.extraInfo;\n  }\n  return
this.state.activeProfile;\n }\n\n isTapeOn(): boolean {\n  return this.state.gradientDepth > 0 &&
this.state.kernelDepth === 0;\n }\n\n private addTapeNode(\n  kernelName: string, inputs: NamedTensorMap,
outputs: Tensor[],\n  gradientsFunc: GradFunc, saved: Tensor[], attrs: NamedAttrMap): void {\n  const
tapeNode: TapeNode =\n    {id: this.state.nextTapeNodeId++, kernelName, inputs, outputs, saved};\n  const
gradConfig = getGradient(kernelName);\n  if (gradConfig != null) {\n    gradientsFunc = gradConfig.gradFunc;\n
  }\n  if (gradientsFunc != null) {\n    tapeNode.gradient = (dys: Tensor[]) => {\n      // TODO(smilkov): To
optimize back-prop, pass dys that are not used in\n      // the backprop graph to the user as null instead of zeros\n
dys = dys.map((dy, i) => {\n        if (dy == null) {\n          const output = outputs[i];\n          const vals =
util.makeZerosTypedArray(output.size, output.dtype);\n          return this.makeTensor(vals, output.shape,
output.dtype);\n        }\n        return dy;\n      });\n      // Grad functions of ops with single outputs expect a dy,
while ops\n      // with multiple outputs expect dys (array of dy).\n      return gradientsFunc(dys.length > 1 ? dys :
dys[0], saved, attrs);\n    };}\n  this.state.activeTape.push(tapeNode);\n }\n\n keep<T extends
Tensor>(result: T): T {\n  result.kept = true;\n  return result;\n }\n\n private startTape() {\n  if
(this.state.gradientDepth === 0) {\n
  this.state.activeTape = [];\n  }\n  this.state.gradientDepth++;\n }\n\n private endTape() {\n
this.state.gradientDepth--;\n }\n\n /**\n  * Start a scope. Use this with endScope() to achieve the same
functionality\n  * as scope() without the need for a function closure.\n  */\n  startScope(name?: string) {\n  const
scopeInfo: ScopeState = {\n    track: [],\n    name: 'unnamed scope',\n    id: this.state.nextScopeId++\n  };}\n  if
(name) {\n    scopeInfo.name = name;\n  }\n  this.state.scopeStack.push(scopeInfo);\n  this.state.activeScope =
scopeInfo;\n }\n\n /**\n  * End a scope. Use this with startScope() to achieve the same functionality\n  * as
scope() without the need for a function closure.\n  */\n  endScope(result?: TensorContainer) {\n  const
tensorsToTrackInParent = getTensorsInContainer(result);\n  const tensorsToTrackInParentSet =\n    new
Set(tensorsToTrackInParent.map(t => t.id));\n\n  // Dispose the arrays tracked in this
scope.\n  for (let i = 0; i < this.state.activeScope.track.length; i++) {\n    const tensor =
this.state.activeScope.track[i];\n    if (!tensor.kept && !tensorsToTrackInParentSet.has(tensor.id)) {\n
tensor.dispose();\n    }\n  }\n\n  const oldScope = this.state.scopeStack.pop();\n  this.state.activeScope =
this.state.scopeStack.length === 0 ?\n    null :\n    this.state.scopeStack[this.state.scopeStack.length - 1];\n\n  //
Track the current result in the parent scope.\n  tensorsToTrackInParent.forEach(tensor => {\n    // Only track the
tensor if was allocated in the inner scope and is not\n    // globally kept.\n    if (!tensor.kept && tensor.scopeId
=== oldScope.id) {\n      this.track(tensor);\n    }\n  });}\n\n  /**\n  * Returns gradients of `f` with respect to
each of the `xs`. The gradients\n  * returned are of the same length as `xs`, but some might be null if `f`\n  * was
not a function of that `x`. It also takes optional dy
to multiply the\n  * gradient, which defaults to `1`.\n  */\n  gradients<T extends Tensor>(\n    f: () => T, xs:
Tensor[], dy?: T,\n    allowNoGradients = false): {value: T, grads: Tensor[]} {\n    util.assert(\n      xs.length > 0,
() => 'gradients() received an empty list of xs.);\n    if (dy != null && dy.dtype !== 'float32') {\n      throw new
Error(`dy must have 'float32' dtype, but has '${dy.dtype}'`);\n    }\n\n    const y = this.scopedRun(\n      () =>
this.startTape(), () => this.endTape(),\n      () => this.tidy('forward', f));\n\n    util.assert(\n      y instanceof
Tensor,\n      () => 'The result y returned by f() must be a tensor.);\n    // Filter out the nodes that don't connect x =>
y.\n    const filteredTape = getFilteredNodesXToY(this.state.activeTape, xs, y);\n    if (!allowNoGradients &&
filteredTape.length === 0 && xs.length > 0) {\n      throw new Error(\n        'Cannot compute gradient of y=f(x)
with respect to x. Make sure ' +\n        'that\n        the f you passed encloses all operations that lead from x ' +\n
        'to y.);\n    }\n\n    return this.tidy('backward', ()
=> {\n      const accumulatedGradientMap: {[tensorId: number]: Tensor} = {};\n      accumulatedGradientMap[y.id]
= (dy == null) ? ones(y.shape) : dy;\n\n      // Backprop gradients through the filtered nodes.\n
backpropagateGradients(\n        accumulatedGradientMap, filteredTape,\n        // Pass the tidy function to avoid
circular dep with `tape.ts`.\n        f => this.tidy(f as ScopeFn<Tensor>),\n        // Pass an add function to avoid a
circular dep with `tape.ts`.\n        add);\n      const grads = xs.map(x => accumulatedGradientMap[x.id]);\n      if

```

```

(this.state.gradientDepth === 0) {\n    // This means that we are not computing higher-order gradients\n    // and can clean up the tape.\n    this.state.activeTape.forEach(node => {\n        for (const tensor of node.saved) {\n            tensor.dispose();\n        }\n    });\n    this.state.activeTape = null;\n    }\n    return {value: y, grads};\n    });\n}\n\n customGrad<T extends Tensor>(f: CustomGradientFunc<T>);\n    (...args: Array<Tensor|GradSaveFunc>) => T {\n    util.assert(\n        util.isFunction(f),\n        () => 'The f passed in customGrad(f) must be a function.);\n    return (...inputs: Tensor[]): T => {\n        util.assert(\n            inputs.every(t => t instanceof Tensor),\n            () => 'The args passed in customGrad(f)(x1, x2,...) must all be '+\n                'tensors');\n        let res: {\n            value: T,\n            gradFunc: (dy: T, saved: Tensor[]) => Tensor | Tensor[],\n        }; \n        const inputMap: NamedTensorMap = {};\n        inputs.forEach((input, i) => {\n            inputMap[i] = input;\n        });\n        const forwardFunc: ForwardFunc<T> = (_, save) => {\n            res = f(...inputs, save);\n            util.assert(\n                res.value instanceof Tensor,\n                () => 'The function f passed in customGrad(f) must return an '+\n                    'object where `obj.value` is a tensor');\n            util.assert(\n                util.isFunction(res.gradFunc),\n                () => 'The function f passed in customGrad(f) must return an '+\n                    'object where `obj.gradFunc` is a function.);\n            return res.value;\n        });\n        const backwardsFunc = (dy: T, saved: Tensor[]) => {\n            const gradRes = res.gradFunc(dy, saved);\n            const grads: Tensor[] = Array.isArray(gradRes) ? gradRes : [gradRes];\n            util.assert(\n                grads.length === inputs.length,\n                () => 'The function f passed in customGrad(f) must return an '+\n                    'object where `obj.gradFunc` is a function that returns '+\n                    'the same number of tensors as inputs passed to f(...).);\n            util.assert(\n                grads.every(t => t instanceof Tensor),\n                () => 'The function f passed in customGrad(f) must return an '+\n                    'object where `obj.gradFunc` is a function that returns '+\n                    'a list of only tensors.);\n            const gradMap: {[key: string]: () => Tensor} = {};\n            grads.forEach((grad, i) => {\n                gradMap[i] = () => grad;\n            });\n            return gradMap;\n        });\n        return this.runKernelFunc({\n            forwardFunc,\n            backwardsFunc,\n            inputs: inputMap,\n        });\n    });\n}\n\n readSync(dataId: DataId): BackendValues {\n    // Route the read to the correct backend.\n    const info = this.state.tensorInfo.get(dataId);\n    return info.backend.readSync(dataId);\n}\n\n read(dataId: DataId): Promise<BackendValues> {\n    // Route the read to the correct backend.\n    const info = this.state.tensorInfo.get(dataId);\n    return info.backend.read(dataId);\n}\n\n async time(query: () => void): Promise<TimingInfo> {\n    const start = now();\n    const timingInfo = await this.backend.time(query) as TimingInfo;\n    timingInfo.wallMs = now() - start;\n}\n\n return timingInfo;\n}\n\n /**\n * Tracks a Tensor in the current scope to be automatically cleaned up\n * when the current scope ends, and returns the value.\n * @param result The Tensor to track in the current scope.\n */\n private track<T extends Tensor>(result: T): T {\n    if (this.state.activeScope != null) {\n        result.scopeId = this.state.activeScope.id;\n        this.state.activeScope.track.push(result);\n    }\n    return result;\n}\n\n get registeredVariables(): NamedVariableMap {\n    return this.state.registeredVariables;\n}\n\n /**\n * Resets the engine state. Removes all backends but does not remove\n * registered backend factories.\n */\n reset(): void {\n    // Make any pending promise obsolete.\n    this.pendingBackendInitId++;\n    this.state.dispose();\n    this.ENV.reset();\n    this.state = new EngineState();\n    for (const backendName in this.registry) {\n        this.disposeRegisteredKernels(backendName);\n        this.registry[backendName].dispose();\n        delete this.registry[backendName];\n    }\n    this.backendName = null;\n    this.backendInstance = null;\n    this.pendingBackendInit = null;\n}\n\nfunction ones(shape: number[]): Tensor {\n    const values = makeOnesTypedArray(sizeFromShape(shape), 'float32');\n    return ENGINE.makeTensor(values, shape, 'float32');\n}\n\nexport function getOrMakeEngine(): Engine {\n    const ns = getGlobalNamespace() as {\n        _tfengine: Engine;\n    }; \n    if (ns._tfengine == null) {\n        const environment = new Environment(ns);\n        ns._tfengine = new Engine(environment);\n    }\n    setEnvironmentGlobal(ns._tfengine.ENV);\n    // Tell the current tensor interface that the global engine is responsible\n    // for tracking.\n    setTensorTracker(() => ns._tfengine);\n    return ns._tfengine;\n}\n\nexport const ENGINE = getOrMakeEngine();\n\n /**\n * A implementation of the add op for use within engine and tape.\n * This allows us to avoid a circular dependency between add.ts and

```

```
engine.\n * It is exported to be available in tape tests.\n *\nexport function add(a: Tensor, b: Tensor): Tensor {\n //  
We duplicate Add here to avoid a circular dependency with add.ts.\n const inputs = {a, b};\n return  
ENGINE.runKernel(Add, inputs as { } as NamedTensorMap);\n}\n", "/*\n * @license\n * Copyright 2017 Google  
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not  
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *  
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,  
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES  
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language  
governing permissions and\n * limitations under the License.\n *
```

```
=====\n *\n\n// tslint:disable-next-line:no-any\nfunction _isNavigatorDefined(): boolean {\n return typeof navigator !==  
'undefined' && navigator !== null;\n}\n\nexport function isMobile(): boolean {\n if (_isNavigatorDefined()) {\n //  
tslint:disable-next-line:no-any\n const a = navigator.userAgent || navigator.vendor || (window as any).opera;\n //  
tslint:disable-next-line:max-line-length\n return  
/(android|bb\\d+|meego).+mobile|avantgo|bada\\|blackberry|blazer|compal|elaine|fennec|hiptop|iemo|ip(hone|od)|  
iris|kindle|lge |maemo|midp|mmp|mobile.+firefox|netfront|opera m(ob|in)i|palm(  
os)?|phone|p(ixi|re)|\\|plucker|pocket|psp|series(4|6|0)|symbian|treo|up\\. (browser|link)|vodafone|wap|windows  
ce|x|xda|xiino/i\n .test(a) ||\n // tslint:disable-next-line:max-line-length\n /1207|6310|6590|3gso|4thp|50[1-6]|i770s|802s|a wa|abac|ac(er|oo|s\\-  
)|ai(ko|rn)|al(av|ca|co)|amoi|an(ex|ny|yw)|aptu|ar(ch|go)|as(te|us)|attw|au(di|-m|r |s  
)|avan|be(ck|ll|nq)|bi(lb|rd)|bl(ac|az)|br(e|v)w|bumb|bw\\-(n|u)|c55\\|capi|ccwa|cdm\\-|cell|chtm|cldc|cmd\\-  
|co(mp|nd)|craw|da(it|ll|ng)|dbte|dc\\-s|devi|dica|dmob|do(c|p)|ods(12\\-d)|el(49|ai)|em(l2|ul)|er(ic|k0)|esl8|ez([4-  
7]0|os|wa|ze)|fetc|fly(\\-|_)g1  
u|g560|gene|gf\\-5|g\\-mo|go(\\.w|od)|gr(ad|un)|haie|hcit|hd\\-(m|p|t)|hei\\-|hi(pt|ta)|hp( i|ip)|hs\\-c|ht(c\\-|  
_|al|g|p|s|t|tp)|hu(aw|tc)|i\\-(20|go|ma)|i230|iac( \\-  
|\\|)|ibro|idea|ig01|ikom|im1k|inno|ipaq|iris|ja(t|v)a|jbro|jemu|jigs|kddi|keji|kgt( \\|\\|)|klon|kpt |kwc\\-  
|kyo(c|k)|le(no|xi)|lg( g\\|(k|l|u)|50|54\\-[-a-w])|libw|lynx|m1\\-w|m3ga|m50\\|ma(te|ui|xo)|mc(01|21|ca)|m\\-  
cr|me(r|ri)|mi(o8|oa|ts)|mmef|mo(01|02|bi|de|do|t(\\-| |o|v)|zz)|mt(50|p1|v )|mwbp|mywa|n10|0-2|n20[2-  
3]|n30(0|2)|n50(0|2|5)|n7(0|1|10)|ne((c|m)\\-  
|on|tf|wf|wg|wt)|nok(6|i)|nzph|o2im|op(ti|wv)|oran|owg1|p800|pan(a|d|t)|pdxg|pg(13\\-([1-  
8]|c))|phil|pire|pl(ay|uc)|pn\\-2|po(ck|rt|se)|prox|psio|pt\\-g|qa\\-a|qc(07|12|21|32|60\\-[-2-7])|i\\-  
)|qtek|r380|r600|raks|rim9|ro(ve|zo)|s55\\|sa(ge|ma|mm|ms|ny|va)|sc(01|h\\-|oo|p\\-)|sdk\\|se(c\\-|  
|0|1|47|mc|nd|ri)|sgh\\-|shar|sie(\\-|m)|sk\\-0|sl(45|id)|sm(al|ar|b3|it|t5)|so(ft|ny)|sp(01|h\\-|v\\-|v  
)|sy(01|mb)|t2(18|50)|t6(00|10|18)|ta(gt|lk)|tcl\\-|tdg\\-|tel(i|m)|tim\\-|t\\-mo|to(pl|sh)|ts(70|m\\-|m3|m5)|tx\\-  
9|up(\\.b|g|l|si)|utst|v400|v750|veri|vi(rg|te)|vk(40|5[0-3])\\-  
v)|vm40|voda|vulc|vx(52|53|60|61|70|80|81|83|85|98)|w3c(\\-| )|webc|whit|wi(g |nc|nw)|wmlb|wonu|x700|yas\\-  
|your|zeto|zte\\-/i\n .test(a.substr(0, 4));\n }\n return false;\n}\n\nexport function isBrowser(): boolean {\n return (typeof window !== 'undefined' && window.document !== null) ||\n // @ts-ignore\n (typeof  
WorkerGlobalScope !== 'undefined');\n}\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights  
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file  
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *  
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is  
distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either  
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under  
the License.\n *
```

```
=====\n *\n\nimport './engine';\nimport * as device_util from './device_util';\nimport {env} from './environment';\nconst
```

```

ENV = env();\n\n/**\n * This file contains environment-related flag registrations.\n *^\n\n/** Whether to enable
debug mode. *\nENV.registerFlag('DEBUG', () => false, debugValue => {\n if (debugValue) {\n
console.warn(\n   'Debugging mode is ON. The output of every math call will ' +\n   'be downloaded to CPU
and checked for NaNs. ' +\n   'This significantly impacts performance.');http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n
*\n * =====\n
*\n\nimport {ENGINE} from './engine';\nimport {env} from './environment';\nimport {Tensor} from
 './tensor';\nimport {DataType, TensorLike} from './types';\nimport {assert, flatten, inferDtype, isTypedArray,
toTypedArray} from './util';\n\nexport function inferShape(val: TensorLike, dtype?: DataType): number[] {\n let
firstElem: typeof val = val;\n if (isTypedArray(val)) {\n   return dtype === 'string' ? [] : [val.length];\n } \n if
(!Array.isArray(val)) {\n   return []; // Scalar.\n } \n const shape: number[] = [];\n\n while
(Array.isArray(firstElem) ||\n   isTypedArray(firstElem) && dtype !== 'string') {\n
  shape.push(firstElem.length);\n   firstElem = firstElem[0];\n } \n if (Array.isArray(val) &&\n
env().getBool('TENSORLIKE_CHECK_SHAPE_CONSISTENCY')) {\n   deepAssertShapeConsistency(val,
shape, []);\n } \n\n return shape;\n}\n\nfunction deepAssertShapeConsistency(\n
  val: TensorLike, shape: number[], indices: number[]) {\n   indices = indices || [];\n   if (!(Array.isArray(val)) &&
!isTypedArray(val)) {\n     assert(\n       shape.length === 0,\n       () => `Element arr[${indices.join(',')}] is a
primitive, ` +\n       `but should be an array/TypedArray of ${shape[0]} elements`);\n     return;\n   }\n   assert(\n
shape.length > 0,\n   () => `Element arr[${indices.join(',')}] should be a primitive, ` +\n     `but is an array of
${val.length} elements`);\n   assert(\n     val.length === shape[0],\n     () => `Element arr[${indices.join(',')}]
should have ${shape[0]} ` +\n     `elements, but has ${val.length} elements`);\n   const subShape =
shape.slice(1);\n   for (let i = 0; i < val.length; ++i) {\n     deepAssertShapeConsistency(val[i], subShape,
indices.concat(i));\n   }\n }\n\nfunction assertDtype(\n  expectedDtype: DataType|'numeric'|'string_or_numeric',\n  actualDType:
DataType, argName: string, functionName: string)
{\n   if (expectedDtype === 'string_or_numeric') {\n     return;\n   }\n   if (expectedDtype == null) {\n     throw new
Error(`Expected dtype cannot be null.`);\n   }\n   if (expectedDtype !== 'numeric' && expectedDtype !==
actualDType ||\n     expectedDtype === 'numeric' && actualDType === 'string') {\n     throw new Error(\n
`Argument '${argName}' passed to '${functionName}' must ` +\n       `be ${expectedDtype} tensor, but got
${actualDType} tensor`);\n   }\n }\n\nexport function convertToTensor<T extends Tensor>(\n  x: T|TensorLike,

```

```

argName: string, functionName: string,\n  parseAsDtype: DataType|'numeric'|'string_or_numeric' = 'numeric'): T
{\n  if (x instanceof Tensor) {\n    assertDtype(parseAsDtype, x.dtype, argName, functionName);\n    return x;\n  }\n  let inferredDtype = inferDtype(x);\n  // If the user expects a bool/int/float, use that info to update the\n  // inferredDtype when it is not a string.\n  if (inferredDtype !== 'string' &&\n    ['bool', 'int32',\n    'float32'].indexOf(parseAsDtype)
>= 0) {\n    inferredDtype = parseAsDtype as DataType;\n  }\n  assertDtype(parseAsDtype, inferredDtype,
argName, functionName);\n\n  if ((x == null) ||\n    (!isTypedArray(x) && !Array.isArray(x) && typeof x !==
'number' &&\n    typeof x !== 'boolean' && typeof x !== 'string')) {\n    const type = x == null ? 'null' : (x as
{}).constructor.name;\n    throw new Error(\n      `Argument '${argName}' passed to '${functionName}' must be a `
+\n      `Tensor or TensorLike, but got '${type}'`);\n  }\n  const inferredShape = inferShape(x, inferredDtype);\n  if
(!isTypedArray(x) && !Array.isArray(x)) {\n    x = [x] as number[];\n  }\n  const skipTypedArray = true;\n  const
values = inferredDtype !== 'string' ?\n    toTypedArray(x, inferredDtype as DataType) :\n    flatten(x as string[],
[], skipTypedArray) as string[];\n  return ENGINE.makeTensor(values, inferredShape, inferredDtype) as
T;\n}\n\nexport function convertToTensorArray<T extends Tensor>(\n  arg:
Array<T|TensorLike>, argName: string, functionName: string,\n  parseAsDtype:
DataType|'numeric'|'string_or_numeric' = 'numeric'): T[] {\n  if (!Array.isArray(arg)) {\n    throw new Error(\n
`Argument ${argName} passed to ${functionName} must be a ` +\n    `Tensor[] or TensorLike[]`);\n  }\n  const tensors = arg as T[];\n  return tensors.map(\n    (t, i) =>\n      convertToTensor(t, `${argName}[${i}]`,
functionName, parseAsDtype));\n}\n\n",/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n *
Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n *
See the License for the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\nimport {ENGINE} from '../engine';\nimport {isPromise} from '../util';\n\nexport const OP_SCOPE_SUFFIX =
'__op';\n\n/**\n * Used for wrapping functions that perform math operations on\n * Tensors. The function will be
wrapped in a named scope that cleans all\n * memory usage after the function is done.\n *\nexport function op<T
extends Function>(f: {[name: string]: T}): T {\n  const keys = Object.keys(f);\n  if (keys.length !== 1) {\n    throw
new Error(\n      `Please provide an object with a single key ` +\n      `(operation name) mapping to a function. Got
an object with ` +\n      `${keys.length} keys.`);\n  }\n\n  let opName = keys[0];\n  const fn = f[opName];\n\n  //
Strip the underscore from the end of the function name.\n  if (opName.endsWith('_')) {\n    opName =
opName.substring(0,
opName.length - 1);\n  }\n\n  // add an __op suffix to distinguish ops from kernels in tf.profile\n  opName =
opName + OP_SCOPE_SUFFIX;\n\n  // tslint:disable-next-line:no-any\n  const f2 = (...args: any[]) => {\n    ENGINE.startScope(opName);\n    try {\n      const result = fn(...args);\n      if (isPromise(result)) {\n        console.error('Cannot return a Promise inside of tidy.);\n      }\n      ENGINE.endScope(result);\n      return result;\n    } catch (ex) {\n      ENGINE.endScope(null);\n      throw ex;\n    }\n  };
\n  Object.defineProperty(f2, 'name', {value:
opName, configurable: true});\n\n  // tslint:disable-next-line:no-any\n  return f2 as any as T;\n}\n\n",/**\n *
@license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required
by applicable law or agreed to in writing, software\n * distributed\n * under the License is distributed on an "AS IS"
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\nimport {ENGINE} from '../engine';\nimport {Complex, ComplexInputs} from '../kernel_names';\nimport

```

```

{Tensor} from '../tensor';\nimport {NamedTensorMap} from '../tensor_types';\nimport {convertToTensor} from
../tensor_util_env';\nimport {TensorLike} from '../types';\nimport * as util from '../util';\n\nimport {op} from
../operation';\n\n/**\n * Converts two real numbers to a complex number.\n *\n * Given a tensor `real` representing
the real part of a complex number, and a\n * tensor `imag` representing the imaginary part of a complex number,
this\n * operation returns complex numbers elementwise
of the form [r0, i0, r1, i1],\n * where r represents the real part and i represents the imag part.\n *\n * The input
tensors real and imag must have the same shape.\n *\n * ``js\n * const real = tf.tensor1d([2.25, 3.25]);\n * const
imag = tf.tensor1d([4.75, 5.75]);\n * const complex = tf.complex(real, imag);\n *\n * complex.print();\n * ``\n *\n @doc {heading: 'Tensors', subheading: 'Creation'}\n *\nfunction complex_<T extends Tensor>(real: T|TensorLike,
imag: T|TensorLike): T {\n  const $real = convertToTensor(real, 'real', 'complex');\n  const $imag =
convertToTensor(imag, 'imag', 'complex');\n  util.assertShapesMatch(\n    $real.shape, $imag.shape,\n    `real and
imag shapes, ${$real.shape} and ${$imag.shape},` +\n    `must match in call to tf.complex().`);\n\n  const
inputs: ComplexInputs = {real: $real, imag: $imag};\n  return ENGINE.runKernel(Complex, inputs as {} as
NamedTensorMap);\n}\n\nexport const complex = op({complex_});\n\n"/**\n * @license\n * Copyright
2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n *
you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {ENGINE} from '../engine';\nimport {Tensor} from '../tensor';\nimport {TensorLike, TypedArray}
from '../types';\nimport {DataType} from '../types';\nimport {assert, assertNonNegativeIntegerDimensions, flatten,
inferDtype, isArray, sizeFromShape, toTypedArray} from '../util';\n\n/** This is
shared code across all tensor creation methods. *\n\nexport function makeTensor(\n  values: TensorLike, shape:
number[], inferredShape: number[],\n  dtype?: DataType): Tensor {\n  if (dtype == null) {\n    dtype =
inferDtype(values);\n  }\n  if (dtype === 'complex64') {\n    throw new Error(\n      `Cannot construct a complex64
tensor directly.`\n    );\n  }\n  if (!isArray(values) &&
!Array.isArray(values) &&\n    typeof values !== 'number' && typeof values !== 'boolean' &&\n    typeof values
!== 'string') {\n    throw new Error(\n      `values passed to tensor(values) must be a number/boolean/string or`\n    );\n  }\n  if (shape != null) {\n
assertNonNegativeIntegerDimensions(shape);\n\n    const providedSize = sizeFromShape(shape);\n    const
inferredSize = sizeFromShape(inferredShape);\n    assert(\n      providedSize === inferredSize,\n      () =>`\n      Based on the provided shape, [${shape}], the tensor should have`\n      `${providedSize}`\n      values but has`\n      `${inferredSize}`);\n\n    for (let i = 0; i < inferredShape.length; ++i) {\n      const inferred = inferredShape[i];\n      const flatDimsDontMatch = i === inferredShape.length - 1 ?\n        inferred !== sizeFromShape(shape.slice(i)) :\n        true;\n      assert(\n        inferredShape[i] === shape[i] || !flatDimsDontMatch,\n        () =>`Error creating a
new Tensor. Inferred shape`\n        `${inferredShape}`\n        does not match the provided`\n        `${shape}`\n        `);\n      }\n      }\n      }\n      }\n      if (!isArray(values) && !Array.isArray(values)) {\n        values = [values] as
number[];\n      }\n      }\n      }\n      }\n      shape = shape || inferredShape;\n      values = dtype !== 'string' ?\n        toTypedArray(values, dtype)\n      :\n        flatten(values as string[], [], true) as string[];\n      return ENGINE.makeTensor(values as TypedArray, shape,
dtype);\n    }\n  }\n\n"/**\n * @license\n * Copyright
2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n *
you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

```

```

=====
import {Tensor} from './tensor';
import {inferShape} from './tensor_util_env';
import {TensorLike} from './types';
import {DataType, Rank, ShapeMap} from './types';
import {makeTensor} from './tensor_ops_util';

/**
 * Creates a `tf.Tensor` with the provided values, shape and dtype.
 *
 * ```js
 * // Pass an array of values to create a vector.
 * tf.tensor([1, 2, 3, 4]).print();
 *
 * // Pass a nested array of values to make a matrix or a higher-dimensional tensor.
 * tf.tensor([[1, 2], [3, 4]]).print();
 *
 * // Pass a flat array and specify a shape yourself.
 * tf.tensor([1, 2, 3, 4], [2, 2]).print();
 *
 * @param values The values of the tensor. Can be nested array of numbers, or a flat array, or a `TypedArray`. If the values are strings, they will be encoded as utf-8 and kept as `Uint8Array[]`.
 * @param shape The shape of the tensor. Optional. If not provided, it is inferred from `values`.
 * @param dtype The data type.
 * @doc {heading: 'Tensors', subheading: 'Creation'}
 */
export function tensor<R> extends Rank>(
  values: TensorLike, shape?: ShapeMap[R], dtype?: DataType): Tensor<R> {
  const inferredShape = inferShape(values, dtype);
  return makeTensor(values, shape, inferredShape, dtype) as Tensor<R>;
}

/**
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 * software distributed under the License is distributed on an "AS IS" BASIS,
 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND,
 * either express or implied. See the License for the specific language
 * governing permissions and limitations under the License.
 */

```

```

=====
/**
 * Type definitions for exporting and importing of models.
 *
 * A map from Tensor dtype to number of bytes per element of the Tensor.
 */
export const DTYPE_VALUE_SIZE_MAP: {[dtype: string]: number} = {
  'float32': 4,
  'float16': 2,
  'int32': 4,
  'uint16': 2,
  'uint8': 1,
  'bool': 1,
  'complex64': 8
};

/**
 * A weight manifest.
 *
 * The weight manifest consists of an ordered list of weight-manifest groups.
 * Each weight-manifest group ("group" for short hereafter) consists of a number of weight values stored in a number of paths.
 * See the documentation of `WeightManifestGroupConfig` below for more details.
 */
export declare type WeightsManifestConfig = WeightsManifestGroupConfig[];

/**
 * A weight-manifest group.
 *
 * Consists of an ordered list of weight values encoded in binary format, stored in an ordered list of paths.
 */
export declare interface WeightsManifestGroupConfig {
  /**
   * An ordered list of paths.
   *
   * Paths are intentionally abstract in order to be general. For example, they can be relative URL paths or relative paths on the file system.
   */
  paths: string[];

  /**
   * Specifications of the weights stored in the paths.
   */
  weights: WeightsManifestEntry[];
}

/**
 * Group to which the weight belongs.
 *
 * - 'optimizer': Weight from a stateful optimizer.
 */
export type WeightGroup = 'model'|'optimizer';

/**
 * An entry in the weight manifest.
 *
 * The entry contains specification of a weight.
 */
export declare interface WeightsManifestEntry {
  /**
   * Name of the weight, e.g., 'Dense_1/bias'.
   */
  name: string;

  /**
   * Shape of the weight.
   */
  shape: number[];

  /**
   * Data type of the weight.
   */
  dtype: 'float32'|'int32'|'bool'|'string'|'complex64';

  /**
   * Type of the weight.
   *
   * Optional.
   *
   * The value 'optimizer' indicates the weight belongs to an optimizer (i.e., used only during model training and not during inference).
   */
  group?: WeightGroup;

  /**
   * Information for dequantization of the weight.
   */
  quantization?: {
    scale?: number, // The scaling constant to multiply by.
    min?: number, // The (possibly nudged) minimum weight to add.
    dtype: 'uint16'|'uint8'|'float16' // The dtype of the quantized weights.
  };
}

/**
 * Options for saving a model.
 *
 * @namespace io
 */
export interface SaveConfig {
  /**
   * Whether to save only the trainable weights of the model, ignoring the non-trainable ones.
   */
  trainableOnly?: boolean;

  /**
   * Whether the optimizer will be saved (if exists).
   */
  includeOptimizer?: boolean;
}

/**
 * Result of a saving operation.
 */
export interface SaveResult {
  /**
   * Information about the model artifacts saved.
   */
}

```

```

modelArtifactsInfo: ModelArtifactsInfo;\n\n /**\n * HTTP responses from the server that handled the model-
saving request (if\n * any). This is applicable only to server-based saving routes.\n *^\n responses?:
Response[];\n\n /**\n * Error messages and related data (if any).\n *^\n errors?: Array<{}|string>;\n\n\nexport
declare interface ModelArtifactsInfo {\n /**\n * Timestamp for when the model is saved.\n *^\n dateSaved:
Date;\n\n /**\n * TODO (cais,yassogba) consider removing GraphDef as GraphDefs now\n * come in a JSON
format and none of our IOHandlers support a non json\n * format. We could conder replacing this with 'Binary' if
we want to\n * allow future handlers to save to non json formats (though they will\n * probably want more
information than 'Binary').\n * Type of the model topology\n *\n * Type of the model topology\n *\n *
Possible values:\n * - JSON: JSON config (human-readable, e.g., Keras JSON).\n * - GraphDef: TensorFlow\n
* [GraphDef](https://www.tensorflow.org/extend/tool_developers/#graphdef)\n * protocol buffer (binary).\n
*^\n modelTopologyType: 'JSON'|'GraphDef';\n\n /**\n * Size of model topology (Keras JSON or GraphDef), in
bytes.\n *^\n modelTopologyBytes?: number;\n\n /**\n * Size of weight
specification or manifest, in bytes.\n *^\n weightSpecsBytes?: number;\n\n /**\n * Size of weight value data, in
bytes.\n *^\n weightDataBytes?: number;}\n\n/** Model training configuration. */^\nexport declare interface
TrainingConfig {\n // TODO(cais): Tighten the typing once keras spec is available to tfjs-core.\n // See\n //
tslint:disable-next-line:max-line-length\n // https://github.com/tensorflow/tfjs-
layers/blob/master/src/keras_format/training_config.ts\n /** Optimizer used for the model training. */^\n
optimizer_config: {};\n\n // TODO(cais): Tighten the typing once keras spec is available to tfjs-core.\n /** Loss
function(s) for the model's output(s). */^\n loss: string|string[]|{[key: string]: string};\n\n // TODO(cais): Tighten the
typing once keras spec is available to tfjs-core.\n /** Metric function(s) for the model's output(s). */^\n metrics?:
string[]|{[key: string]: string};\n\n // TODO(cais): Tighten the typing once keras spec is available to tfjs-core.\n
weighted_metrics?: string[];\n\n // TODO(cais): Tighten the typing once keras spec is available to tfjs-core.\n
sample_weight_mode?: string;\n\n loss_weights?: number[]|{[key: string]: number};\n\n\n/**\n * The serialized
artifacts of a model, including topology and weights.\n *\n * The `modelTopology`, `trainingConfig`, `weightSpecs`
and `weightData` fields\n * of this interface are optional, in order to support topology- or weights-only\n * saving
and loading.\n *\n * Note this interface is used internally in IOHandlers. For the file format\n * written to disk as
`model.json`, see `ModelJSON`.\n *\nexport declare interface ModelArtifacts {\n /**\n * Model topology.\n *\n
* For Keras-style `tf.Model`s, this is a JSON object.\n * For TensorFlow-style models (e.g., `SavedModel`), this is
the JSON\n * encoding of the `GraphDef` protocol buffer.\n *^\n modelTopology?: {}|ArrayBuffer;\n\n /**\n *
Serialized configuration for the model's training.\n *^\n
trainingConfig?: TrainingConfig;\n\n /**\n * Weight specifications.\n *\n * This corresponds to the
weightsData below.\n *^\n weightSpecs?: WeightsManifestEntry[];\n\n /**\n * Binary buffer for all weight
values concatenated in the order specified\n * by `weightSpecs`.\n *^\n weightData?: ArrayBuffer;\n\n /**\n *
Hard-coded format name for models saved from TensorFlow.js or converted\n * by TensorFlow.js Converter.\n
*^\n format?: string;\n\n /**\n * What library is responsible for originally generating this artifact.\n *\n * Used
for debugging purposes. E.g., 'TensorFlow.js v1.0.0'.\n *^\n generatedBy?: string;\n\n /**\n * What library or
tool is responsible for converting the original model\n * to this format, applicable only if the model is output by a
converter.\n *\n * Used for debugging purposes. E.g., 'TensorFlow.js Converter v1.0.0'.\n *\n * A value of
`null` means the model artifacts are generated without any\n * conversion
process (e.g., saved directly from a TensorFlow.js\n * `tf.LayersModel` instance.)\n *^\n convertedBy?:
string|null;\n\n /**\n * Inputs and outputs signature for saved model.\n *^\n signature?: {};\n\n /**\n * User-
defined metadata about the model.\n *^\n userDefinedMetadata?: {[key: string]: {}};\n\n /**\n *_INITIALIZER for
the model.\n *^\n modelInitializer?: {};\n\n\n/**\n * The on-disk format of the `model.json` file.\n *\n * TF.js 1.0
always populates the optional fields when writing model.json.\n * Prior versions did not provide those fields.\n
*^\nexport declare interface ModelJSON {\n /**\n * Model topology.\n *\n * For Keras-style `tf.Model`s, this is
a JSON object.\n * For TensorFlow-style models (e.g., `SavedModel`), this is the JSON\n * encoding of the
`GraphDef` protocol buffer.\n *^\n modelTopology: {};\n\n /**\n * Model training configuration. */^\n
trainingConfig?: TrainingConfig;\n\n /**\n * Weights manifest.\n *\n * The weights

```


manifest consists of an ordered list of weight-manifest groups. Each weight-manifest group consists of a number of weight values stored in a number of paths. See the documentation of `WeightsManifestConfig`` for more details.

`weightsManifest: WeightsManifestConfig;`

`/* Hard-coded format name for models saved from TensorFlow.js or converted by TensorFlow.js Converter. format?: string;`

`/* What library is responsible for originally generating this artifact. Used for debugging purposes. E.g., 'TensorFlow.js v1.0.0'. generatedBy?: string;`

`/* What library or tool is responsible for converting the original model to this format, applicable only if the model is output by a converter. Used for debugging purposes. E.g., 'TensorFlow.js Converter v1.0.0'. A value of `null` means the model artifacts are generated without any conversion process (e.g., saved directly from a TensorFlow.js tf.LayersModel` instance.) convertedBy?: string|null;`

`/* Inputs and outputs signature for saved model. signature?: {};`

`/* User-defined metadata about the model. userDefinedMetadata?: {[key: string]: {}};`

`/* Initializer for the model. modelInitializer?: {};`

`/* Type definition for handlers of loading operations. export type LoadHandler = () => Promise<ModelArtifacts>;`

`/* Type definition for handlers of saving operations. export type SaveHandler = (modelArtifact: ModelArtifacts) => Promise<SaveResult>;`

`/* Interface for a model import/export handler. The `save` and `load` handlers are both optional, in order to allow handlers that support only saving or loading. tslint:disable-next-line:interface-name export interface IOHandler { save?: SaveHandler; load?: LoadHandler; }`

`/* An interface for the manager of a model store. A model store is defined as a storage medium on which multiple models can be stored. Each stored model has a unique `path` as its identifier. A `ModelStoreManager` for the store allows actions including`

- Listing the models stored in the store.
- Deleting a model from the store.

`export interface ModelStoreManager {`

- `/* List all models in the model store. @returns A dictionary mapping paths of existing models to their model artifacts info. Model artifacts info include type of the model's topology, byte sizes of the topology, weights, etc.`
- `listModels(): Promise<{[path: string]: ModelArtifactsInfo}>;`
- `/* Remove a model specified by `path`. @param path @returns ModelArtifactsInfo of the deleted model (if and only if deletion is successful). @throws Error if deletion fails, e.g., if no model exists at `path`. removeModel(path: string): Promise<ModelArtifactsInfo>;`

`/* Callback for the progress of a long-running action such as an HTTP request for a large binary object. `fraction` should be a number in the [0, 1] interval, indicating how much of the action has completed. export type OnProgressCallback = (fraction: number) => void;`

`@innamespace io export interface LoadOptions {`

- `/* RequestInit (options) for HTTP requests. For detailed information on the supported fields, see https://developer.mozilla.org/en-US/docs/Web/API/Request/Request`
- `requestInit?: RequestInit;`
- `/* Progress callback. onProgress?: OnProgressCallback;`
- `/* A function used to override the `window.fetch` function. fetchFunc?: Function;`
- `/* Strict loading model: whether extraneous weights or missing weights should trigger an `Error`. If `true`, require that the provided weights exactly match those required by the layers. `false` means that both extra weights and missing weights will be silently ignored. Default: `true`. strict?: boolean;`
- `/* Path prefix for weight files, by default this is calculated from the path of the model JSON file. For instance, if the path to the model JSON file is `http://localhost/foo/model.json`, then the default path prefix will be `http://localhost/foo/`. If a weight file has the path value `group1-shard1of2` in the weight manifest, then the weight file will be loaded from `http://localhost/foo/group1-shard1of2` by default. However, if you provide a `weightPathPrefix` value of `http://localhost/foo/alt-weights`, then the weight file will be loaded from the path `http://localhost/foo/alt-weights/group1-shard1of2` instead. weightPathPrefix?: string;`
- `/* Whether the module or model is to be loaded from TF Hub. Setting this to `true` allows passing a TF-Hub module URL, omitting the standard model file name and the query parameters. Default: `false`.`

```

fromTFHub?: boolean;\n\n /**\n * An async function to convert weight file name to URL. The weight file\n * names are stored in model.json's weightsManifest.paths field. By default we\n * consider weight files are colocated with the model.json file. For example:\n * model.json URL: https://www.google.com/models/1/model.json\n * group1-shard1of1.bin url:\n * https://www.google.com/models/1/group1-shard1of1.bin\n *\n * With this func you can convert the weight file name to any URL.\n */\n weightUrlConverter?: (weightFileName: string) => Promise<string>;\n}\n\n/**\n * Additional options for Platform.fetch\n */\nexport interface RequestDetails {\n /**\n * Is this request for a binary file (as opposed to a json file)\n */\n isBinary?: boolean;\n}\n\n","use strict"\n\nexports.byteLength = byteLength\n\nexports.toByteArray = toByteArray\n\nexports.fromByteArray = fromByteArray\n\n\nvar lookup = []\n\nvar revLookup = []\n\nvar Arr = typeof Uint8Array !== 'undefined' ? Uint8Array : Array\n\n\nvar code = 'ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz0123456789+/'\n\nfor (var i = 0, len = code.length; i < len; ++i) {\n  lookup[i] = code[i]\n  revLookup[code.charCodeAt(i)] = i\n}\n\n// Support decoding URL-safe base64 strings, as Node.js does. See:\n// https://en.wikipedia.org/wiki/Base64#URL_applications\n\nrevLookup['-'.charCodeAt(0)] = 62\n\nrevLookup['_'.charCodeAt(0)] = 63\n\n\nfunction getLens (b64) {\n  var len = b64.length\n\n  if (len % 4 > 0) {\n    throw new Error('Invalid string. Length must be a multiple of 4')\n  }\n\n  // Trim off extra bytes after placeholder bytes are found\n  // See: https://github.com/beatgammit/base64-js/issues/42\n  var validLen = b64.indexOf('=')\n  if (validLen === -1) validLen = len\n\n  var\n    placeholdersLen = validLen === len\n      ? 0\n      : 4 - (validLen % 4)\n\n  return [validLen, placeholdersLen]\n}\n\n// base64 is 4/3 + up to two characters of the original data\n\nfunction byteLength (b64) {\n  var lens = getLens(b64)\n  var validLen = lens[0]\n  var placeholdersLen = lens[1]\n  return ((validLen + placeholdersLen) * 3 / 4) - placeholdersLen\n}\n\n\nfunction _byteLength (b64, validLen, placeholdersLen) {\n  return ((validLen + placeholdersLen) * 3 / 4) - placeholdersLen\n}\n\n\nfunction toByteArray (b64) {\n  var tmp\n  var lens = getLens(b64)\n  var validLen = lens[0]\n  var placeholdersLen = lens[1]\n\n  var arr = new Arr(_byteLength(b64, validLen, placeholdersLen))\n  var curByte = 0\n\n  // if there are placeholders, only get up to the last complete 4 chars\n  var len = placeholdersLen > 0\n    ? validLen - 4\n    : validLen\n\n  var i\n  for (i = 0; i < len; i += 4) {\n    tmp =\n      (revLookup[b64.charCodeAt(i)] << 18) |\n      (revLookup[b64.charCodeAt(i + 1)] << 12) |\n      (revLookup[b64.charCodeAt(i + 2)] << 6) |\n      revLookup[b64.charCodeAt(i + 3)]\n\n    arr[curByte++] = (tmp >> 16) & 0xFF\n    arr[curByte++] = (tmp >> 8) & 0xFF\n    arr[curByte++] = tmp & 0xFF\n  }\n\n  if (placeholdersLen === 2) {\n    tmp =\n      (revLookup[b64.charCodeAt(i)] << 2) |\n      (revLookup[b64.charCodeAt(i + 1)] >> 4)\n    arr[curByte++] = tmp & 0xFF\n  }\n\n  if (placeholdersLen === 1) {\n    tmp =\n      (revLookup[b64.charCodeAt(i)] << 10) |\n      (revLookup[b64.charCodeAt(i + 1)] << 4) |\n      (revLookup[b64.charCodeAt(i + 2)] >> 2)\n    arr[curByte++] = (tmp >> 8) & 0xFF\n    arr[curByte++] = tmp & 0xFF\n  }\n\n  return arr\n}\n\n\nfunction tripletToBase64 (num) {\n  return lookup[num >> 18 & 0x3F] +\n    lookup[num >> 12 & 0x3F] +\n    lookup[num >> 6 & 0x3F] +\n    lookup[num & 0x3F]\n}\n\n\nfunction encodeChunk (uint8, start, end) {\n  var tmp\n  var output = []\n\n  for (var i = start; i < end; i += 3) {\n    tmp =\n      ((uint8[i] << 16) & 0xFF0000) +\n      ((uint8[i + 1] << 8) & 0xFF00) +\n      (uint8[i + 2] & 0xFF)\n    output.push(tripletToBase64(tmp))\n  }\n\n  return output.join('')\n}\n\n\nfunction fromByteArray (uint8) {\n  var tmp\n  var len = uint8.length\n  var extraBytes = len % 3 // if we have 1 byte left, pad 2 bytes\n  var parts = []\n  var maxChunkLength = 16383 // must be multiple of 3\n\n  // go through the array every three bytes, we'll deal with trailing stuff later\n  for (var i = 0, len2 = len - extraBytes; i < len2; i += maxChunkLength) {\n    parts.push(encodeChunk(uint8, i, (i + maxChunkLength) > len2 ? len2 : (i + maxChunkLength)))\n  }\n\n  // pad the end with zeros, but make sure to not forget the extra bytes\n  if (extraBytes === 1) {\n    tmp = uint8[len - 1]\n    parts.push(\n      lookup[tmp >> 2] +\n      lookup[(tmp << 4) & 0x3F] +\n      '='\n    )\n  } else if (extraBytes === 2) {\n    tmp = (uint8[len - 2] << 8) + uint8[len - 1]\n    parts.push(\n      lookup[tmp >> 10] +\n      lookup[(tmp >> 4) & 0x3F] +\n      lookup[(tmp << 2) & 0x3F] +\n      '='\n    )\n  }\n\n  return parts.join('')\n}\n\n","exports.read = function (buffer, offset, isLE, mLen, nBytes) {\n  var e, m\n  var eLen = (nBytes

```

```

* 8) - mLen - 1\n var eMax = (1 << eLen) - 1\n var eBias = eMax >> 1\n var nBits = -7\n var i = isLE ? (nBytes -
1) : 0\n var d = isLE ? -1 : 1\n var s = buffer[offset + i]\n i += d\n e = s & ((1 << (-nBits)) - 1)\n s >>= (-
nBits)\n nBits += eLen\n for (; nBits > 0; e = (e * 256) + buffer[offset + i], i += d, nBits -= 8) {\n m = e & ((1
<< (-nBits)) - 1)\n e >>= (-nBits)\n nBits += mLen\n for (; nBits > 0; m = (m * 256) + buffer[offset + i], i += d,
nBits -= 8) {\n if (e === 0) {\n e = 1 - eBias\n } else if (e === eMax) {\n return m ? NaN : ((s ? -1 : 1) *
Infinity)\n } else {\n m = m + Math.pow(2, mLen)\n e = e - eBias\n }\n return (s ? -1 : 1) * m * Math.pow(2, e
- mLen)\n }\n\nexports.write = function (buffer, value, offset, isLE,
mLen, nBytes) {\n var e, m, c\n var eLen = (nBytes * 8) - mLen - 1\n var eMax = (1 << eLen) - 1\n var eBias =
eMax >> 1\n var rt = (mLen === 23 ? Math.pow(2, -24) - Math.pow(2, -77) : 0)\n var i = isLE ? 0 : (nBytes - 1)\n
var d = isLE ? 1 : -1\n var s = value < 0 || (value === 0 && 1 / value < 0) ? 1 : 0\n value = Math.abs(value)\n if
(isNaN(value) || value === Infinity) {\n m = isNaN(value) ? 1 : 0\n e = eMax\n } else {\n e =
Math.floor(Math.log(value) / Math.LN2)\n if (value * (c = Math.pow(2, -e)) < 1) {\n e--\n c *= 2\n }\n if
(e + eBias >= 1) {\n value += rt / c\n } else {\n value += rt * Math.pow(2, 1 - eBias)\n }\n if (value * c
>= 2) {\n e++\n c /= 2\n }\n if (e + eBias >= eMax) {\n m = 0\n e = eMax\n } else if (e + eBias
>= 1) {\n m = ((value * c) - 1) * Math.pow(2, mLen)\n e = e + eBias\n } else {\n m = value *
Math.pow(2, eBias - 1) * Math.pow(2, mLen)\n e
= 0\n }\n }\n\n for (; mLen >= 8; buffer[offset + i] = m & 0xff, i += d, m /= 256, mLen -= 8) {\n e = (e <<
mLen) | m\n eLen += mLen\n for (; eLen > 0; buffer[offset + i] = e & 0xff, i += d, e /= 256, eLen -= 8) {\n
buffer[offset + i - d] |= s * 128\n}\n", "var toString = {}.toString;\n\nmodule.exports = Array.isArray || function (arr)
{\n return toString.call(arr) == '[object Array]';\n};\n", "/*!\n * The buffer module from node.js, for the browser.\n
*\n * @author Feross Aboukhadijeh <feross@feross.org> <http://feross.org>\n * @license MIT\n */\n\n * eslint-
disable no-proto\n */\n\n'use strict\n\nvar base64 = require('base64-js')\nvar ieee754 = require('ieee754')\nvar isArray
= require('isArray')\n\nexports.Buffer = Buffer\nexports.SlowBuffer =
SlowBuffer\n\nexports.INSPECT_MAX_BYTES = 50\n\n**\n * If `Buffer.TYPED_ARRAY_SUPPORT`:\n * ===
true Use Uint8Array implementation (fastest)\n * === false Use Object implementation (most compatible, even
IE6)\n * \n * Browsers
that support typed arrays are IE 10+, Firefox 4+, Chrome 7+, Safari 5.1+,\n * Opera 11.6+, iOS 4.2+.\n * \n * Due to
various browser bugs, sometimes the Object implementation will be used even\n * when the browser supports typed
arrays.\n * \n * Note:\n * - Firefox 4-29 lacks support for adding new properties to `Uint8Array` instances,\n *
See: https://bugzilla.mozilla.org/show\_bug.cgi?id=695438.\n * - Chrome 9-10 is missing the
`TypedArray.prototype.subarray` function.\n * - IE10 has a broken `TypedArray.prototype.subarray` function
which returns arrays of\n * incorrect length in some situations.\n * \n * We detect these buggy browsers and set
`Buffer.TYPED_ARRAY_SUPPORT` to `false` so they\n * get the Object implementation, which is slower but
behaves correctly.\n * \n * \n * Buffer.TYPED_ARRAY_SUPPORT = global.TYPED_ARRAY_SUPPORT !==
undefined\n * ? global.TYPED_ARRAY_SUPPORT\n * : typedArraySupport()\n * \n * Export kMaxLength after
typed array support is determined.\n
*\n\nexports.kMaxLength = kMaxLength()\n\nfunction typedArraySupport () {\n try {\n var arr = new
Uint8Array(1)\n arr.__proto__ = {__proto__: Uint8Array.prototype, foo: function () { return 42 }}\n return
arr.foo() === 42 && // typed array instances can be augmented\n typeof arr.subarray === 'function' && //
chrome 9-10 lack `subarray`\n arr.subarray(1, 1).byteLength === 0 // ie10 has broken `subarray`\n } catch (e)
{\n return false\n }\n}\n\nfunction kMaxLength () {\n return Buffer.TYPED_ARRAY_SUPPORT\n ?
0x7fffffff\n : 0x3fffffff\n}\n\nfunction createBuffer (that, length) {\n if (kMaxLength() < length) {\n throw new
RangeError('Invalid typed array length')\n }\n if (Buffer.TYPED_ARRAY_SUPPORT) {\n // Return an
augmented `Uint8Array` instance, for best performance\n that = new Uint8Array(length)\n that.__proto__ =
Buffer.prototype\n } else {\n // Fallback: Return an object instance of the Buffer class\n if (that === null)
{\n that = new Buffer(length)\n }\n that.length = length\n }\n\n return that\n}\n\n**\n * The Buffer
constructor returns instances of `Uint8Array` that have their\n * prototype changed to `Buffer.prototype`.
Furthermore, `Buffer` is a subclass of\n * `Uint8Array`, so the returned instances will have all the node `Buffer`

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methods\n * and the `Uint8Array` methods. Square bracket notation works as expected -- it\n * returns a single
octet.\n *\n * The `Uint8Array` prototype remains unmodified.\n */\n\nfunction Buffer (arg, encodingOrOffset,
length) {\n  if (!Buffer.TYPED_ARRAY_SUPPORT && !(this instanceof Buffer)) {\n    return new Buffer(arg,
encodingOrOffset, length)\n  }\n\n  // Common case.\n  if (typeof arg === 'number') {\n    if (typeof
encodingOrOffset === 'string') {\n      throw new Error(\n        'If encoding is specified then the first argument must
be a string'\n      )\n    }\n    return allocUnsafe(this, arg)\n  }\n  return from(this, arg, encodingOrOffset,
length)\n}\n\nBuffer.poolSize
= 8192 // not used by this implementation\n\n// TODO: Legacy, not needed anymore. Remove in next major
version.\n\nBuffer._augment = function (arr) {\n  arr.__proto__ = Buffer.prototype\n  return arr\n}\n\nfunction from
(that, value, encodingOrOffset, length) {\n  if (typeof value === 'number') {\n    throw new TypeError("\nvalue\n"
argument must not be a number')\n  }\n\n  if (typeof ArrayBuffer !== 'undefined' && value instanceof ArrayBuffer)
{\n    return fromArrayBuffer(that, value, encodingOrOffset, length)\n  }\n\n  if (typeof value === 'string') {\n
return fromString(that, value, encodingOrOffset)\n  }\n\n  return fromObject(that, value)\n}\n\n/**\n * Functionally
equivalent to Buffer(arg, encoding) but throws a TypeError\n * if value is a number.\n * Buffer.from(str[,
encoding])\n * Buffer.from(array)\n * Buffer.from(buffer)\n * Buffer.from(arrayBuffer[, byteOffset[, length]])\n
**\n\nBuffer.from = function (value, encodingOrOffset, length) {\n  return
from(null, value, encodingOrOffset, length)\n}\n\nif (Buffer.TYPED_ARRAY_SUPPORT) {\n
Buffer.prototype.__proto__ = Uint8Array.prototype\n  Buffer.__proto__ = Uint8Array\n  if (typeof Symbol !==
'undefined' && Symbol.species &&\n    Buffer[Symbol.species] === Buffer) {\n    // Fix subarray() in ES2016.
See: https://github.com/feross/buffer/pull/97\n    Object.defineProperty(Buffer, Symbol.species, {\n      value: null,\n
configurable: true\n    })\n  }\n}\n\nfunction assertSize (size) {\n  if (typeof size !== 'number') {\n    throw new
TypeError("\nsize\n" argument must be a number')\n  } else if (size < 0) {\n    throw new RangeError("\nsize\n"
argument must not be negative')\n  }\n}\n\nfunction alloc (that, size, fill, encoding) {\n  assertSize(size)\n  if (size
<= 0) {\n    return createBuffer(that, size)\n  }\n  if (fill !== undefined) {\n    // Only pay attention to encoding if it's
a string. This\n    // prevents accidentally sending in a number that would\n    // be interpreted
as a start offset.\n    return typeof encoding === 'string'\n      ? createBuffer(that, size).fill(fill, encoding)\n      :
createBuffer(that, size).fill(fill)\n  }\n  return createBuffer(that, size)\n}\n\n/**\n * Creates a new filled Buffer
instance.\n * alloc(size[, fill[, encoding]])\n **\n\nBuffer.alloc = function (size, fill, encoding) {\n  return alloc(null,
size, fill, encoding)\n}\n\nfunction allocUnsafe (that, size) {\n  assertSize(size)\n  that = createBuffer(that, size < 0 ?
0 : checked(size) | 0)\n  if (!Buffer.TYPED_ARRAY_SUPPORT) {\n    for (var i = 0; i < size; ++i) {\n      that[i] =
0\n    }\n  }\n  return that\n}\n\n/**\n * Equivalent to Buffer(num), by default creates a non-zero-filled Buffer
instance.\n * *\n\nBuffer.allocUnsafe = function (size) {\n  return allocUnsafe(null, size)\n}\n\n/**\n * Equivalent to
SlowBuffer(num), by default creates a non-zero-filled Buffer instance.\n * *\n\nBuffer.allocUnsafeSlow = function
(size) {\n  return allocUnsafe(null, size)\n}\n\nfunction
fromString (that, string, encoding) {\n  if (typeof encoding !== 'string' || encoding === '') {\n    encoding = 'utf8'\n
}\n\n  if (!Buffer.isEncoding(encoding)) {\n    throw new TypeError("\nencoding\n" must be a valid string
encoding')\n  }\n\n  var length = byteLength(string, encoding) | 0\n  that = createBuffer(that, length)\n\n  var actual =
that.write(string, encoding)\n  if (actual !== length) {\n    // Writing a hex string, for example, that contains invalid
characters will\n    // cause everything after the first invalid character to be ignored. (e.g.\n    // 'abxcd' will be
treated as 'ab')\n    that = that.slice(0, actual)\n  }\n\n  return that\n}\n\nfunction fromArrayLike (that, array) {\n
var length = array.length < 0 ? 0 : checked(array.length) | 0\n  that = createBuffer(that, length)\n  for (var i = 0; i <
length; i += 1) {\n    that[i] = array[i] & 255\n  }\n  return that\n}\n\nfunction fromArrayBuffer (that, array,
byteOffset, length) {\n  array.byteLength
\n  // this throws if `array` is not a valid ArrayBuffer\n\n  if (byteOffset < 0 || array.byteLength < byteOffset) {\n
throw new RangeError("\n'offset\n" is out of bounds')\n  }\n\n  if (array.byteLength < byteOffset + (length || 0)) {\n
throw new RangeError("\n'length\n" is out of bounds')\n  }\n\n  if (byteOffset === undefined && length ===
undefined) {\n    array = new Uint8Array(array)\n  } else if (length === undefined) {\n    array = new
Uint8Array(array, byteOffset)\n  } else {\n    array = new Uint8Array(array, byteOffset, length)\n  }\n\n  if

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(Buffer.TYPED_ARRAY_SUPPORT) {\n // Return an augmented `Uint8Array` instance, for best performance\n
that = array\n that.__proto__ = Buffer.prototype\n } else {\n // Fallback: Return an object instance of the Buffer\n
class\n that = fromArrayLike(that, array)\n }\n return that\n}\n\nfunction fromObject (that, obj) {\n if\n
(Buffer.isBuffer(obj)) {\n var len = checked(obj.length) | 0\n that = createBuffer(that,\n
len)\n\n if (that.length === 0) {\n return that\n }\n\n obj.copy(that, 0, 0, len)\n return that\n }\n\n if (obj)\n
{\n if ((typeof ArrayBuffer !== 'undefined' &&\n obj.buffer instanceof ArrayBuffer) || 'length' in obj) {\n if\n
(typeof obj.length !== 'number' || isnan(obj.length)) {\n return createBuffer(that, 0)\n }\n return\n
fromArrayLike(that, obj)\n }\n\n if (obj.type === 'Buffer' && isArray(obj.data)) {\n return\n
fromArrayLike(that, obj.data)\n }\n\n throw new TypeError('First argument must be a string, Buffer,\n
ArrayBuffer, Array, or array-like object.')\n }\n\nfunction checked (length) {\n // Note: cannot use `length <=\n
kMaxLength()` here because that fails when\n // length is NaN (which is otherwise coerced to zero.)\n if (length >=\n
kMaxLength()) {\n throw new RangeError('Attempt to allocate Buffer larger than maximum ' +\n
'size: 0x' + kMaxLength().toString(16) + ' bytes')\n }\n return\n
length | 0\n}\n\nfunction SlowBuffer (length) {\n if (+length !== length) { // eslint-disable-line eqeqeq\n length =\n
0\n }\n return Buffer.alloc(+length)\n}\n\nBuffer.isBuffer = function isBuffer (b) {\n return !! (b != null &&\n
b._isBuffer)\n}\n\nBuffer.compare = function compare (a, b) {\n if (!Buffer.isBuffer(a) || !Buffer.isBuffer(b)) {\n\n
throw new TypeError('Arguments must be Buffers')\n }\n\n if (a === b) return 0\n\n var x = a.length\n var y =\n
b.length\n\n for (var i = 0, len = Math.min(x, y); i < len; ++i) {\n if (a[i] !== b[i]) {\n x = a[i]\n y = b[i]\n\n
break\n }\n }\n\n if (x < y) return -1\n if (y < x) return 1\n return 0\n}\n\nBuffer.isEncoding = function\n
isEncoding (encoding) {\n switch (String(encoding).toLowerCase()) {\n case 'hex':\n case 'utf8':\n case 'utf-\n
8':\n case 'ascii':\n case 'latin1':\n case 'binary':\n case 'base64':\n case 'ucs2':\n case 'ucs-2':\n case\n
'utf16le':\n case 'utf-16le':\n\n return true\n default:\n return false\n }\n}\n\nBuffer.concat = function concat (list, length) {\n if\n
(!isArray(list)) {\n throw new TypeError('"list" argument must be an Array of Buffers')\n }\n\n if (list.length\n
=== 0) {\n return Buffer.alloc(0)\n }\n\n var i\n if (length === undefined) {\n length = 0\n for (i = 0; i <\n
list.length; ++i) {\n length += list[i].length\n }\n }\n\n var buffer = Buffer.allocUnsafe(length)\n var pos = 0\n\n
for (i = 0; i < list.length; ++i) {\n var buf = list[i]\n if (!Buffer.isBuffer(buf)) {\n throw new\n
TypeError('"list" argument must be an Array of Buffers')\n }\n buf.copy(buffer, pos)\n pos += buf.length\n\n
}\n\n return buffer\n}\n\nfunction byteLength (string, encoding) {\n if (Buffer.isBuffer(string)) {\n return\n
string.length\n }\n\n if (typeof ArrayBuffer !== 'undefined' && typeof ArrayBuffer.isView === 'function' &&\n
(ArrayBuffer.isView(string) || string instanceof ArrayBuffer))\n\n {\n return string.byteLength\n }\n\n if (typeof string !== 'string') {\n string = '' + string\n }\n\n var len =\n
string.length\n if (len === 0) return 0\n\n // Use a for loop to avoid recursion\n var loweredCase = false\n for (;;) {\n\n
switch (encoding) {\n case 'ascii':\n case 'latin1':\n case 'binary':\n return len\n case 'utf8':\n\n
case 'utf-8':\n case undefined:\n return utf8ToBytes(string).length\n case 'ucs2':\n case 'ucs-2':\n\n
case 'utf16le':\n case 'utf-16le':\n return len * 2\n case 'hex':\n return len >>> 1\n case 'base64':\n\n
return base64ToBytes(string).length\n default:\n if (loweredCase) return utf8ToBytes(string).length //\n
assume utf8\n encoding = (" + encoding).toLowerCase()\n loweredCase = true\n }\n\n\n}\n}\n\nBuffer.byteLength = byteLength\n\nfunction slowToString (encoding, start, end) {\n var loweredCase =\n
false\n\n // No need\n\n to verify that `this.length <= MAX_UINT32` since it's a read-only\n // property of a typed array.\n\n // This\n
behaves neither like String nor Uint8Array in that we set start/end\n // to their upper/lower bounds if the value\n
passed is out of range.\n // undefined is handled specially as per ECMA-262 6th Edition,\n // Section 13.3.3.7\n
Runtime Semantics: KeyedBindingInitialization.\n if (start === undefined || start < 0) {\n start = 0\n }\n // Return\n
early if start > this.length. Done here to prevent potential uint32\n // coercion fail below.\n if (start > this.length)\n
{\n return ""\n }\n\n if (end === undefined || end > this.length) {\n end = this.length\n }\n\n if (end <= 0) {\n\n
return ""\n }\n\n // Force coercion to uint32. This will also coerce falsey/NaN values to 0.\n end >>>= 0\n start\n
>>>= 0\n\n if (end <= start) {\n return ""\n }\n\n if (!encoding) encoding = 'utf8'\n\n while (true) {\n switch

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(encoding) {\n  case 'hex':\n    return
hexSlice(this, start, end)\n\n  case 'utf8':\n    case 'utf-8':\n      return utf8Slice(this, start, end)\n\n  case
'ascii':\n    return asciiSlice(this, start, end)\n\n  case 'latin1':\n    case 'binary':\n      return latin1Slice(this,
start, end)\n\n  case 'base64':\n    return base64Slice(this, start, end)\n\n  case 'ucs2':\n    case 'ucs-2':\n
case 'utf16le':\n    case 'utf-16le':\n      return utf16leSlice(this, start, end)\n\n  default:\n    if (loweredCase)
throw new TypeError('Unknown encoding: ' + encoding)\n    encoding = (encoding + '').toLowerCase()\n
loweredCase = true\n  }\n}\n\n// The property is used by `Buffer.isBuffer` and `is-buffer` (in Safari 5-7) to
detect\n// Buffer instances.\nBuffer.prototype._isBuffer = true\n\nfunction swap (b, n, m) {\n  var i = b[n]\n  b[n] =
b[m]\n  b[m] = i\n}\n\nBuffer.prototype.swap16 = function swap16 () {\n  var len = this.length\n  if (len % 2 !== 0)
{\n
throw new RangeError('Buffer size must be a multiple of 16-bits')\n  }\n  for (var i = 0; i < len; i += 2) {\n
swap(this, i, i + 1)\n  }\n  return this\n}\n\nBuffer.prototype.swap32 = function swap32 () {\n  var len = this.length\n
if (len % 4 !== 0) {\n  throw new RangeError('Buffer size must be a multiple of 32-bits')\n  }\n  for (var i = 0; i <
len; i += 4) {\n  swap(this, i, i + 3)\n  swap(this, i + 1, i + 2)\n  }\n  return this\n}\n\nBuffer.prototype.swap64 =
function swap64 () {\n  var len = this.length\n  if (len % 8 !== 0) {\n  throw new RangeError('Buffer size must be a
multiple of 64-bits')\n  }\n  for (var i = 0; i < len; i += 8) {\n  swap(this, i, i + 7)\n  swap(this, i + 1, i + 6)\n
swap(this, i + 2, i + 5)\n  swap(this, i + 3, i + 4)\n  }\n  return this\n}\n\nBuffer.prototype.toString = function
toString () {\n  var length = this.length | 0\n  if (length === 0) return ""\n  if (arguments.length === 0) return
utf8Slice(this, 0, length)\n  return slowToString.apply(this,
arguments)\n}\n\nBuffer.prototype.equals = function equals (b) {\n  if (!Buffer.isBuffer(b)) throw new
TypeError('Argument must be a Buffer')\n  if (this === b) return true\n  return Buffer.compare(this, b) ===
0\n}\n\nBuffer.prototype.inspect = function inspect () {\n  var str = ""\n  var max =
exports.INSPECT_MAX_BYTES\n  if (this.length > 0) {\n  str = this.toString('hex', 0, max).match(/.{2}/g).join('
')\n  if (this.length > max) str += ' ... '\n  }\n  return '<Buffer ' + str + '>'\n}\n\nBuffer.prototype.compare = function
compare (target, start, end, thisStart, thisEnd) {\n  if (!Buffer.isBuffer(target)) {\n  throw new
TypeError('Argument must be a Buffer')\n  }\n  if (start === undefined) {\n  start = 0\n  }\n  if (end ===
undefined) {\n  end = target ? target.length : 0\n  }\n  if (thisStart === undefined) {\n  thisStart = 0\n  }\n  if
(thisEnd === undefined) {\n  thisEnd = this.length\n  }\n  if (start < 0 || end > target.length || thisStart
< 0 || thisEnd > this.length) {\n  throw new RangeError('out of range index')\n  }\n  if (thisStart >= thisEnd &&
start >= end) {\n  return 0\n  }\n  if (thisStart >= thisEnd) {\n  return -1\n  }\n  if (start >= end) {\n  return 1\n
}\n\n  start >>>= 0\n  end >>>= 0\n  thisStart >>>= 0\n  thisEnd >>>= 0\n  if (this === target) return 0\n  var x =
thisEnd - thisStart\n  var y = end - start\n  var len = Math.min(x, y)\n  var thisCopy = this.slice(thisStart,
thisEnd)\n  var targetCopy = target.slice(start, end)\n  for (var i = 0; i < len; ++i) {\n  if (thisCopy[i] !==
targetCopy[i]) {\n  x = thisCopy[i]\n  y = targetCopy[i]\n  break\n  }\n  }\n  if (x < y) return -1\n  if (y <
x) return 1\n  return 0\n}\n\n// Finds either the first index of `val` in `buffer` at offset >= `byteOffset`,\n// OR the last
index of `val` in `buffer` at offset <= `byteOffset`.\n// Arguments:\n// - buffer - a Buffer to search\n// - val - a
string, Buffer, or number\n// -
byteOffset - an index into `buffer`; will be clamped to an int32\n// - encoding - an optional encoding, relevant if val
is a string\n// - dir - true for indexOf, false for lastIndexOf\nfunction bidirectionalIndexOf (buffer, val, byteOffset,
encoding, dir) {\n  // Empty buffer means no match\n  if (buffer.length === 0) return -1\n  // Normalize
byteOffset\n  if (typeof byteOffset === 'string') {\n  encoding = byteOffset\n  byteOffset = 0\n  } else if
(byteOffset > 0x7fffffff) {\n  byteOffset = 0x7fffffff\n  } else if (byteOffset < -0x80000000) {\n  byteOffset = -
0x80000000\n  }\n  byteOffset = +byteOffset // Coerce to Number.\n  if (isNaN(byteOffset)) {\n  // byteOffset: it
it's undefined, null, NaN, \"foo\", etc, search whole buffer\n  byteOffset = dir ? 0 : (buffer.length - 1)\n  }\n  //
Normalize byteOffset: negative offsets start from the end of the buffer\n  if (byteOffset < 0) byteOffset =
buffer.length + byteOffset\n  if (byteOffset >= buffer.length) {\n  if (dir)
return -1\n  else byteOffset = buffer.length - 1\n  } else if (byteOffset < 0) {\n  if (dir) byteOffset = 0\n  else
return -1\n  }\n  // Normalize val\n  if (typeof val === 'string') {\n  val = Buffer.from(val, encoding)\n  }\n  //

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Finally, search either indexOf (if dir is true) or lastIndexOf\n if (Buffer.isBuffer(val)) {\n // Special case: looking
for empty string/buffer always fails\n if (val.length === 0) {\n return -1\n }\n return arrayIndexOf(buffer,
val, byteOffset, encoding, dir)\n } else if (typeof val === 'number') {\n val = val & 0xFF // Search for a byte value
[0-255]\n if (Buffer.TYPED_ARRAY_SUPPORT &&\n typeof Uint8Array.prototype.indexOf === 'function')
{\n if (dir) {\n return Uint8Array.prototype.indexOf.call(buffer, val, byteOffset)\n } else {\n return
Uint8Array.prototype.lastIndexOf.call(buffer, val, byteOffset)\n }\n }\n return arrayIndexOf(buffer, [ val ],
byteOffset, encoding, dir)\n
}\n\n throw new TypeError('val must be string, number or Buffer')\n}\n\nfunction arrayIndexOf (arr, val,
byteOffset, encoding, dir) {\n var indexSize = 1\n var arrLength = arr.length\n var valLength = val.length\n\n if
(encoding !== undefined) {\n encoding = String(encoding).toLowerCase()\n if (encoding === 'ucs2' || encoding
=== 'ucs-2' ||\n encoding === 'utf16le' || encoding === 'utf-16le') {\n if (arr.length < 2 || val.length < 2) {\n
return -1\n }\n indexSize = 2\n arrLength /= 2\n valLength /= 2\n byteOffset /= 2\n }\n }\n\n function read (buf, i) {\n if (indexSize === 1) {\n return buf[i]\n } else {\n return buf.readUInt16BE(i *
indexSize)\n }\n }\n\n var i\n if (dir) {\n var foundIndex = -1\n for (i = byteOffset; i < arrLength; i++) {\n
if (read(arr, i) === read(val, foundIndex === -1 ? 0 : i - foundIndex)) {\n if (foundIndex === -1) foundIndex =
i\n if (i - foundIndex +
1 === valLength) return foundIndex * indexSize\n } else {\n if (foundIndex !== -1) i -= i - foundIndex\n
foundIndex = -1\n }\n }\n } else {\n if (byteOffset + valLength > arrLength) byteOffset = arrLength -
valLength\n for (i = byteOffset; i >= 0; i--) {\n var found = true\n for (var j = 0; j < valLength; j++) {\n
if (read(arr, i + j) !== read(val, j)) {\n found = false\n break\n }\n }\n if (found) return i\n }\n }\n return -1\n}\n\nBuffer.prototype.includes = function includes (val, byteOffset, encoding) {\n return
this.indexOf(val, byteOffset, encoding) !== -1\n}\n\nBuffer.prototype.indexOf = function indexOf (val, byteOffset,
encoding) {\n return bidirectionalIndexOf(this, val, byteOffset, encoding, true)\n}\n\nBuffer.prototype.lastIndexOf
= function lastIndexOf (val, byteOffset, encoding) {\n return bidirectionalIndexOf(this, val, byteOffset, encoding,
false)\n}\n\nfunction hexWrite (buf,
string, offset, length) {\n offset = Number(offset) || 0\n var remaining = buf.length - offset\n if (!length) {\n
length = remaining\n } else {\n length = Number(length)\n if (length > remaining) {\n length = remaining\n
}\n }\n\n // must be an even number of digits\n var strLen = string.length\n if (strLen % 2 !== 0) throw new
TypeError('Invalid hex string')\n\n if (length > strLen / 2) {\n length = strLen / 2\n }\n for (var i = 0; i < length;
++i) {\n var parsed = parseInt(string.substr(i * 2, 2), 16)\n if (isNaN(parsed)) return i\n buf[offset + i] =
parsed\n }\n return i\n}\n\nfunction utf8Write (buf, string, offset, length) {\n return blitBuffer(utf8ToBytes(string,
buf.length - offset), buf, offset, length)\n}\n\nfunction asciiWrite (buf, string, offset, length) {\n return
blitBuffer(asciiToBytes(string), buf, offset, length)\n}\n\nfunction latin1Write (buf, string, offset, length) {\n return
asciiWrite(buf, string, offset, length)\n}\n\nfunction
base64Write (buf, string, offset, length) {\n return blitBuffer(base64ToBytes(string), buf, offset,
length)\n}\n\nfunction ucs2Write (buf, string, offset, length) {\n return blitBuffer(utf16leToBytes(string, buf.length
- offset), buf, offset, length)\n}\n\nBuffer.prototype.write = function write (string, offset, length, encoding) {\n //
Buffer#write(string)\n if (offset === undefined) {\n encoding = 'utf8'\n length = this.length\n offset = 0\n //
Buffer#write(string, encoding)\n } else if (length === undefined && typeof offset === 'string') {\n encoding =
offset\n length = this.length\n offset = 0\n // Buffer#write(string, offset[, length][, encoding])\n } else if
(isFinite(offset)) {\n offset = offset | 0\n if (isFinite(length)) {\n length = length | 0\n if (encoding ===
undefined) encoding = 'utf8'\n } else {\n encoding = length\n length = undefined\n }\n } // legacy
write(string, encoding, offset, length) - remove
in v0.13\n } else {\n throw new Error(\n 'Buffer.write(string, encoding, offset[, length]) is no longer
supported'\n )\n }\n\n var remaining = this.length - offset\n if (length === undefined || length > remaining) length
= remaining\n if ((string.length > 0 && (length < 0 || offset < 0)) || offset > this.length) {\n throw new
RangeError('Attempt to write outside buffer bounds')\n }\n\n if (!encoding) encoding = 'utf8'\n\n var loweredCase
= false\n for (;;) {\n switch (encoding) {\n case 'hex':\n return hexWrite(this, string, offset, length)\n

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case 'utf8':\n case 'utf-8':\n return utf8Write(this, string, offset, length)\n\n case 'ascii':\n return
asciiWrite(this, string, offset, length)\n\n case 'latin1':\n case 'binary':\n return latin1Write(this, string,
offset, length)\n\n case 'base64':\n // Warning: maxLength not taken into account in base64Write\n
return base64Write(this, string,
offset, length)\n\n case 'ucs2':\n case 'ucs-2':\n case 'utf16le':\n case 'utf-16le':\n return
ucs2Write(this, string, offset, length)\n\n default:\n if (loweredCase) throw new TypeError('Unknown
encoding: ' + encoding)\n encoding = (' + encoding).toLowerCase()\n loweredCase = true\n }\n
}\n\n\nBuffer.prototype.toJSON = function toJSON () {\n return {\n type: 'Buffer',\n data:
Array.prototype.slice.call(this._arr || this, 0)\n }\n}\n\nfunction base64Slice (buf, start, end) {\n if (start === 0 &&
end === buf.length) {\n return base64.fromByteArray(buf)\n } else {\n return
base64.fromByteArray(buf.slice(start, end))\n }\n}\n\nfunction utf8Slice (buf, start, end) {\n end =
Math.min(buf.length, end)\n var res = []\n var i = start\n while (i < end) {\n var firstByte = buf[i]\n var
codePoint = null\n var bytesPerSequence = (firstByte > 0xEF) ? 4\n : (firstByte > 0xDF) ? 3\n : (firstByte
> 0xBF) ? 2\n : 1\n\n if (i + bytesPerSequence <= end) {\n var secondByte, thirdByte, fourthByte,
tempCodePoint\n\n switch (bytesPerSequence) {\n case 1:\n if (firstByte < 0x80) {\n codePoint
= firstByte\n }\n break\n case 2:\n secondByte = buf[i + 1]\n if ((secondByte & 0xC0)
=== 0x80) {\n tempCodePoint = (firstByte & 0x1F) << 0x6 | (secondByte & 0x3F)\n if
(tempCodePoint > 0x7F) {\n codePoint = tempCodePoint\n }\n }\n break\n case 3:\n
secondByte = buf[i + 1]\n thirdByte = buf[i + 2]\n if ((secondByte & 0xC0) === 0x80 && (thirdByte
& 0xC0) === 0x80) {\n tempCodePoint = (firstByte & 0xF) << 0xC | (secondByte & 0x3F) << 0x6 |
(thirdByte & 0x3F)\n if (tempCodePoint > 0x7FF && (tempCodePoint < 0xD800 || tempCodePoint >
0xDFFF)) {\n codePoint = tempCodePoint\n }\n }\n }\n break\n case 4:\n secondByte = buf[i + 1]\n thirdByte = buf[i + 2]\n
fourthByte = buf[i + 3]\n if ((secondByte & 0xC0) === 0x80 && (thirdByte & 0xC0) === 0x80 &&
(fourthByte & 0xC0) === 0x80) {\n tempCodePoint = (firstByte & 0xF) << 0x12 | (secondByte & 0x3F) <<
0xC | (thirdByte & 0x3F) << 0x6 | (fourthByte & 0x3F)\n if (tempCodePoint > 0xFFFF && tempCodePoint
< 0x110000) {\n codePoint = tempCodePoint\n }\n }\n }\n }\n\n if (codePoint === null)
{\n // we did not generate a valid codePoint so insert a\n // replacement char (U+FFFD) and advance only 1
byte\n codePoint = 0xFFFF\n bytesPerSequence = 1\n } else if (codePoint > 0xFFFF) {\n // encode to
utf16 (surrogate pair dance)\n codePoint -= 0x10000\n res.push(codePoint >>> 10 & 0x3FF | 0xD800)\n
codePoint = 0xDC00 | codePoint & 0x3FF\n }\n\n res.push(codePoint)\n
i += bytesPerSequence\n }\n\n return decodeCodePointsArray(res)\n}\n\n// Based on
http://stackoverflow.com/a/22747272/680742, the browser with\n// the lowest limit is Chrome, with 0x10000
args.\n// We go 1 magnitude less, for safety\nvar MAX_ARGUMENTS_LENGTH = 0x1000\n\nfunction
decodeCodePointsArray (codePoints) {\n var len = codePoints.length\n if (len <=
MAX_ARGUMENTS_LENGTH) {\n return String.fromCharCode.apply(String, codePoints) // avoid extra
slice()\n }\n\n // Decode in chunks to avoid "call stack size exceeded"\n var res = ""\n var i = 0\n while (i < len)
{\n res += String.fromCharCode.apply(\n String,\n codePoints.slice(i, i +=
MAX_ARGUMENTS_LENGTH)\n )\n }\n return res\n}\n\nfunction asciiSlice (buf, start, end) {\n var ret = ""\n
end = Math.min(buf.length, end)\n\n for (var i = start; i < end; ++i) {\n ret += String.fromCharCode(buf[i] &
0x7F)\n }\n return ret\n}\n\nfunction latin1Slice (buf, start, end) {\n var ret = ""\n
end = Math.min(buf.length, end)\n\n for (var i = start; i < end; ++i) {\n ret += String.fromCharCode(buf[i])\n
}\n return ret\n}\n\nfunction hexSlice (buf, start, end) {\n var len = buf.length\n\n if (!start || start < 0) start = 0\n
if (!end || end < 0 || end > len) end = len\n\n var out = ""\n for (var i = start; i < end; ++i) {\n out +=
toHex(buf[i])\n }\n return out\n}\n\nfunction utf16leSlice (buf, start, end) {\n var bytes = buf.slice(start, end)\n
var res = ""\n for (var i = 0; i < bytes.length; i += 2) {\n res += String.fromCharCode(bytes[i] + bytes[i + 1] *
256)\n }\n return res\n}\n\nBuffer.prototype.slice = function slice (start, end) {\n var len = this.length\n start =
~~start\n end = end === undefined ? len : ~~end\n\n if (start < 0) {\n start += len\n if (start < 0) start = 0\n }

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else if (start > len) {
  start = len
}
if (end < 0) {
  end += len
  if (end < 0) end = 0
} else if (end > len) {
  end = len
}
if (end < start) end = start
var newBuf
if (Buffer.TYPED_ARRAY_SUPPORT) {
  newBuf = this.subarray(start, end)
  newBuf.__proto__ = Buffer.prototype
} else {
  var sliceLen = end - start
  newBuf = new Buffer(sliceLen, undefined)
  for (var i = 0; i < sliceLen; ++i) {
    newBuf[i] = this[i + start]
  }
}
return newBuf
}
*
* Need to make sure that buffer isn't trying to write out of bounds.
function checkOffset(offset, ext, length) {
  if ((offset % 1) !== 0 || offset < 0) throw new RangeError('offset is not uint')
  if (offset + ext > length) throw new RangeError('Trying to access beyond buffer length')
}
Buffer.prototype.readUIntLE = function readUIntLE(offset, byteLength, noAssert) {
  offset = offset | 0
  byteLength = byteLength | 0
  if (!noAssert) checkOffset(offset, byteLength, this.length)
  var val = this[offset]
  var mul = 1
  var i = 0
  while (++i < byteLength && (mul *= 0x100)) {
    val += this[offset + i] * mul
  }
  return val
}
Buffer.prototype.readUIntBE = function readUIntBE(offset, byteLength, noAssert) {
  offset = offset | 0
  byteLength = byteLength | 0
  if (!noAssert) {
    checkOffset(offset, byteLength, this.length)
  }
  var val = this[offset + --byteLength]
  var mul = 1
  while (byteLength > 0 && (mul *= 0x100)) {
    val += this[offset + --byteLength] * mul
  }
  return val
}
Buffer.prototype.readUInt8 = function readUInt8(offset, noAssert) {
  if (!noAssert) checkOffset(offset, 1, this.length)
  return this[offset]
}
Buffer.prototype.readUInt16LE = function readUInt16LE(offset, noAssert) {
  if (!noAssert) checkOffset(offset, 2, this.length)
  return this[offset] | (this[offset + 1] << 8)
}
Buffer.prototype.readUInt16BE = function readUInt16BE(offset, noAssert) {
  if (!noAssert) checkOffset(offset, 2, this.length)
  return (this[offset] << 8) | this[offset + 1]
}
Buffer.prototype.readUInt32LE = function readUInt32LE(offset, noAssert) {
  if (!noAssert) checkOffset(offset, 4, this.length)
  return ((this[offset]) | (this[offset + 1] << 8) | (this[offset + 2] << 16) + (this[offset + 3] * 0x1000000))
}
Buffer.prototype.readUInt32BE = function readUInt32BE(offset, noAssert) {
  if (!noAssert) checkOffset(offset, 4, this.length)
  return (this[offset] * 0x1000000) + ((this[offset + 1] << 16) | (this[offset + 2] << 8) | this[offset + 3])
}
Buffer.prototype.readIntLE = function readIntLE(offset, byteLength, noAssert) {
  offset = offset | 0
  byteLength = byteLength | 0
  if (!noAssert) checkOffset(offset, byteLength, this.length)
  var val = this[offset]
  var mul = 1
  var i = 0
  while (++i < byteLength && (mul *= 0x100)) {
    val += this[offset + i] * mul
  }
  mul *= 0x80
  if (val >= mul) val -= Math.pow(2, 8 * byteLength)
  return val
}
Buffer.prototype.readIntBE = function readIntBE(offset, byteLength, noAssert) {
  offset = offset | 0
  byteLength = byteLength | 0
  if (!noAssert) checkOffset(offset, byteLength, this.length)
  var i = byteLength
  var mul = 1
  var val = this[offset + --i]
  while (i > 0 && (mul *= 0x100)) {
    val += this[offset + --i] * mul
  }
  mul *= 0x80
  if (val >= mul) val -= Math.pow(2, 8 * byteLength)
  return val
}
Buffer.prototype.readInt8 = function readInt8(offset, noAssert) {
  if (!noAssert) checkOffset(offset, 1, this.length)
  if (!(this[offset] & 0x80)) return (this[offset])
  return ((0xff - this[offset] + 1) * -1)
}
Buffer.prototype.readInt16LE = function readInt16LE(offset, noAssert) {
  if (!noAssert) checkOffset(offset, 2, this.length)
  var val = this[offset] | (this[offset + 1] << 8)
  return (val & 0x8000) ? val | 0xFFFF0000 : val
}
Buffer.prototype.readInt16BE = function readInt16BE(offset, noAssert) {
  if (!noAssert) checkOffset(offset, 2, this.length)
  var val = this[offset + 1] | (this[offset] << 8)
  return (val & 0x8000) ? val | 0xFFFF0000 : val
}
Buffer.prototype.readInt32LE = function readInt32LE(offset, noAssert) {
  if (!noAssert) checkOffset(offset, 4, this.length)
  return (this[offset]) | (this[offset + 1] << 8) | (this[offset + 2] << 16) | (this[offset + 3] << 24)
}
Buffer.prototype.readInt32BE = function readInt32BE(offset, noAssert) {
  if (!noAssert) checkOffset(offset, 4, this.length)
  return (this[offset] << 24) | (this[offset + 1] << 16) | (this[offset + 2] << 8) | (this[offset + 3])
}
Buffer.prototype.readFloatLE = function readFloatLE(offset, noAssert) {
  if (!noAssert) checkOffset(offset, 4, this.length)
  return ieee754.read(this, offset, true, 23, 4)
}
Buffer.prototype.readFloatBE = function readFloatBE(offset, noAssert) {
  if (!noAssert) checkOffset(offset, 4, this.length)
  return ieee754.read(this, offset, false, 23, 4)
}
Buffer.prototype.readDoubleLE = function readDoubleLE(offset, noAssert)

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    {\n if (!noAssert) checkOffset(offset, 8, this.length)\n return ieee754.read(this, offset, true, 52,
8)\n}\n\nBuffer.prototype.readDoubleBE = function readDoubleBE (offset, noAssert) {\n if (!noAssert)
checkOffset(offset, 8, this.length)\n return ieee754.read(this, offset, false, 52, 8)\n}\n\nfunction checkInt (buf,
value, offset, ext, max, min) {\n if (!Buffer.isBuffer(buf)) throw new TypeError('"buffer" argument must be a
Buffer instance')\n if (value > max || value < min) throw new RangeError('"value" argument is out of bounds')\n if
(offset + ext > buf.length) throw new RangeError('Index out of range')\n}\n\nBuffer.prototype.writeUIntLE =
function writeUIntLE (value, offset, byteLength, noAssert) {\n value = +value\n offset = offset | 0\n byteLength =
byteLength | 0\n if (!noAssert) {\n var maxBytes = Math.pow(2, 8 * byteLength) - 1\n checkInt(this, value,
offset, byteLength, maxBytes, 0)\n }\n\n var mul = 1\n var i = 0\n this[offset] = value & 0xFF\n
while (++i < byteLength && (mul *= 0x100)) {\n this[offset + i] = (value / mul) & 0xFF\n }\n\n return offset +
byteLength\n}\n\nBuffer.prototype.writeUIntBE = function writeUIntBE (value, offset, byteLength, noAssert) {\n
value = +value\n offset = offset | 0\n byteLength = byteLength | 0\n if (!noAssert) {\n var maxBytes =
Math.pow(2, 8 * byteLength) - 1\n checkInt(this, value, offset, byteLength, maxBytes, 0)\n }\n\n var i =
byteLength - 1\n var mul = 1\n this[offset + i] = value & 0xFF\n while (--i >= 0 && (mul *= 0x100)) {\n
this[offset + i] = (value / mul) & 0xFF\n }\n\n return offset + byteLength\n}\n\nBuffer.prototype.writeUInt8 =
function writeUInt8 (value, offset, noAssert) {\n value = +value\n offset = offset | 0\n if (!noAssert) checkInt(this,
value, offset, 1, 0xff, 0)\n if (!Buffer.TYPED_ARRAY_SUPPORT) value = Math.floor(value)\n this[offset] =
(value & 0xff)\n return offset + 1\n}\n\nfunction objectWriteUInt16 (buf, value, offset, littleEndian)
{\n if (value < 0) value = 0xffff + value + 1\n for (var i = 0, j = Math.min(buf.length - offset, 2); i < j; ++i) {\n
buf[offset + i] = (value & (0xff << (8 * (littleEndian ? i : 1 - i)))) >>>\n (littleEndian ? i : 1 - i) * 8\n
}\n}\n\nBuffer.prototype.writeUInt16LE = function writeUInt16LE (value, offset, noAssert) {\n value = +value\n
offset = offset | 0\n if (!noAssert) checkInt(this, value, offset, 2, 0xffff, 0)\n if
(Buffer.TYPED_ARRAY_SUPPORT) {\n this[offset] = (value & 0xff)\n this[offset + 1] = (value >>> 8)\n }
else {\n objectWriteUInt16(this, value, offset, true)\n }\n return offset + 2\n}\n\nBuffer.prototype.writeUInt16BE
= function writeUInt16BE (value, offset, noAssert) {\n value = +value\n offset = offset | 0\n if (!noAssert)
checkInt(this, value, offset, 2, 0xffff, 0)\n if (Buffer.TYPED_ARRAY_SUPPORT) {\n this[offset] = (value >>>
8)\n this[offset + 1] = (value & 0xff)\n } else {\n objectWriteUInt16(this, value, offset, false)\n
}\n return offset + 2\n}\n\nfunction objectWriteUInt32 (buf, value, offset, littleEndian) {\n if (value < 0) value =
0xffffffff + value + 1\n for (var i = 0, j = Math.min(buf.length - offset, 4); i < j; ++i) {\n buf[offset + i] = (value
>>> (littleEndian ? i : 3 - i) * 8) & 0xff\n }\n}\n\nBuffer.prototype.writeUInt32LE = function writeUInt32LE
(value, offset, noAssert) {\n value = +value\n offset = offset | 0\n if (!noAssert) checkInt(this, value, offset, 4,
0xffffffff, 0)\n if (Buffer.TYPED_ARRAY_SUPPORT) {\n this[offset + 3] = (value >>> 24)\n this[offset + 2]
= (value >>> 16)\n this[offset + 1] = (value >>> 8)\n this[offset] = (value & 0xff)\n } else {\n
objectWriteUInt32(this, value, offset, true)\n }\n return offset + 4\n}\n\nBuffer.prototype.writeUInt32BE =
function writeUInt32BE (value, offset, noAssert) {\n value = +value\n offset = offset | 0\n if (!noAssert)
checkInt(this, value, offset, 4, 0xffffffff, 0)\n if (Buffer.TYPED_ARRAY_SUPPORT)
{\n this[offset] = (value >>> 24)\n this[offset + 1] = (value >>> 16)\n this[offset + 2] = (value >>> 8)\n
this[offset + 3] = (value & 0xff)\n } else {\n objectWriteUInt32(this, value, offset, false)\n }\n return offset +
4\n}\n\nBuffer.prototype.writeIntLE = function writeIntLE (value, offset, byteLength, noAssert) {\n value =
+value\n offset = offset | 0\n if (!noAssert) {\n var limit = Math.pow(2, 8 * byteLength - 1)\n\n checkInt(this,
value, offset, byteLength, limit - 1, -limit)\n }\n\n var i = 0\n var mul = 1\n var sub = 0\n this[offset] = value &
0xFF\n while (++i < byteLength && (mul *= 0x100)) {\n if (value < 0 && sub === 0 && this[offset + i - 1] !==
0) {\n sub = 1\n }\n this[offset + i] = ((value / mul) >>> 0) - sub & 0xFF\n }\n\n return offset +
byteLength\n}\n\nBuffer.prototype.writeIntBE = function writeIntBE (value, offset, byteLength, noAssert) {\n
value = +value\n offset = offset | 0\n if (!noAssert) {\n var limit
= Math.pow(2, 8 * byteLength - 1)\n\n checkInt(this, value, offset, byteLength, limit - 1, -limit)\n }\n\n var i =
byteLength - 1\n var mul = 1\n var sub = 0\n this[offset + i] = value & 0xFF\n while (--i >= 0 && (mul *=
0x100)) {\n if (value < 0 && sub === 0 && this[offset + i + 1] !== 0) {\n sub = 1\n }\n this[offset + i] =

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((value / mul) >> 0) - sub & 0xFF\n } \n\n return offset + byteLength\n}\n\nBuffer.prototype.writeInt8 = function
writeInt8 (value, offset, noAssert) {\n value = +value\n offset = offset | 0\n if (!noAssert) checkInt(this, value,
offset, 1, 0x7f, -0x80)\n if (!Buffer.TYPED_ARRAY_SUPPORT) value = Math.floor(value)\n if (value < 0) value
= 0xff + value + 1\n this[offset] = (value & 0xff)\n return offset + 1\n}\n\nBuffer.prototype.writeInt16LE =
function writeInt16LE (value, offset, noAssert) {\n value = +value\n offset = offset | 0\n if (!noAssert)
checkInt(this, value, offset, 2, 0x7fff, -0x8000)\n if (Buffer.TYPED_ARRAY_SUPPORT)
{\n this[offset] = (value & 0xff)\n this[offset + 1] = (value >>> 8)\n } else {\n objectWriteUInt16(this, value,
offset, true)\n }\n return offset + 2\n}\n\nBuffer.prototype.writeInt16BE = function writeInt16BE (value, offset,
noAssert) {\n value = +value\n offset = offset | 0\n if (!noAssert) checkInt(this, value, offset, 2, 0x7fff, -0x8000)\n
if (Buffer.TYPED_ARRAY_SUPPORT) {\n this[offset] = (value >>> 8)\n this[offset + 1] = (value & 0xff)\n }
else {\n objectWriteUInt16(this, value, offset, false)\n }\n return offset + 2\n}\n\nBuffer.prototype.writeInt32LE
= function writeInt32LE (value, offset, noAssert) {\n value = +value\n offset = offset | 0\n if (!noAssert)
checkInt(this, value, offset, 4, 0x7fffffff, -0x80000000)\n if (Buffer.TYPED_ARRAY_SUPPORT) {\n
this[offset] = (value & 0xff)\n this[offset + 1] = (value >>> 8)\n this[offset + 2] = (value >>> 16)\n this[offset
+ 3] = (value >>> 24)\n } else {\n objectWriteUInt32(this, value,
offset, true)\n }\n return offset + 4\n}\n\nBuffer.prototype.writeInt32BE = function writeInt32BE (value, offset,
noAssert) {\n value = +value\n offset = offset | 0\n if (!noAssert) checkInt(this, value, offset, 4, 0x7fffffff, -
0x80000000)\n if (value < 0) value = 0xffffffff + value + 1\n if (Buffer.TYPED_ARRAY_SUPPORT) {\n
this[offset] = (value >>> 24)\n this[offset + 1] = (value >>> 16)\n this[offset + 2] = (value >>> 8)\n this[offset
+ 3] = (value & 0xff)\n } else {\n objectWriteUInt32(this, value, offset, false)\n }\n return offset +
4\n}\n\nfunction checkIEEE754 (buf, value, offset, ext, max, min) {\n if (offset + ext > buf.length) throw new
RangeError('Index out of range')\n if (offset < 0) throw new RangeError('Index out of range')\n}\n\nfunction
writeFloat (buf, value, offset, littleEndian, noAssert) {\n if (!noAssert) {\n checkIEEE754(buf, value, offset, 4,
3.4028234663852886e+38, -3.4028234663852886e+38)\n }\n ieee754.write(buf, value, offset,
littleEndian, 23, 4)\n return offset + 4\n}\n\nBuffer.prototype.writeFloatLE = function writeFloatLE (value, offset,
noAssert) {\n return writeFloat(this, value, offset, true, noAssert)\n}\n\nBuffer.prototype.writeFloatBE = function
writeFloatBE (value, offset, noAssert) {\n return writeFloat(this, value, offset, false, noAssert)\n}\n\nfunction
writeDouble (buf, value, offset, littleEndian, noAssert) {\n if (!noAssert) {\n checkIEEE754(buf, value, offset, 8,
1.7976931348623157E+308, -1.7976931348623157E+308)\n }\n ieee754.write(buf, value, offset, littleEndian, 52,
8)\n return offset + 8\n}\n\nBuffer.prototype.writeDoubleLE = function writeDoubleLE (value, offset, noAssert)
{\n return writeDouble(this, value, offset, true, noAssert)\n}\n\nBuffer.prototype.writeDoubleBE = function
writeDoubleBE (value, offset, noAssert) {\n return writeDouble(this, value, offset, false, noAssert)\n}\n\n//
copy(targetBuffer, targetStart=0, sourceStart=0, sourceEnd=buffer.length)\nBuffer.prototype.copy
= function copy (target, targetStart, start, end) {\n if (!start) start = 0\n if (!end && end !== 0) end = this.length\n
if (targetStart >= target.length) targetStart = target.length\n if (!targetStart) targetStart = 0\n if (end > 0 && end <
start) end = start\n\n // Copy 0 bytes; we're done\n if (end === start) return 0\n if (target.length === 0 || this.length
=== 0) return 0\n\n // Fatal error conditions\n if (targetStart < 0) {\n throw new RangeError('targetStart out of
bounds')\n }\n if (start < 0 || start >= this.length) throw new RangeError('sourceStart out of bounds')\n if (end < 0)
throw new RangeError('sourceEnd out of bounds')\n\n // Are we oob?\n if (end > this.length) end = this.length\n if
(target.length - targetStart < end - start) {\n end = target.length - targetStart + start\n }\n\n var len = end - start\n
var i\n\n if (this === target && start < targetStart && targetStart < end) {\n // descending copy from end\n for (i
= len
- 1; i >= 0; --i) {\n target[i + targetStart] = this[i + start]\n }\n } else if (len < 1000 ||
!Buffer.TYPED_ARRAY_SUPPORT) {\n // ascending copy from start\n for (i = 0; i < len; ++i) {\n target[i +
targetStart] = this[i + start]\n }\n } else {\n Uint8Array.prototype.set.call(\n target,\n this.subarray(start,
start + len),\n targetStart\n )\n }\n\n return len\n}\n\n// Usage:\n// buffer.fill(number[, offset[, end]])\n//
buffer.fill(buffer[, offset[, end]])\n// buffer.fill(string[, offset[, end]][, encoding])\nBuffer.prototype.fill = function
fill (val, start, end, encoding) {\n // Handle string cases:\n if (typeof val === 'string') {\n if (typeof start ===

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'string') {\n  encoding = start\n  start = 0\n  end = this.length\n } else if (typeof end === 'string') {\n
encoding = end\n  end = this.length\n }\n  if (val.length === 1) {\n    var code = val.charCodeAt(0)\n    if
(code < 256) {\n
    val = code\n    }\n  }\n  if (encoding !== undefined && typeof encoding !== 'string') {\n    throw new
TypeError('encoding must be a string')\n  }\n  if (typeof encoding === 'string' && !Buffer.isEncoding(encoding))
{\n    throw new TypeError('Unknown encoding: ' + encoding)\n  }\n } else if (typeof val === 'number') {\n  val
= val & 255\n }\n\n // Invalid ranges are not set to a default, so can range check early.\n if (start < 0 || this.length <
start || this.length < end) {\n  throw new RangeError('Out of range index')\n }\n\n if (end <= start) {\n  return
this\n }\n\n start = start >>> 0\n end = end === undefined ? this.length : end >>> 0\n if (!val) val = 0\n var i\n
if (typeof val === 'number') {\n  for (i = start; i < end; ++i) {\n    this[i] = val\n  }\n } else {\n  var bytes =
Buffer.isBuffer(val)\n    ? val\n    : utf8ToBytes(new Buffer(val, encoding).toString())\n  var len = bytes.length\n
  for (i = 0; i < end - start; ++i)
  {\n    this[i + start] = bytes[i % len]\n  }\n }\n\n return this\n}\n\n// HELPER FUNCTIONS\n//
=====\n\nvar INVALID_BASE64_RE = /[^+\/0-9A-Za-z-_]/g\n\nfunction base64clean (str) {\n //
Node strips out invalid characters like \\n and \\t from the string, base64-js does not\n str =
stringtrim(str).replace(INVALID_BASE64_RE, "")\n // Node converts strings with length < 2 to "" if (str.length <
2) return ""\n // Node allows for non-padded base64 strings (missing trailing ===), base64-js does not\n while
(str.length % 4 !== 0) {\n  str = str + '='\n }\n return str\n}\n\nfunction stringtrim (str) {\n if (str.trim) return
str.trim()\n return str.replace(/^\\s+|\\s+$/g, "")\n}\n\nfunction toHex (n) {\n if (n < 16) return '0' + n.toString(16)\n
return n.toString(16)\n}\n\nfunction utf8ToBytes (string, units) {\n  units = units || Infinity\n  var codePoint\n  var
length = string.length\n  var leadSurrogate = null\n  var bytes = []\n  for (var i = 0; i < length;
  ++i) {\n    codePoint = string.charCodeAt(i)\n    // is surrogate component\n    if (codePoint > 0xD7FF &&
codePoint < 0xE000) {\n      // last char was a lead\n      if (!leadSurrogate) {\n        // no lead yet\n        if (codePoint
> 0xDBFF) {\n          // unexpected trail\n          if ((units -= 3) > -1) bytes.push(0xEF, 0xBF, 0xBD)\n
          continue\n        } else if (i + 1 === length) {\n          // unpaired lead\n          if ((units -= 3) > -1) bytes.push(0xEF,
0xBF, 0xBD)\n          continue\n        }\n        // valid lead\n        leadSurrogate = codePoint\n        continue\n
      }\n      // 2 leads in a row\n      if (codePoint < 0xDC00) {\n        if ((units -= 3) > -1) bytes.push(0xEF, 0xBF,
0xBD)\n        leadSurrogate = codePoint\n        continue\n      }\n      // valid surrogate pair\n      codePoint =
(leadSurrogate - 0xD800 << 10 | codePoint - 0xDC00) + 0x10000\n    } else if (leadSurrogate) {\n      // valid bmp
char, but last char was a lead\n
      if ((units -= 3) > -1) bytes.push(0xEF, 0xBF, 0xBD)\n    }\n    leadSurrogate = null\n    // encode utf8\n    if
(codePoint < 0x80) {\n      if ((units -= 1) < 0) break\n      bytes.push(codePoint)\n    } else if (codePoint < 0x800)
{\n      if ((units -= 2) < 0) break\n      bytes.push(\n        codePoint >> 0x6 | 0xC0,\n        codePoint & 0x3F | 0x80\n
      )\n    } else if (codePoint < 0x10000) {\n      if ((units -= 3) < 0) break\n      bytes.push(\n        codePoint >> 0xC |
0xE0,\n        codePoint >> 0x6 & 0x3F | 0x80,\n        codePoint & 0x3F | 0x80\n      )\n    } else if (codePoint <
0x110000) {\n      if ((units -= 4) < 0) break\n      bytes.push(\n        codePoint >> 0x12 | 0xF0,\n        codePoint >>
0xC & 0x3F | 0x80,\n        codePoint >> 0x6 & 0x3F | 0x80,\n        codePoint & 0x3F | 0x80\n      )\n    } else {\n
throw new Error('Invalid code point')\n    }\n  }\n\n return bytes\n}\n\nfunction asciiToBytes (str) {\n var
byteArray = []\n  for (var
  i = 0; i < str.length; ++i) {\n    // Node's code seems to be doing this and not & 0x7F.\n
byteArray.push(str.charCodeAt(i) & 0xFF)\n  }\n  return byteArray\n}\n\nfunction utf16leToBytes (str, units) {\n
var c, hi, lo\n  var byteArray = []\n  for (var i = 0; i < str.length; ++i) {\n    if ((units -= 2) < 0) break\n    c =
str.charCodeAt(i)\n    hi = c >> 8\n    lo = c % 256\n    byteArray.push(lo)\n    byteArray.push(hi)\n  }\n\n return
byteArray\n}\n\nfunction base64ToBytes (str) {\n return base64.toByteArray(base64clean(str))\n}\n\nfunction
blitBuffer (src, dst, offset, length) {\n  for (var i = 0; i < length; ++i) {\n    if ((i + offset >= dst.length) || (i >=
src.length)) break\n    dst[i + offset] = src[i]\n  }\n  return i\n}\n\nfunction isnan (val) {\n return val !== val // eslint-
disable-line no-self-compare\n}\n\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n *
Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not

```

use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

```
=====\n*\n\nimport { complex } from './ops/complex';\nimport { tensor } from './ops/tensor';\nimport { NamedTensor,  
NamedTensorMap } from './tensor_types';\nimport { TypedArray } from './types';\nimport { sizeFromShape } from './util';\nimport { DTYPE_VALUE_SIZE_MAP, ModelArtifacts, ModelArtifactsInfo, WeightGroup,  
WeightsManifestEntry } from './types';\n\n/** Number of bytes reserved for the length of the string. (32bit integer). */\nconst\n  NUM_BYTES_STRING_LENGTH = 4;\n\n/**\n * Encode a map from names to weight values as an ArrayBuffer,  
along with an\n * `Array` of `WeightsManifestEntry` as specification of the encoded weights.\n *\n * This function does not perform sharding.\n *\n * This function is the reverse of `decodeWeights`.\n *\n * @param tensors A map (\"dict\") from names to tensors.\n * @param group Group to which the weights belong (optional).\n * @returns A\n * `Promise` of\n * - A flat `ArrayBuffer` with all the binary values of the `Tensor`s\n * concatenated.\n * - An\n * `Array` of `WeightManifestEntry`s, carrying information including\n * tensor names, `dtype`s and shapes.\n *\n * @throws Error: on unsupported tensor `dtype`.\n */\nexport async function encodeWeights(\n  tensors:  
NamedTensorMap|NamedTensor[], group?: WeightGroup):  
Promise<{data: ArrayBuffer, specs:  
WeightsManifestEntry[]}> {\n  // TODO(adarob, cais): Support quantization.\n  const specs:  
WeightsManifestEntry[] = [];\n  const dataPromises:  
Array<Promise<TypedArray>> = [];\n\n  const names: string[] = Array.isArray(tensors) ?\n    tensors.map(tensor => tensor.name) :  
Object.keys(tensors);\n\n  for (let i = 0; i < names.length; ++i) {\n    const name = names[i];\n    const t = Array.isArray(tensors) ? tensors[i].tensor : tensors[name];\n    if (t.dtype !== 'float32' && t.dtype !== 'int32' && t.dtype !== 'bool' &&\n        t.dtype !== 'string' && t.dtype !== 'complex64') {\n      throw new Error(`Unsupported dtype in weight '${name}': ${t.dtype}`);\n    }\n    const spec: WeightsManifestEntry = {name, shape: t.shape, dtype: t.dtype};\n    if (t.dtype === 'string') {\n      const utf8bytes = new Promise<TypedArray>(async resolve => {\n        const vals = await t.bytes() as Uint8Array[];\n        const totalNumBytes = vals.reduce((p, c) => p + c.length, 0) +\n          NUM_BYTES_STRING_LENGTH * vals.length;\n        const bytes = new Uint8Array(totalNumBytes);\n        let offset = 0;\n        for (let i = 0; i < vals.length; i++) {\n          const val = vals[i];\n          const bytesOfLength = new Uint8Array(new Uint32Array([val.length]).buffer);\n          bytes.set(bytesOfLength, offset);\n          offset += NUM_BYTES_STRING_LENGTH;\n          bytes.set(val, offset);\n          offset += val.length;\n        }\n        resolve(bytes);\n      });\n      dataPromises.push(utf8bytes);\n    } else {\n      dataPromises.push(t.data());\n    }\n  }\n\n  if (group != null) {\n    spec.group = group;\n  }\n  specs.push(spec);\n}\n\nconst tensorValues = await Promise.all(dataPromises);\nreturn {data: concatenateTypedArrays(tensorValues), specs};\n}\n\n/**\n * Decode flat ArrayBuffer as weights.\n *\n * This function does not handle sharding.\n *\n * This function is the reverse of `encodeWeights`.\n *\n * @param buffer A flat ArrayBuffer carrying the binary values of the tensors\n * concatenated in the order specified in `specs`.\n * @param specs Specifications of the names, dtypes and shapes of the tensors\n * whose value are encoded by `buffer`.\n *\n * @return A map from tensor name to tensor value, with the names corresponding\n * to names in `specs`.\n *\n * @throws Error, if any of the tensors has unsupported dtype.\n */\nexport function decodeWeights(\n  buffer: ArrayBuffer, specs:  
WeightsManifestEntry[]): NamedTensorMap {\n  // TODO(adarob, cais): Support quantization.\n  const out:  
NamedTensorMap = {};\n  let float16Decode: (buffer: Uint16Array) => Float32Array | undefined;\n  let offset = 0;\n  for (const spec of specs) {\n    const name = spec.name;\n    const dtype = spec.dtype;\n    const shape = spec.shape;\n    const size = sizeFromShape(shape);\n    let values: TypedArray|string[]|Uint8Array[];\n    if ('quantization' in spec) {\n      const quantization = spec.quantization;\n      if (quantization.dtype === 'uint8' || quantization.dtype === 'uint16') {\n        if (!('min' in quantization) && 'scale' in quantization) {\n
```

```

    throw new Error(`Weight ${spec.name} with quantization ${quantization.dtype} ` +
    `doesn't have corresponding metadata min and scale.`);
  } else if (quantization.dtype === 'float16') {
    if (dtype !== 'float32') {
      throw new Error(`Weight ${spec.name} is quantized with
      ${quantization.dtype} ` +
      `which only supports weights of type float32 not ${dtype}.`);
    }
  } else {
    throw new Error(`Weight ${spec.name} has unknown ` +
    `quantization dtype
    ${quantization.dtype}. ` +
    `Supported quantization dtypes are: ` +
    `'uint8', 'uint16', and
    'float16'.`);
  }
  const quantizationSizeFactor = DTYPE_VALUE_SIZE_MAP[quantization.dtype];
  const byteBuffer = buffer.slice(offset, offset + size * quantizationSizeFactor);
  const quantizedArray =
    (quantization.dtype === 'uint8') ?
    new Uint8Array(byteBuffer)
    :
    new Uint16Array(byteBuffer);
  if (dtype === 'float32') {
    if (quantization.dtype === 'uint8' ||
    quantization.dtype === 'uint16') {
      values = new Float32Array(quantizedArray.length);
      for (let i = 0; i < quantizedArray.length; i++) {
        const v = quantizedArray[i];
        values[i] = v * quantization.scale +
        quantization.min;
      }
    } else if (quantization.dtype === 'float16') {
      if (float16Decode ===
      undefined) {
        float16Decode = getFloat16Decoder();
      }
      values =
      float16Decode(quantizedArray as Uint16Array);
    } else {
      throw new Error(`Unsupported
      quantization type ${quantization.dtype} ` +
      `for weight type float32.`);
    }
  } else if (dtype ===
  'int32') {
    if (quantization.dtype !== 'uint8' &&
    quantization.dtype !== 'uint16') {
      throw new Error(`
      `Unsupported quantization
      type ${quantization.dtype} ` +
      `for weight type int32.`);
    }
    values = new
    Int32Array(quantizedArray.length);
    for (let i = 0; i < quantizedArray.length; i++) {
      const v =
      quantizedArray[i];
      values[i] = Math.round(v * quantization.scale +
      quantization.min);
    }
  } else {
    throw new Error(`Unsupported dtype in weight
    '${name}': ${dtype}`);
  }
  offset += size *
  quantizationSizeFactor;
  } else if (dtype === 'string') {
    const size = sizeFromShape(spec.shape);
    values
    = [];
    for (let i = 0; i < size; i++) {
      const byteLength = new Uint32Array(
      buffer.slice(offset,
      offset + NUM_BYTES_STRING_LENGTH))[0];
      offset += NUM_BYTES_STRING_LENGTH;
      const
      bytes = new Uint8Array(buffer.slice(offset,
      offset + byteLength));
      (values as Uint8Array[]).push(bytes);
      offset += byteLength;
    }
  } else {
    const dtypeFactor
    = DTYPE_VALUE_SIZE_MAP[dtype];
    const byteBuffer = buffer.slice(offset,
    offset + size *
    dtypeFactor);
    if (dtype === 'float32') {
      values = new Float32Array(byteBuffer);
    } else if (dtype
    === 'int32') {
      values = new Int32Array(byteBuffer);
    } else if (dtype === 'bool') {
      values = new
      Uint8Array(byteBuffer);
    } else if (dtype === 'complex64') {
      values = new Float32Array(byteBuffer);
      const real = new Float32Array(values.length / 2);
      const image = new Float32Array(values.length / 2);
      for (let i = 0; i < real.length; i++) {
        real[i] = values[i * 2];
        image[i] = values[i * 2 + 1];
      }
      const realTensor = tensor(real, shape, 'float32');
      const imageTensor = tensor(image, shape, 'float32');
      out[name] = complex(realTensor, imageTensor);
      realTensor.dispose();
      imageTensor.dispose();
    }
  }
  } else {
    throw new Error(`Unsupported
    dtype in weight '${name}': ${dtype}`);
  }
  offset += size * dtypeFactor;
  }
  if (dtype !==
  'complex64') {
    out[name] = tensor(values, shape, dtype);
  }
  }
  return out;
}

/**
 * Concatenate
 * TypedArrays into an ArrayBuffer.
 * @export function concatenateTypedArrays(xs: TypedArray[]): ArrayBuffer
 * // TODO(adarob, cais): Support quantization.
 * if (xs === null) {
 *   throw new Error(`Invalid input value:
 *   ${JSON.stringify(xs)}`);
 * }
 * let totalByteLength = 0;
 * // `normalizedXs` is here for this reason: a
 * `TypedArray`'s `buffer`
 * // can have a different byte length from that of the `TypedArray` itself,
 * // for example,
 * when the `TypedArray` is created from an offset in an
 * // `ArrayBuffer`.
 * `normliazedXs` holds `TypedArray`s
 * whose `buffer`s match
 * // the `TypedArray` in byte length. If an element of `xs` does not show
 * // this property, a
 * new `TypedArray` that satisfy this property will be
 * // constructed and pushed
 * into `normalizedXs`.
 * const normalizedXs: TypedArray[] = [];
 * xs.forEach((x: TypedArray) => {
 *   totalByteLength += x.byteLength;
 *   // tslint:disable:no-any
 *   normalizedXs.push(
 *     x.byteLength ===
 *     x.buffer.byteLength ? x :
 *     new (x.constructor as any)(x));
 *   if (!(x as any instanceof

```

```

Float32Array || x as any instanceof Int32Array ||\n      x as any instanceof Uint8Array)) {\n  throw new
Error(`Unsupported TypedArray subtype: ${x.constructor.name}`);\n } \n // tslint:disable:no-any\n });\n\n const
y = new Uint8Array(totalByteLength);\n let offset = 0;\n normalizedXs.forEach((x: TypedArray) => {\n
y.set(new Uint8Array(x.buffer), offset);\n offset += x.byteLength;\n });\n\n return y.buffer;\n }\n\n// Use Buffer
on Node.js instead of Blob/atob/btoa\nconst useNodeBuffer = typeof Buffer !== 'undefined' &&\n (typeof Blob
=== 'undefined' || typeof atob === 'undefined' ||\n  typeof btoa === 'undefined');\n\n/**\n * Calculate the byte length of a JavaScript string.\n *\n * Note that a JavaScript string can contain wide characters,
therefore the\n * length of the string is not necessarily equal to the byte length.\n *\n * @param str Input string.\n *
@return Byte length.\n */\nexport function stringByteLength(str: string): number {\n if (useNodeBuffer) {\n
return Buffer.byteLength(str);\n } \n return new Blob([str]).size;\n }\n\n/**\n * Encode an ArrayBuffer as a base64
encoded string.\n *\n * @param buffer `ArrayBuffer` to be converted.\n * @returns A string that base64-encodes
`buffer`.\n */\nexport function arrayBufferToBase64String(buffer: ArrayBuffer): string {\n if (useNodeBuffer) {\n
return Buffer.from(buffer).toString('base64');\n } \n const buf = new Uint8Array(buffer);\n let s = '';\n for (let i = 0,
l = buf.length; i < l; i++) {\n s += String.fromCharCode(buf[i]);\n } \n return btoa(s);\n }\n\n/**\n * Decode a
base64 string as an ArrayBuffer.\n *\n * @param
str Base64 string.\n * @returns Decoded `ArrayBuffer`.\n */\nexport function base64StringToArrayBuffer(str:
string): ArrayBuffer {\n if (useNodeBuffer) {\n const buf = Buffer.from(str, 'base64');\n return
buf.buffer.slice(buf.byteOffset, buf.byteOffset + buf.byteLength);\n } \n const s = atob(str);\n const buffer = new
Uint8Array(s.length);\n for (let i = 0; i < s.length; ++i) {\n buffer.set([s.charCodeAt(i)], i);\n } \n return
buffer.buffer;\n }\n\n/**\n * Concatenate a number of ArrayBuffers into one.\n *\n * @param buffers A number of
array buffers to concatenate.\n * @returns Result of concatenating `buffers` in order.\n */\nexport function
concatenateArrayBuffers(buffers: ArrayBuffer[]): ArrayBuffer {\n if (buffers.length === 1) {\n return
buffers[0];\n } \n let totalByteLength = 0;\n buffers.forEach((buffer: ArrayBuffer) => {\n totalByteLength +=
buffer.byteLength;\n });\n\n const temp = new Uint8Array(totalByteLength);\n let offset = 0;\n buffers.forEach((buffer:
ArrayBuffer) => {\n temp.set(new Uint8Array(buffer), offset);\n offset += buffer.byteLength;\n });\n return
temp.buffer;\n }\n\n/**\n * Get the basename of a path.\n *\n * Behaves in a way analogous to Linux's basename
command.\n *\n * @param path\n */\nexport function basename(path: string): string {\n const SEPARATOR = '/';\n
path = path.trim();\n while (path.endsWith(SEPARATOR)) {\n path = path.slice(0, path.length - 1);\n } \n const
items = path.split(SEPARATOR);\n return items[items.length - 1];\n }\n\n/**\n * Populate ModelArtifactsInfo
fields for a model with JSON topology.\n *\n * @param modelArtifacts\n * @returns A ModelArtifactsInfo object.\n */\nexport function getModelArtifactsInfoForJSON(modelArtifacts: ModelArtifacts):\n ModelArtifactsInfo {\n if
(modelArtifacts.modelTopology instanceof ArrayBuffer) {\n throw new Error('Expected JSON model topology,
received ArrayBuffer.');http://www.fox-toolkit.org/ftp/fasthalffloatconversion.pdf\n *\n * @returns
Uint32Array, 2048 mantissa lookup values.\n */\nfunction computeFloat16MantissaTable(): Uint32Array {\n const
convertMantissa = (i: number): number => {\n let m = i << 13;\n let e = 0;\n\n while ((m & 0x00800000) ===
0) {\n e -= 0x00800000;\n m <<= 1;\n } \n m &= ~0x00800000;\n e += 0x38800000;\n\n return m | e;\n
};\n\n const mantissaTable = new Uint32Array(2048);\n\n mantissaTable[0]
= 0;\n for (let i = 1; i < 1024; i++) {\n mantissaTable[i] = convertMantissa(i);\n } \n for (let i = 1024; i < 2048;
i++) {\n mantissaTable[i] = 0x38800000 + ((i - 1024) << 13);\n } \n\n return mantissaTable;\n }\n\n/**\n *
Computes exponent table for casting Float16 to Float32\n * See http://www.fox-
toolkit.org/ftp/fasthalffloatconversion.pdf\n *\n * @returns Uint32Array, 64 exponent lookup values.\n */\nfunction

```



```

handlerType: 'save'|'load',\n    loadOptions?: LoadOptions): IOHandler[] {\n  const validHandlers: IOHandler[] =
[];\n  const routers = handlerType === 'load' ?\n    IORouterRegistry.getInstance().loadRouters :\n    IORouterRegistry.getInstance().saveRouters;\n  routers.forEach(router => {\n    const handler = router(url,
loadOptions);\n    if (handler !== null) {\n      validHandlers.push(handler);\n    }\n  });\n  return
validHandlers;\n}\n}\n\nexport const registerSaveRouter = (loadRouter: IORouter) =>\n
IORouterRegistry.registerSaveRouter(loadRouter);\nexport const registerLoadRouter = (loadRouter: IORouter)
=>\n
IORouterRegistry.registerLoadRouter(loadRouter);\nexport
const getSaveHandlers = (url: string|string[]) =>\n
IORouterRegistry.getSaveHandlers(url);\nexport const
getLoadHandlers =\n
(url: string|string[], loadOptions?: LoadOptions) =>\n
IORouterRegistry.getLoadHandlers(url, loadOptions);\n"
"/**\n * @license\n * Copyright 2018 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport './flags';\nimport {env} from './environment';\nimport {getModelArtifactsInfoForJSON} from
 './io_utils';\nimport {IORouter, IORouterRegistry} from './router_registry';\nimport {IOHandler, ModelArtifacts,
ModelArtifactsInfo, ModelStoreManager, SaveResult} from './types';\n\nconst DATABASE_NAME =
'tensorflowjs';\nconst DATABASE_VERSION = 1;\n\n// Model data and ModelArtifactsInfo (metadata) are stored
in two separate\n// stores for efficient access of the list of stored models and their metadata.\n// 1. The object store
for model data: topology, weights and weight manifests.\nconst MODEL_STORE_NAME = 'models_store';\n// 2.
The object store for ModelArtifactsInfo, including meta-information such\n// as the type of topology (JSON vs
binary), byte size of the topology, byte\n// size of the weights, etc.\nconst INFO_STORE_NAME =
'model_info_store';\n\n/**\n * Delete the entire database for tensorflow.js, including the models store.\n */\nexport
async
function deleteDatabase(): Promise<void> {\n  const idbFactory = getIndexedDBFactory();\n\n  return new
Promise<void>((resolve, reject) => {\n    const deleteRequest =
idbFactory.deleteDatabase(DATABASE_NAME);\n    deleteRequest.onsuccess = () => resolve();\n
deleteRequest.onerror = error => reject(error);\n  });\n}\n\nfunction getIndexedDBFactory(): IDBFactory {\n
if (!env().getBool('IS_BROWSER')) {\n  // TODO(cais): Add more info about what IOHandler subtypes are
available.\n  // Maybe point to a doc page on the web and/or automatically determine\n  // the available
IOHandlers and print them in the error message.\n  throw new Error(\n    'Failed to obtain IndexedDB factory
because the current environment' +\n    ' is not a web browser.');

```

```

= modelPath;\n } \n\n async save(modelArtifacts: ModelArtifacts): Promise<SaveResult> {\n // TODO(cais):
Support saving GraphDef models.\n if (modelArtifacts.modelTopology instanceof ArrayBuffer) {\n throw new
Error(\n 'BrowserLocalStorage.save() does not support saving model topology ' +\n 'in binary formats
yet.);\n } \n\n return this.databaseAction(this.modelPath, modelArtifacts) as\n Promise<SaveResult>;\n
} \n\n async load(): Promise<ModelArtifacts> {\n return this.databaseAction(this.modelPath) as
Promise<ModelArtifacts>;\n } \n\n /**\n * Perform database action to put model artifacts into or read model
artifacts\n * from IndexedDB object store.\n * \n * Whether the action is put or get depends on whether
`modelArtifacts` is\n * specified. If it is specified, the action will be put; otherwise the action\n * will be get.\n * \n * @param modelPath A unique string path for the model.\n * @param modelArtifacts
If specified, it will be the model artifacts to be\n * stored in IndexedDB.\n * @returns A `Promise` of
`SaveResult`, if the action is put, or a `Promise`\n * of `ModelArtifacts`, if the action is get.\n */\n private
databaseAction(modelPath: string, modelArtifacts?: ModelArtifacts):\n Promise<ModelArtifacts|SaveResult> {\n
return new Promise<ModelArtifacts|SaveResult>((resolve, reject) => {\n const openRequest =
this.indexedDB.open(DATABASE_NAME, DATABASE_VERSION);\n openRequest.onupgradeneeded = () =>
setUpDatabase(openRequest);\n openRequest.onsuccess = () => {\n const db = openRequest.result;\n\n
if (modelArtifacts == null) {\n // Read model out from object store.\n const modelTx =
db.transaction(MODEL_STORE_NAME, 'readonly');\n const modelStore =
modelTx.objectStore(MODEL_STORE_NAME);\n const getRequest = modelStore.get(this.modelPath);\n
getRequest.onsuccess = () => {\n if
(getRequest.result == null) {\n db.close();\n return reject(new Error(\n 'Cannot find
model with path `${this.modelPath}` '\n +\n 'in IndexedDB. `));\n } else {\n
resolve(getRequest.result.modelArtifacts);\n }\n }; \n\n getRequest.onerror = error => {\n
db.close();\n return reject(getRequest.error);\n }; \n\n modelTx.oncomplete = () => db.close();\n
} else {\n // Put model into object store.\n const modelArtifactsInfo: ModelArtifactsInfo =\n
getModelArtifactsInfoForJSON(modelArtifacts);\n // First, put ModelArtifactsInfo into info store.\n
const infoTx = db.transaction(INFO_STORE_NAME, 'readwrite');\n let infoStore =
infoTx.objectStore(INFO_STORE_NAME);\n const putInfoRequest =\n infoStore.put({ modelPath:
this.modelPath, modelArtifactsInfo });\n let modelTx:
IDBTransaction;\n putInfoRequest.onsuccess = () => {\n // Second, put model data into model store.\n
modelTx = db.transaction(MODEL_STORE_NAME, 'readwrite');\n const modelStore =
modelTx.objectStore(MODEL_STORE_NAME);\n const putModelRequest = modelStore.put({\n
modelPath: this.modelPath,\n modelArtifacts,\n modelArtifactsInfo\n });\n
putModelRequest.onsuccess = () => resolve({modelArtifactsInfo});\n putModelRequest.onerror = error =>
{\n // If the put-model request fails, roll back the info entry as\n // well.\n infoStore =
infoTx.objectStore(INFO_STORE_NAME);\n const deleteInfoRequest =
infoStore.delete(this.modelPath);\n deleteInfoRequest.onsuccess = () => {\n db.close();\n
return reject(putModelRequest.error);\n }; \n\n deleteInfoRequest.onerror
= error => {\n db.close();\n return reject(putModelRequest.error);\n }; \n\n
}; \n\n putInfoRequest.onerror = error => {\n db.close();\n return reject(putInfoRequest.error);\n
}; \n\n infoTx.oncomplete = () => {\n if (modelTx == null) {\n db.close();\n } else {\n
modelTx.oncomplete = () => db.close();\n }\n }; \n\n }\n }; \n\n openRequest.onerror = error
=> reject(openRequest.error);\n });\n } \n\n\nexport const indexedDBRouter: IORouter = (url: string|string[]) =>
{\n if (!env().getBool('IS_BROWSER')) {\n return null;\n } else {\n if (!Array.isArray(url) &&
url.startsWith(BrowserIndexedDB.URL_SCHEME)) {\n return
browserIndexedDB(url.slice(BrowserIndexedDB.URL_SCHEME.length));\n } else {\n return null;\n }\n
}\n};\nIORouterRegistry.registerSaveRouter(indexedDBRouter);\nIORouterRegistry.registerLoadRouter(indexedD
BRouter);\n\n/**\n

```

```

* Creates a browser IndexedDB IOHandler for saving and loading models.\n *\n * ``js\n * const model =
tf.sequential();\n * model.add(\n *   tf.layers.dense({units: 1, inputShape: [100], activation: 'sigmoid'}));\n *\n *
const saveResult = await model.save('indexeddb://MyModel');\n * console.log(saveResult);\n * ``\n *\n * @param
modelPath A unique identifier for the model to be saved. Must be a\n * non-empty string.\n * @returns An
instance of `BrowserIndexedDB` (subclass of `IOHandler`),\n * which can be used with, e.g., `tf.Model.save`.\n
*\n * ^\n * export function browserIndexedDB(modelPath: string): IOHandler {\n *   return new
BrowserIndexedDB(modelPath);\n * }\n * \n * function maybeStripScheme(key: string) {\n *   return
key.startsWith(BrowserIndexedDB.URL_SCHEME) ?\n *     key.slice(BrowserIndexedDB.URL_SCHEME.length)
:\n *     key;\n * }\n * \n * export class BrowserIndexedDBManager implements ModelStoreManager {\n *   private
indexedDB:
IDBFactory;\n *   constructor() {\n *     this.indexedDB = getIndexedDBFactory();\n *   }\n *   async listModels():
Promise<{[path: string]: ModelArtifactsInfo}> {\n *     return new Promise<{[path: string]: ModelArtifactsInfo}>(\n
*       (resolve, reject) => {\n *         const openRequest =\n *           this.indexedDB.open(DATABASE_NAME,\n
DATABASE_VERSION);\n *         openRequest.onupgradeneeded = () => setUpDatabase(openRequest);\n *         \n
*         openRequest.onsuccess = () => {\n *           const db = openRequest.result;\n *           const tx =
db.transaction(INFO_STORE_NAME, 'readonly');\n *           const store = tx.objectStore(INFO_STORE_NAME);\n
*           // tslint:disable:max-line-length\n *           // Need to cast `store` as `any` here because TypeScript's DOM\n
*           // library does not have the `getAll()` method even though the\n *           // method is supported in the latest version of
most mainstream\n *           // browsers:\n *           // https://developer.mozilla.org/en-US/docs/Web/API/IDBObjectStore/getAll\n
*           // tslint:enable:max-line-length\n *           // tslint:disable-next-line:no-any\n *           const getAllInfoRequest =
(store as any).getAll() as IDBRequest;\n *           getAllInfoRequest.onsuccess = () => {\n *             const out: {[path:
string]: ModelArtifactsInfo} = {};\n *             for (const item of getAllInfoRequest.result) {\n *               \n
*               out[item.modelPath] = item.modelArtifactsInfo;\n *             }\n *             resolve(out);\n *           };\n
*           getAllInfoRequest.onerror = error => {\n *             db.close();\n *             return reject(getAllInfoRequest.error);\n
*           };\n *           tx.oncomplete = () => db.close();\n *           };\n *           openRequest.onerror = error =>
reject(openRequest.error);\n *         });\n *       }\n *     }\n *   }\n *   async removeModel(path: string): Promise<ModelArtifactsInfo> {\n
*     path = maybeStripScheme(path);\n *     return new Promise<ModelArtifactsInfo>((resolve, reject) => {\n *       const
openRequest
= this.indexedDB.open(DATABASE_NAME, DATABASE_VERSION);\n *       openRequest.onupgradeneeded = ()
=> setUpDatabase(openRequest);\n *       \n *       openRequest.onsuccess = () => {\n *         const db = openRequest.result;\n
*         const infoTx = db.transaction(INFO_STORE_NAME, 'readwrite');\n *         const infoStore =
infoTx.objectStore(INFO_STORE_NAME);\n *         const getInfoRequest = infoStore.get(path);\n *         let modelTx:
IDBTransaction;\n *         getInfoRequest.onsuccess = () => {\n *           if (getInfoRequest.result == null) {\n *             \n
*             db.close();\n *             return reject(new Error(\n *               `Cannot find model with path '${path}'` +\n *               `\n
*               IndexedDB.`));\n *           } else {\n *             // First, delete the entry in the info store.\n *             const deleteInfoRequest =
infoStore.delete(path);\n *             const deleteModelData = () => {\n *               // Second, delete the entry in the model
store.\n *               modelTx = db.transaction(MODEL_STORE_NAME,\n *                 'readwrite');\n *               const modelStore = modelTx.objectStore(MODEL_STORE_NAME);\n *               const
deleteModelRequest = modelStore.delete(path);\n *               deleteModelRequest.onsuccess = () =>\n *                 resolve(getInfoRequest.result.modelArtifactsInfo);\n *               deleteModelRequest.onerror = error =>\n
*                 reject(getInfoRequest.error);\n *             };\n *             // Proceed with deleting model data regardless of whether
deletion\n *             // of info data succeeds or not.\n *             deleteInfoRequest.onsuccess = deleteModelData;\n *             deleteInfoRequest.onerror = error => {\n *               deleteModelData();\n *               db.close();\n *               return
reject(getInfoRequest.error);\n *             };\n *           }\n *         };\n *         getInfoRequest.onerror = error => {\n *           db.close();\n *           return reject(getInfoRequest.error);\n *         };\n *         infoTx.oncomplete = () => {\n *           if
(modelTx == null) {\n

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        db.close();\n    } else {\n        modelTx.oncomplete = () => db.close();\n    }\n};\n};\n\nopenRequest.onerror = error => reject(openRequest.error);\n});\n}\n}\n\n", "/*\n * @license\n * Copyright 2018\n * Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you\n * may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n *\n *=====\n\n*\n\nimport './flags';\nimport {env} from './environment';\nimport\n  {assert} from './util';\nimport {arrayBufferToBase64String, base64StringToArrayBuffer,\n  getModelArtifactsInfoForJSON} from './io_utils';\nimport {IORouter, IORouterRegistry} from\n  './router_registry';\nimport {IOHandler, ModelArtifacts, ModelArtifactsInfo, ModelStoreManager, SaveResult}\n  from './types';\n\nconst PATH_SEPARATOR = '/';\nconst PATH_PREFIX = 'tensorflowjs_models';\nconst\n  INFO_SUFFIX = 'info';\nconst MODEL_TOPOLOGY_SUFFIX = 'model_topology';\nconst\n  WEIGHT_SPECS_SUFFIX = 'weight_specs';\nconst WEIGHT_DATA_SUFFIX = 'weight_data';\nconst\n  MODEL_METADATA_SUFFIX = 'model_metadata';\n\n/**\n * Purge all tensorflow.js-saved model artifacts from\n * local storage.\n * \n * @returns Paths of the models purged.\n */\nexport function purgeLocalStorageArtifacts():\n  string[] {\n  if (!env().getBool('IS_BROWSER') || typeof window === 'undefined' ||\n    typeof\n    window.localStorage === 'undefined') {\n    throw new Error(\n      'purgeLocalStorageModels() cannot proceed\n      because local storage is\n      '\n      +\n      'unavailable in the current environment.);\n  }\n  const LS = window.localStorage;\n  const\n    purgedModelPaths: string[] = [];\n  for (let i = 0; i < LS.length; ++i) {\n    const key = LS.key(i);\n    const prefix =\n      PATH_PREFIX + PATH_SEPARATOR;\n    if (key.startsWith(prefix) && key.length > prefix.length) {\n      LS.removeItem(key);\n      const modelName = getModelPathFromKey(key);\n      if\n        (purgedModelPaths.indexOf(modelName) === -1) {\n        purgedModelPaths.push(modelName);\n      }\n    }\n  }\n  return purgedModelPaths;\n}\n\nfunction getModelKeys(path: string): {\n  info: string,\n  topology: string,\n  weightSpecs: string,\n  weightData: string,\n  modelMetadata: string\n} {\n  return {\n    info: [PATH_PREFIX,\n      path, INFO_SUFFIX].join(PATH_SEPARATOR),\n    topology: [PATH_PREFIX, path,\n      MODEL_TOPOLOGY_SUFFIX].join(PATH_SEPARATOR),\n    weightSpecs: [PATH_PREFIX, path,\n      WEIGHT_SPECS_SUFFIX].join(PATH_SEPARATOR),\n    weightData: [PATH_PREFIX, path,\n      WEIGHT_DATA_SUFFIX].join(PATH_SEPARATOR),\n    modelMetadata:\n      [PATH_PREFIX, path, MODEL_METADATA_SUFFIX].join(PATH_SEPARATOR)\n  };\n}\n\n/**\n * Get model path from a local-storage key.\n * \n * E.g., 'tensorflowjs_models/my/model/1/info' -->\n * 'my/model/1'\n * \n * @param key\n */\nfunction getModelPathFromKey(key: string) {\n  const items =\n    key.split(PATH_SEPARATOR);\n  if (items.length < 3) {\n    throw new Error(`Invalid key format: ${key}`);\n  }\n  return items.slice(1, items.length - 1).join(PATH_SEPARATOR);\n}\n\nfunction maybeStripScheme(key: string)\n  {\n  return key.startsWith(BrowserLocalStorage.URL_SCHEME) ?\n    key.slice(BrowserLocalStorage.URL_SCHEME.length) :\n    key;\n}\n\ndeclare type LocalStorageKeys = {\n  info: string,\n  topology: string,\n  weightSpecs: string,\n  weightData: string,\n  modelMetadata: string\n};\n\n/**\n * IOHandler subclass: Browser Local Storage.\n * \n * See the doc string to `browserLocalStorage` for more\n * details.\n */\nexport class BrowserLocalStorage\n  implements IOHandler {\n  protected readonly LS: Storage;\n  protected readonly modelPath: string;\n  protected\n    readonly keys: LocalStorageKeys;\n\n  static readonly URL_SCHEME = 'localStorage://';\n\n  constructor(modelPath: string) {\n    if (!env().getBool('IS_BROWSER') || typeof window === 'undefined' ||\n      typeof\n      window.localStorage === 'undefined') {\n      // TODO(cais): Add more info about what IOHandler subtypes\n      are\n      // available.\n      // Maybe point to a doc page on the web and/or automatically determine\n      // the\n      available IOHandlers and print them in the error message.\n      throw new Error(\n        'The current environment

```

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does not support local storage.);\n  }\n  this.LS = window.localStorage;\n\n  if (modelPath === null || !modelPath)\n  {\n    throw new Error(\n      'For local storage, modelPath must not be null, undefined or empty.');

```

```

(weightDataBase64 == null) {\n    throw new Error(\n        `In local storage, the binary weight values of model `
+\n        `${this.modelPath}` are missing.`);\n    }\n    out.weightData =
base64StringToArrayBuffer(weightDataBase64);\n\n    return out;\n    }\n\n\nexport const localStorageRouter: IORouter = (url: string|string[]) => {\n    if
(!env().getBool('IS_BROWSER')) {\n        return null;\n    } else {\n        if (!Array.isArray(url) &&
url.startsWith(BrowserLocalStorage.URL_SCHEME)) {\n            return browserLocalStorage(\n
url.slice(BrowserLocalStorage.URL_SCHEME.length));\n        } else {\n            return null;\n        }\n
    };\n\n    IORouterRegistry.registerSaveRouter(localStorageRouter);\n    IORouterRegistry.registerLoadRouter(localStor
ageRouter);\n\n\n    /**\n     * Factory function for local storage IOHandler.\n     * This `IOHandler` supports both `save`
and `load`.\n     * For each model's saved artifacts, four items are saved to local storage.\n     * -
`${PATH_SEPARATOR}/${modelPath}/info`: Contains meta-info about the\n     * model, such as date saved, type
of the topology, size in bytes, etc.\n     * - `${PATH_SEPARATOR}/${modelPath}/topology`: Model topology. For
Keras-\n     * style models, this is a
stringized JSON.\n     * - `${PATH_SEPARATOR}/${modelPath}/weight_specs`: Weight specs of the\n     * model,
can be used to decode the saved binary weight values (see\n     * item below).\n     * -
`${PATH_SEPARATOR}/${modelPath}/weight_data`: Concatenated binary\n     * weight values, stored as a
base64-encoded string.\n     * Saving may throw an `Error` if the total size of the artifacts exceed the\n     * browser-
specific quota.\n     * @param modelPath A unique identifier for the model to be saved. Must be a\n     * non-empty
string.\n     * @returns An instance of `IOHandler`, which can be used with, e.g.,\n     * `tf.Model.save`.\n     */\n\n    export
function browserLocalStorage(modelPath: string): IOHandler {\n        return new
BrowserLocalStorage(modelPath);\n    }\n\n\n    export class BrowserLocalStorageManager implements
ModelStoreManager {\n        private readonly LS: Storage;\n\n        constructor() {\n            assert(\n
env().getBool('IS_BROWSER'),\n                () => 'Current environment is not a web browser');\n            assert(\n
typeof window === 'undefined' ||\n                typeof window.localStorage !== 'undefined',\n                () => 'Current
browser does not appear to support localStorage');\n            this.LS = window.localStorage;\n        }\n\n        async listModels():
Promise<[[path: string]: ModelArtifactsInfo]> {\n            const out: [[path: string]: ModelArtifactsInfo] = {};\n            const
prefix = PATH_PREFIX + PATH_SEPARATOR;\n            const suffix = PATH_SEPARATOR + INFO_SUFFIX;\n            for (let i = 0; i < this.LS.length; ++i) {\n                const key = this.LS.key(i);\n                if (key.startsWith(prefix) &&
key.endsWith(suffix)) {\n                    const modelPath = getModelPathFromKey(key);\n                    out[modelPath] =
JSON.parse(this.LS.getItem(key)) as ModelArtifactsInfo;\n                }\n            }\n            return out;\n        }\n\n        async
removeModel(path: string): Promise<ModelArtifactsInfo> {\n            path = maybeStripScheme(path);\n            const keys =
getModelKeys(path);\n            if (this.LS.getItem(keys.info) == null) {\n                throw new Error(`Cannot find model at
path '${path}'`);\n            }\n            const info = JSON.parse(this.LS.getItem(keys.info)) as ModelArtifactsInfo;\n            this.LS.removeItem(keys.info);\n            this.LS.removeItem(keys.topology);\n            this.LS.removeItem(keys.weightSpecs);\n            this.LS.removeItem(keys.weightData);\n            return info;\n        }\n    }\n\n\n    /**\n     * @license\n     * Copyright 2018 Google LLC. All Rights Reserved.\n     * Licensed under the Apache License, Version
2.0 (the `License`);\n     * you may not use this file except in compliance with the License.\n     * You may obtain a
copy of the License at\n     * http://www.apache.org/licenses/LICENSE-2.0\n     * Unless required by applicable
law or agreed to in writing, software\n     * distributed under the License is distributed on an `AS IS` BASIS,\n     * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n     * See the License for
the specific language governing permissions and\n     * limitations under the License.\n     */\n\n    =====\n\n    /**\n     * Classes and functions for model management across multiple storage mediums.\n     * Supported
client actions:\n     * - Listing models on all registered storage mediums.\n     * - Remove model by URL from any
registered storage mediums, by using URL\n     * string.\n     * - Moving or copying model from one path to another in
the same medium or from\n     * one medium to another, by using URL strings.\n     */\n\n    import {assert} from
'./util';\n    import {IORouterRegistry} from './router_registry';\n    import {ModelArtifactsInfo, ModelStoreManager}
from './types';\n\n    const URL_SCHEME_SUFFIX = '://';\n\n    export class ModelStoreManagerRegistry {\n        //

```

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Singleton instance.\n private static instance: ModelStoreManagerRegistry;\n\n private managers: {[scheme: string]:
ModelStoreManager};\n\n private constructor() {\n this.managers = {};\n }\n\n private static getInstance():
ModelStoreManagerRegistry {\n if (ModelStoreManagerRegistry.instance == null) {\n
ModelStoreManagerRegistry.instance
= new ModelStoreManagerRegistry();\n }\n return ModelStoreManagerRegistry.instance;\n }\n\n /**\n *
Register a save-handler router.\n *\n * @param saveRouter A function that maps a URL-like string onto an
instance\n * of `IOHandler` with the `save` method defined or `null`.\n */\n static registerManager(scheme:
string, manager: ModelStoreManager) {\n assert(scheme != null, () => 'scheme must not be undefined or null.');

```



```

console.log(JSON.stringify(await tf.io.listModels()));\n *\n * // Move the model, from Local Storage to
IndexedDB.\n *\n * await tf.io.moveModel(\n *   'localstorage://demo/management/model1',\n *   'indexeddb://demo/management/model1');\n *\n * // List models again.\n *\n * console.log(JSON.stringify(await
tf.io.listModels()));\n *\n * // Remove the moved model.\n *\n * await
tf.io.removeModel('indexeddb://demo/management/model1');\n *\n * \n *\n * @param sourceURL Source URL of
moving.\n * @param destURL Destination URL of moving.\n * @returns ModelArtifactsInfo of the copied
model (if and only if copying\n * is successful).\n * @throws Error if moving fails, e.g., if no model exists at
`sourceURL`, or\n * if `oldPath` and `newPath` are identical.\n *\n * @doc {\n *   heading: 'Models',\n *
subheading: 'Management',\n *   namespace: 'io',\n *   ignoreCI: true\n * }\n *\n * ^\n *\n * async function moveModel(\n
sourceURL: string, destURL: string): Promise<ModelArtifactsInfo> {\n *   const deleteSource = true;\n *   return
cloneModelInternal(sourceURL, destURL, deleteSource);\n * }\n *\n * \n *\n * export { moveModel, copyModel, removeModel,
listModels};\n *"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an
\n * "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n *
See the License for the specific language governing permissions and\n * limitations under the License.\n *
=====
\n *\n * \n *\n * import './flags';\n *\n * import {env} from './environment';\n *\n * import {BrowserIndexedDB,
BrowserIndexedDBManager} from './io/indexed_db';\n *\n * import {BrowserLocalStorage,
BrowserLocalStorageManager} from './io/local_storage';\n *\n * import {ModelStoreManagerRegistry} from
 './io/model_management';\n *\n * import {Platform} from './platform';\n *\n * \n *\n * export class PlatformBrowser implements
Platform {\n *   // According to the spec, the built-in encoder can do only UTF-8 encoding.\n *   //
https://developer.mozilla.org/en-US/docs/Web/API/TextEncoder/TextEncoder\n *   private textEncoder:
TextEncoder;\n *\n *   fetch(path: string, init?: RequestInit): Promise<Response> {\n *     return fetch(path, init);\n *   }\n *\n *
now(): number {\n *     return
performance.now();\n *   }\n *\n *   encode(text: string, encoding: string): Uint8Array {\n *     if (encoding !== 'utf-8' &&
encoding !== 'utf8') {\n *       throw new Error(\n *         `Browser's encoder only supports utf-8, but got
${encoding}`);\n *     }\n *     if (this.textEncoder == null) {\n *       this.textEncoder = new TextEncoder();\n *     }\n *     return
this.textEncoder.encode(text);\n *   }\n *\n *   decode(bytes: Uint8Array, encoding: string): string {\n *     return new
TextDecoder(encoding).decode(bytes);\n *   }\n * }\n *\n * \n *\n * if (env().get('IS_BROWSER')) {\n *   env().setPlatform('browser',
new PlatformBrowser());\n * }\n *\n * // Register LocalStorage IOHandler\n * try {\n *
ModelStoreManagerRegistry.registerManager(\n *   BrowserLocalStorage.URL_SCHEME, new
BrowserLocalStorageManager());\n * } catch (err) {\n *   }\n *\n * // Register IndexedDB IOHandler\n * try {\n *
ModelStoreManagerRegistry.registerManager(\n *   BrowserIndexedDB.URL_SCHEME, new
BrowserIndexedDBManager());\n * } catch (err) {\n *   }\n * }\n *"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
"License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an\n * "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
=====
\n *\n * \n *\n * import {env} from './environment';\n *\n * import {Platform} from './platform';\n *\n * \n *\n * // We are wrapping this within an
object so it can be stubbed by Jasmine.\n *\n * export const getNodeFetch = {\n *   // tslint:disable-next-line:no-require-
imports\n *   importFetch: () => require('node-fetch')\n * };
\n *\n * type FetchFn

```

```
= (url: string, init?: RequestInit) => Promise<Response>;\nlet systemFetch: FetchFn;\n// These getters and setters  
are for testing so we don't export a mutable\n// variable.\n\nexport function resetSystemFetch() {\n  systemFetch =  
null;\n}\n\nexport function setSystemFetch(fetchFn: FetchFn) {\n  systemFetch = fetchFn;\n}\n\nexport function  
getSystemFetch(): FetchFn {\n  return systemFetch;\n}\n\n\nexport class PlatformNode implements Platform {\n  private textEncoder: TextEncoder;\n  // tslint:disable-next-line:no-any\n  util: any;\n\n  constructor() {\n    //  
tslint:disable-next-line:no-require-imports\n    this.util = require('util');\n    // According to the spec, the built-in  
encoder can do only UTF-8 encoding.\n    // https://developer.mozilla.org/en-  
US/docs/Web/API/TextEncoder/TextEncoder\n    this.textEncoder = new this.util.TextEncoder();\n  }\n\n  fetch(path: string, requestInit?: RequestInit): Promise<Response> {\n    if (env().global.fetch != null) {\n      return  
env().global.fetch(path,  
requestInit);\n    }\n    if (systemFetch == null) {\n      systemFetch = getNodeFetch.importFetch();\n    }\n    return systemFetch(path, requestInit);\n  }\n\n  now(): number {\n    const time = process.hrtime();\n    return  
time[0] * 1000 + time[1] / 1000000;\n  }\n\n  encode(text: string, encoding: string): Uint8Array {\n    if (encoding  
!= 'utf-8' && encoding != 'utf8') {\n      throw new Error(\n        `Node built-in encoder only supports utf-8, but  
got ${encoding}`);\n    }\n    return this.textEncoder.encode(text);\n  }\n  decode(bytes: Uint8Array, encoding:  
string): string {\n    if (bytes.length === 0) {\n      return '';\n    }\n    return new  
this.util.TextDecoder(encoding).decode(bytes);\n  }\n}\n\nif (env().get('IS_NODE')) {\n  env().setPlatform('node',  
new PlatformNode());\n}\n\n"/**\n * @license\n * Copyright 2020 Google Inc. All Rights Reserved.\n * Licensed  
under the Apache License, Version 2.0 (the "License");\n * you may not use this file except  
in compliance with the License.\n * You may obtain a copy of the License at\n *\n *  
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,  
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES  
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language  
governing permissions and\n * limitations under the License.\n */
```

```
=====\n\n*\n\nimport {TensorBuffer} from './tensor';\nimport {DataType, DataTypeMap, Rank, ShapeMap} from  
 './types';\nimport * as util from './util';\n\n/**\n * Creates an empty `tf.TensorBuffer` with the specified `shape` and  
 `dtype`.\n * The values are stored in CPU as `TypedArray`. Fill the buffer using\n * `buffer.set()`, or by  
 modifying directly `buffer.values`.\n * When done, call `buffer.toTensor()` to get an immutable `tf.Tensor`  
 with\n *  
 those values.\n * ``js\n * // Create a buffer and set values at particular indices.\n * const buffer = tf.buffer([2,  
 2]);\n * buffer.set(3, 0, 0);\n * buffer.set(5, 1, 0);\n * // Convert the buffer back to a tensor.\n *  
 buffer.toTensor().print();\n *``\n * @param shape An array of integers defining the output tensor shape.\n * @param dtype The dtype of the buffer. Defaults to 'float32'.\n * @param values The values of the buffer as  
 `TypedArray`. Defaults to\n * zeros.\n * @doc {heading: 'Tensors', subheading: 'Creation'}\n *\n\nexport  
function buffer<R extends Rank, D extends DataType = 'float32'>(\n  shape: ShapeMap[R], dtype: D = 'float32' as  
 D,\n  values?: DataTypeMap[D]): TensorBuffer<R, D> {\n  dtype = dtype || 'float32' as D;\n  util.assertNonNegativeIntegerDimensions(shape);\n  return new TensorBuffer<R, D>(shape, dtype,  
values);\n}\n\n"/**\n * @license\n * Copyright 2020 Google Inc. All Rights Reserved.\n * Licensed under the  
Apache License, Version 2.0 (the  
 "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the  
License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or  
agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *  
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for  
the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n\n*\n\nimport {ENGINE} from './engine';\nimport {Cast, CastAttrs, CastInputs} from './kernel_names';\nimport  
{NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from
```

```

../tensor_types';\nimport {convertToTensor} from '../tensor_util_env';\nimport {DataType, TensorLike} from
../types';\nimport * as util from '../util';\nimport {op} from './operation';\n\n/**\n * Casts a `tf.Tensor` to a new dtype.\n * @param x const x = tf.tensor1d([1.5, 2.5, 3]);\n * @param dtype The dtype to cast the input
tensor to.\n * @doc {heading: 'Tensors', subheading: 'Transformations'}\n * @function cast_<T extends
Tensor>(x: T|TensorLike, dtype: DataType): T {\n  const $x = convertToTensor(x, 'x', 'cast');\n  // Sanity checks.\n  if (!util.isValidDtype(dtype)) {\n    throw new Error(`Failed to cast to unknown dtype ${dtype}`);\n  }\n  if (dtype
=== 'string' && $x.dtype !== 'string' ||\n      dtype !== 'string' && $x.dtype === 'string') {\n    throw new Error('Only
strings can be casted to strings');\n  }\n  const inputs: CastInputs = {x: $x};\n  const attrs: CastAttrs = {dtype};\n  return ENGINE.runKernel(\n    Cast, inputs as {} as NamedTensorMap, attrs as {} as
NamedAttrMap);\n}\n\nexport const cast = op({cast_});\n\n",/**\n * @license\n * Copyright 2020
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *\n
=====\n\n\nimport {ENGINE} from '../engine';\nimport {Identity, IdentityInputs} from './kernel_names';\nimport
{Tensor} from '../tensor';\nimport {NamedTensorMap} from '../tensor_types';\nimport {convertToTensor} from
../tensor_util_env;\nimport {TensorLike} from '../types';\nimport {op} from './operation';\n\n/**\n *
Creates a new tensor with the same values and shape as the specified\n * tensor.\n * @param x const x =
tf.tensor([1, 2]);\n * @param x The tensor to clone.\n * @doc {heading:
'Tensors', subheading: 'Creation'}\n * @function clone_<T extends Tensor>(x: T|TensorLike): T {\n  const $x =
convertToTensor(x, 'x', 'clone', 'string_or_numeric');\n  const inputs: IdentityInputs = {x: $x};\n  // Note this op is
called tf.identity in python. Hence the kernel name used\n  // here.\n  return ENGINE.runKernel(Identity, inputs as
{} as NamedTensorMap);\n}\n\nexport const clone = op({clone_});\n\n",/**\n * @license\n * Copyright 2020
Google Inc. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed
to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT
WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *\n
=====\n\n\nimport {Tensor} from '../tensor';\n\n/**\n * Prints information about the `tf.Tensor` including its data.\n *
@param x The tensor to be printed.\n * @param verbose Whether to print verbose information about the `Tensor`,\n * including dtype and
size.\n * @doc {heading: 'Tensors', subheading: 'Creation'}\n * @function print_<T extends Tensor>(x: T,
verbose = false): void {\n  console.log(x.toString(verbose));\n}\n\n",/**\n * @license\n * Copyright 2020 Google
Inc. All Rights Reserved.\n * Licensed under the Apache
License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You
may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required
by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS"
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *\n
=====\n\n\n// Required side effectful code for tfjs-core\n// Set up Engine and ENV\nimport {getOrMakeEngine} from
../engine';\ngetOrMakeEngine();\n\n// Register backend-agnostic flags.\nimport './flags';\n// Register

```

```
platforms\nimport './platforms/platform_browser';\nimport './platforms/platform_node';\n\n// Set up
OpHandler\nimport {buffer} from './ops/buffer';\nimport {cast}
from './ops/cast';\nimport {clone} from './ops/clone';\nimport {print} from './ops/print';\nimport {OpHandler,
setOpHandler} from './tensor';\nconst opHandler: OpHandler = {\n  buffer,\n  cast,\n  clone,\n  print\n};\nsetOpHandler(opHandler);\n\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
```

```
=====
*\n\n**\n * IOHandlers related
to files, such as browser-triggered file downloads,\n * user-selected files in browser.\n *\n\nimport
'./flags';\nimport {env} from './environment';\nimport {basename, concatenateArrayBuffers,
getModelArtifactsInfoForJSON} from './io_utils';\nimport {IORouter, IORouterRegistry} from
'/router_registry';\nimport {IOHandler, ModelArtifacts, ModelJSON, SaveResult, WeightsManifestConfig,
WeightsManifestEntry} from './types';\n\nconst DEFAULT_FILE_NAME_PREFIX = 'model';\nconst
DEFAULT_JSON_EXTENSION_NAME = '.json';\nconst DEFAULT_WEIGHT_DATA_EXTENSION_NAME =
'.weights.bin';\n\nfunction defer<T>(f: () => T): Promise<T> {\n  return new Promise(resolve =>
setTimeout(resolve)).then(f);\n}\n\nexport class BrowserDownloads implements IOHandler {\n  private readonly
modelTopologyFileName: string;\n  private readonly weightDataFileName: string;\n  private readonly jsonAnchor:
HTMLAnchorElement;\n  private readonly weightDataAnchor: HTMLAnchorElement;\n\n  static readonly
URL_SCHEME = 'downloads://';\n\n  constructor(fileNamePrefix?: string) {\n    if (!env().getBool('IS_BROWSER')) {\n      // TODO(cais): Provide info
on what IOHandlers are available under the\n      // current environment.\n      throw new Error(\n
'browserDownloads() cannot proceed because the current environment ' +\n      'is not a browser.);\n    }\n    if
(fileNamePrefix.startsWith(BrowserDownloads.URL_SCHEME)) {\n      fileNamePrefix =
fileNamePrefix.slice(BrowserDownloads.URL_SCHEME.length);\n    }\n    if (fileNamePrefix == null ||
fileNamePrefix.length === 0) {\n      fileNamePrefix = DEFAULT_FILE_NAME_PREFIX;\n    }\n    this.modelTopologyFileName = fileNamePrefix + DEFAULT_JSON_EXTENSION_NAME;\n
this.weightDataFileName =\n      fileNamePrefix + DEFAULT_WEIGHT_DATA_EXTENSION_NAME;\n  }\n\n  async save(modelArtifacts: ModelArtifacts): Promise<SaveResult> {\n    if (typeof (document) === 'undefined') {\n
throw new Error(\n      'Browser downloads are not supported in\n
' +\n      'this environment since `document` is not present');\n    }\n    const weightsURL =
window.URL.createObjectURL(new Blob(\n      [modelArtifacts.weightData], {type: 'application/octet-
stream'}));\n\n    if (modelArtifacts.modelTopology instanceof ArrayBuffer) {\n      throw new Error(\n
'BrowserDownloads.save() does not support saving model topology ' +\n      'in binary formats yet.);\n    } else {\n
const weightsManifest: WeightsManifestConfig = [{\n      paths: ['./' + this.weightDataFileName],\n      weights:
modelArtifacts.weightSpecs\n    }];\n    const modelTopologyAndWeightManifest: ModelJSON = {\n
modelTopology: modelArtifacts.modelTopology,\n      format: modelArtifacts.format,\n      generatedBy:
modelArtifacts.generatedBy,\n      convertedBy: modelArtifacts.convertedBy,\n      weightsManifest\n    };\n    if (modelArtifacts.signature != null) {\n      modelTopologyAndWeightManifest.signature =
modelArtifacts.signature;\n    }\n    if (modelArtifacts.userDefinedMetadata != null) {\n
modelTopologyAndWeightManifest.userDefinedMetadata =\n      modelArtifacts.userDefinedMetadata;\n    }\n    if (modelArtifacts.modelInitializer != null) {\n      modelTopologyAndWeightManifest.modelInitializer =\n      modelArtifacts.modelInitializer;\n    }\n    const modelTopologyAndWeightManifestURL =\n
```

```

window.URL.createObjectURL(new Blob(\n      [JSON.stringify(modelTopologyAndWeightManifest)],\n
  {type: 'application/json'}));\n\n  // If anchor elements are not provided, create them without attaching them\n
// to parents, so that the downloaded file names can be controlled.\n  const jsonAnchor = this.jsonAnchor == null
? document.createElement('a') :\n      this.jsonAnchor;\n  jsonAnchor.download =
this.modelTopologyFileName;\n  jsonAnchor.href = modelTopologyAndWeightManifestURL;\n
  // Trigger downloads by evoking a click event on the download anchors.\n  // When multiple downloads are
started synchronously, Firefox will only\n  // save the last one.\n  await defer(() =>
jsonAnchor.dispatchEvent(new MouseEvent('click')));\n\n  if (modelArtifacts.weightData != null) {\n    const
weightDataAnchor = this.weightDataAnchor == null ?\n      document.createElement('a') :\n      this.weightDataAnchor;\n    weightDataAnchor.download = this.weightDataFileName;\n
weightDataAnchor.href = weightsURL;\n    await defer(\n      () => weightDataAnchor.dispatchEvent(new
MouseEvent('click')));\n  }\n\n  return {modelArtifactsInfo:
getModelArtifactsInfoForJSON(modelArtifacts)};\n  }\n }\n}\n\n\nclass BrowserFiles implements IOHandler {\n
private readonly files: File[];\n\n  constructor(files: File[]) {\n    if (files == null || files.length < 1) {\n      throw new
Error(\n        `When calling browserFiles, at least
1 file is required, ` +\n        `but received ${files}`);\n    }\n    this.files = files;\n  }\n\n  async load():
Promise<ModelArtifacts> {\n    const jsonFile = this.files[0];\n    const weightFiles = this.files.slice(1);\n\n    return
new Promise<ModelArtifacts>((resolve, reject) => {\n      const jsonReader = new FileReader();\n
jsonReader.onload = (event: Event) => {\n        // tslint:disable-next-line:no-any\n        const modelJSON =
JSON.parse((event.target as any).result) as ModelJSON;\n        const modelTopology =
modelJSON.modelTopology;\n        if (modelTopology == null) {\n          reject(new Error(\n
`modelTopology field is missing from file ${jsonFile.name}`));\n          return;\n        }\n        if
(weightFiles.length === 0) {\n          resolve({modelTopology});\n        }\n        const weightsManifest =
modelJSON.weightsManifest;\n        if (weightsManifest == null) {\n          reject(new Error(\n
`weightManifest field
is missing from file ${jsonFile.name}`));\n          return;\n        }\n        let pathToFile: {[path: string]: File};\n
try {\n          pathToFile =\n            this.checkManifestAndWeightFiles(weightsManifest, weightFiles);\n        }
catch (err) {\n          reject(err);\n          return;\n        }\n        const weightSpecs: WeightsManifestEntry[] = [];\n
const paths: string[] = [];\n        const perFileBuffers: ArrayBuffer[] = [];\n
weightsManifest.forEach(weightsGroup => {\n          weightsGroup.paths.forEach(path => {\n
paths.push(path);\n          perFileBuffers.push(null);\n        });\n        weightSpecs.push(...weightsGroup.weights);\n      });\n      weightsManifest.forEach(weightsGroup => {\n
weightsGroup.paths.forEach(path => {\n          const weightFileReader = new FileReader();\n
weightFileReader.onload = (event: Event) => {\n            // tslint:disable-next-line:no-any\n
const weightData = (event.target as any).result as ArrayBuffer;\n            const index = paths.indexOf(path);\n
perFileBuffers[index] = weightData;\n            if (perFileBuffers.indexOf(null) === -1) {\n              const result:
ModelArtifacts = {\n                modelTopology,\n                weightSpecs,\n                weightData:\n                concatenateArrayBuffers(perFileBuffers),\n                format: modelJSON.format,\n                generatedBy:
modelJSON.generatedBy,\n                convertedBy: modelJSON.convertedBy\n              };\n              if
(modelJSON.signature != null) {\n                result.signature = modelJSON.signature;\n              }\n              if
(modelJSON.userDefinedMetadata != null) {\n                result.userDefinedMetadata =
modelJSON.userDefinedMetadata;\n              }\n              if (modelJSON.modelInitializer != null) {\n
result.modelInitializer = modelJSON.modelInitializer;\n              }\n              resolve(result);\n            }\n          }\n          weightFileReader.onerror = error =>\n
reject(`Failed to weights data from file of path '${path}'.`);\n
weightFileReader.readAsArrayBuffer(pathToFile[path]);\n        });\n      });\n      jsonReader.onerror =
error => reject(\n        `Failed to read model topology and weights manifest JSON ` +\n        `from file
'${jsonFile.name}'. BrowserFiles supports loading ` +\n        `Keras-style tf.Model artifacts only.`);\n

```

```

jsonReader.readAsText(jsonFile);\n  });\n }\n\n /**\n  * Check the compatibility between weights manifest and
weight files.\n  *\n  private checkManifestAndWeightFiles(\n    manifest: WeightsManifestConfig, files: File[]):
{[path: string]: File} {\n    const basenames: string[] = [];\n    const fileNames = files.map(file =>
basename(file.name));\n    const pathToFile: {[path: string]: File} = {};\n    for (const
group of manifest) {\n      group.paths.forEach(path => {\n        const pathBasename = basename(path);\n        if
(basenames.indexOf(pathBasename) !== -1) {\n          throw new Error(\n            `Duplicate file basename found in
weights manifest: ` +\n              `${pathBasename}`);\n          }\n          basenames.push(pathBasename);\n          if
(fileNames.indexOf(pathBasename) === -1) {\n            throw new Error(\n              `Weight file with basename
'${pathBasename}' is not provided.`);\n          } else {\n            pathToFile[path] =
files[fileNames.indexOf(pathBasename)];\n          }\n        });\n      });\n }\n\n if (basenames.length !== files.length) {\n
throw new Error(\n    `Mismatch in the number of files in weights manifest ` +\n      `${basenames.length}`
and the number of weight files provided ` +\n        `${files.length}`);\n }\n return pathToFile;\n
}\n}\n\nexport const browserDownloadsRouter: IORouter = (url: string|string[]) => {\n
  if (!env().getBool('IS_BROWSER')) {\n    return null;\n  } else {\n    if (!Array.isArray(url) &&
url.startsWith(BrowserDownloads.URL_SCHEME)) {\n      return
browserDownloads(url.slice(BrowserDownloads.URL_SCHEME.length));\n    } else {\n      return null;\n    }\n
}\n};\n\nIORouterRegistry.registerSaveRouter(browserDownloadsRouter);\n\n/**\n  * Creates an IOHandler that
triggers file downloads from the browser.\n  *\n  * The returned `IOHandler` instance can be used as model exporting
methods such\n  * as `tf.Model.save` and supports only saving.\n  *\n  * ```js\n  * const model = tf.sequential();\n  *
model.add(tf.layers.dense({units: 1, inputShape: [10], activation: 'sigmoid'}));\n  * const saveResult = await
model.save('downloads://mymodel');\n  * // This will trigger downloading of two files:\n  * // 'mymodel.json' and
'mymodel.weights.bin'.\n  * console.log(saveResult);\n  * ```\n  *\n  * @param fileNamePrefix Prefix name of the files
to be downloaded. For use with\n  * `tf.Model`,
`fileNamePrefix` should follow either of the following two\n  * formats:\n  * 1. `null` or `undefined`, in which
case the default file\n  * names will be used:\n  * - 'model.json' for the JSON file containing the model topology
and\n  * weights manifest.\n  * - 'model.weights.bin' for the binary file containing the binary weight\n  *
values.\n  * 2. A single string or an Array of a single string, as the file name prefix.\n  * For example, if `foo` is
provided, the downloaded JSON\n  * file and binary weights file will be named 'foo.json' and\n  *
'foo.weights.bin', respectively.\n  *\n  * @param config Additional configuration for triggering downloads.\n  * @returns
An instance of `BrowserDownloads` `IOHandler`.\n  *\n  * @doc {\n  * heading: 'Models',\n  * subheading:
'Loading',\n  * namespace: 'io',\n  * ignoreCI: true\n  * }\n  *\n  \nexport function browserDownloads(fileNamePrefix =
'model'): IOHandler {\n  return new BrowserDownloads(fileNamePrefix);\n }\n\n/**\n  * Creates an IOHandler that loads model artifacts from user-selected files.\n  *\n  * This method can be used for
loading from files such as user-selected files\n  * in the browser.\n  *\n  * When used in conjunction with
`tf.loadLayersModel`, an instance of\n  * `tf.LayersModel` (Keras-style) can be constructed from the loaded
artifacts.\n  *\n  * ```js\n  * // Note: This code snippet won't run properly without the actual file input\n  * // elements
in the HTML DOM.\n  * // Suppose there are two HTML file input (<input type="file" ...>)\n  * // elements.\n  *
const uploadJSONInput = document.getElementById('upload-json');\n  * const uploadWeightsInput =
document.getElementById('upload-weights');\n  * const model = await tf.loadLayersModel(tf.io.browserFiles([\n  *
uploadJSONInput.files[0], uploadWeightsInput.files[0]]));\n  * ```\n  *\n  * @param files `File`s to load from.
Currently, this function supports only\n  * loading from files that contain Keras-style models (i.e., `tf.Model`s),
for\n  * which an `Array` of `File`s is expected (in that order):\n  * - A JSON file containing the model topology
and weight manifest.\n  * - Optionally, One or more binary files containing the binary weights.\n  * These files
must have names that match the paths in the `weightsManifest`\n  * contained by the aforementioned JSON file, or
errors will be thrown\n  * during loading. These weights files have the same format as the ones\n  * generated by
`tensorflowjs_converter` that comes with the `tensorflowjs`\n  * Python PIP package. If no weights files are
provided, only the model\n  * topology will be loaded from the JSON file above.\n  * @returns An instance of
`Files` `IOHandler`.\n  *\n  * @doc {\n  * heading: 'Models',\n  * subheading: 'Loading',\n  * namespace: 'io',\n  *

```

```

ignoreCI: true\n * }\n *\nexport function browserFiles(files: File[]): IOHandler {\n return new
BrowserFiles(files);\n}\n", "/*\n * @license\n * Copyright 2019 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {assert} from './util';\n\nimport {OnProgressCallback} from './types';\n\n/**\n * Monitor Promise.all
progress, fire onProgress callback function.\n *\n * @param promises Promise list going to be monitored\n *
@param onProgress Callback function. Fired when a promise resolved.\n * @param startFraction Optional fraction
start. Default to 0.\n * @param endFraction Optional fraction end. Default to 1.\n *\nexport function
monitorPromisesProgress(\n promises: Array<Promise<{}>>, onProgress: OnProgressCallback,\n startFraction?: number, endFraction?: number) {\n checkPromises(promises);\n startFraction = startFraction ==
null ? 0 : startFraction;\n endFraction = endFraction == null ? 1 : endFraction;\n checkFraction(startFraction,
endFraction);\n let resolvedPromise = 0;\n\n const registerMonitor = (promise: Promise<{}>) => {\n
promise.then(value => {\n const fraction = startFraction +\n ++resolvedPromise / promises.length *
(endFraction - startFraction);\n // pass fraction as parameter to callback function.\n onProgress(fraction);\n
return value;\n });\n return promise;\n };\n\n function checkPromises(promises: Array<Promise<{}>>):
void {\n assert(\n promises != null && Array.isArray(promises) && promises.length > 0,\n ()
=> 'promises must be a none empty array');\n }\n\n function checkFraction(startFraction: number, endFraction:
number): void {\n assert(\n startFraction >= 0 && startFraction <= 1,\n () => `Progress fraction must be
in range [0, 1], but ` +\n `got startFraction ${startFraction}`);\n assert(\n endFraction >= 0 &&
endFraction <= 1,\n () => `Progress fraction must be in range [0, 1], but ` +\n `got endFraction
${endFraction}`);\n assert(\n endFraction >= startFraction,\n () => `startFraction must be no more than
endFraction, but ` +\n `got startFraction ${startFraction} and endFraction ` +\n ` ${endFraction}`);\n
}\n\n return Promise.all(promises.map(registerMonitor));\n}\n", "/*\n * @license\n * Copyright 2018 Google LLC.
All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this
file except in compliance with the License.\n * You may
obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by
applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\"
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {env} from './environment';\n\nimport {NamedTensorMap} from './tensor_types';\n\nimport * as util
from './util';\n\nimport {decodeWeights} from './io_utils';\n\nimport {monitorPromisesProgress} from
'/progress';\n\nimport {DTYPE_VALUE_SIZE_MAP, LoadOptions, WeightsManifestConfig,
WeightsManifestEntry} from './types';\n\n/**\n * Reads binary weights data from a number of URLs.\n *\n *
@param fetchURLs URLs to send the HTTP requests at, using `fetch` calls.\n * @param requestOptions
RequestInit
(options) for the HTTP requests.\n * @param fetchFunc Optional overriding value for the `window.fetch`
function.\n * @param onProgress Optional, progress callback function, fired periodically\n * before the load is
completed.\n * @returns A `Promise` of an Array of `ArrayBuffer`. The Array has the same\n * length as
`fetchURLs`. \n *\nexport async function loadWeightsAsArrayBuffer(\n fetchURLs: string[], loadOptions?:
LoadOptions): Promise<ArrayBuffer[]> {\n if (loadOptions == null) {\n loadOptions = {};\n }\n\n const
fetchFunc = loadOptions.fetchFunc == null ? env().platform.fetch :\n loadOptions.fetchFunc;\n\n // Create the requests for all of the weights in parallel.\n const requests =

```

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fetchURLs.map(\n  fetchURL =>\n    fetchFunc(fetchURL, loadOptions.requestInit, {isBinary: true}));\n\n
const fetchStartFraction = 0;\n const fetchEndFraction = 0.5;\n\n const responses = loadOptions.onProgress == null
?\n  await Promise.all(requests) :\n  await monitorPromisesProgress(\n    requests, loadOptions.onProgress,
fetchStartFraction,\n    fetchEndFraction);\n\n const bufferPromises = responses.map(response =>
response.arrayBuffer());\n\n const bufferStartFraction = 0.5;\n const bufferEndFraction = 1;\n\n const buffers =
loadOptions.onProgress == null ?\n  await Promise.all(bufferPromises) :\n  await monitorPromisesProgress(\n
  bufferPromises, loadOptions.onProgress, bufferStartFraction,\n    bufferEndFraction);\n return
buffers;\n}\n\n/**\n * Reads a weights manifest JSON configuration, fetches the weights and\n * returns them as
`Tensor`s.\n *\n * @param manifest The weights manifest JSON.\n * @param filePathPrefix The path prefix for
filenames given in the manifest.\n * Defaults to the empty string.\n * @param weightNames The names of the
weights to be fetched.\n */\n\nexport async function loadWeights(\n  manifest: WeightsManifestConfig,
filePathPrefix = "",\n  weightNames?: string[],\n  requestInit?: RequestInit): Promise<NamedTensorMap> {\n //
TODO(nsthorat): Groups are currently fetched atomically. If you need a\n // single weight from a group, the whole
group will be fetched. At a future\n // date, we should support fetching only the individual shards within a\n //
group that are needed to reconstruct the requested weight.\n // TODO(cais): Use `decodeWeights` for
implementation.\n\n const fetchWeights = (fetchUrls: string[]) =>\n  loadWeightsAsArrayBuffer(fetchUrls,
{requestInit});\n\n const loadWeights = weightsLoaderFactory(fetchWeights);\n\n return loadWeights(manifest,
filePathPrefix, weightNames);\n}\n\n/**\n * Creates a function, which reads a weights manifest JSON
configuration,\n * fetches the weight files using the specified function and returns them as\n * `Tensor`s.\n *\n *
```js\n * // example for creating a nodejs weight loader, which reads the weight files\n * // from disk using
fs.readFileSync\n *\n * import * as fs from 'fs'\n *\n * const fetchWeightsFromDisk = (filePaths: string[]) =>\n *
filePaths.map(filePath => fs.readFileSync(filePath).buffer)\n *\n * const loadWeights =
tf.io.weightsLoaderFactory(fetchWeightsFromDisk)\n *\n * const manifest = JSON.parse(\n *
fs.readFileSync('./my_model-weights_manifest').toString()\n *)\n *\n * const weightMap = await
loadWeights(manifest, './')\n * ```\n *\n * @param fetchWeightsFunction The function used for fetching the weight
files.\n * @returns Weight loading function.\n */\n\nexport function weightsLoaderFactory(\n
fetchWeightsFunction: (fetchUrls: string[]) => Promise<ArrayBuffer[]>):\n (manifest: WeightsManifestConfig,
filePathPrefix?: string,\n weightNames?: string[]) => Promise<NamedTensorMap> {\n return async(\n
manifest: WeightsManifestConfig, filePathPrefix = "",\n weightNames?: string[]):
Promise<NamedTensorMap> => {\n // Collect all the groups, weights, and their relative offsets
to be\n // fetched.\n const groupIndicesToFetchMap = manifest.map(() => false);\n const
groupWeightsToFetch: {\n [group: number]: Array<{\n manifestEntry: WeightsManifestEntry; groupOffset:
number;\n sizeBytes: number;\n }>\n } = {};\n const weightsFound =\n weightNames != null ?
weightNames.map(() => false) : [];\n const allManifestWeightNames: string[] = [];\n
manifest.forEach((manifestGroupConfig, groupIndex) => {\n let groupOffset = 0;\n
manifestGroupConfig.weights.forEach(weightsEntry => {\n const rawDtype = ('quantization' in weightsEntry)
?\n weightsEntry.quantization.dtype :\n weightsEntry.dtype;\n\n const weightsBytes =
DTTYPE_VALUE_SIZE_MAP[rawDtype] *\n util.sizeFromShape(weightsEntry.shape);\n\n const
enqueueWeightsForFetchingFn = () => {\n groupIndicesToFetchMap[groupIndex] = true;\n if
(groupWeightsToFetch[groupIndex] == null) {\n
groupWeightsToFetch[groupIndex] = [];\n }\n\n groupWeightsToFetch[groupIndex].push({\n
manifestEntry: weightsEntry,\n groupOffset,\n sizeBytes: weightsBytes\n });\n });\n\n if
(weightNames != null) {\n weightNames.forEach((weightName, weightIndex) => {\n if (weightName
=== weightsEntry.name) {\n enqueueWeightsForFetchingFn();\n weightsFound[weightIndex] =
true;\n }\n });\n } else {\n enqueueWeightsForFetchingFn();\n }\n\n
allManifestWeightNames.push(weightsEntry.name);\n groupOffset += weightsBytes;\n });\n });\n\n if
(!weightsFound.every(found => found)) {\n const weightsNotFound = weightNames.filter(, i) =>

```



```

!weightsFound[i]);\n throw new Error(\n `Could not find weights in manifest with names: ` +\n
`${weightsNotFound.join(', ')}. \n` +\n `Manifest JSON has\n
weights with names: ` +\n `${allManifestWeightNames.join(', ')}`);\n }\n\n // Convert the one-hot boolean
groupId => shouldFetch map to a list of group\n // IDs.\n const groupIndicesToFetch =\n
groupIndicesToFetchMap.reduce((accumulator, shouldFetch, i) => {\n if (shouldFetch) {\n
accumulator.push(i);\n }\n return accumulator;\n }, []);\n\n const fetchUrls: string[] = [];\n
groupIndicesToFetch.forEach(i => {\n manifest[i].paths.forEach(filepath => {\n const fetchUrl =
filePathPrefix +\n (!filePathPrefix.endsWith('/') ? '/' : '') + filepath;\n fetchUrls.push(fetchUrl);\n });\n
});\n const buffers = await fetchWeightsFunction(fetchUrls);\n\n const weightsTensorMap: NamedTensorMap =
{};\n let bufferIndexOffset = 0;\n groupIndicesToFetch.forEach(i => {\n const numBuffers =
manifest[i].paths.length;\n let groupBytes = 0;\n for (let i = 0; i <
numBuffers; i++) {\n groupBytes += buffers[bufferIndexOffset + i].byteLength;\n }\n\n // Create a buffer
for the whole group.\n const groupBuffer = new ArrayBuffer(groupBytes);\n const groupByteBuffer = new
Uint8Array(groupBuffer);\n let groupBufferOffset = 0;\n for (let i = 0; i < numBuffers; i++) {\n const
buffer = new Uint8Array(buffers[bufferIndexOffset + i]);\n groupByteBuffer.set(buffer, groupBufferOffset);\n
 groupBufferOffset += buffer.byteLength;\n }\n\n const weightsEntries = groupWeightsToFetch[i];\n
weightsEntries.forEach(weightsEntry => {\n const byteBuffer = groupBuffer.slice(\n
weightsEntry.groupOffset,\n weightsEntry.groupOffset + weightsEntry.sizeBytes);\n const
nameToTensorMap =\n decodeWeights(byteBuffer, [weightsEntry.manifestEntry]);\n for (const name in
nameToTensorMap) {\n weightsTensorMap[name] = nameToTensorMap[name];\n }\n
 });\n bufferIndexOffset += numBuffers;\n });\n\n return weightsTensorMap;\n });\n\n"/**\n *
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2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
*/\n\n/**\n * IOHandler implementations based on HTTP requests in the web browser.\n * Uses\n
[fetch`](https://developer.mozilla.org/en-US/docs/Web/API/Fetch_API).\n */\n\nimport\n
{env} from './environment';\nimport {assert} from './util';\nimport {concatenateArrayBuffers,\n
getModelArtifactsInfoForJSON} from './io_utils';\nimport {IORouter, IORouterRegistry} from
'/router_registry';\nimport {IOHandler, LoadOptions, ModelArtifacts, ModelJSON, OnProgressCallback,\n
SaveResult, WeightsManifestConfig, WeightsManifestEntry} from './types';\nimport {loadWeightsAsArrayBuffer}
from './weights_loader';\n\nconst OCTET_STREAM_MIME_TYPE = 'application/octet-stream';\nconst
JSON_TYPE = 'application/json';\n\nexport class HTTPRequest implements IOHandler {\n protected readonly path:\n
string;\n protected readonly requestInit: RequestInit;\n\n private readonly fetch: Function;\n private readonly
weightUrlConverter: (weightName: string) => Promise<string>;\n\n readonly DEFAULT_METHOD = 'POST';\n\n
static readonly URL_SCHEME_REGEX = /^https?:\\|\\/|/;\n\n private readonly weightPathPrefix: string;\n private
readonly onProgress: OnProgressCallback;\n\n constructor(path:\n
string, loadOptions?: LoadOptions) {\n if (loadOptions == null) {\n loadOptions = {};\n }\n
this.weightPathPrefix = loadOptions.weightPathPrefix;\n this.onProgress = loadOptions.onProgress;\n
this.weightUrlConverter = loadOptions.weightUrlConverter;\n\n if (loadOptions.fetchFunc != null) {\n
assert(\n typeof loadOptions.fetchFunc === 'function',\n () => 'Must pass a function that matches the
signature of ' +\n `fetch` (see ' +\n `https://developer.mozilla.org/en-
US/docs/Web/API/Fetch_API)`);\n this.fetch = loadOptions.fetchFunc;\n } else {\n this.fetch =
env().platform.fetch;\n }\n\n assert(\n path != null && path.length > 0,\n () => 'URL path for http must
not be null, undefined or ' +\n 'empty.');\n\n if (Array.isArray(path)) {\n assert(\n path.length ===

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2,\n () => 'URL paths for http must have a length of 2, ' +\n `(\n actual\n length is ${path.length}).`);\n }\n this.path = path;\n\n if (loadOptions.requestInit != null &&\n loadOptions.requestInit.body != null) {\n throw new Error(\n `requestInit is expected to have no pre-\n existing body, but has one.`);\n }\n this.requestInit = loadOptions.requestInit || {};\n }\n\n async\n save(modelArtifacts: ModelArtifacts): Promise<SaveResult> {\n if (modelArtifacts.modelTopology instanceof\n ArrayBuffer) {\n throw new Error(\n `BrowserHTTPRequest.save() does not support saving model topology\n ' +\n 'in binary formats yet.`);\n }\n\n const init = Object.assign({method: this.DEFAULT_METHOD},\n this.requestInit);\n init.body = new FormData();\n\n const weightsManifest: WeightsManifestConfig = [{\n paths: ['./model.weights.bin'],\n weights: modelArtifacts.weightSpecs,\n }];\n const\n modelTopologyAndWeightManifest: ModelJSON = {\n modelTopology: modelArtifacts.modelTopology,\n format:\n modelArtifacts.format,\n generatedBy: modelArtifacts.generatedBy,\n convertedBy:\n modelArtifacts.convertedBy,\n weightsManifest\n };\n if (modelArtifacts.signature != null) {\n modelTopologyAndWeightManifest.signature = modelArtifacts.signature;\n }\n if\n (modelArtifacts.userDefinedMetadata != null) {\n modelTopologyAndWeightManifest.userDefinedMetadata =\n modelArtifacts.userDefinedMetadata;\n }\n if (modelArtifacts.modelInitializer != null) {\n modelTopologyAndWeightManifest.modelInitializer =\n modelArtifacts.modelInitializer;\n }\n init.body.append(\n 'model.json',\n new Blob([\n JSON.stringify(modelTopologyAndWeightManifest),\n {type: JSON_TYPE}],\n 'model.json'));\n\n if\n (modelArtifacts.weightData != null) {\n init.body.append(\n 'model.weights.bin',\n new\n Blob([modelArtifacts.weightData],\n {type: OCTET_STREAM_MIME_TYPE}),\n 'model.weights.bin');\n }\n\n const response = await this.fetch(this.path, init);\n if (response.ok) {\n return {\n modelArtifactsInfo: getModelArtifactsInfoForJSON(modelArtifacts),\n responses: [response],\n }; \n } else\n {\n throw new Error(\n `BrowserHTTPRequest.save() failed due to HTTP response status ` +\n `${response.status}.`);\n }\n }\n\n /**\n * Load model artifacts via HTTP request(s).\n * See the\n * documentation to `tf.io.http` for details on the saved\n * artifacts.\n * @returns The loaded model artifacts (if\n * loading succeeds).\n */\n async load(): Promise<ModelArtifacts> {\n const modelConfigRequest = await\n this.fetch(this.path, this.requestInit);\n if (!modelConfigRequest.ok) {\n throw new Error(\n `Request to\n ${this.path} failed with status code ` +\n `${modelConfigRequest.status}. Please verify this URL points to ` +\n `the model JSON of the model to\n load.`);\n }\n let modelConfig: ModelJSON;\n try {\n modelConfig = await modelConfigRequest.json();\n } catch (e) {\n let message = `Failed to parse model JSON of response from\n ${this.path}.`;\n //\n TODO(nsthorat): Remove this after some time when we're comfortable that\n // .pb files are mostly gone.\n if\n (this.path.endsWith('.pb')) {\n message += ' Your path contains a .pb file extension. '\n +\n 'Support for .pb\n models have been removed in TensorFlow.js 1.0 ' +\n 'in favor of .json models. You can re-convert your\n Python '\n +\n 'TensorFlow model using the TensorFlow.js 1.0 conversion scripts '\n +\n 'or you can\n convert your.pb models with the \\pb2json\\'\n +\n 'NPM script in the tensorflow/tfjs-converter repository.';\n }\n else {\n message += ' Please make sure the server is serving valid '\n +\n 'JSON for this request.';\n }\n throw new Error(message);\n }\n\n const modelTopology = modelConfig.modelTopology;\n const weightsManifest =\n modelConfig.weightsManifest;\n const generatedBy = modelConfig.generatedBy;\n const convertedBy =\n modelConfig.convertedBy;\n const format = modelConfig.format;\n const signature = modelConfig.signature;\n const userDefinedMetadata = modelConfig.userDefinedMetadata;\n\n // We do not allow both modelTopology\n and weightsManifest to be missing.\n if (modelTopology == null && weightsManifest == null) {\n throw new\n Error(\n `The JSON from HTTP path ${this.path} contains neither model ` +\n `topology or manifest for\n weights.`);\n }\n\n let weightSpecs: WeightsManifestEntry[];\n let weightData: ArrayBuffer;\n if\n (weightsManifest != null) {\n const results = await this.loadWeights(weightsManifest);\n [weightSpecs,\n weightData] = results;\n }\n\n const artifacts: ModelArtifacts = {\n modelTopology,\n weightSpecs,\n }

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weightData,\n
 generatedBy,\n convertedBy,\n format\n });\n\n if (signature != null) {\n artifacts.signature =\n signature;\n }\n if (userDefinedMetadata != null) {\n artifacts.userDefinedMetadata =\n userDefinedMetadata;\n }\n\n const initializer = modelConfig.modelInitializer;\n if (initializer) {\n artifacts.modelInitializer = initializer;\n }\n\n return artifacts;\n }\n\n private async\n loadWeights(weightsManifest: WeightsManifestConfig):\n Promise<[WeightsManifestEntry[], ArrayBuffer]>\n {\n const weightPath = Array.isArray(this.path) ? this.path[1] : this.path;\n const [prefix, suffix] =\n parseUrl(weightPath);\n const pathPrefix = this.weightPathPrefix || prefix;\n\n const weightSpecs = [];\n for\n (const entry of weightsManifest) {\n weightSpecs.push(...entry.weights);\n }\n\n const fetchURLs: string[] =\n [];\n const urlPromises: Array<Promise<string>> = [];\n for (const weightsGroup of weightsManifest) {\n\n for (const path of weightsGroup.paths) {\n if (this.weightUrlConverter != null) {\n\n urlPromises.push(this.weightUrlConverter(path));\n } else {\n fetchURLs.push(pathPrefix + path +\n suffix);\n }\n }\n\n if (this.weightUrlConverter) {\n fetchURLs.push(...await\n Promise.all(urlPromises));\n }\n\n const buffers = await loadWeightsAsArrayBuffer(fetchURLs, {\n requestInit: this.requestInit,\n fetchFunc: this.fetch,\n onProgress: this.onProgress\n });\n return\n [weightSpecs, concatenateArrayBuffers(buffers)];\n }\n}\n\n/**\n * Extract the prefix and suffix of the url, where\n the prefix is the path before\n * the last file, and suffix is the search params after the last file.\n * ``\n * const url =\n * 'http://tfhub.dev/model/1/tensorflowjs_model.pb?tfjs-format=file'\n * [prefix, suffix] = parseUrl(url)\n * // prefix =\n * 'http://tfhub.dev/model/1/'\n * // suffix = '?tfjs-format=file'\n * ``\n * @param url the model\n url to be parsed.\n */\nexport function parseUrl(url: string): [string, string] {\n const lastSlash =\n url.lastIndexOf('/);\n const lastSearchParam = url.lastIndexOf('?);\n const prefix = url.substring(0, lastSlash);\n const suffix =\n lastSearchParam > lastSlash ? url.substring(lastSearchParam) : '';\n return [prefix + '/',\n suffix];\n}\n\nexport function isHTTPScheme(url: string): boolean {\n return\n url.match(HTTPRequest.URL_SCHEME_REGEX) != null;\n}\n\nexport const httpRouter: IORouter =\n (url:\n string, loadOptions?: LoadOptions) => {\n if (typeof fetch === 'undefined' &&\n (loadOptions === null ||\n loadOptions.fetchFunc === null)) {\n // `http` uses `fetch` or `node-fetch`, if one wants to use it in\n // an\n environment that is not the browser or node they have to setup a\n // global fetch polyfill.\n return null;\n } else {\n let isHTTP = true;\n if (Array.isArray(url)) {\n isHTTP = url.every(urlItem\n => isHTTPScheme(urlItem));\n } else {\n isHTTP = isHTTPScheme(url);\n }\n\n if (isHTTP) {\n return http(url, loadOptions);\n }\n }\n return null;\n}\n\nIORouterRegistry.registerSaveRouter(httpRouter);\nIORouterRegistry.registerLoadRouter(httpRouter);\n}\n\n/**\n * Creates an IOHandler subtype that sends model artifacts to HTTP server.\n * An HTTP request of the\n * `multipart/form-data` mime type will be sent to the\n * `path` URL. The form data includes artifacts that represent\n the topology\n * and/or weights of the model. In the case of Keras-style `tf.Model`, two\n * blobs (files) exist in\n form-data:\n * - A JSON file consisting of `modelTopology` and `weightsManifest`\n * - A binary weights file\n consisting of the concatenated weight values.\n * These files are in the same format as the one generated by\n * [tfjs_converter](https://js.tensorflow.org/tutorials/import-keras.html).\n * The following code snippet\n exemplifies\n the client-side code that uses this\n * function:\n * ``js\n * const model = tf.sequential();\n * model.add(\n * tf.layers.dense({units: 1, inputShape: [100], activation: 'sigmoid'}));\n * const saveResult = await\n * model.save(tf.io.http(\n * 'http://model-server:5000/upload', {requestInit: {method: 'PUT'}}));\n * console.log(saveResult);\n * ``\n * If the default `POST` method is to be used, without any custom parameters\n * such as headers, you can simply pass an HTTP or HTTPS URL to `model.save`:\n * ``js\n * const saveResult\n * = await model.save('http://model-server:5000/upload');\n * ``\n * The following GitHub Gist\n * https://gist.github.com/dsmilkov/1b6046fd6132d7408d5257b0976f7864\n * implements a server based on\n [flask](https://github.com/pallets/flask) that\n * can receive the request. Upon receiving the model artifacts via the\n request,\n * this particular server reconstitutes instances of [Keras\n * Models](https://keras.io/models/model/) in\n memory.\n

```

\*\n \*\n \* @param path A URL path to the model.\n \* Can be an absolute HTTP path (e.g.,\n \* 'http://localhost:8000/model-upload') or a relative path (e.g.,\n \* './model-upload').\n \* @param requestInit Request configurations to be used when sending\n \* HTTP request to server using `fetch`. It can contain fields such as\n \* `method`, `credentials`, `headers`, `mode`, etc. See\n \* https://developer.mozilla.org/en-US/docs/Web/API/Request/Request\n \* for more information. `requestInit` must not have a body, because the\n \* body will be set by TensorFlow.js. File blobs representing the model\n \* topology (filename: 'model.json') and the weights of the model (filename:\n \* 'model.weights.bin') will be appended to the body. If `requestInit` has a\n \* `body`, an Error will be thrown.\n \* @param loadOptions Optional configuration for the loading. It includes the\n \* following fields:\n \* - weightPathPrefix Optional, this specifies the path prefix for weight\n \* files, by default this is calculated from the path param.\n \* - fetchFunc Optional, custom `fetch` function. E.g., in Node.js,\n \* the `fetch` from node-fetch can be used here.\n \* - onProgress Optional, progress callback function, fired periodically\n \* before the load is completed.\n \* @returns An instance of `IOHandler`.\n \* @doc {\n \* heading: 'Models',\n \* subheading: 'Loading',\n \* namespace: 'io',\n \* ignoreCI: true\n \* }\n \*/\n export function http(path: string, loadOptions?: LoadOptions): IOHandler {\n return new HTTPRequest(path, loadOptions);\n }\n\n/\*\*\n \* Deprecated. Use `tf.io.http`.\n \* @param path\n \* @param loadOptions\n \*/\n export function browserHTTPRequest(\n path: string, loadOptions?: LoadOptions): IOHandler {\n return http(path, loadOptions);\n }\n\n", /\*\*\n \* @license\n \* Copyright 2018 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the "License");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \*\n \* http://www.apache.org/licenses/LICENSE-2.0\n \*\n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an "AS IS" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*/

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=====
*/\n\n/**\n * IOHandlers that pass through the in-memory ModelArtifacts format.\n */\nimport {IOHandler, ModelArtifacts, SaveResult, TrainingConfig, WeightsManifestEntry} from './types';\n\nclass PassthroughLoader implements IOHandler {\n constructor(private readonly modelArtifacts?: ModelArtifacts) {}\n\n async load(): Promise<ModelArtifacts> {\n return this.modelArtifacts;\n }\n\n class PassthroughSaver implements IOHandler {\n constructor(\n private readonly saveHandler:\n (artifacts: ModelArtifacts) => Promise<SaveResult>) {}\n\n async save(modelArtifacts: ModelArtifacts) {\n return this.saveHandler(modelArtifacts);\n }\n }\n\n\n/**\n * Creates an IOHandler that loads model artifacts from memory.\n * When used in conjunction with `tf.loadLayersModel`, an instance of\n * `tf.LayersModel` (Keras-style) can be constructed from the loaded artifacts.\n * ``js\n * const model = await tf.loadLayersModel(tf.io.fromMemory(\n * modelTopology, weightSpecs, weightData));\n * ``\n * @param modelArtifacts a object containing model topology (i.e., parsed from\n * the JSON format).\n * @param weightSpecs An array of `WeightsManifestEntry` objects describing the\n * names, shapes, types, and quantization of the weight data.\n * @param weightData A single `ArrayBuffer` containing the weight data,\n * concatenated in the order described by the weightSpecs.\n * @param trainingConfig Model training configuration. Optional.\n * @returns A passthrough `IOHandler` that simply loads the provided data.\n */\n export function fromMemory(\n modelArtifacts: {}|ModelArtifacts, weightSpecs?: WeightsManifestEntry[],\n weightData?: ArrayBuffer, trainingConfig?: TrainingConfig): IOHandler {\n if (arguments.length === 1) {\n const isModelArtifacts =\n (modelArtifacts as ModelArtifacts).modelTopology != null ||\n (modelArtifacts as ModelArtifacts).weightSpecs != null;\n if (isModelArtifacts) {\n return new PassthroughLoader(modelArtifacts as ModelArtifacts);\n } else {\n // Legacy support: with only modelTopology.\n // TODO(cais): Remove this deprecated API.\n console.warn(\n 'Please call tf.io.fromMemory() with only one argument. ' +\n 'The argument should be of type ModelArtifacts. ' +\n 'The multi-argument signature of tf.io.fromMemory() has been ' +\n 'deprecated and will be removed in a future release.);\n return
```

```

new PassthroughLoader({modelTopology: modelArtifacts as {}};\n }\n } else {\n // Legacy support.\n //
TODO(cais): Remove this deprecated API.\n console.warn(\n 'Please call tf.io.fromMemory() with only one
argument. ' +\n 'The argument should be of type ModelArtifacts. ' +\n 'The multi-argument signature of
tf.io.fromMemory() has been ' +\n 'deprecated and will be removed in a future release.);\n return new
PassthroughLoader({\n modelTopology: modelArtifacts as {},\n weightSpecs,\n weightData,\n trainingConfig\n });\n }\n\n/**\n * Creates an IOHandler that passes saved model artifacts to a callback.\n *\n * ```js\n * function handleSave(artifacts) {\n * // ... do something with the artifacts ... \n * return
{modelArtifactsInfo: {...}, ...};\n * }\n *\n * const saveResult = model.save(tf.io.withSaveHandler(handleSave));\n * ```\n *\n * @param saveHandler A function that accepts a `ModelArtifacts` and returns
a\n * `SaveResult`.\n *\n * @export function withSaveHandler(\n saveHandler: (artifacts: ModelArtifacts) =>\n
Promise<SaveResult>): IOHandler {\n return new PassthroughSaver(saveHandler);\n }\n\n",/**\n * @license\n *
Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
`License`);\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an `AS IS` BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *

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=====\n
*\n\n// Importing local_storage and indexed_db is necessary for the routers
to be\n// registered.\nimport './indexed_db';\nimport './local_storage';\n\nimport {browserFiles} from
 './browser_files';\nimport {browserHTTPRequest, http, isHTTPSscheme} from './http';\nimport
 {concatenateArrayBuffers, decodeWeights, encodeWeights, getModelArtifactsInfoForJSON} from
 './io_utils';\nimport {fromMemory, withSaveHandler} from './passthrough';\nimport {getLoadHandlers,
getSaveHandlers, registerLoadRouter, registerSaveRouter} from './router_registry';\nimport {IOHandler,
LoadHandler, LoadOptions, ModelArtifacts, ModelArtifactsInfo, ModelJSON, ModelStoreManager,
OnProgressCallback, RequestDetails, SaveConfig, SaveHandler, SaveResult, WeightGroup,
WeightsManifestConfig, WeightsManifestEntry} from './types';\nimport {loadWeights, weightsLoaderFactory}
from './weights_loader';\n\nexport {copyModel, listModels, moveModel, removeModel} from
 './model_management';\nexport {\n browserFiles,\n browserHTTPRequest,\n concatenateArrayBuffers,\n
decodeWeights,\n encodeWeights,\n
fromMemory,\n getLoadHandlers,\n getModelArtifactsInfoForJSON,\n getSaveHandlers,\n http,\n
IOHandler,\n isHTTPSscheme,\n LoadHandler,\n LoadOptions,\n loadWeights,\n ModelArtifacts,\n
ModelArtifactsInfo,\n ModelJSON,\n ModelStoreManager,\n OnProgressCallback,\n registerLoadRouter,\n
registerSaveRouter,\n RequestDetails,\n SaveConfig,\n SaveHandler,\n SaveResult,\n WeightGroup,\n
weightsLoaderFactory,\n WeightsManifestConfig,\n WeightsManifestEntry,\n withSaveHandler\n};\n\n",/**\n *
@license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the `License`);\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an `AS IS` BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY
KIND, either express or implied.\n * See the License for the specific language governing permissions and\n *
limitations under the License.\n *

```

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=====\n
*\n\nimport {ENGINE} from './engine';\nimport {BatchMatMul, BatchMatMulAttrs, BatchMatMulInputs} from
 './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport
 {NamedTensorMap} from './tensor_types';\nimport {makeTypesMatch} from './tensor_util';\nimport
 {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\n\nimport {op} from
 './operation';\n\n/**\n * Computes the dot product of two matrices, A * B. These must be matrices.\n *\n * ```js\n *

```

```

const a = tf.tensor2d([1, 2], [1, 2]);\n * const b = tf.tensor2d([1, 2, 3, 4], [2, 2]);\n *\n * a.matMul(b).print(); // or
tf.matMul(a, b)\n * ```\n * @param a First matrix in dot product operation.\n * @param b Second matrix in dot
product operation.\n
* @param transposeA If true, `a` is transposed before multiplication.\n * @param transposeB If true, `b` is
transposed before multiplication.\n *\n * @doc {heading: 'Operations', subheading: 'Matrices'}\n *\nfunction
matMul_<T extends Tensor>(\n a: Tensor|TensorLike, b: Tensor|TensorLike, transposeA = false,\n transposeB =
false): T {\n let $a = convertToTensor(a, 'a', 'matMul');\n let $b = convertToTensor(b, 'b', 'matMul');\n [$a, $b] =
makeTypesMatch($a, $b);\n \n const inputs: BatchMatMulInputs = {a: $a, b: $b};\n const attrs: BatchMatMulAttrs
= {transposeA, transposeB};\n \n return ENGINE.runKernel(\n BatchMatMul, inputs as {} as NamedTensorMap,
attrs as {} as NamedAttrMap);\n }\n\nexport const matMul = op({matMul_});\n"/**\n * @license\n * Copyright
2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n *
you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {ENGINE} from '../engine';\nimport {OneHot, OneHotAttrs, OneHotInputs} from
'../kernel_names';\nimport {NamedAttrMap} from '../kernel_registry';\nimport {Tensor} from '../tensor';\nimport
{NamedTensorMap} from '../tensor_types';\nimport {convertToTensor} from '../tensor_util_env';\nimport
{TensorLike} from '../types';\nimport {op} from '../operation';\n/**\n * Creates a one-hot `tf.Tensor`. The
locations represented by `indices` take\n * value `onValue` (defaults to 1), while all other locations take
value\n * `offValue` (defaults to 0). If `indices` is rank `R`, the output has rank\n * `R+1` with the last axis of size
`depth`.\n *\n * ```\n *\n * tf.oneHot(tf.tensor1d([0, 1], 'int32'), 3).print();\n *\n * @param indices `tf.Tensor` of
indices with dtype `int32`.\n * @param depth The depth of the one hot dimension.\n * @param onValue A number
used to fill in the output when the index matches\n * the location.\n * @param offValue A number used to fill in the
output when the index does\n * not match the location.\n *\n * @doc {heading: 'Tensors', subheading:
'Creation'}\n *\nfunction oneHot_(\n indices: Tensor|TensorLike, depth: number, onValue = 1,\n offValue = 0):
Tensor {\n if (depth < 2) {\n throw new Error(`Error in oneHot: depth must be >=2, but it is ${depth}`);\n }\n \n const $indices = convertToTensor(indices, 'indices', 'oneHot', 'int32');\n \n const inputs: OneHotInputs = {indices:
$indices};\n const attrs: OneHotAttrs = {depth, onValue, offValue};\n \n return ENGINE.runKernel(\n OneHot, inputs as unknown as NamedTensorMap,\n attrs as unknown as
NamedAttrMap);\n }\n\nexport const oneHot = op({oneHot_});\n"/**\n * @license\n * Copyright 2018 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {ENGINE} from '../engine';\nimport {Transpose, TransposeAttrs, TransposeInputs} from
'../kernel_names';\nimport
{NamedAttrMap} from '../kernel_registry';\nimport {Tensor} from '../tensor';\nimport {NamedTensorMap} from
'../tensor_types';\nimport {convertToTensor} from '../tensor_util_env';\nimport {TensorLike} from '../types';\nimport
* as util from '../util';\nimport {op} from '../operation';\n/**\n * Transposes the `tf.Tensor`. Permutes the
dimensions according to `perm`.\n *\n * The returned `tf.Tensor`'s dimension `i` will correspond to the input\n *
dimension `perm[i]`. If `perm` is not given, it is set to `[n-1...0]`,\n *\n * where `n` is the rank of the input `tf.Tensor`.
Hence by default, this\n * operation performs a regular matrix transpose on 2-D input `tf.Tensor`s.\n *\n * ```\n *\n *

```

```

const a = tf.tensor2d([1, 2, 3, 4, 5, 6], [2, 3]);\n * \n * a.transpose().print(); // or tf.transpose(a)\n * \n * \n * @param x The tensor to transpose.\n * @param perm The permutation of the dimensions of a.\n * \n * @doc
{heading: 'Operations', subheading: 'Matrices'}\n *\nfunction transpose_<T
 extends Tensor>(x: T|TensorLike, perm?: number[]): T {\n const $x = convertToTensor(x, 'x', 'transpose');\n\n if
 (perm == null) {\n perm = $x.shape.map((s, i) => i).reverse();\n }\n util.assert(\n $x.rank === perm.length,\n () => `Error in transpose: rank of input ${$x.rank}` +\n ` must match length of perm ${perm}`);\n\n perm.forEach(axis => {\n util.assert(\n axis >= 0 && axis < $x.rank,\n () => `All entries in 'perm' must be
 between 0 and ${$x.rank - 1}` +\n ` but got ${perm}`);\n });\n\n if ($x.rank <= 1) {\n return $x.clone();\n }\n\n const inputs: TransposeInputs = {x: $x};\n const attrs: TransposeAttrs = {perm};\n\n return
 ENGINE.runKernel(\n Transpose, inputs as {} as NamedTensorMap, attrs as {} as
 NamedAttrMap);\n}\n\nexport const transpose = op({transpose_});\n"/**\n * @license\n * Copyright 2018
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 * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n
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 WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
 language governing permissions and\n * limitations under the License.\n *\n
 =====\n\n * \n\nimport {Tensor1D, Tensor2D} from './tensor';\nimport {convertToTensor} from './tensor_util_env';\nimport
 {TensorLike} from './types';\nimport * as util from './util';\n\nimport {cast} from './cast';\nimport {matMul} from
 './mat_mul';\nimport {oneHot} from './one_hot';\nimport {op} from './operation';\nimport {transpose} from
 './transpose';\n"/**\n * Computes the confusion matrix from true labels and predicted
 labels.\n * \n * `js` \n * const labels = tf.tensor1d([0, 1, 2, 1, 0], 'int32');\n * const predictions = tf.tensor1d([0, 2, 2,
 1, 0], 'int32');\n * const numClasses = 3;\n * const out = tf.math.confusionMatrix(labels, predictions, numClasses);\n
 *\n * out.print();\n * // Expected output matrix:\n * // [[2, 0, 0],\n * // [0, 1, 1],\n * // [0, 0, 1]]\n * \n * @param
 labels The target labels, assumed to be 0-based integers\n * for the classes. The shape is `[numExamples]`, where\n
 * `numExamples` is the number of examples included.\n * @param predictions The predicted classes, assumed to
 be\n * 0-based integers for the classes. Must have the same shape as `labels`. \n * @param numClasses Number of
 all classes, as an integer.\n * Its value must be larger than the largest element in `labels` and\n * `predictions`. \n
 * @returns The confusion matrix as a int32-type 2D tensor. The value at\n * row `r` and column `c` is the number of
 times examples of actual class\n * `r` were
 predicted as class `c`.\n * \n * @doc {heading: 'Operations', subheading: 'Evaluation'}\n *\nfunction
 confusionMatrix_(\n labels: Tensor1D|TensorLike, predictions: Tensor1D|TensorLike,\n numClasses: number):
 Tensor2D {\n const $labels = convertToTensor(labels, 'labels', 'confusionMatrix');\n const $predictions =\n
 convertToTensor(predictions, 'predictions', 'confusionMatrix');\n\n util.assert(\n numClasses == null ||
 numClasses > 0 && Number.isInteger(numClasses),\n () => `If provided, numClasses must be a positive integer,
 ` +\n ` but got ${numClasses}`);\n\n util.assert(\n $labels.rank === 1,\n () => `Expected the rank of labels
 to be 1, but got ${$labels.rank}`);\n\n util.assert(\n $predictions.rank === 1,\n () => `Expected the rank of
 predictions to be 1, ` +\n ` but got ${$predictions.rank}`);\n\n util.assert(\n $labels.shape[0] ===
 $predictions.shape[0],\n () => `Mismatch in the number of examples: ` +\n
 ` ${$labels.shape[0]} vs. ${$predictions.shape[0]}. ` +\n ` Labels and predictions should have the same
 number of elements.`);\n\n util.assert(\n numClasses > 0 && Number.isInteger(numClasses),\n () =>
 `numClasses is required to be a positive integer, but got ` +\n ` ${numClasses}`);\n\n // TODO(cais): In the
 future, if oneHot supports tensors inputs for\n // `numClasses`, `confusionMatrix` can make `numClasses`
 optional.\n\n const oneHotLabels = oneHot(cast($labels, 'int32'), numClasses) as Tensor2D;\n const
 oneHotPredictions =\n oneHot(cast($predictions, 'int32'), numClasses) as Tensor2D;\n const oneHotLabelsT:
 Tensor2D = transpose(oneHotLabels);\n const product: Tensor2D = matMul(oneHotLabelsT, oneHotPredictions);\n
 return cast(product, 'int32');\n}\n\nexport const confusionMatrix = op({confusionMatrix_});\n"/**\n * @license

```

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```
=====\n*\n\n**\n * Exports under the tf.math.* namespace.\n *\n\nimport { confusionMatrix } from
 './ops/confusion_matrix';\n\nexport { confusionMatrix};\n\n","/**\n * @license\n * Copyright 2018 Google LLC. All
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 governing permissions and\n * limitations under the License.\n *\n
```

```
=====\n*\n\nimport { Tensor3D } from './tensor';\nimport { inferShape } from './tensor_util_env';\nimport { TensorLike3D }
 from './types';\nimport { DataType } from './types';\nimport { assertNonNull } from './util';\nimport { makeTensor }
 from './tensor_ops_util';\n\n/**\n * Creates rank-3 `tf.Tensor` with the provided values, shape and dtype.\n *\n * The same functionality can be achieved with `tf.tensor`, but in general\n * we recommend using `tf.tensor3d` as it makes
 the code more readable.\n *\n * ```js\n * // Pass a nested array.\n * tf.tensor3d([[[[1,
 [2]], [[3], [4]]]]).print();\n *\n * // Pass a flat array and specify a shape.\n * tf.tensor3d([1, 2, 3, 4], [2, 2,
 1]).print();\n *\n * @param values The values of the tensor. Can be nested array of numbers,\n * or a flat array, or a `TypedArray`.\n * @param shape The shape of the tensor. If not provided, it is inferred from\n * `values`.\n * @param dtype The data type.\n * @doc {heading: 'Tensors', subheading: 'Creation'}\n *\n\nexport
 function tensor3d(\n values: TensorLike3D, shape?: [number, number, number],\n dtype?: DataType): Tensor3D
 {\n assertNonNull(values);\n if (shape != null && shape.length !== 3) {\n throw new Error('tensor3d() requires
 shape to have three numbers');\n }\n const inferredShape = inferShape(values, dtype);\n if (inferredShape.length
 !== 3 && inferredShape.length !== 1) {\n throw new Error(\n 'tensor3d() requires values to be number[][][]
 or flat/TypedArray');\n }\n if (inferredShape.length
 === 1 && shape == null) {\n throw new Error(\n 'tensor3d() requires shape to be provided when `values` '\n +\n 'are a flat array');\n }\n return makeTensor(values, shape, inferredShape, dtype) as Tensor3D;\n}\n\n","/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
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```

```
=====\n*\n\nimport { ENGINE } from './engine';\nimport
 { FromPixels, FromPixelsAttrs, FromPixelsInputs } from './kernel_names';\nimport { getKernel, NamedAttrMap }
 from './kernel_registry';\nimport { Tensor, Tensor2D, Tensor3D } from './tensor';\nimport { NamedTensorMap } from
 './tensor_types';\nimport { convertToTensor } from './tensor_util_env';\nimport { PixelData, TensorLike } from
 './types';\n\nimport { cast } from './cast';\nimport { op } from './operation';\nimport { tensor3d } from './tensor3d';\n\nlet
 fromPixels2DContext: CanvasRenderingContext2D;\n\n/**\n * Creates a `tf.Tensor` from an image.\n *\n * ```js\n * const image = new ImageData(1, 1);\n * image.data[0] = 100;\n * image.data[1] = 150;\n * image.data[2] = 200;\n * image.data[3] = 255;\n *\n * tf.browser.fromPixels(image).print();\n *\n * @param pixels The input image to
```



construct the tensor from. The supported image types are all 4-channel. You can also pass in an image object with following attributes:

```
{data: Uint8Array; width: number; height: number}
```

`numChannels` The number of channels of the output tensor. A `numChannels` value less than 4 allows you to ignore channels. Defaults to 3 (ignores alpha channel of input image).

`namespace: 'browser', ignoreCI: true`

function `fromPixels_(pixels: PixelData|ImageData|HTMLImageElement|HTMLCanvasElement|HTMLVideoElement|ImageBitmap, numChannels = 3): Tensor3D`

```
{
 // Sanity checks.
 if (numChannels > 4) {
 throw new Error('Cannot construct Tensor with more than 4 channels from pixels.');
```

```
 }
 if (pixels == null) {
 throw new Error('pixels passed to tf.browser.fromPixels() can not be null');
```

```
 }
 let isPixelData = false;
 let isImageData = false;
 let isVideo = false;
 let isImage = false;
 let isCanvasLike = false;
 let isImageBitmap = false;
 if ((pixels as PixelData).data instanceof Uint8Array) {
 isPixelData = true;
 } else if (typeof (ImageData) !== 'undefined' && pixels instanceof ImageData) {
 isImageData = true;
 } else if (typeof (HTMLVideoElement) !== 'undefined' && pixels instanceof HTMLVideoElement) {
 isVideo = true;
 } else if (typeof (HTMLImageElement) !== 'undefined' && pixels instanceof HTMLImageElement) {
 isImage = true;
 } // tslint:disable-next-line: no-any
 } else if ((pixels as any).getContext != null) {
 isCanvasLike = true;
 } else if (typeof (ImageBitmap) !== 'undefined' && pixels instanceof ImageBitmap) {
 isImageBitmap = true;
 } else {
 throw new Error('pixels passed to tf.browser.fromPixels() must be either an `HTMLVideoElement, HTMLImageElement, HTMLCanvasElement, ImageData` in browser, or `OffscreenCanvas, ImageData` in webworker` or {data: Uint32Array, width: number, height: number},` but was ${pixels as {}}.constructor.name');
```

```
 }
 if (isVideo) {
 const HAVE_CURRENT_DATA_READY_STATE = 2;
 if (isVideo && (pixels as HTMLVideoElement).readyState < HAVE_CURRENT_DATA_READY_STATE) {
 throw new Error('The video element has not loaded data yet. Please wait for `loadeddata` event on the <video> element.');
```

```
 }
 }
 // If the current backend has 'FromPixels' registered, it has a more // efficient way of handling pixel uploads, so we call that.
 const kernel = getKernel(FromPixels, ENGINE.backendName);
 if (kernel != null) {
 const inputs: FromPixelsInputs = {pixels};
 const attrs: FromPixelsAttrs = {numChannels};
 return ENGINE.runKernel(FromPixels, inputs as { } as NamedTensorMap, attrs as { } as NamedAttrMap);
 }
 const [width, height] = isVideo ? [(pixels as HTMLVideoElement).videoWidth, (pixels as HTMLVideoElement).videoHeight] : [pixels.width, pixels.height];
 let vals: Uint8ClampedArray|Uint8Array;
 if (isCanvasLike) {
 vals = (pixels as any).getContext('2d').getImageData(0, 0, width, height).data;
 } else if (isImageData || isPixelData) {
 vals = (pixels as PixelData | ImageData).data;
 } else if (isImage || isVideo || isImageBitmap) {
 if (fromPixels2DContext == null) {
 fromPixels2DContext = document.createElement('canvas').getContext('2d');
```

```
 }
 fromPixels2DContext.canvas.width = width;
 fromPixels2DContext.canvas.height = height;
 fromPixels2DContext.drawImage(pixels as HTMLVideoElement, 0, 0, width, height);
 vals = fromPixels2DContext.getImageData(0, 0, width, height).data;
 }
 let values: Int32Array;
 if (numChannels === 4) {
 values = new Int32Array(vals);
 } else {
 const numPixels = width * height;
 values = new Int32Array(numPixels * numChannels);
 for (let i = 0; i < numPixels; i++) {
 for (let channel = 0; channel < numChannels; ++channel) {
 values[i * numChannels + channel] = vals[i * 4 + channel];
 }
 }
 const outShape: [number, number, number] = [height, width, numChannels];
 return tensor3d(values, outShape, 'int32');
```

```
 }
}
```

`Draws a tf.Tensor of pixel values to a byte array or optionally a canvas. When the dtype of the input is 'float32', we assume values in the range [0-1]. Otherwise, when input is 'int32', we assume values in the range [0-255]. Returns a promise that resolves when the canvas has been drawn to.`

`@param img` A rank-2 or rank-3 tensor. If rank-2, draws grayscale. If rank-3, must have depth of 1, 3 or 4. When depth of 1, draws grayscale. When depth of 3, we draw with the first three components of the depth dimension

corresponding to r, g, b and alpha = 1. When depth of  $n * 4$ , all four components of the depth dimension correspond to r, g, b, a.

`@param canvas` The canvas to draw to.

`@doc {heading: 'Browser', namespace: 'browser'}`

`export async function toPixels(img: Tensor2D|Tensor3D|TensorLike, canvas?: HTMLCanvasElement): Promise<Uint8ClampedArray>`

```
{
 let $img = convertToTensor(img, 'img', 'toPixels');
 if (!(img instanceof Tensor)) {
 // Assume int32 if user passed a native array.
 const originalImgTensor = $img;
 $img = cast(originalImgTensor, 'int32');
 originalImgTensor.dispose();
 }
 if ($img.rank !== 2 && $img.rank !== 3) {
 throw new Error(`toPixels only supports rank 2 or 3 tensors, got rank ${$img.rank}.`);
 }
 const [height, width] = $img.shape.slice(0, 2);
 const depth = $img.rank === 2 ? 1 : $img.shape[2];
 if (depth > 4 || depth === 2) {
 throw new Error(`toPixels only supports depth of size 1, 3 or 4 but got ${depth}.`);
 }
 if ($img.dtype !== 'float32' && $img.dtype !== 'int32') {
 throw new Error(`Unsupported type for toPixels: ${$img.dtype}. Please use float32 or int32 tensors.`);
 }
 const data = await $img.data();
 const multiplier = $img.dtype === 'float32' ? 255 : 1;
 const bytes = new Uint8ClampedArray(width * height * 4);
 for (let i = 0; i < height * width; ++i) {
 const rgba = [0, 0, 0, 255];
 for (let d = 0; d < depth; d++) {
 const value = data[i * depth + d];
 if ($img.dtype === 'float32') {
 if (value < 0 || value > 1) {
 throw new Error(`Tensor values for a float32 Tensor must be in the range [0 - 1] but encountered ${value}.`);
 }
 } else if ($img.dtype === 'int32') {
 if (value < 0 || value > 255) {
 throw new Error(`Tensor values for a int32 Tensor must be in the range [0 - 255] but encountered ${value}.`);
 }
 }
 if (depth === 1) {
 rgba[0] = value * multiplier;
 rgba[1] = value * multiplier;
 rgba[2] = value * multiplier;
 } else {
 rgba[d] = value * multiplier;
 }
 const j = i * 4;
 bytes[j + 0] = Math.round(rgba[0]);
 bytes[j + 1] = Math.round(rgba[1]);
 bytes[j + 2] = Math.round(rgba[2]);
 bytes[j + 3] = Math.round(rgba[3]);
 }
 if (canvas != null) {
 canvas.width = width;
 canvas.height = height;
 const ctx = canvas.getContext('2d');
 const imageData = new ImageData(bytes, width, height);
 ctx.putImageData(imageData, 0, 0);
 }
 if ($img !== img) {
 $img.dispose();
 }
 return bytes;
 }
}
export const fromPixels = op({fromPixels_});

```

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`*/`

```

import {TensorInfo} from '../kernel_registry';
import {computeStrides, sizeFromShape} from '../util';
/**
 * Validate gather nd inputs.
 * @param tensor The tensor contains the source values.
 * @param indices The tensor contains the indices to slice the source.
 * @returns [resultShape, numUpdates, sliceSize, strides]
 */
export function prepareAndValidate(tensor: TensorInfo, indices: TensorInfo): [number[], number, number, number[]] {
 const tensorRank = tensor.shape.length;
 const indicesRank = indices.shape.length;
 if (tensorRank < 1) {
 throw new Error(`tf.gatherND() expects the input to be rank 1 or higher,`
 + ` but the rank was ${tensorRank}.`);
 }
 if (indicesRank < 1) {
 throw new Error(`tf.gatherND() expects the indices to be rank 1 or higher,`
 + ` but the rank was ${indicesRank}.`);
 }
 if (indices.dtype !== 'int32') {
 throw new Error(`tf.gatherND() expects the indices to be int32 type,`
 + ` but the dtype was ${indices.dtype}.`);
 }
 if (indices.shape[indicesRank - 1] > tensorRank) {
 throw new Error(`index innermost dimension length must be <= tensor rank; saw: `
 + `${indices.shape[indicesRank - 1]} vs. ${tensorRank}.`);
 }
 if (sizeFromShape(tensor.shape) === 0) {
 throw new Error(`Requested more than 0 entries, but input is empty.`
 + ` Input shape: ${tensor.shape}.`);
 }
 const indicesShape = indices.shape;
 const sliceRank =

```

```

indicesShape[indicesShape.length - 1];\n\n // The result shape is\n // indices.shape[:-1] +
params.shape[indices.shape[-1]:]\n
let nResult = 1;\n for (let i = 0; i < indicesShape.length - 1; ++i) {\n nResult *= indicesShape[i];\n }\n\n const
inputShape = tensor.shape;\n\n const resultShape = indicesShape.slice();\n resultShape.pop();\n\n let sliceSize =
1;\n for (let i = sliceRank; i < tensorRank; ++i) {\n sliceSize *= inputShape[i];\n
resultShape.push(inputShape[i]);\n }\n\n const strides =\n [...computeStrides(tensor.shape).map(stride => stride
/ sliceSize),\n 1].slice(0, sliceRank);\n\n return [resultShape, nResult, sliceSize, strides];\n}\n"/**\n *
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on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
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License.\n *
=====
*/\nimport {TensorInfo} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport {computeStrides,
sizeFromShape} from './util';\n\n/**\n * Check whether updates.shape = indices.shape[:batchDim] +\n *
shape[sliceDim:]\n * @param x The input tensor.\n */\nexport function validateUpdateShape(\n shape:
number[], indices: Tensor, updates: Tensor) {\n const sliceDim = (indices.rank > 1) ? indices.shape[indices.rank -
1] : 1;\n const batchDim = (indices.rank > 1) ? indices.rank - 1 : 1;\n const shapeError = 'Must have
updates.shape = indices.shape[:batchDim] + '\n `shape[sliceDim:], got updates.shape: ${updates.shape}` +\n
`, indices.shape: ${indices.shape}, shape: ${shape}`\n
+`\n `, sliceDim: ${sliceDim}, and batchDim: ${batchDim}.`;\n if (updates.rank < batchDim) {\n throw new
Error(shapeError + `update.rank < ${batchDim}.`);\n }\n if (shape.length < sliceDim + (updates.rank -
batchDim)) {\n throw new Error(\n shapeError +`\n `Output shape length < ${sliceDim + (updates.rank -
batchDim)}`);\n }\n if (updates.rank !== batchDim + shape.length - sliceDim) {\n throw new Error(\n
shapeError + `update.rank !== ${batchDim + shape.length - sliceDim}`);\n }\n for (let d = 0; d < batchDim; ++d)
{\n if (updates.shape[d] !== indices.shape[d]) {\n throw new Error(\n shapeError +`\n `
updates.shape[${d}] (${updates.shape[d]}) !== indices.shape[${d}] (${indices.shape[d]}.`);\n }\n }\n for (let d = 0; d < updates.rank - batchDim; ++d) {\n if (updates.shape[d + batchDim] !== shape[d + sliceDim])
{\n throw new Error(\n shapeError +`\n `updates.shape[${d
+ batchDim}] (${updates.shape[d + batchDim]}) !== shape[${d + batchDim}] (${shape[d +
batchDim]}.`);\n }\n }\n }\n\nexport interface ScatterShapeInfo {\n sliceRank: number;\n numUpdates:
number;\n sliceSize: number;\n strides: number[];\n outputSize: number;\n}\n\n/**\n * Validate scatter nd inputs.\n
*\n * @param update The tensor contains the update values.\n * @param indices The tensor contains the indices for
the update values.\n * @param shape The shape of the output tensor.\n */\nexport function validateInput(\n
updates: Tensor, indices: Tensor, shape: number[]) {\n if (indices.rank < 1) {\n throw new Error(\n
'tf.scatterND() expects the indices to be rank 1 or higher,' +`\n `but the rank was ${indices.rank}.`);\n }\n if
(updates.rank < 1) {\n throw new Error(\n 'tf.scatterND() expects the updates to be rank 1 or higher,' +`\n
`but the rank was ${updates.rank}.`);\n }\n if (indices.dtype !== 'int32')
{\n throw new Error(`The dtype of 'indices' should be int32, but got dtype: ${indices.dtype}`);\n }\n if
(shape.length < 1) {\n throw new Error(\n `Output rank must be greater or equal to 1, but got shape:
${shape}`);\n }\n if (shape.length === 0) {\n if (indices.size === 0) {\n throw new Error(`Indices specified
for empty output. indices shape: ${indices.shape}`);\n }\n if (updates.size === 0) {\n throw new
Error(`Updates specified for empty output. updates shape: ${updates.shape}`);\n }\n }\n }\n\n
validateUpdateShape(shape, indices, updates);\n}\n\n/**\n * Calculate the shape information for the output.\n *\n *
@param update The tensor contains the update values.\n * @param indices The tensor contains the indices for the
update values.\n * @param shape The shape of the output tensor.\n */\nexport

```

```

function calculateShapes(\n updates: TensorInfo, indices: TensorInfo,\n shape:
 number[]): ScatterShapeInfo {\n // Calculate the number of dimensions in indices\n const indicesRank =
indices.shape.length;\n const sliceRank = (indicesRank > 1) ? indices.shape[indicesRank - 1] : 1;\n\n // Calculate
the number of elements that make up each slice of our updated\n // tensor. This allows us to work with flattened
tensors and copy over whole\n // slices at a time.\n const totalNd = shape.length;\n\n let sliceSize = 1;\n for (let i =
sliceRank; i < totalNd; ++i) {\n sliceSize *= shape[i];\n }\n\n const safeSliceDim = (sliceRank < 1) ? 1 :
sliceRank;\n const numUpdates = sizeFromShape(indices.shape) / safeSliceDim;\n\n const strides =
[...computeStrides(shape.slice(0, sliceRank)), 1];\n const outputSize = sizeFromShape(shape);\n return {sliceRank,
numUpdates, sliceSize, strides, outputSize};\n}\n\n", /**\n * @license\n * Copyright 2017 Google LLC. All Rights
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governing permissions and\n * limitations under the License.\n *
=====*\n
*\n\nimport {TensorInfo} from './kernel_registry';\nimport * as util from './util';\n\nexport type SliceInfo = {\n
nonStrided: boolean,\n $begin: number[],\n $end: number[],\n $strides: number[],\n size: number[],\n newShape:
number[],\n outShape: number[]\n};\n\nexport function assertParamsValid(\n input: TensorInfo, begin: number[],
size: number[]): void {\n const inputRank = input.shape.length;\n util.assert(\n
inputRank === begin.length,\n () => `Error in slice${inputRank}D: Length of begin ${begin} must ` +\n
`match the rank of the array (${inputRank}).`);\n util.assert(\n
inputRank === size.length,\n () => `Error in
slice${inputRank}D: Length of size ${size} must ` +\n
`match the rank of the array (${inputRank}).`);\n\n for (let i = 0; i < inputRank; ++i) {\n
util.assert(\n
begin[i] + size[i] <= input.shape[i],\n () => `Error in
slice${inputRank}D: begin[${i}] + size[${i}] ` +\n
` (${begin[i] + size[i]}) would overflow input.shape[${i}]
(${input.shape[i]})`);\n }\n}\n\n/** Converts a binary mask to an array of axes. Used in stridedSlice().
*\n\nexport function maskToAxes(mask: number): number[] {\n const axes = [];\n let axis = 0;\n while (mask > 0)
{\n if (mask & 1) {\n axes.push(axis);\n }\n mask /= 2;\n axis++;\n }\n return axes;\n}\n\n/** Computes
the output shape given the strided
slice params. *\n\nexport function computeOutShape(\n begin: number[], end: number[], strides: number[]):
number[] {\n const size = [];\n for (let axis = 0; axis < begin.length; axis++) {\n
size[axis] = Math.ceil((end[axis]
- begin[axis]) / strides[axis]);\n }\n return size;\n}\n\n// Creates full selection at the elided dimensions. If the
dimension matches\n// the ellipsis mask, override the current stride value. Otherwise, insert.\n\nexport function
stridesWithElidedDims(\n strides: number[], ellipsisInsertionIndex: number, numElidedAxes: number,\n inputShape: number[]): number[] {\n const newStrides = [...strides];\n for (let i = newStrides.length; i <
inputShape.length; i++) {\n
newStrides.push(1);\n }\n for (let i = 0; i < numElidedAxes; i++) {\n
if (i === 0)
{\n
newStrides[ellipsisInsertionIndex] = 1;\n
} else {\n
newStrides.splice(ellipsisInsertionIndex, 0 /*
num elements to delete */,\n
1 /* element to add */);\n
newStrides.pop();\n
}\n
}\n return newStrides;\n}\n\nfunction unnormalizeAxis(\n ellipsisInsertionIndex: number, numElidedAxes:
number,\n normalizedAxis: number): number {\n if (normalizedAxis <= ellipsisInsertionIndex) {\n
return
normalizedAxis;\n }\n return normalizedAxis - (numElidedAxes - 1);\n}\n\nfunction
getElidedAxes(numElidedAxes: number, ellipsisInsertionIndex: number) {\n const elidedAxes = [];\n for (let i = 0;
i < numElidedAxes; i++) {\n
elidedAxes.push(ellipsisInsertionIndex + i);\n }\n return elidedAxes;\n}\n\n//
Normalize the start, end and strides.\n\nexport function getNormalizedAxes(\n inputShape: number[], ellipsisAxes:
number[], numInterpolatedAxes: number,\n begin: number[], end: number[], strides: number[], beginMask:
number,\n endMask: number,\n ellipsisMask: number): {begin: number[], end: number[], strides: number[]} {\n
const inputRank = inputShape.length;\n let normalizedBegin = new Array(inputRank),\n
normalizedEnd =

```

```

new Array(inputRank),\n normalizedStrides = new Array(inputRank);\n if (ellipsisAxes.length &&\n numInterpolatedAxes > 0) {\n const fullIndex = ellipsisAxes[0];\n // The ellipsis applies to the masked index\n as well as any dimensions\n // that are interpolated.\n const numElidedAxes = numInterpolatedAxes + 1;\n normalizedBegin = startIndicesWithElidedDims(\n beginMask, fullIndex, numElidedAxes, begin,\n inputShape);\n normalizedEnd = stopIndicesWithElidedDims(\n endMask, fullIndex, numElidedAxes, end,\n inputShape);\n normalizedStrides =\n stridesWithElidedDims(strides, fullIndex, numElidedAxes,\n inputShape);\n } else {\n for (let axis = 0; axis < inputRank; axis++) {\n normalizedBegin[axis] =\n startForAxis(\n beginMask, begin, strides, inputShape, axis, ellipsisMask);\n normalizedEnd[axis] =\n stopForAxis(endMask, end, strides, inputShape, axis, ellipsisMask);\n normalizedStrides[axis] =\n stridesForAxis(strides,\n axis, ellipsisMask);\n }\n }\n return {\n begin: normalizedBegin,\n end: normalizedEnd,\n strides:\n normalizedStrides\n };\n}\n\n// Creates full selection at the elided dimensions. If the dimension matches\n// the\n// ellipsis mask, override the current start value. Otherwise, insert.\n\nexport function startIndicesWithElidedDims(\n beginMask: number, ellipsisInsertionIndex: number, numElidedAxes: number,\n originalBegin: number[],\n inputShape: number[]): number[] {\n const newIndices = [...inputShape];\n const elidedAxes =\n getElidedAxes(numElidedAxes, ellipsisInsertionIndex);\n for (let axis = 0; axis < newIndices.length; axis++) {\n if (elidedAxes.indexOf(axis) > -1) {\n newIndices[axis] = 0;\n } else {\n const originalAxis =\n unnormalizeAxis(ellipsisInsertionIndex, numElidedAxes, axis);\n let originalValue =\n originalBegin[originalAxis];\n if (beginMask & 1 << originalAxis) {\n originalValue = 0;\n }\n newIndices[axis]\n = originalValue;\n }\n }\n return newIndices;\n}\n\n// Creates full selection at the elided dimensions. If the\n// dimension matches\n// the ellipsis mask, override the current stop value. Otherwise, insert.\n\nexport function stopIndicesWithElidedDims(\n endMask: number, ellipsisInsertionIndex: number, numElidedAxes: number,\n originalEnd: number[], inputShape: number[]): number[] {\n const newIndices = [...inputShape];\n const elidedAxes =\n getElidedAxes(numElidedAxes, ellipsisInsertionIndex);\n for (let axis = 0; axis <\n newIndices.length; axis++) {\n if (elidedAxes.indexOf(axis) > -1) {\n newIndices[axis] =\n Number.MAX_SAFE_INTEGER;\n } else {\n const originalAxis =\n unnormalizeAxis(ellipsisInsertionIndex, numElidedAxes, axis);\n let originalValue =\n originalEnd[originalAxis];\n if (endMask & 1 << originalAxis) {\n originalValue =\n Number.MAX_SAFE_INTEGER;\n }\n newIndices[axis] = originalValue;\n }\n }\n for (let i = 0; i < newIndices.length; i++) {\n // Handle negative indices\n const axisSize = inputShape[i];\n if (newIndices[i] < 0) {\n newIndices[i] += axisSize;\n }\n newIndices[i] = util.clamp(0, newIndices[i],\n inputShape[i]);\n }\n return newIndices;\n}\n\nexport function stridesForAxis(\n strides: number[], axis: number,\n ellipsisMask: number): number {\n let stride = strides[axis];\n if (ellipsisMask & (1 << axis) || stride == null) {\n stride = 1;\n }\n return stride;\n}\n\nexport function startForAxis(\n beginMask: number, startIndices:\n number[], strides: number[],\n inputShape: number[], axis: number, ellipsisMask: number): number {\n // Begin\n with the specified index\n let start = startIndices[axis];\n const stride = strides[axis] || 1;\n // Check the axis bit\n from right of masked axes, or the begin index is not set\n // for the axis.\n if (beginMask & 1 << axis || ellipsisMask\n & 1 << axis || start == null) {\n if (stride\n > 0) {\n // Forward iteration - use the first element. These values will get\n // clamped below (Note: We could\n have set them to 0 and axis_size-1, but\n // use lowest() and max() to maintain symmetry with StopForAxis())\n start = Number.MIN_SAFE_INTEGER;\n } else {\n // Backward iteration - use the last element.\n start =\n Number.MAX_SAFE_INTEGER;\n }\n }\n // Handle negative indices\n const axisSize = inputShape[axis];\n if (start < 0) {\n start += axisSize;\n }\n // Clamping\n start = util.clamp(0, start, axisSize - 1);\n return\n start;\n}\n\nexport function stopForAxis(\n endMask: number, stopIndices: number[], strides: number[],\n inputShape: number[], axis: number, ellipsisMask: number): number {\n // Begin with the specified index\n let stop\n = stopIndices[axis];\n const stride = strides[axis] || 1;\n // Check the axis bit from right of masked axes, or if the\n stop index is not\n // set for this axis.\n if (endMask &

```

```

(1 << axis) || ellipsisMask & (1 << axis) || stop == null) {\n if (stride > 0) {\n // Forward iteration - use the last
element. These values will get\n // clamped below\n stop = Number.MAX_SAFE_INTEGER;\n } else {\n // Backward iteration - use the first element.\n stop = Number.MIN_SAFE_INTEGER;\n }\n}\n\n // Handle
negative indices\n const axisSize = inputShape[axis];\n if (stop < 0) {\n stop += axisSize;\n }\n\n // Clamping\n
// Because the end index points one past the last element, we need slightly\n // different clamping ranges depending
on the direction.\n if (stride > 0) {\n // Forward iteration\n stop = util.clamp(0, stop, axisSize);\n } else {\n //
Backward iteration\n stop = util.clamp(-1, stop, axisSize - 1);\n }\n\n return stop;\n}\n\n/**\n * Returns true if the
slice occupies a continuous set of elements in the\n * 'flat' space.\n */\nexport function isSliceContinuous(\n shape:
number[], begin: number[], size:
number[]) {\n // Index of the first axis that has size > 1.\n let firstNonOneAxis = size.length;\n for (let i = 0; i <
size.length; i++) {\n if (size[i] > 1) {\n firstNonOneAxis = i;\n break;\n }\n }\n\n for (let i =
firstNonOneAxis + 1; i < size.length; i++) {\n if (begin[i] > 0 || size[i] !== shape[i]) {\n return false;\n }\n }\n
return true;\n}\n\nexport function computeFlatOffset(begin: number[], strides: number[]): number {\n let
flatOffset = begin.length > 0 ? begin[begin.length - 1] : 1;\n for (let i = 0; i < begin.length - 1; i++) {\n flatOffset
+= begin[i] * strides[i];\n }\n return flatOffset;\n}\n\nexport function parseSliceParams(\n x: TensorInfo, begin:
number|number[], size?: number|number[]) {\n // The following logic allows for more ergonomic calls.\n let
begin_: number[];\n const xRank = x.shape.length;\n if (typeof begin === 'number') {\n begin_ = [begin, ...new
Array(xRank - 1).fill(0)];\n } else if (begin.length <
xRank) {\n begin_ = begin.concat(new Array(xRank - begin.length).fill(0));\n } else {\n begin_ =
begin.slice();\n }\n begin_.forEach(d => {\n util.assert(\n d !== -1, () => 'slice() does not support negative
begin indexing.);\n });\n let size_: number[];\n if (size === null) {\n size_ = new Array(xRank).fill(-1);\n } else
if (typeof size === 'number') {\n size_ = [size, ...new Array(xRank - 1).fill(-1)];\n } else if (size.length < xRank)
{\n size_ = size.concat(new Array(xRank - size.length).fill(-1));\n } else {\n size_ = size;\n }\n size_ =
size_.map((d, i) => {\n if (d >= 0) {\n return d;\n } else {\n util.assert(\n d === -1, \n () =>
`Negative size values should be exactly -1 but got ` +\n ` ${d} for the slice() size at index ${i}.`);\n return
x.shape[i] - begin_[i];\n }\n });\n return [begin_, size_];\n}\n\nexport function sliceInfo(\n xShape: number[],
begin: number[], end: number[],
strides: number[],\n beginMask: number, endMask: number, ellipsisMask: number,\n newAxisMask: number,
shrinkAxisMask: number): SliceInfo {\n // make a copy because it may be modified further down.\n let $begin =
begin.slice();\n let $end = end.slice();\n let $strides = strides;\n\n if (strides === null) {\n $strides = new
Array($begin.length);\n }\n\n const ellipsisAxes = maskToAxes(ellipsisMask);\n if (ellipsisAxes.length > 1) {\n throw
new Error('Multiple ellipses in slice is not allowed.);\n }\n\n if (ellipsisMask !== 0 && newAxisMask !==
0) {\n throw new Error(\n 'Using both ellipsisMask and newAxisMask is not yet supported.);\n }\n\n if
(ellipsisMask !== 0 && shrinkAxisMask !== 0) {\n throw new Error(\n 'Using both ellipsisMask and
shrinkAxisMask is not yet supported.);\n }\n\n const numInterpolatedAxes = xShape.length - $begin.length;\n\n //
Expand the dims of x based on the newAxisMask.\n const expandAxes = maskToAxes(newAxisMask);\n const newShape =
xShape.slice();\n expandAxes.forEach(axis => {\n $begin[axis] = 0;\n $end[axis] = 1;\n newShape.splice(axis, 0, 1);\n });\n\n const {\n begin: normalizedBegin,\n end: normalizedEnd,\n strides:
normalizedStrides\n } =\n getNormalizedAxes(\n newShape, ellipsisAxes, numInterpolatedAxes, $begin,\n $end, $strides,\n beginMask, endMask, ellipsisMask);\n $begin = normalizedBegin;\n $end =
normalizedEnd;\n $strides = normalizedStrides;\n\n const shrinkAxes = maskToAxes(shrinkAxisMask);\n //
Adjust the ends based on the shrink mask.\n shrinkAxes.forEach(axis => {\n $end[axis] = $begin[axis] + 1;\n $strides[axis] = 1;\n });\n\n // Figure out the output shape.\n const size = computeOutShape($begin, $end,\n $strides);\n // Remove the axes based on shrinkMask.\n const outShape = size.filter((_, axis) =>
shrinkAxes.indexOf(axis) === -1);\n\n const nonStrided = $strides.every(v => v === 1);\n return {nonStrided,\n $begin,\n $end, $strides, size, newShape, outShape};\n}\n\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file

```

except in compliance with the License.\n \* You may obtain a copy of the License at\n \*\n \* http://www.apache.org/licenses/LICENSE-2.0\n \*\n \* Unless required by applicable law or agreed to in writing,  
software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES  
OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language  
governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\nimport {assert} from './util';\n\n/**\n * Types to support JSON-esque data structures internally.\n *\n * Internally ConfigDict's use camelCase keys and values where the\n * values are class names to be instantiated. On the python side, these\n * will be snake_case. Internally we allow Enums into the values for better\n * type safety, but these need to be converted to raw primitives (usually\n * strings) for round-tripping with python.\n *\n * toConfig returns the TS-friendly representation. model.toJSON() returns\n * the pythonic version as that's the portable format. If you need to\n * python-ify a non-model level toConfig output, you'll need to use a\n * convertTsToPythonic from serialization_utils in -Layers.\n *\n * ^\nexport declare type ConfigDictValue =\nboolean | number | string | null | ConfigDictArray | ConfigDict;\nexport declare interface ConfigDict {\n [key: string]: ConfigDictValue;\n}\nexport declare interface ConfigDictArray extends Array<ConfigDictValue>\n {\n}\n\n/**\n * Type to represent the class-type of Serializable objects.\n *\n * Ie the class prototype with access to the constructor and any\n * static members/methods. Instance methods are not listed here.\n *\n * Source for this idea: https://stackoverflow.com/a/43607255\n *\n * ^\nexport declare type SerializableConstructor<T extends Serializable> = {\n // tslint:disable-next-line:no-any\n new (...args: any[]): T; className: string; fromConfig: FromConfigMethod<T>;\n};\nexport declare type FromConfigMethod<T extends Serializable> =\n (cls: SerializableConstructor<T>, config: ConfigDict) => T;\n\n/**\n * Serializable defines the serialization contract.\n *\n * TFJS requires serializable classes to return their className when asked\n * to avoid issues with minification.\n *\n * ^\nexport abstract class Serializable {\n /**\n * Return the class name for this class to use in serialization contexts.\n *\n * Generally speaking this will be the same thing that constructor.name\n * would have returned. However, the class name needs to be robust\n * against minification for serialization/deserialization to work properly.\n *\n * There's also places such as initializers.VarianceScaling, where\n * implementation details between different languages led to different\n * class hierarchies and a non-leaf node is used for serialization purposes.\n *\n * ^\n getClassName(): string {\n return (this.constructor as SerializableConstructor<Serializable>).className;\n }\n\n /**\n * Return all the non-weight state needed to serialize this object.\n *\n * ^\n abstract getConfig(): ConfigDict;\n\n /**\n * Creates an instance of T from a ConfigDict.\n *\n * This works for most descendants of serializable. A few need to\n * provide special handling.\n *\n * @param cls A Constructor for the class to instantiate.\n * @param config The Configuration for the object.\n *\n * ^\n /** @nocollapse *\n static fromConfig<T extends Serializable>(\n cls: SerializableConstructor<T>, config: ConfigDict): T {\n return new cls(config);\n }\n}\n\n/**\n * Maps string keys to class constructors.\n *\n * Used during (de)serialization from the cross-language JSON format, which\n * requires the class name in the serialization format matches the class\n * names as used in Python, should it exist.\n *\n * ^\nexport class SerializationMap {\n private static instance: SerializationMap;\n classNameMap: {\n [className: string]:\n [SerializableConstructor<Serializable>, FromConfigMethod<Serializable>]\n };\n\n private constructor() {\n this.classNameMap = {};\n }\n\n /**\n * Returns the singleton instance of the map.\n *\n * ^\n static getMap(): SerializationMap {\n if (SerializationMap.instance == null) {\n SerializationMap.instance = new SerializationMap();\n }\n return SerializationMap.instance;\n }\n\n /**\n * Registers the class as serializable.\n *\n * ^\n static register<T extends Serializable>(cls: SerializableConstructor<T>) {\n SerializationMap.getMap().classNameMap[cls.className] =\n [cls, cls.fromConfig];\n }\n}\n\n/**\n * Maps\n *\n * Register a class with the serialization map of TensorFlow.js.\n *\n * This is often used for registering custom Layers, so they can be\n * serialized and deserialized.\n *\n * Example:\n *\n * ```js\n * class MyCustomLayer extends tf.layers.Layer {\n * static className = 'MyCustomLayer';\n *\n * constructor(config) {\n * super(config);\n * }\n *\n * }\n *\n * tf.serialization.registerClass(MyCustomLayer);\n *\n * ^\n *\n * @param cls
```

The class to be registered. It must have a public static member called `className` defined and the value must be a non-empty string.

```

 * @doc {heading: 'Models', subheading: 'Serialization', ignoreCI: true}
 * ^\nexport
function registerClass<T extends Serializable>(\n cls: SerializableConstructor<T>) {\n assert(\n cls.className
 != null,\n () => `Class being registered does not have the static className ` +\n `property defined.`);\n assert(\n typeof cls.className === 'string',\n () => `className is required to be a string, but got type ` +\n typeof cls.className);\n assert(\n cls.className.length
 > 0,\n () => `Class being registered has an empty-string as its className, ` +\n `which is disallowed.`);\n \n SerializationMap.register(cls);\n}

```

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```

=====
*\n\nimport {ENGINE} from './engine';\nimport {inferShape} from './tensor_util_env';\nimport {RecursiveArray, TensorLike, TypedArray} from './types';\nimport {arraysEqual, encodeString, flatten, isString, isTypedArray} from './util';\n\nconst TEST_EPSILON_FLOAT32 = 1e-3;\nexport const TEST_EPSILON_FLOAT16 = 1e-1;\n\nexport function expectArraysClose(\n actual: TypedArray|number|RecursiveArray<number>,\n expected: TypedArray|number|RecursiveArray<number>, epsilon?: number) {\n if (epsilon == null) {\n epsilon = testEpsilon();\n }\n return expectArraysPredicate(\n actual, expected, (a, b) => areClose(a as number, b as number, epsilon));\n}\n\nexport function testEpsilon() {\n return ENGINE.backend.floatPrecision() === 32 ? TEST_EPSILON_FLOAT32 : TEST_EPSILON_FLOAT16;\n}\n\nfunction expectArraysPredicate(\n actual: TensorLike, expected: TensorLike,\n predicate: (a: {}, b: {}) => boolean) {\n let checkClassType = true;\n if (isTypedArray(actual) || isTypedArray(expected)) {\n checkClassType = false;\n }\n if (isTypedArray(actual) && isTypedArray(expected)) {\n checkClassType = true;\n }\n if (checkClassType) {\n const aType = actual.constructor.name;\n const bType = expected.constructor.name;\n if (aType !== bType) {\n throw new Error(\n `Arrays are of different type. Actual: ${aType}. ` +\n `Expected: ${bType}`);\n }\n }\n if (Array.isArray(actual) && Array.isArray(expected)) {\n const actualShape = inferShape(actual);\n const expectedShape = inferShape(expected);\n if (!arraysEqual(actualShape, expectedShape)) {\n throw new Error(\n `Arrays have different shapes. ` +\n `Actual: [${actualShape}]. Expected: [${expectedShape}]`);\n }\n }\n const actualFlat = isTypedArray(actual) ? actual : flatten(actual as RecursiveArray<number>);\n const expectedFlat = isTypedArray(expected) ? expected : flatten(expected as RecursiveArray<number>);\n if (actualFlat.length !== expectedFlat.length) {\n throw new Error(\n `Arrays have different lengths actual: ${actualFlat.length} vs ` +\n `expected: ${expectedFlat.length}. ` +\n `Actual: [${actualFlat}]. ` +\n `Expected: [${expectedFlat}]`);\n }\n for (let i = 0; i < expectedFlat.length; ++i) {\n const a = actualFlat[i];\n const e = expectedFlat[i];\n if (!predicate(a, e)) {\n throw new Error(\n `Arrays differ: actual[${i}] = ${a}, expected[${i}] = ${e}. ` +\n `Actual: [${actualFlat}]. ` +\n `Expected: [${expectedFlat}]`);\n }\n }\n}\n\nexport interface DoneFn {\n (): void;\n fail: (message?: Error|string) => void;\n}\n\nexport function expectPromiseToFail(fn: () => Promise<{}>, done: DoneFn): void {\n fn().then(() => done.fail(), () => done());\n}\n\nexport function expectArraysEqual(actual: TensorLike, expected: TensorLike) {\n const exp = typeof expected === 'string' || typeof expected === 'number' ||\n typeof expected === 'boolean' ?\n [expected] as number[] :\n expected as number[];\n if (isString(actual) || isString((actual as string[])[0]) ||\n isString(expected) || isString((expected as string[])[0])) {\n // tslint:disable-next-line: triple-equals\n return expectArraysPredicate(actual, exp, (a, b) => a == b);\n }\n return expectArraysPredicate(\n actual, expected, (a,

```





allocated.  
 \* - `numDataBuffers`: Number of unique data buffers allocated (undisposed) at this time, which is the number of tensors (e.g. `a.reshape(newShape)` makes a new Tensor that shares the same data buffer with `a`).

\* - `unreliable`: True if the memory usage is unreliable. See `reasons` when `unreliable` is true.

\* - `reasons`: `string[]`, reasons why the memory is unreliable, present if `unreliable` is true.

\* WebGL Properties:  
 \* - `numBytesInGPU`: Number of bytes allocated (undisposed) in the GPU only at this time.

\* @doc {heading: 'Performance', subheading: 'Memory'}  
 \* ^/nexport function memory(): MemoryInfo {  
 return ENGINE.memory();  
 }  
 \* Executes the provided function `f` and returns a promise that resolves with information about the function's memory use:  
 \* - `newBytes`: the number of new bytes allocated  
 \* - `newTensors`: the number of new tensors created  
 \* - `peakBytes`: the peak number of bytes allocated  
 \* - `kernels`: an array of objects for each kernel involved that reports their input and output shapes, number of bytes used, and number of new tensors created.  
 \* - `kernelNames`: an array of unique strings with just the names of the kernels in the `kernels` array.

```

 * `js`
 * const profile = await tf.profile() => {
 * const x = tf.tensor1d([1, 2, 3]);
 * let x2 = x.square();
 * x2.dispose();
 * x2 = x.square();
 * x2.dispose();
 * return x;
 * };
 * console.log(`newBytes: ${profile.newBytes}`);
 * console.log(`newTensors: ${profile.newTensors}`);
 * console.log(`byte usage over all kernels: ${profile.kernels.map(k => k.totalBytesSnapshot)}`);
 * `
 * @doc {heading: 'Performance', subheading: 'Profile'}
 * ^/nexport function profile(f: () => (TensorContainer | Promise<TensorContainer>)):
 * Promise<ProfileInfo> {
 * return ENGINE.profile(f);
 * }
 * Executes the provided function `fn` and after it is executed, cleans up all intermediate tensors allocated by `fn` except those returned by `fn`. `fn` must not return a Promise (async functions not allowed). The returned result can be a complex object.
 * Using this method helps avoid memory leaks. In general, wrap calls to operations in `tf.tidy` for automatic memory cleanup.
 * NOTE: Variables do not get cleaned up when inside a tidy(). If you want to dispose variables, please use `tf.disposeVariables` or call `dispose` directly on variables.
 * `js`
 * // y = 2 ^ 2 + 1
 * const y = tf.tidy(() => {
 * // a, b, and one will be cleaned up when the tidy ends.
 * const one = tf.scalar(1);
 * const a = tf.scalar(2);
 * const b = a.square();
 * console.log(`numTensors (in tidy): ` + tf.memory().numTensors);
 * // The value returned inside the tidy function will return through the tidy, in this case to the variable y.
 * return b.add(one);
 * });
 * console.log(`numTensors (outside tidy): ` + tf.memory().numTensors);
 * y.print();
 * `
 * @param nameOrFn The name of the closure, or the function to execute. If a name is provided, the 2nd argument should be the function. If debug mode is on, the timing and the memory usage of the function will be tracked and displayed on the console using the provided name.
 * @param fn The function to execute.
 * @doc {heading: 'Performance', subheading: 'Memory'}
 * ^/nexport function tidy<T extends TensorContainer>(
 * nameOrFn: string | ScopeFn<T>,
 * fn?: ScopeFn<T>): T {
 * return ENGINE.tidy(nameOrFn, fn);
 * }
 * Disposes any `tf.Tensor`s found within the provided object.
 * @param container an object that may be a `tf.Tensor` or may directly contain `tf.Tensor`s, such as a `Tensor[]` or `{key: Tensor, ...}`. If the object is not a `tf.Tensor` or does not contain `Tensors`, nothing happens. In general it is safe to pass any object here, except that `Promise`s are not supported.
 * @doc {heading: 'Performance', subheading: 'Memory'}
 * ^/nexport function dispose(container: TensorContainer) {
 * const tensors = getTensorsInContainer(container);
 * tensors.forEach(tensor => tensor.dispose());
 * }
 * Keeps a `tf.Tensor` generated inside a `tf.tidy` from being disposed automatically.
 * `js`
 * let b;
 * const y = tf.tidy(() => {
 * const one = tf.scalar(1);
 * const a = tf.scalar(2);
 * // b will not be cleaned up by the tidy. a and one will be cleaned up when the tidy ends.
 * b = tf.keep(a.square());
 * console.log(`numTensors (in tidy): ` + tf.memory().numTensors);
 * // The value returned inside the tidy function will return through the tidy, in this case to the variable y.
 * return b.add(one);
 * });
 * console.log(`numTensors (outside tidy): ` + tf.memory().numTensors);
 * console.log('y:');
 * y.print();
 * console.log('b:');
 * b.print();
 * `
 * @param result The tensor to keep from being disposed.
 * @doc {heading: 'Performance', subheading: 'Memory'}
 * ^/nexport function keep<T extends Tensor>(result: T): T {
 * return ENGINE.keep(result);
 * }
 * Executes `f` and returns a promise that resolves with timing

```

information.  
 \* The result is an object with the following properties:  
 \* - `wallMs`: Wall execution time.  
 \* - `kernelMs`: Kernel execution time, ignoring data transfer. If using the WebGL backend and the query timer extension is not available, this will return an error object.  
 \* - On `WebGL` The following additional properties exist:  
 \* - `uploadWaitMs`: CPU blocking time on texture uploads.  
 \* - `downloadWaitMs`: CPU blocking time on texture downloads (readPixels).  
 \* - `js`  
 \* const x = tf.randomNormal([20, 20]);  
 \* const time = await tf.time(() => x.matMul(x));  
 \* console.log(`kernelMs: \${time.kernelMs}, wallTimeMs: \${time.wallMs}`);  
 \* @param f The function to execute and time.  
 \* @doc {heading: 'Performance', subheading: 'Timing'}  
 \* ^\nexport function time(f: () => void): Promise<TimingInfo> {\n return ENGINE.time(f);  
 \* }  
 \* Sets the backend (cpu, webgl, wasm, etc) responsible for creating tensors and executing operations on those tensors. Returns a promise that resolves to a boolean if the backend initialization was successful.  
 \* Note this disposes the current backend, if any, as well as any tensors associated with it. A new backend is initialized, even if it is of the same type as the previous one.  
 \* @param backendName The name of the backend. Currently supports `webgl` in the browser, `tensorflow` under node.js (requires tfjs-node), and `wasm` (requires tfjs-backend-wasm).  
 \* @doc {heading: 'Backends'}  
 \* ^\nexport function setBackend(backendName: string): Promise<boolean> {\n return ENGINE.setBackend(backendName);  
 \* }  
 \* Returns a promise that resolves when the currently selected backend (or the highest priority one) has initialized. Await this promise when you are using a backend that has async initialization.  
 \* @doc {heading: 'Backends'}  
 \* ^\nexport function ready(): Promise<void> {\n return ENGINE.ready();  
 \* }  
 \* Returns the current backend name (cpu, webgl, etc). The backend is responsible for creating tensors and executing operations on those tensors.  
 \* @doc {heading: 'Backends'}  
 \* ^\nexport function getBackend(): string {\n return ENGINE.backendName;  
 \* }  
 \* Removes a backend and the registered factory.  
 \* @doc {heading: 'Backends'}  
 \* ^\nexport function removeBackend(name: string): void {\n ENGINE.removeBackend(name);  
 \* }  
 \* Finds the backend registered under the provided name. Returns null if the name is not in the registry, or the registration hasn't finished yet.  
 \* ^\nexport function findBackend(name: string): KernelBackend {\n return ENGINE.findBackend(name);  
 \* }  
 \* Finds the backend factory registered under the provided name. Returns a function that produces a new backend when called. Returns null if the name is not in the registry.  
 \* ^\nexport function findBackendFactory(name: string): () => KernelBackend | Promise<KernelBackend> {\n return ENGINE.findBackendFactory(name);  
 \* }  
 \* Registers a global backend. The registration should happen when importing a module file (e.g. when importing `backend\_webgl.ts`), and is used for modular builds (e.g. custom tfjs bundle with only webgl support).  
 \* @param factory The backend factory function. When called, it should return a backend instance, or a promise of an instance.  
 \* @param priority The priority of the backend (higher = more important). In case multiple backends are registered, the priority is used to find the best backend. Defaults to 1.  
 \* @return False if there is already a registered backend under this name, true if not.  
 \* @doc {heading: 'Backends'}  
 \* ^\nexport function registerBackend(\n name: string, factory: () => KernelBackend | Promise<KernelBackend>, \n priority = 1): boolean {\n return ENGINE.registerBackend(name, factory, priority);  
 \* }  
 \* Gets the current backend. If no backends have been initialized, this will attempt to initialize the best backend. Will throw an error if the highest priority backend has async initialization, in which case, you should call `await tf.ready()` before running other code.  
 \* @doc {heading: 'Backends'}  
 \* ^\nexport function backend(): KernelBackend {\n return ENGINE.backend;  
 \* }  
 \* Sets the global platform.  
 \* @param platformName The name of this platform.  
 \* @param platform A platform implementation.  
 \* ^\nexport function setPlatform(platformName: string, platform: Platform) {\n env().setPlatform(platformName, platform);  
 \* }  
 \* @license Copyright 2020 Google LLC. All Rights Reserved. Licensed under the Apache License, Version 2.0 (the "License"); you may not use this file except in compliance with the License. You may obtain a copy of the License at http://www.apache.org/licenses/LICENSE-2.0 Unless required by applicable law or agreed to in writing, software distributed under the License is distributed on an "AS IS" BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied. See the License for

the specific language governing permissions and limitations under the License.

```
=====
*\nimport {ENGINE} from './engine';\nimport {Add, AddInputs} from './kernel_names';\nimport
 {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {makeTypesMatch} from
 './tensor_util';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport
 {op} from './operation';\n\n/**\n * Adds two `tf.Tensor`s element-wise, A + B. Supports broadcasting.\n *\n *`js`\n * const a = tf.tensor1d([1, 2, 3, 4]);\n * const b = tf.tensor1d([10, 20, 30, 40]);\n *\n * a.add(b).print(); // or
tf.add(a, b)\n *````\n *`js`\n * // Broadcast add a with b.\n * const a = tf.scalar(5);\n * const b = tf.tensor1d([10,
20, 30, 40]);\n *\n * a.add(b).print(); // or tf.add(a, b)\n *````\n * @param a The first `tf.Tensor` to add.\n * @param
b The second `tf.Tensor` to add. Must have the same type as `a`.\n * @doc {heading: 'Operations', subheading:
'Arithmetic'}\n *\n *function add_<T extends Tensor>(a: Tensor|TensorLike, b: Tensor|TensorLike): T {\n let $a =
 convertToTensor(a, 'a', 'add');\n let $b =
 convertToTensor(b, 'b', 'add');\n [$a, $b] = makeTypesMatch($a, $b);\n const inputs: AddInputs = {a: $a, b:
$b};\n return ENGINE.runKernel(Add, inputs as {} as NamedTensorMap);\n}\n\nexport const add =
op({add_});\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and
limitations under the
License.\n *
=====
*\nimport {ENGINE} from './engine';\nimport {FloorDiv,
 FloorDivInputs} from './kernel_names';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from
 './tensor_types';\nimport {makeTypesMatch} from './tensor_util';\nimport {convertToTensor} from
 './tensor_util_env';\nimport {TensorLike} from './types';\nimport {op} from './operation';\n\n/**\n * Divides two
`tf.Tensor`s element-wise, A / B. Supports broadcasting.\n * The result is rounded with floor function.\n *\n *`js`\n * const a = tf.tensor1d([1, 4, 9, 16]);\n * const b = tf.tensor1d([1, 2, 3, 4]);\n *\n * a.floorDiv(b).print(); // or
tf.div(a, b)\n *````\n *`js`\n * // Broadcast div a with b.\n * const a = tf.tensor1d([2, 4, 6, 8]);\n * const b =
tf.scalar(2);\n *\n * a.floorDiv(b).print(); // or tf.floorDiv(a, b)\n *````\n * @param a The first tensor as the
numerator.\n * @param b The second tensor as the denominator. Must have the same dtype as
`a`.\n * @doc {heading: 'Operations', subheading: 'Arithmetic'}\n *\n *function floorDiv_<T extends
 Tensor>(a: Tensor|TensorLike, b: Tensor|TensorLike): T {\n let $a = convertToTensor(a, 'a', 'floorDiv');\n let
$b = convertToTensor(b, 'b', 'floorDiv');\n [$a, $b] = makeTypesMatch($a, $b);\n const inputs: FloorDivInputs =
 {a: $a, b: $b};\n return ENGINE.runKernel(FloorDiv, inputs as {} as NamedTensorMap);\n}\n\nexport const
floorDiv = op({floorDiv_});\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and
limitations under
the License.\n *
=====
*\nimport {ENGINE} from './engine';\nimport {RealDiv, RealDivInputs} from './kernel_names';\nimport
 {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {makeTypesMatch} from
 './tensor_util';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport
 {floorDiv} from './floorDiv';\nimport {op} from './operation';\n\n/**\n * Divides two `tf.Tensor`s element-wise, A /
```

B. Supports broadcasting.  
const a = tf.tensor1d([1, 4, 9, 16]);  
const b = tf.tensor1d([1, 2, 3, 4]);  
a.div(b).print(); // or tf.div(a, b)  
const a = tf.tensor1d([2, 4, 6, 8]);  
const b = tf.scalar(2);  
a.div(b).print(); // or tf.div(a, b)  
@param a The first tensor as the numerator.  
@param b The second tensor as the denominator. Must have

the same dtype as `a`.  
@doc {heading: 'Operations', subheading: 'Arithmetic'}  
function div\_<T extends Tensor>(a: Tensor|TensorLike, b: Tensor|TensorLike): T {  
 let \$a = convertToTensor(a, 'a', 'div');  
 let \$b = convertToTensor(b, 'b', 'div');  
 [\$a, \$b] = makeTypesMatch(\$a, \$b);  
 if (\$a.dtype === 'int32' && \$b.dtype === 'int32') {  
 return floorDiv(\$a, \$b);  
 }  
 const inputs: RealDivInputs = {a: \$a, b: \$b};  
 const attrs = {};  
 // tslint:disable-next-line: no-unnecessary-type-assertion  
 return ENGINE.runKernel(RealDiv, inputs as {} as NamedTensorMap, attrs) as T;  
}  
export const div = op({div\_});  
/\*\*  
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 \* distributed under the License is distributed on an "AS IS" BASIS,  
 \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.  
 \* See the License for the specific language governing permissions and  
 \* limitations under the License.  
 \*/  
=====

import {ENGINE} from '../engine';  
import {Multiply, MultiplyInputs} from '../kernel\_names';  
import {Tensor} from '../tensor';  
import {NamedTensorMap} from '../tensor\_types';  
import {makeTypesMatch} from '../tensor\_util';  
import {convertToTensor} from '../tensor\_util\_env';  
import {TensorLike} from '../types';  
import {op} from './operation';  
/\*\*  
 \* Multiplies two `tf.Tensor`s element-wise, A \* B. Supports broadcasting.  
 \* We also expose `tf.mulStrict` which has the same signature as this op and  
 \* asserts that `a` and `b` are the same shape (does not broadcast).  
 \* const a = tf.tensor1d([1, 2, 3, 4]);  
 \* const b = tf.tensor1d([2, 3, 4, 5]);  
 \* a.mul(b).print(); // or tf.mul(a, b)  
 \* const a = tf.tensor1d([1, 2, 3, 4]);  
 \* const b = tf.scalar(5);  
 \* a.mul(b).print(); // or tf.mul(a, b)  
 \* @param a The first tensor to multiply.  
 \* @param b The second tensor to multiply. Must have the same dtype as `a`.  
 \* @doc {heading: 'Operations', subheading: 'Arithmetic'}  
 \* function mul\_<T extends Tensor>(a: Tensor|TensorLike, b: Tensor|TensorLike): T {  
 \* let \$a = convertToTensor(a, 'a', 'mul');  
 \* let \$b = convertToTensor(b, 'b', 'mul');  
 \* [\$a, \$b] = makeTypesMatch(\$a, \$b);  
 \* const inputs: MultiplyInputs = {a: \$a, b: \$b};  
 \* return ENGINE.runKernel(Multiply, inputs as {} as NamedTensorMap);  
 \* }  
 \* export const mul = op({mul\_});  
 \* /\*\*  
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 \* distributed under the License is distributed on an "AS IS" BASIS,  
 \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.  
 \* See the License for the specific language governing permissions and  
 \* limitations under the License.  
 \*/  
=====

import {ENGINE} from '../engine';  
import {Abs, AbsInputs, ComplexAbs, ComplexAbsInputs} from '../kernel\_names';  
import {Tensor} from '../tensor';  
import {NamedTensorMap} from '../tensor\_types';  
import {convertToTensor} from '../tensor\_util\_env';  
import {TensorLike} from '../types';  
import {op} from './operation';  
/\*\*  
 \* Computes absolute value element-wise: `abs(x)`  
 \* const x = tf.tensor1d([-1, 2, -3, 4]);  
 \* x.abs().print(); // or tf.abs(x)  
 \* @param x The input `tf.Tensor`.  
 \* @doc {heading: 'Operations', subheading: 'Basic math'}  
 \* function abs\_<T extends Tensor>(x: T|TensorLike): T {  
 \* const \$x = convertToTensor(x, 'x', 'abs');  
 \* if (\$x.dtype === 'complex64') {  
 \* const inputs: ComplexAbsInputs = {x: \$x};  
 \* return ENGINE.runKernel(ComplexAbs, inputs as {} as NamedTensorMap);  
 \* } else {  
 \* const inputs: AbsInputs = {x: \$x};  
 \* return ENGINE.runKernel(Abs, inputs as {} as NamedTensorMap);  
 \* }  
 \* }  
 \* export

const abs = op({abs\_});\n", "/\*\n \* @license\n \* Copyright 2018 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the \"License\");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \* http://www.apache.org/licenses/LICENSE-2.0\n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\nimport {ENGINE} from './engine';\nimport {Acos, AcosInputs} from './kernel_names';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport {op} from './operation';\n\n/* Computes acos of the input `tf.Tensor` element-wise: `acos(x)`\n * const x = tf.tensor1d([0, 1, -1, .7]);\n * x.acos().print(); // or tf.acos(x)\n * @param x The input tensor.\n * @doc {heading: 'Operations', subheading: 'Basic math'}\n */\nfunction acos_<T extends Tensor>(x: T|TensorLike): T {\n const $x = convertToTensor(x, 'x', 'acos');\n const inputs:
```

```
 AcosInputs = {x: $x};\n return ENGINE.runKernel(Acos, inputs as {} as NamedTensorMap);\n}\n\nexport const acos = op({acos_});\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\nimport {ENGINE} from './engine';\nimport {Acosh, AcoshInputs} from './kernel_names';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport {op} from './operation';\n\n/* Computes the inverse hyperbolic cos of the input `tf.Tensor` element-wise:\n * `acosh(x)`\n * const x = tf.tensor1d([10, 1, 3, 5.7]);\n * x.acosh().print(); // or tf.acosh(x)\n * @param x The input tensor.\n * @doc {heading: 'Operations', subheading: 'Basic math'}\n */\nfunction acosh_<T extends Tensor>(x: T|TensorLike): T {\n const $x = convertToTensor(x, 'x', 'acosh');\n const inputs: AcoshInputs = {x: $x};\n return ENGINE.runKernel(Acosh, inputs as {} as NamedTensorMap);\n}\n\nexport const acosh = op({acosh_});\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *
```

```
\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\nimport {ENGINE} from './engine';\nimport {AddN, AddNInputs} from './kernel_names';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport * as util from './util';\nimport {op} from './operation';\n\n/* Adds a list of `tf.Tensor`'s element-wise, each with the same shape and dtype.\n * const a = tf.tensor1d([1, 2]);\n * const b = tf.tensor1d([3, 4]);\n * const c = tf.tensor1d([5, 6]);\n * tf.addN([a, b, c]).print();\n * @param tensors A list of tensors with the same shape and dtype.\n * @doc {heading: 'Operations', subheading: 'Arithmetic'}\n */\nfunction addN_<T extends Tensor>(tensors: Array<T|TensorLike>): T
```

```

{\n util.assert(\n Array.isArray(tensors),\n () => "The argument passed to tf.addN() must be a list of
tensors");\n util.assert(\n tensors.length >= 1,\n () => `Must pass at least one tensor to tf.addN(), but got ` +\n
 `${tensors.length}`);\n\n const $tensors =\n tensors.map((t, i) => convertToTensor(t, `tensors${i}`),
'addN');\n\n const firstTensor = $tensors[0];\n $tensors.forEach(t => {\n if (t.dtype !== firstTensor.dtype) {\n
throw new Error(\n 'All tensors passed to tf.addN() must have the same dtype');\n }\n });\n\n
$tensors.forEach(t => {\n if (!util.arraysEqual(t.shape, firstTensor.shape)) {\n throw new Error(\n 'All
tensors passed to tf.addN() must have the same shape');\n }\n
});\n\n const inputs: AddNInputs = $tensors;\n\n return ENGINE.runKernel(AddN, inputs as { } as
NamedTensorMap);\n}\n\nexport const addN = op({addN_});\n", "/**\n * @license\n * Copyright 2020 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {ENGINE} from '../engine';\nimport {All, AllAttrs, AllInputs} from '../kernel_names';\nimport
{NamedAttrMap}
from '../kernel_registry';\nimport {Tensor} from '../tensor';\nimport {NamedTensorMap} from
'../tensor_types';\nimport {convertToTensor} from '../tensor_util_env';\nimport {TensorLike} from
'../types';\n\nimport {op} from './operation';\n\n/**\n * Computes the logical and of elements across dimensions of a
`tf.Tensor`.\n *\n * Reduces the input along the dimensions given in `axes`. Unless `keepDims`\n * is true, the rank
of the `tf.Tensor` is reduced by 1 for each entry in\n * `axes`. If `keepDims` is true, the reduced dimensions are
retained with\n * length 1. If `axes` has no entries, all dimensions are reduced, and an\n * `tf.Tensor` with a single
element is returned.\n *\n * ```js\n * const x = tf.tensor1d([1, 1, 1], 'bool');\n * x.all().print(); // or tf.all(x)\n *
```\n *\n * ```js\n * const x = tf.tensor2d([1, 1, 0, 0], [2, 2], 'bool');\n * const axis = 1;\n * x.all(axis).print(); // or
tf.all(x, axis)\n * ```\n *\n * @param x The input tensor. Must be of dtype bool.\n
* @param axis The dimension(s) to reduce. By default it reduces\n * all dimensions.\n * @param keepDims If
true, retains reduced dimensions with size 1.\n *\n * @doc {heading: 'Operations', subheading: 'Reduction'}\n
*/\n\nfunction all_<T extends Tensor>(\n   x: Tensor|TensorLike, axis: number|number[] = null, keepDims = false): T
{\n   const $x = convertToTensor(x, 'x', 'all', 'bool');\n\n   const inputs: AllInputs = {x: $x};\n   const attrs: AllAttrs =
{axis, keepDims};\n\n   return ENGINE.runKernel(\n     All, inputs as { } as NamedTensorMap, attrs as { } as
NamedAttrMap);\n}\n\nexport const all = op({all_});\n", "/**\n * @license\n * Copyright 2020 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n
* distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR
CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing
permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {ENGINE} from '../engine';\nimport {Any, AnyAttrs, AnyInputs} from '../kernel_names';\nimport
{NamedAttrMap} from '../kernel_registry';\nimport {Tensor} from '../tensor';\nimport {NamedTensorMap} from
'../tensor_types';\nimport {convertToTensor} from '../tensor_util_env';\nimport {TensorLike} from
'../types';\n\nimport {op} from './operation';\n\n/**\n * Computes the logical or of elements across dimensions of a
`tf.Tensor`.\n *\n * Reduces the input along the dimensions given in `axes`. Unless `keepDims`\n * is true, the rank
of the `tf.Tensor` is reduced by 1 for each entry in\n * `axes`. If `keepDims` is true, the reduced dimensions are

```

```

retained with\n * length 1. If `axes` has no entries, all dimensions are reduced, and an\n * `tf.Tensor` with a single
element is returned.\n *\n * ````js\n * const x = tf.tensor1d([1, 1, 1], 'bool');\n *\n * x.any().print(); // or tf.any(x)\n *\n * ````\n *\n * ````js\n * const x = tf.tensor2d([1, 1, 0, 0], [2, 2], 'bool');\n *\n * const axis = 1;\n *\n * x.any(axis).print(); //
or tf.any(x, axis)\n *\n * ````\n *\n * @param x The input tensor. Must be of dtype bool.\n *\n * @param axis The
dimension(s) to reduce. By default it reduces\n * all dimensions.\n *\n * @param keepDims If true, retains reduced
dimensions with size 1.\n *\n * @doc {heading: 'Operations', subheading: 'Reduction'}\n *\n * \nfunction any_<T
extends Tensor>(\n * x: Tensor|TensorLike, axis: number|number[] = null, keepDims = false): T {\n * const $x =
convertToTensor(x, 'x', 'any', 'bool');\n *\n * const inputs: AnyInputs = {x: $x};\n * const attrs: AnyAttrs = {axis,
keepDims};\n *\n * return ENGINE.runKernel(\n * Any, inputs as { } as NamedTensorMap,
attrs as { } as NamedAttrMap);\n *\n * \n}\n *\n * // tslint:disable-next-line:variable-name\n * \nexport const any =
op({any_});\n * \n * \n * \n * @license\n * Copyright 2020 Google Inc. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

```

```

=====
*\n *\n * \nimport {ENGINE} from './engine';\n *\n * \nimport {ArgMax, ArgMaxAttrs, ArgMaxInputs} from
'./kernel_names';\n *\n * \nimport {NamedAttrMap} from './kernel_registry';\n *\n * \nimport
{Tensor} from './tensor';\n *\n * \nimport {NamedTensorMap} from './tensor_types';\n *\n * \nimport {convertToTensor} from
'./tensor_util_env';\n *\n * \nimport {TensorLike} from './types';\n *\n * \nimport {op} from './operation';\n *\n * \n * \n * Returns the
indices of the maximum values along an `axis`.\n *\n * The result has the same shape as `input` with the dimension
along `axis`\n *\n * removed.\n *\n * ````js\n * const x = tf.tensor1d([1, 2, 3]);\n *\n * x.argmax().print(); // or
tf.argmax(x)\n *\n * ````\n *\n * ````js\n * const x = tf.tensor2d([1, 2, 4, 3], [2, 2]);\n *\n * const axis = 1;\n *\n *
x.argmax(axis).print(); // or tf.argmax(x, axis)\n *\n * ````\n *\n * @param x The input tensor.\n *\n * @param axis The
dimension to reduce. Defaults to 0 (outer-most dimension).\n *\n * @doc {heading: 'Operations', subheading:
'Reduction'}\n *\n * \nfunction argMax_<T extends Tensor>(x: Tensor|TensorLike, axis = 0): T {\n * const $x =
convertToTensor(x, 'x', 'argMax');\n *\n * const inputs: ArgMaxInputs = {x: $x};\n * const attrs: ArgMaxAttrs
= {axis};\n *\n * return ENGINE.runKernel(\n * ArgMax, inputs as { } as NamedTensorMap, attrs as { } as
NamedAttrMap);\n *\n * \n}\n *\n * \nexport const argMax = op({argMax_});\n * \n * \n * \n * @license\n * Copyright 2020 Google
Inc. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

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```

=====
*\n *\n * \nimport {ENGINE} from './engine';\n *\n * \nimport {ArgMin, ArgMinAttrs, ArgMinInputs} from
'./kernel_names';\n *\n * \nimport
{NamedAttrMap} from './kernel_registry';\n *\n * \nimport {Tensor} from './tensor';\n *\n * \nimport {NamedTensorMap} from
'./tensor_types';\n *\n * \nimport {convertToTensor} from './tensor_util_env';\n *\n * \nimport {TensorLike} from
'./types';\n *\n * \nimport {op} from './operation';\n *\n * \n * \n * Returns the indices of the minimum values along an `axis`.\n *\n *
The result has the same shape as `input` with the dimension along `axis`\n *\n * removed.\n *\n * ````js\n * const x
= tf.tensor1d([1, 2, 3]);\n *\n * x.argMin().print(); // or tf.argMin(x)\n *\n * ````\n *\n * ````js\n * const x = tf.tensor2d([1,
2, 4, 3], [2, 2]);\n *\n * const axis = 1;\n *\n * x.argMin(axis).print(); // or tf.argMin(x, axis)\n *\n * ````\n *\n * @param x
The input tensor.\n *\n * @param axis The dimension to reduce. Defaults to 0 (outer-most dimension).\n *\n * @doc
{heading: 'Operations', subheading: 'Reduction'}\n *\n * \nfunction argMin_<T extends Tensor>(x: Tensor|TensorLike,

```



```
axis = 0): T {\n  const $x = convertToTensor(x, 'x', 'argMin');\n  const inputs:\n    ArgMinInputs = {x: $x};\n  const attrs: ArgMinMaxAttrs = {axis};\n  return ENGINE.runKernel(\n    ArgMin,\n    inputs as {} as NamedTensorMap, attrs as {} as NamedAttrMap);\n}\n\nexport const argMin =\n  op({argMin_});\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the\n * Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the\n * License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n * on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n * implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n * License.\n */
```

```
=====\n\n*/\n\nimport {ENGINE} from './engine';\nimport {Asin, AsinInputs}\n  from './kernel_names';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from\n  './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from\n  './types';\n\nimport {op} from './operation';\n\n/**\n * Computes asin of the input `tf.Tensor` element-wise:\n * `asin(x)`\n *\n * @param x The input tensor.\n * @doc {heading: 'Operations', subheading: 'Basic math'}\n */\nfunction asin_<T\n  extends Tensor>(x: T|TensorLike): T {\n  const $x = convertToTensor(x, 'x', 'asin');\n  const inputs: AsinInputs =\n    {x: $x};\n  return ENGINE.runKernel(Asin, inputs as {} as NamedTensorMap);\n}\n\nexport const asin =\n  op({asin_});\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the\n * Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the\n * License.\n * You may obtain a copy\n * of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n\n*/\n\nimport {ENGINE} from './engine';\nimport {Asinh, AsinhInputs} from './kernel_names';\nimport {Tensor}\n  from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from\n  './tensor_util_env';\nimport {TensorLike} from './types';\nimport {op} from './operation';\n\n/**\n * Computes\n * inverse hyperbolic sin of the input `tf.Tensor` element-wise:\n * `asinh(x)`\n *\n * @param x The input tensor.\n * @doc {heading: 'Operations', subheading: 'Basic math'}\n */\nfunction asinh_<T\n  extends Tensor>(x: T|TensorLike): T {\n  const $x = convertToTensor(x, 'x', 'asinh');\n  const inputs:\n    AsinhInputs = {x: $x};\n  return ENGINE.runKernel(Asinh, inputs as {} as NamedTensorMap);\n}\n\nexport const asinh =\n  op({asinh_});\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed\n * under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the\n * License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n * on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n * implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n * License.\n */
```

```
=====\n\n*/\n\nimport {ENGINE} from './engine';\nimport {Atan, AtanInputs} from './kernel_names';\nimport {Tensor}\n  from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from\n  './tensor_util_env';\nimport {TensorLike} from './types';\nimport {op} from './operation';\n\n/**\n * Computes\n * atan of the input `tf.Tensor` element-wise:\n * `atan(x)`\n *\n * @param x The input tensor.\n * @doc {heading: 'Operations',
```

```

subheading: 'Basic math'})\n *\nfunction atan_<T extends Tensor>(x: T|TensorLike): T {\n  const $x =
convertToTensor(x, 'x', 'atan');\n\n  const inputs: AtanInputs = {x: $x};\n\n  return ENGINE.runKernel(Atan, inputs
as { } as NamedTensorMap);\n}\n\nexport const atan = op({atan_});\n"/**\n * @license\n * Copyright 2020 Google
LLC. All Rights Reserved.\n * Licensed under
the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

```

```

=====\n
*\n\nimport {ENGINE} from './engine';\nimport {Atan2, Atan2Inputs} from './kernel_names';\nimport {Tensor}
from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {makeTypesMatch} from
 './tensor_util';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\n\nimport
{op} from './operation';\n\n/**\n * Computes

```

```

arctangent of `tf.Tensor`s a / b element-wise: `atan2(a, b)`.\n * Supports broadcasting.\n *\n * ```\n * const a =
tf.tensor1d([1.0, 1.0, -1.0, .7]);\n * const b = tf.tensor1d([2.0, 13.0, 3.5, .21]);\n *\n * tf.atan2(a, b).print()\n * ```\n
*\n * @param a The first tensor.\n * @param b The second tensor. Must have the same dtype as `a`.\n *\n * @doc
{heading: 'Operations', subheading: 'Basic math'})\n *\nfunction atan2_<T extends Tensor>(a:
Tensor|TensorLike, b: Tensor|TensorLike): T {\n  let $a = convertToTensor(a, 'a', 'atan2');\n  let $b =
convertToTensor(b, 'b', 'atan2');\n  [$a, $b] = makeTypesMatch($a, $b);\n\n  const inputs: Atan2Inputs = {a: $a, b:
$b};\n\n  return ENGINE.runKernel(Atan2, inputs as { } as NamedTensorMap);\n}\n\nexport const atan2 =
op({atan2_});\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n

```

```

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required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an
"AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n
*\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```

```

=====\n
*\n\nimport {ENGINE} from './engine';\nimport {Atanh, AtanhInputs} from './kernel_names';\nimport {Tensor}
from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from
 './tensor_util_env';\nimport {TensorLike} from './types';\n\nimport {op} from './operation';\n\n/**\n * Computes
inverse hyperbolic tan of the input `tf.Tensor` element-wise:\n * `atanh(x)`\n *\n * ```\n * const x = tf.tensor1d([0,
.1, -.1, .7]);\n *\n * x.atanh().print();

```

```

// or tf.atanh(x)\n * ```\n * @param x The input tensor.\n *\n * @doc {heading: 'Operations', subheading: 'Basic
math'})\n *\nfunction atanh_<T extends Tensor>(x: T|TensorLike): T {\n  const $x = convertToTensor(x, 'x',
'atanh');\n\n  const inputs: AtanhInputs = {x: $x};\n\n  return ENGINE.runKernel(Atanh, inputs as { } as
NamedTensorMap);\n}\n\nexport const atanh = op({atanh_});\n"/**\n * @license\n * Copyright 2020 Google LLC.
All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations
under the License.\n *

```

```

=====\n
*\n\nntype PadType = 'SAME'|'VALID'|'NUMBER'|'EXPLICIT';\n\n// For NHWC should be in the following

```

```

form:\n// [[0, 0], [pad_top,pad_bottom], [pad_left, pad_right], [0, 0]]\n// For NCHW should be in the following
form:\n// [[0, 0], [0, 0], [pad_top,pad_bottom], [pad_left, pad_right]]\n// Reference:
https://www.tensorflow.org/api_docs/python/tf/nn/conv2d\nexport type ExplicitPadding =\n  [[number, number],
[number, number], [number, number], [number, number]];\n\nexport type PadInfo = {\n  top: number,\n  left:
number,\n  right: number,\n  bottom: number,\n  type: PadType\n};\n\nexport type PadInfo3D = {\n  top: number,\n
left: number,\n  right: number,\n  bottom: number,\n  front: number,\n  back: number,\n  type: PadType\n};\n\n/**\n * Information about the forward pass of a convolution/pooling operation.\n * It includes input and output shape,
strides, filter size and padding\n
 * information.\n */\nexport type Conv2DInfo = {\n  batchSize: number,\n  inHeight: number,\n  inWidth: number,\n
inChannels: number,\n  outHeight: number,\n  outWidth: number,\n  outChannels: number,\n  dataFormat:
'channelsFirst'|'channelsLast',\n  strideHeight: number,\n  strideWidth: number,\n  dilationHeight: number,\n
dilationWidth: number,\n  filterHeight: number,\n  filterWidth: number,\n  effectiveFilterHeight: number,\n
effectiveFilterWidth: number,\n  padInfo: PadInfo,\n  inShape: [number, number, number, number],\n  outShape:
[number, number, number, number],\n  filterShape: [number, number, number, number]};\n\n/**\n * @param
inputShape Input tensor shape is of the following dimensions:\n *   `[batch, height, width, inChannels]`.\n *
@param filterShape The filter shape is of the following dimensions:\n *   `[filterHeight, filterWidth, depth]`.\n *
@param strides The strides of the sliding window for each dimension of the\n *   input tensor: `[strideHeight,
strideWidth]`.\n
 * If `strides` is a single number,\n *   then `strideHeight == strideWidth`.\n * @param pad The type of padding
algorithm.\n *   - `same` and stride 1: output will be of same size as input,\n *   regardless of filter size.\n *
- `valid`: output will be smaller than input if filter is larger\n *   than 1*1x1.\n *   - For more info, see this guide:\n
*   [https://www.tensorflow.org/api_guides/python/nn#Convolution](\n *
https://www.tensorflow.org/api_guides/python/nn#Convolution))\n * @param dataFormat The data format of the
input and output data.\n *   Defaults to 'NHWC'.\n * @param dilations The dilation rates: `[dilationHeight,
dilationWidth]`.\n *   Defaults to `[1, 1]`. If `dilations` is a single number, then\n *   `dilationHeight ==
dilationWidth`.\n */\nexport function computeDilation2DInfo(\n  inputShape: [number, number, number,
number],\n  filterShape: [number, number, number],\n  strides: number|[number, number],\n  pad:
'same'|'valid'|number,\n  dataFormat: 'NHWC' = 'NHWC',\n  dilations: number|[number, number]) {\n  // `computerConv2DInfo` require
filterShape to be in the dimension of:\n  // `[filterHeight, filterWidth, depth, outDepth]`, dilation2d doesn't have\n
// outDepth, it should have the same depth as the input.\n  // Input shape: [batch, height, width, inChannels]\n  const
inputChannels = inputShape[3];\n  const $filterShape =\n    [...filterShape, inputChannels] as [number, number,
number, number];\n  const $dataFormat = convertConv2DDataFormat(dataFormat);\n\n  return
computeConv2DInfo(\n    inputShape, $filterShape, strides, dilations, pad,\n    null /* roundingMode */, null /*
depthWise */, $dataFormat);\n}\n\nexport function computePool2DInfo(\n  inShape: [number, number, number,
number],\n  filterSize: [number, number]|number,\n  strides: number|[number, number],\n  dilations:
number|[number, number],\n  pad: 'same'|'valid'|number,\n  roundingMode?: 'floor'|'round'|'ceil',\n  dataFormat:
'channelsFirst'|'channelsLast' = 'channelsLast'): Conv2DInfo {\n  const [filterHeight, filterWidth] =
parseTupleParam(filterSize);\n\n  let filterShape: [number, number, number, number];\n  if (dataFormat ===
'channelsLast') {\n    filterShape = [filterHeight, filterWidth, inShape[3], inShape[3]];\n  } else if (dataFormat ===
'channelsFirst') {\n    filterShape = [filterHeight, filterWidth, inShape[1], inShape[1]];\n  } else {\n    throw new
Error(`Unknown dataFormat ${dataFormat}`);\n  }\n\n  return computeConv2DInfo(\n    inShape, filterShape,
strides, dilations, pad, roundingMode, false,\n    dataFormat);\n}\n\n/**\n * Computes the information for a
forward pass of a pooling3D operation.\n */\nexport function computePool3DInfo(\n  inShape: [number, number,
number, number, number],\n  filterSize: number|[number, number, number],\n  strides: number|[number, number,
number, number],\n  dilations: number|[number, number, number],\n  pad: 'same'|'valid'|number,\n  roundingMode?:
'floor'|'round'|'ceil',\n  dataFormat: 'NDHWC'|'NCDHW' = 'NDHWC'): Conv3DInfo {\n  const [filterDepth,
filterHeight, filterWidth] = parse3TupleParam(filterSize);\n\n  let filterShape: [number, number, number, number,

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number];\n let $dataFormat: 'channelsFirst'|'channelsLast';\n if (dataFormat === 'NDHWC') {\n  $dataFormat =
'channelsLast';\n  filterShape =\n    [filterDepth, filterHeight, filterWidth, inShape[4], inShape[4]];\n } else if
(dataFormat === 'NCDHW') {\n  $dataFormat = 'channelsFirst';\n  filterShape =\n    [filterDepth, filterHeight,
filterWidth, inShape[1], inShape[1]];\n } else {\n  throw new Error(`Unknown dataFormat ${dataFormat}`);\n
}\n\n return computeConv3DInfo(\n  inShape, filterShape, strides, dilations, pad, false, $dataFormat,\n
roundingMode);\n}\n\n/**\n * Computes the information for a forward pass of a convolution/pooling\n *
operation.\n */\n\nexport function computeConv2DInfo(\n  inShape: [number, number, number, number],\n
  filterShape: [number, number, number, number],\n  strides: number|[number, number], dilations:
number|[number, number],\n  pad: 'same'|'valid'|number|ExplicitPadding,\n  roundingMode?: 'floor'|'round'|'ceil',
depthwise = false,\n  dataFormat: 'channelsFirst'|'channelsLast' = 'channelsLast'): Conv2DInfo {\n let [batchSize,
inHeight, inWidth, inChannels] = [-1, -1, -1, -1];\n if (dataFormat === 'channelsLast') {\n  [batchSize, inHeight,
inWidth, inChannels] = inShape;\n } else if (dataFormat === 'channelsFirst') {\n  [batchSize, inChannels,
inHeight, inWidth] = inShape;\n } else {\n  throw new Error(`Unknown dataFormat ${dataFormat}`);\n }\n\n
const [filterHeight, filterWidth, , filterChannels] = filterShape;\n const [strideHeight, strideWidth] =
parseTupleParam(strides);\n const [dilationHeight, dilationWidth] = parseTupleParam(dilations);\n\n const
effectiveFilterHeight =\n  getEffectiveFilterSize(filterHeight, dilationHeight);\n const effectiveFilterWidth
=\n  getEffectiveFilterSize(filterWidth, dilationWidth);\n const {padInfo, outHeight, outWidth} =
getPadAndOutInfo(\n  pad, inHeight, inWidth, strideHeight, strideWidth, effectiveFilterHeight,\n
effectiveFilterWidth, roundingMode, dataFormat);\n\n const outChannels = depthwise ? filterChannels *
inChannels : filterChannels;\n\n let outShape: [number, number, number, number];\n if (dataFormat ===
'channelsFirst') {\n  outShape = [batchSize, outChannels, outHeight, outWidth];\n } else if (dataFormat ===
'channelsLast') {\n  outShape = [batchSize, outHeight, outWidth, outChannels];\n }\n\n return {\n  batchSize,\n
dataFormat,\n  inHeight,\n  inWidth,\n  inChannels,\n  outHeight,\n  outWidth,\n  outChannels,\n
padInfo,\n  strideHeight,\n  strideWidth,\n  filterHeight,\n  filterWidth,\n  effectiveFilterHeight,\n
effectiveFilterWidth,\n  dilationHeight,\n  dilationWidth,\n  inShape,\n  outShape,\n  filterShape\n
};\n}\n\n/**\n * Information about the forward pass of a 3D convolution/pooling operation.\n * It includes input and output shape,
strides, filter size and padding\n * information.\n */\n\nexport type Conv3DInfo = {\n  batchSize: number,\n
inDepth: number,\n  inHeight: number,\n  inWidth: number,\n  inChannels: number,\n  outDepth: number,\n  outHeight:
number,\n  outWidth: number,\n  outChannels: number,\n  dataFormat: 'channelsFirst'|'channelsLast',\n  strideDepth:
number,\n  strideHeight: number,\n  strideWidth: number,\n  dilationDepth: number,\n  dilationHeight: number,\n
dilationWidth: number,\n  filterDepth: number,\n  filterHeight: number,\n  filterWidth: number,\n
effectiveFilterDepth: number,\n  effectiveFilterHeight: number,\n  effectiveFilterWidth: number,\n  padInfo:
PadInfo3D,\n  inShape: [number, number, number, number, number],\n  outShape: [number, number, number,
number, number],\n  filterShape: [number, number, number, number, number]};\n}\n\n/**\n * Computes the
information\n for a forward pass of a 3D convolution/pooling\n * operation.\n */\n\nexport function computeConv3DInfo(\n
inShape: [number, number, number, number, number],\n  filterShape: [number, number, number, number,
number],\n  strides: number|[number, number, number],\n  dilations: number|[number, number, number], pad:
'same'|'valid'|number,\n  depthwise = false,\n  dataFormat: 'channelsFirst'|'channelsLast' = 'channelsLast',\n
roundingMode?: 'floor'|'round'|'ceil'): Conv3DInfo {\n let [batchSize, inDepth, inHeight, inWidth, inChannels] =\n
[-1, -1, -1, -1, -1];\n if (dataFormat === 'channelsLast') {\n  [batchSize, inDepth, inHeight, inWidth, inChannels]
= inShape;\n } else if (dataFormat === 'channelsFirst') {\n  [batchSize, inChannels, inDepth, inHeight, inWidth]
= inShape;\n } else {\n  throw new Error(`Unknown dataFormat ${dataFormat}`);\n }\n\n const [filterDepth,
filterHeight, filterWidth, , filterChannels] =\n  filterShape;\n const [strideDepth,
strideHeight, strideWidth] = parse3TupleParam(strides);\n const [dilationDepth, dilationHeight, dilationWidth] =\n
parse3TupleParam(dilations);\n\n const effectiveFilterDepth =\n  getEffectiveFilterSize(filterDepth,
dilationDepth);\n const effectiveFilterHeight =\n  getEffectiveFilterSize(filterHeight, dilationHeight);\n const

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effectiveFilterWidth =\n  getEffectiveFilterSize(filterWidth, dilationWidth);\n const {padInfo, outDepth,
outHeight, outWidth} = get3DPadAndOutInfo(\n  pad, inDepth, inHeight, inWidth, strideDepth, strideHeight,
strideWidth,\n  effectiveFilterDepth, effectiveFilterHeight, effectiveFilterWidth,\n  roundingMode);\n\n const
outChannels = depthwise ? filterChannels * inChannels : filterChannels;\n\n let outShape: [number, number,
number, number, number];\n if (dataFormat === 'channelsFirst') {\n  outShape = [batchSize, outChannels,
outDepth, outHeight, outWidth];\n } else if (dataFormat === 'channelsLast') {\n  outShape = [batchSize,
outDepth, outHeight, outWidth, outChannels];\n }\n\n return {\n  batchSize,\n  dataFormat,\n  inDepth,\n  inHeight,\n  inWidth,\n  inChannels,\n  outDepth,\n  outHeight,\n  outWidth,\n  outChannels,\n  padInfo,\n  strideDepth,\n  strideHeight,\n  strideWidth,\n  filterDepth,\n  filterHeight,\n  filterWidth,\n  effectiveFilterDepth,\n  effectiveFilterHeight,\n  effectiveFilterWidth,\n  dilationDepth,\n  dilationHeight,\n  dilationWidth,\n  inShape,\n  outShape,\n  filterShape\n };}\n\nfunction computeOutputShape2D(\n inShape: [number, number], fieldSize: number, stride: number,\n  zeroPad?: number, roundingMode?:
'floor'|'round'|'ceil'): [number, number] {\n  if (zeroPad == null) {\n   zeroPad = computeDefaultPad(inShape,
fieldSize, stride);\n  }\n  const inputRows = inShape[0];\n  const inputCols = inShape[1];\n  const outputRows =\n    round((inputRows - fieldSize + 2 * zeroPad) / stride + 1, roundingMode);\n  const outputCols =\n    round((inputCols - fieldSize + 2 * zeroPad) / stride + 1, roundingMode);\n  return
[outputRows, outputCols];}\n\nfunction computeOutputShape4D(\n  inShape: [number, number, number,
number], fieldSize: number,\n  outChannels: number, stride: number, zeroPad?: number,\n  roundingMode?:
'floor'|'round'|'ceil'): [number, number, number, number] {\n  if (zeroPad == null) {\n   zeroPad =
computeDefaultPad(inShape, fieldSize, stride);\n  }\n  const inputDepth = inShape[0];\n  const inputRows =
inShape[1];\n  const inputCols = inShape[2];\n  const outputDepths =\n    round((inputDepth - fieldSize + 2 *
zeroPad) / stride + 1, roundingMode);\n  const outputRows =\n    round((inputRows - fieldSize + 2 *
zeroPad) / stride + 1, roundingMode);\n  const outputCols =\n    round((inputCols - fieldSize + 2 *
zeroPad) / stride + 1,
roundingMode);\n  return [outputDepths, outputRows, outputCols, outChannels];}\n\nexport function
computeDefaultPad(\n  inputShape:
[number, number][[number, number, number, number],\n  fieldSize: number, stride: number, dilation = 1): number
{\n  const effectiveFieldSize = getEffectiveFilterSize(fieldSize, dilation);\n  return Math.floor(\n    (inputShape[0]
* (stride - 1) - stride + effectiveFieldSize) / 2);\n}\n\nfunction parseTupleParam(param: number|number[]):
[number, number, number] {\n  if (typeof param === 'number') {\n   return [param, param, param];\n  }\n  if
(param.length === 2) {\n   return [param[0], param[1], 1];\n  }\n  return param as [number, number,
number];}\n\nfunction parse3TupleParam(param: number|[number, number, number]):\n  [number, number,
number] {\n  return typeof param === 'number' ? [param, param, param] : param;\n}\n\n/* See
https://www.tensorflow.org/api\_docs/python/tf/nn/atrous\_conv2d\n * Atrous convolution is equivalent to standard
convolution with upsampled\n * filters with effective_filter_height =\n * filter_height + (filter_height - 1) * (dilation
- 1)\n * and effective_filter_width =\n * filter_width + (filter_width - 1) * (dilation - 1),\n * produced by inserting dilation
- 1 zeros along consecutive elements across\n * the filters' spatial dimensions.\n * When there is a dilation, this
converts a filter dimension to the\n * effective filter dimension, so it can be used in a standard convolution.\n
*\n\nfunction getEffectiveFilterSize(filterSize: number, dilation: number) {\n  if (dilation <= 1) {\n   return
filterSize;\n  }\n  return filterSize + (filterSize - 1) * (dilation - 1);\n}\n\nfunction getPadAndOutInfo(\n  pad:
'same'|'valid'|number|ExplicitPadding, inHeight: number,\n  inWidth: number, strideHeight: number, strideWidth:
number,\n  filterHeight: number, filterWidth: number,\n  roundingMode: 'floor'|'round'|'ceil',\n  dataFormat:
'channelsFirst'|'channelsLast'): {padInfo: PadInfo, outHeight: number, outWidth: number} {\n  let padInfo:
PadInfo;\n  let outHeight: number;\n  let outWidth: number;\n  if (typeof
pad === 'number') {\n   const padType = (pad === 0) ? 'VALID' : 'NUMBER';\n   padInfo = {top: pad, bottom:
pad, left: pad, right: pad, type: padType};\n   const outShape = computeOutputShape2D(\n     [inHeight, inWidth],
filterHeight, strideHeight, pad, roundingMode);\n   outHeight = outShape[0];\n   outWidth = outShape[1];\n  } else
if (pad === 'same') {\n   outHeight = Math.ceil(inHeight / strideHeight);\n   outWidth = Math.ceil(inWidth /

```

```

strideWidth);\n  const padAlongHeight =\n    Math.max(0, (outHeight - 1) * strideHeight + filterHeight -
inHeight);\n  const padAlongWidth =\n    Math.max(0, (outWidth - 1) * strideWidth + filterWidth - inWidth);\n
const top = Math.floor(padAlongHeight / 2);\n  const bottom = padAlongHeight - top;\n  const left =
Math.floor(padAlongWidth / 2);\n  const right = padAlongWidth - left;\n  padInfo = {top, bottom, left, right, type:
'SAME'};\n } else if (pad === 'valid') {\n  padInfo = {top: 0, bottom: 0, left: 0, right:
0, type: 'VALID'};\n  outHeight = Math.ceil((inHeight - filterHeight + 1) / strideHeight);\n  outWidth =
Math.ceil((inWidth - filterWidth + 1) / strideWidth);\n } else if (typeof pad === 'object') {\n  const top =
dataFormat === 'channelsLast' ? pad[1][0] : pad[2][0];\n  const bottom = dataFormat === 'channelsLast' ?
pad[1][1] : pad[2][1];\n  const left = dataFormat === 'channelsLast' ? pad[2][0] : pad[3][0];\n  const right =
dataFormat === 'channelsLast' ? pad[2][1] : pad[3][1];\n  const padType = (top === 0 && bottom === 0 && left
=== 0 && right === 0) ?\n    'VALID' :\n    'EXPLICIT';\n  padInfo = {top, bottom, left, right, type:
padType};\n  outHeight = round(\n    (inHeight - filterHeight + top + bottom) / strideHeight + 1,\n
roundingMode);\n  outWidth = round(\n    (inWidth - filterWidth + left + right) / strideWidth + 1,\n
roundingMode);\n } else {\n  throw Error(`Unknown padding parameter: ${pad}`);\n }\n return {padInfo,
outHeight,
outWidth};\n}\n\nfunction get3DPadAndOutInfo(\n  pad: 'same'|'valid'|number, inDepth: number, inHeight:
number,\n  inWidth: number, strideDepth: number, strideHeight: number, strideWidth: number, filterDepth:
number, filterHeight: number,\n  filterWidth: number, roundingMode?: 'floor'|'round'|'ceil'): {\n  padInfo:
PadInfo3D,\n  outDepth: number,\n  outHeight: number,\n  outWidth: number}\n {\n  let padInfo: PadInfo3D;\n  let
outDepth: number;\n  let outHeight: number;\n  let outWidth: number;\n\n  if (typeof pad === 'number') {\n  const
padType = (pad === 0) ? 'VALID' : 'NUMBER';\n  padInfo = {\n    top: pad,\n    bottom: pad,\n    left: pad,\n
right: pad,\n    front: pad,\n    back: pad,\n    type: padType\n  };\n  const outShape =
computeOutputShape4D(\n    [inDepth, inHeight, inWidth, 1], filterDepth, 1, strideDepth, pad,\n
roundingMode);\n  outDepth = outShape[0];\n  outHeight = outShape[1];\n  outWidth = outShape[2];\n
} else if (pad === 'same') {\n  outDepth = Math.ceil(inDepth / strideDepth);\n  outHeight = Math.ceil(inHeight /
strideHeight);\n  outWidth = Math.ceil(inWidth / strideWidth);\n  const padAlongDepth = (outDepth - 1) *
strideDepth + filterDepth - inDepth;\n  const padAlongHeight =\n    (outHeight - 1) * strideHeight + filterHeight
- inHeight;\n  const padAlongWidth = (outWidth - 1) * strideWidth + filterWidth - inWidth;\n  const front =
Math.floor(padAlongDepth / 2);\n  const back = padAlongDepth - front;\n  const top =
Math.floor(padAlongHeight / 2);\n  const bottom = padAlongHeight - top;\n  const left =
Math.floor(padAlongWidth / 2);\n  const right = padAlongWidth - left;\n\n  padInfo = {top, bottom, left, right,
front, back, type: 'SAME'};\n } else if (pad === 'valid') {\n  padInfo = {\n    top: 0,\n    bottom: 0,\n    left: 0,\n
right: 0,\n    front: 0,\n    back: 0,\n    type: 'VALID'\n  };\n  outDepth = Math.ceil((inDepth - filterDepth
+ 1) / strideDepth);\n  outHeight = Math.ceil((inHeight - filterHeight + 1) / strideHeight);\n  outWidth =
Math.ceil((inWidth - filterWidth + 1) / strideWidth);\n } else {\n  throw Error(`Unknown padding parameter:
${pad}`);\n }\n return {padInfo, outDepth, outHeight, outWidth};\n}\n\n/**\n * Rounds a value depending on the
rounding mode\n * @param value\n * @param roundingMode A string from: 'ceil', 'round', 'floor'. If none is\n *
provided, it will default to truncate.\n */\nfunction round(value: number, roundingMode?: 'floor'|'round'|'ceil') {\n  if
(!roundingMode) {\n    return Math.trunc(value);\n  }\n  switch (roundingMode) {\n    case 'round':\n      // used for
Caffe Conv\n      return Math.round(value);\n    case 'ceil':\n      // used for Caffe Pool\n      return Math.ceil(value);\n
case 'floor':\n      return Math.floor(value);\n    default:\n      throw new Error(`Unknown roundingMode
${roundingMode}`);\n  }\n}\n\nexport function tupleValuesAreOne(param:
number|number[]): boolean {\n  const [dimA, dimB, dimC] = parseTupleParam(param);\n  return dimA === 1 &&
dimB === 1 && dimC === 1;\n}\n\nexport function eitherStridesOrDilationsAreOne(\n  strides: number|number[],
dilations: number|number[]): boolean {\n  return tupleValuesAreOne(strides) ||
tupleValuesAreOne(dilations);\n}\n\n/**\n * Convert Conv2D dataFormat from 'NHWC'|'NCHW' to\n *
'channelsLast'|'channelsFirst'\n * @param dataFormat in 'NHWC'|'NCHW' mode\n * @return dataFormat in
'channelsLast'|'channelsFirst' mode\n * @throws unknown dataFormat\n */\nexport function

```

convertConv2DDataFormat(dataFormat: 'NHWC'|'NCHW');\n 'channelsLast'|'channelsFirst' {\n if (dataFormat === 'NHWC') {\n return 'channelsLast';\n } else if (dataFormat === 'NCHW') {\n return 'channelsFirst';\n } else {\n throw new Error('Unknown dataFormat \${dataFormat}');\n }\n}\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License,

Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```
=====\n*\n\nimport {ENGINE} from './engine';\nimport {Reshape, ReshapeAttrs, ReshapeInputs} from './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {Rank, ShapeMap, TensorLike} from './types';\nimport {op} from './operation';\n\n/**\n * Reshapes a `tf.Tensor` to a given shape.\n * Given an input tensor, returns a new tensor with the same values as the\n * input tensor with shape `shape`.\n * If one component of shape is the special value -1, the size of that\n * dimension is computed so that the total size remains constant. In\n * particular, a shape of [-1] flattens into 1-D. At most one component of\n * shape can be -1.\n * If shape is 1-D or higher, then the operation returns a tensor with shape\n * shape filled with the values of tensor. In this case, the number of\n * elements implied by shape must be the same as the number of elements in\n * tensor.\n * `const x = tf.tensor1d([1, 2, 3, 4]);\n * x.reshape([2, 2]).print();`\n * @param x The input tensor to be reshaped.\n * @param shape An array of integers defining the output tensor shape.\n * @doc {heading: 'Tensors', subheading: 'Transformations'}\n */\nfunction reshape_<R extends Rank>(\n  x: Tensor|TensorLike,\n  shape: ShapeMap[R]): Tensor<R> {\n  const $x = convertToTensor(x, 'x', 'reshape', 'string_or_numeric');\n  const inputs: ReshapeInputs = {x: $x};\n  const attrs: ReshapeAttrs = {shape};\n  return ENGINE.runKernel(\n    Reshape, inputs as {} as NamedTensorMap, attrs as {} as NamedAttrMap);\n}\n\nexport const reshape =\n  op({reshape_});\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport {ENGINE} from './engine';\nimport {AvgPool, AvgPoolAttrs, AvgPoolInputs} from './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor3D, Tensor4D} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport * as util from './util';\nimport {cast} from './cast';\nimport * as conv_util from './conv_util';\nimport {op} from './operation';\nimport {reshape} from './reshape';\n\n/**\n * Computes the 2D average pooling of an image.\n * @param x The input tensor, of rank 4 or rank 3 of shape\n * `[batch, height, width, inChannels]`. If rank 3, batch of 1 is assumed.\n * @param filterSize The filter size: `[filterHeight, filterWidth]`. If\n * `filterSize` is a single number, then `filterHeight == filterWidth`.\n * @param strides The strides of the pooling: `[strideHeight, strideWidth]`.\n * If `strides` is a single number, then `strideHeight == strideWidth`.\n * @param pad The type of padding algorithm:\n * - `same` and stride 1: output will be of same size as input,\n * regardless of filter size.\n * - `valid`: output will be smaller than input if filter is larger\n * than 1x1.\n * - For more info, see this guide:\n * [https://www.tensorflow.org/api_guides/python/nn#Convolution](\n * https://www.tensorflow.org/api_guides/python/nn#Convolution)\n * @param dimRoundingMode A string from:
```

```

'ceil', 'round', 'floor'. If none is provided, it will default to truncate.
function avgPool_<T extends Tensor3D|Tensor4D>(
  x: T|TensorLike, filterSize: [number, number]|number,
  strides: [number, number]|number, pad: 'valid'|'same'|number,
  dimRoundingMode?: 'floor'|'round'|'ceil'): T {
  const $x = convertToTensor(x, 'x', 'avgPool', 'float32');
  const dilations = 1;
  util.assert(
    conv_util.eitherStridesOrDilationsAreOne(strides,
      dilations),
    () => `Error in avgPool: Either strides or dilations must be 1.`
    `Got strides ${strides} and dilations ${dilations}`);
  let x4D = $x as Tensor4D;
  let reshapedTo4D = false;
  if ($x.rank === 3) {
    reshapedTo4D = true;
    x4D = reshape($x, [1, $x.shape[0], $x.shape[1], $x.shape[2]]);
  }
  util.assert(
    x4D.rank === 4,
    () => `Error in avgPool: x must be rank 4 but got rank ${x4D.rank}`);
  if (dimRoundingMode != null) {
    util.assert(
      util.isInt(pad as number),
      () => `Error in avgPool: pad must be an integer when using, `
      `dimRoundingMode ${dimRoundingMode} but got pad ${pad}`);
  }
  const inputs: AvgPoolInputs = {x: x4D};
  const attrs: AvgPoolAttrs = {filterSize, strides, pad,
    dimRoundingMode};
  // tslint:disable-next-line: no-unnecessary-type-assertion
  let res = ENGINE.runKernel(
    AvgPool, inputs as {} as NamedTensorMap,
    attrs as {} as NamedAttrMap) as T;
  res = cast(res, $x.dtype);
  if (reshapedTo4D) {
    return reshape(res, [res.shape[1], res.shape[2], res.shape[3]]) as T;
  }
  return res;
}
export const avgPool = op({avgPool_});

```

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```

=====
import {ENGINE}
from './engine';
import {AvgPool3D, AvgPool3DAttrs, AvgPool3DInputs} from './kernel_names';
import {NamedAttrMap} from './kernel_registry';
import {Tensor4D, Tensor5D} from './tensor';
import {NamedTensorMap} from './tensor_types';
import {convertToTensor} from './tensor_util_env';
import {TensorLike} from './types';
import * as util from './util';
import {cast} from './cast';
import {op} from './operation';
import {reshape} from './reshape';
/** Computes the 3D average pooling.
 * @param x The input tensor, of rank 5 or rank 4 of shape [batch, depth, height, width, inChannels].
 * @param filterSize The filter size: [filterDepth, filterHeight, filterWidth]. If filterSize is a single number, then filterDepth == filterHeight == filterWidth.
 * @param strides The strides of the pooling: [strideDepth, strideHeight, strideWidth]. If strides is a single number, then strideDepth == strideHeight == strideWidth.
 * @param pad The type of padding algorithm. - `same` and stride 1: output will be of same size as input, regardless of filter size. - `valid`: output will be smaller than input if filter is larger than 1*1*1. - For more info, see this guide: [https://www.tensorflow.org/api_guides/python/nn#Convolution](https://www.tensorflow.org/api_guides/python/nn#Convolution)
 * @param dimRoundingMode A string from: 'ceil', 'round', 'floor'. If none is provided, it will default to truncate.
 * @param dataFormat An optional string from: "NDHWC", "NCDHW". Defaults to "NDHWC". Specify the data format of the input and output data. With the default format "NDHWC", the data is stored in the order of: [batch, depth, height, width, channels]. Only "NDHWC" is currently supported.
 */
function avgPool3d_<T extends Tensor4D|Tensor5D>(
  x: T|TensorLike, filterSize: [number, number, number]|number,
  strides: [number, number, number]|number, pad: 'valid'|'same'|number,
  dimRoundingMode?: 'floor'|'round'|'ceil', dataFormat: 'NDHWC'|'NCDHW' = 'NDHWC'): T {
  const $x = convertToTensor(x, 'x', 'avgPool3d', 'float32');
  let x5D = $x as Tensor5D;

```


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```
=====
\n
*\n\nimport {ENGINE} from './engine';\nimport {Sigmoid, SigmoidInputs} from './kernel_names';\nimport
{Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from
 './tensor_util_env';\nimport {TensorLike} from './types';\nimport {op} from './operation';\n\n**\n
 * Computes sigmoid element-wise,  $1 / (1 + \exp(-x))$ \n * \n * tf.tensor1d([0, -1, 2, -3]);\n * \n *
x.sigmoid().print(); // or tf.sigmoid(x)\n * @param x The input tensor.\n * @doc {heading: 'Operations',
subheading: 'Basic math'}\n * \nfunction sigmoid_<T extends Tensor>(x: T|TensorLike): T {\n const $x =
convertToTensor(x, 'x', 'sigmoid');\n\n const inputs: SigmoidInputs = {x: $x};\n\n return
ENGINE.runKernel(Sigmoid, inputs as {} as NamedTensorMap);\n}\n\nexport const sigmoid =
op({sigmoid_});\n", "**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under
the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * \n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT
WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
```

```
=====
\n
*\n\nimport {ENGINE} from './engine';\nimport {Slice, SliceAttrs, SliceInputs} from './kernel_names';\nimport
{NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from
 './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {Rank, TensorLike} from
 './types';\nimport {op} from './operation';\n\n**\n
 * Extracts a slice from a `tf.Tensor` starting at coordinates
`begin`\n * and is of size `size`.\n * Also available are stricter rank-specific methods with the same signature\n *
as this method that assert that `x` is of the given rank:\n * - `tf.slice1d`\n * - `tf.slice2d`\n * - `tf.slice3d`\n * -
`tf.slice4d`\n * \n * tf.tensor1d([1, 2, 3, 4]);\n * \n * x.slice([1, [2]]).print();\n * \n * tf.tensor2d([1, 2, 3, 4], [2, 2]);\n * \n *
x.slice([1, 0], [1, 2]).print();\n * \n * @param x The input `tf.Tensor` to slice from.\n * @param begin The
coordinates to start the slice from. The length can be\n * less than the rank of x - the rest of the axes will have
implicit 0 as\n * start. Can also be a single number, in which case it specifies the\n * first axis.\n * @param size
The size of the slice. The length can be less than the rank of\n * x - the rest of the axes will have implicit -1. A
value of -1 requests\n * the rest of the dimensions in the axis. Can also be a single number,\n * in which case it
specifies the size of the first axis.\n * \n * @doc {heading: 'Tensors', subheading: 'Slicing and Joining'}\n
*\nfunction slice_<R extends Rank, T extends Tensor<R>>(\n x: T|TensorLike, begin: number|number[], size?:
number|number[]): T {\n const $x = convertToTensor(x,
'x', 'slice', 'string_or_numeric');\n\n if ($x.rank === 0) {\n throw new Error('Slicing scalar is not possible');\n
}\n\n const inputs: SliceInputs = {x: $x};\n const attrs: SliceAttrs = {begin, size};\n\n return
ENGINE.runKernel(\n Slice, inputs as {} as NamedTensorMap, attrs as {} as NamedAttrMap);\n}\n\nexport
const slice = op({slice_});\n", "**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * \n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
```

```
=====
\n
*\n\nimport {ENGINE} from './engine';\nimport {Tanh, TanhInputs} from './kernel_names';\nimport {Tensor}
from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from
 './tensor_util_env';\nimport {TensorLike} from './types';\nimport {op} from './operation';\n\n**\n
 * Computes
```

```
hyperbolic tangent of the input `tf.Tensor` element-wise: `tanh(x)`\n *\n * ``js\n * const x = tf.tensor1d([0, 1, -1, 70]);\n *\n * x.tanh().print(); // or tf.tanh(x)\n *\n * @param x The input tensor.\n *\n * @doc {heading: 'Operations', subheading: 'Basic math'}\n *\n * \nfunction tanh_<T extends Tensor>(x: T|TensorLike): T {\n  const $x = convertToTensor(x, 'x', 'tanh');\n  \n  const inputs: TanhInputs = {x: $x};\n  \n  return ENGINE.runKernel(Tanh, inputs as {} as NamedTensorMap);\n}\n\nexport const tanh = op({tanh_});\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n
```

```
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```

```
=====\n *\n * \nimport {Scalar, Tensor1D, Tensor2D} from './tensor';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport {add} from './add';\nimport {concat} from './concat';\nimport {matMul} from './mat_mul';\nimport {mul} from './mul';\nimport {op} from './operation';\nimport {sigmoid} from './sigmoid';\nimport {slice} from './slice';\nimport {tanh} from './tanh';\n\n/**\n * Computes the next state and output of a BasicLSTMCell.\n *\n * Returns [newC, newH].\n *\n * Derived from tf.contrib.rnn.BasicLSTMCell.\n *\n * @param forgetBias Forget bias for the cell.\n * @param lstmKernel The weights for the cell.\n * @param lstmBias The bias for the cell.\n * @param data The input to the cell.\n * @param c Previous cell state.\n * @param h Previous cell output.\n *\n * @doc {heading: 'Operations', subheading: 'RNN'}\n *\n * \nfunction basicLSTMCell_(\n  forgetBias: Scalar|TensorLike, lstmKernel: Tensor2D|TensorLike,\n  lstmBias: Tensor1D|TensorLike, data: Tensor2D|TensorLike,\n  c: Tensor2D|TensorLike, h: Tensor2D|TensorLike): [Tensor2D, Tensor2D] {\n  const $forgetBias =\n    convertToTensor(forgetBias, 'forgetBias', 'basicLSTMCell');\n  const $lstmKernel =\n    convertToTensor(lstmKernel, 'lstmKernel', 'basicLSTMCell');\n  const $lstmBias = convertToTensor(lstmBias, 'lstmBias',\n    'basicLSTMCell');\n  const $data = convertToTensor(data, 'data', 'basicLSTMCell');\n  const $c =\n    convertToTensor(c, 'c', 'basicLSTMCell');\n  const $h = convertToTensor(h, 'h', 'basicLSTMCell');\n  \n  const combined = concat([$data, $h], 1);\n  const weighted = matMul(combined, $lstmKernel);\n  const res: Tensor2D = add(weighted, $lstmBias);\n  \n  // i = input_gate, j = new_input, f = forget_gate, o = output_gate\n  const batchSize = res.shape[0];\n  const sliceCols = res.shape[1] / 4;\n  const sliceSize: [number, number] = [batchSize, sliceCols];\n  const i = slice(res, [0, 0], sliceSize);\n  const j = slice(res, [0, sliceCols], sliceSize);\n  const f = slice(res, [0, sliceCols * 2], sliceSize);\n  const o = slice(res, [0, sliceCols * 3], sliceSize);\n  \n  const newC: Tensor2D =\n    add(mul(sigmoid(i), tanh(j)),\n      mul($c, sigmoid(add($forgetBias, f) as Tensor2D)));\n  const newH: Tensor2D =\n    mul(tanh(newC), sigmoid(o));\n  \n  return [newC, newH];\n}\n\nexport const basicLSTMCell = op({basicLSTMCell_});\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n *\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *\n
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```
=====\n *\n * \nimport {ENGINE} from './engine';\nimport {BatchToSpaceND, BatchToSpaceNDAttrs, BatchToSpaceNDInputs} from './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport
```

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{convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport * as util from
 './util';\n\nimport {op} from './operation';\n\n/**\n * This operation reshapes the \"batch\" dimension 0 into `M + 1`
 dimensions of\n * shape `blockShape + [batch]`, interleaves these blocks back into the grid\n * defined by the
 spatial dimensions `[1, ..., M]`, to obtain a result with\n * the same rank as the input. The spatial dimensions of this
 intermediate\n * result are then optionally cropped according to `crops` to produce the\n * output. This is the reverse
 of `tf.spaceToBatchND`. See below for a precise\n * description.\n * `js`\n * const x = tf.tensor4d([1, 2, 3, 4],
 [4, 1, 1, 1]);\n * const blockShape = [2, 2];\n * const crops = [[0, 0], [0, 0]];\n * x.batchToSpaceND(blockShape,
 crops).print();\n * `@param x A `tf.Tensor`. N-D with `x.shape` = `[batch] + spatialShape +\n *
 remainingShape`, where spatialShape has `M` dimensions.\n
 * @param blockShape A 1-D array. Must have shape `[M]`, all values must\n * be  $\geq 1$ .\n * @param crops A 2-D
 array. Must have shape `[M, 2]`, all values must be  $\geq 0$ .\n * `crops[i] = [cropStart, cropEnd]` specifies the amount
 to crop from input\n * dimension `i + 1`, which corresponds to spatial dimension `i`. It is required\n * that
 `cropStart[i] + cropEnd[i] <= blockShape[i] * inputShape[i + 1]`\n * This operation is equivalent to the
 following steps:\n * 1. Reshape `x` to `reshaped` of shape: `[blockShape[0], ..., \n * blockShape[M-1], batch /
 prod(blockShape), x.shape[1], ..., \n * x.shape[N-1]]`\n * 2. Permute dimensions of `reshaped` to produce
 `permuted` of shape `[batch /\n * prod(blockShape), x.shape[1], blockShape[0], ..., x.shape[M], \n * blockShape[M-
 1], x.shape[M+1], ..., x.shape[N-1]]`\n * 3. Reshape `permuted` to produce `reshapedPermuted` of shape `[batch
 /\n * prod(blockShape), x.shape[1] * blockShape[0], ..., x.shape[M] * \n * blockShape[M-1], x.shape[M+1],
 ..., x.shape[N-1]]`\n * 4. Crop the start and end of dimensions `[1, ..., M]` of `reshapedPermuted`\n * according
 to `crops` to produce the output of shape: `[batch /\n * prod(blockShape), x.shape[1] * blockShape[0] - crops[0,0] -
 crops[0,1], \n * ..., x.shape[M] * blockShape[M-1] - crops[M-1,0] - \n * crops[M-1,1], x.shape[M+1], ..., x.shape[N-
 1]]`\n * @doc {heading: 'Tensors', subheading: 'Transformations'}\n * \nfunction batchToSpaceND_<T extends
 Tensor>(\n  x: T|TensorLike, blockShape: number[], crops: number[][]): T {\n  const $x = convertToTensor(x, 'x',
 'batchToSpaceND');\n  const prod = blockShape.reduce((a, b) => a * b);\n  util.assert(\n    $x.rank >= 1 +
 blockShape.length, \n    () => `input rank is ${$x.rank} but should be > than blockShape.length ${\n
 blockShape.length}`);\n  util.assert(\n    crops.length === blockShape.length, \n    () => `crops.length is ${\n
 crops.length} but should be equal to blockShape.length ${\n    blockShape.length}`);\n  util.assert(\n    $x.shape[0] % prod === 0, \n    () => `input tensor batch is ${\n
 $x.shape[0]} but is not
 divisible by the product of ` + \n    `the elements of blockShape ${blockShape.join(' *')} === ${prod}`);\n  const inputs: BatchToSpaceNDInputs = {x: $x};\n  const attrs: BatchToSpaceNDAttrs = {blockShape, crops};\n  return ENGINE.runKernel(\n    BatchToSpaceND, inputs as {} as NamedTensorMap, \n    attrs as {} as
 NamedAttrMap);\n  }\n\nexport const batchToSpaceND = op({batchToSpaceND_});\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
 \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
 License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
 agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n
 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License
 for the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\nimport {Tensor, Tensor4D} from './tensor';\nimport {Rank} from './types';\nimport {reshape} from
 './reshape';\n\nexport function xAs4D<R extends Rank>(x: Tensor<R>) {\n  let x4D: Tensor4D;\n  if (x.rank === 0
 || x.rank === 1) {\n    x4D = reshape(x, [1, 1, 1, x.size]);\n  } else if (x.rank === 2) {\n    x4D = reshape(x, [1, 1,
 x.shape[0], x.shape[1]]);\n  } else if (x.rank === 3) {\n    x4D = reshape(x, [1, x.shape[0], x.shape[1], x.shape[2]]);\n
  } else {\n    x4D = x as Tensor4D;\n  }\n  return x4D;\n}\n\n"/**\n * @license\n * Copyright 2020 Google LLC.
 All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this
 file except in compliance with the License.\n
 * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless
 required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an

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\"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n
 * See the License for the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {ENGINE} from './engine';\nimport {FusedBatchNorm, FusedBatchNormAttrs,\nFusedBatchNormInputs} from './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport\n{Tensor, Tensor1D, Tensor4D} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport\n{convertToTensor} from './tensor_util_env';\nimport {Rank, TensorLike} from './types';\nimport * as util from\n './util';\nimport {xAs4D} from './batchnorm_util';\nimport {op} from './operation';\nimport\n{reshape} from './reshape';\n\n/**\n * Batch normalization.\n *\n * As described in\n *\n [http://arxiv.org/abs/1502.03167](http://arxiv.org/abs/1502.03167).\n *\n * Mean, variance, scale, and offset can be\n * of two shapes:\n * - The same shape as the input.\n * - In the common case, the depth dimension is the last\n * dimension of x, so\n * the values would be an `tf.Tensor1D` of shape [depth].\n *\n * Also available are stricter\n * rank-specific methods with the same signature\n * as this method that assert that parameters passed are of given\n * rank\n * - `tf.batchNorm2d`\n * - `tf.batchNorm3d`\n * - `tf.batchNorm4d`\n *\n * @param x The input\n * Tensor.\n * @param mean A mean Tensor.\n * @param variance A variance Tensor.\n * @param offset An offset\n * Tensor.\n * @param scale A scale Tensor.\n * @param varianceEpsilon A small float number to avoid dividing by\n * 0.\n *\n * @doc {heading: 'Operations', subheading: 'Normalization'}\n */\nfunction batchNorm<R> extends\n Rank>(\n\n  x: Tensor<R>|TensorLike, mean: Tensor<R>|Tensor1D|TensorLike,\n  variance:\n  Tensor<R>|Tensor1D|TensorLike,\n  offset?: Tensor<R>|Tensor1D|TensorLike,\n  scale?:\n  Tensor<R>|Tensor1D|TensorLike,\n  varianceEpsilon?: number): Tensor<R> {\n  if (varianceEpsilon == null) {\n    varianceEpsilon = 0.001;\n  }\n  const $x = convertToTensor(x, 'x', 'batchNorm');\n  const $mean =\n  convertToTensor(mean, 'mean', 'batchNorm');\n  const $variance = convertToTensor(variance, 'variance',\n  'batchNorm');\n  let $scale: Tensor<R>|Tensor1D;\n  if (scale != null) {\n    $scale = convertToTensor(scale, 'scale',\n  'batchNorm');\n  }\n  let $offset: Tensor<R>|Tensor1D;\n  if (offset != null) {\n    $offset = convertToTensor(offset,\n  'offset', 'batchNorm');\n  }\n  util.assert(\n    $mean.rank === $variance.rank,\n    () => 'Batch normalization\n  gradient requires mean and variance to have '\n    +\n    'equal ranks.);\n  util.assert(\n    $offset == null ||\n    $mean.rank === $offset.rank,\n    () =>\n    'Batch normalization gradient requires mean and offset to have '\n    +\n    'equal ranks.);\n  util.assert(\n    $scale\n    == null || $mean.rank === $scale.rank,\n    () => 'Batch normalization gradient requires mean and scale to have '\n    +\n    'equal ranks.);\n  const x4D: Tensor4D = xAs4D($x);\n  const inputs: FusedBatchNormInputs = {\n    x: x4D,\n    scale: $scale,\n    offset: $offset,\n    mean: $mean,\n    variance: $variance\n  };\n  const attrs:\n  FusedBatchNormAttrs = {varianceEpsilon};\n  // tslint:disable-next-line: no-unnecessary-type-assertion\n  const\n  res = ENGINE.runKernel(\n    FusedBatchNorm, inputs as { } as NamedTensorMap,\n    attrs as { }\n  as NamedAttrMap) as Tensor<R>;\n  return reshape(res, $x.shape);\n}\n\nexport const batchNorm =\n op({batchNorm_});\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under\n * the Apache License, Version 2.0 (the \"License\");\n * you may not use this file\n * except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n */\n\n=====
*\nimport {Tensor1D, Tensor2D} from './tensor';\nimport {convertToTensor} from './tensor_util_env';\nimport\n{TensorLike} from './types';\nimport * as util from './util';\nimport {batchNorm} from './batchnorm';\nimport\n{op} from './operation';\n\n/**\n * Batch normalization, strictly for 2D. For the more relaxed version, see\n *\n `tf.batchNorm`.\n *\n * @param x The input Tensor.\n * @param mean A mean Tensor.\n * @param variance A\n * variance

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Tensor.\n * @param offset An offset Tensor.\n * @param scale A scale Tensor.\n * @param varianceEpsilon A
small float number to avoid dividing by 0.\n */\nfunction batchNorm2d(\n  x: Tensor2D|TensorLike, mean:
Tensor2D|Tensor1D|TensorLike,\n  variance: Tensor2D|Tensor1D|TensorLike,\n  offset?:
Tensor2D|Tensor1D|TensorLike, scale?: Tensor2D|Tensor1D|TensorLike,\n  varianceEpsilon?: number):
Tensor2D {\n  const $x = convertToTensor(x, 'x', 'batchNorm');\n  const $mean = convertToTensor(mean, 'mean',
'batchNorm');\n  const $variance = convertToTensor(variance, 'variance', 'batchNorm');\n  let $scale:
Tensor2D|Tensor1D;\n  if (scale != null) {\n    $scale = convertToTensor(scale, 'scale', 'batchNorm');\n  }\n  let
$offset: Tensor2D|Tensor1D;\n  if (offset != null) {\n    $offset = convertToTensor(offset, 'offset', 'batchNorm');\n
}\n  util.assert(\n    $x.rank === 2,\n    () => `Error in batchNorm2D: x must be rank 2 but got rank ` +\n
`${$x.rank}.`);\n  util.assert(\n    $mean.rank === 2 || $mean.rank === 1,\n    () => `Error in batchNorm2D: mean must be rank 2 or rank 1 but `
+\n    `got rank ${$mean.rank}.`);\n  util.assert(\n    $variance.rank === 2 || $variance.rank === 1,\n    () =>
`Error in batchNorm2D: variance must be rank 2 or rank 1 ` +\n    `but got rank ${$variance.rank}.`);\n  if
($scale != null) {\n    util.assert(\n      $scale.rank === 2 || $scale.rank === 1,\n      () => `Error in batchNorm2D:
scale must be rank 2 or rank 1 ` +\n      `but got rank ${$scale.rank}.`);\n  }\n  if ($offset != null) {\n
util.assert(\n    $offset.rank === 2 || $offset.rank === 1,\n    () => `Error in batchNorm2D: offset must be rank 2
or rank 1 ` +\n    `but got rank ${$offset.rank}.`);\n  }\n  return batchNorm($x, $mean, $variance, $offset,
$scale, varianceEpsilon);\n}\n\nexport const batchNorm2d = op({batchNorm2d});\n"/**\n * @license\n *
Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with
the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n
*\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is
distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n */
=====\n
*/\nimport {Tensor1D, Tensor3D} from '../tensor';\nimport {convertToTensor} from '../tensor_util_env';\nimport
{TensorLike} from '../types';\nimport * as util from '../util';\n\nimport {batchNorm} from './batchnorm';\nimport
{op} from './operation';\n\n/**\n * Batch normalization, strictly for 3D. For the more relaxed version, see\n
`tf.batchNorm`. \n */\n\n * @param x The input Tensor.\n * @param mean A mean Tensor.\n * @param variance A variance Tensor.\n *
@param offset An offset Tensor.\n * @param scale A scale Tensor.\n * @param varianceEpsilon A small float
number to avoid dividing by 0.\n */\nfunction batchNorm3d(\n  x: Tensor3D|TensorLike, mean:
Tensor3D|Tensor1D|TensorLike,\n  variance: Tensor3D|Tensor1D|TensorLike,\n  offset?:
Tensor3D|Tensor1D|TensorLike, scale?: Tensor3D|Tensor1D|TensorLike,\n  varianceEpsilon?: number):
Tensor3D {\n  const $x = convertToTensor(x, 'x', 'batchNorm');\n  const $mean = convertToTensor(mean, 'mean',
'batchNorm');\n  const $variance = convertToTensor(variance, 'variance', 'batchNorm');\n  let $scale:
Tensor3D|Tensor1D;\n  if (scale != null) {\n    $scale = convertToTensor(scale, 'scale', 'batchNorm');\n  }\n  let
$offset: Tensor3D|Tensor1D;\n  if (offset != null) {\n    $offset = convertToTensor(offset, 'offset', 'batchNorm');\n
}\n  util.assert(\n    $x.rank === 3,\n    () => `Error
in batchNorm3D: x must be rank 3 but got rank ` +\n    `${$x.rank}.`);\n  util.assert(\n    $mean.rank === 3 ||
$mean.rank === 1,\n    () => `Error in batchNorm3D: mean must be rank 3 or rank 1 but ` +\n    `got rank
${$mean.rank}.`);\n  util.assert(\n    $variance.rank === 3 || $variance.rank === 1,\n    () => `Error in
batchNorm3D: variance must be rank 3 or rank 1 ` +\n    `but got rank ${$variance.rank}.`);\n  if ($scale != null)
{\n    util.assert(\n      $scale.rank === 3 || $scale.rank === 1,\n      () => `Error in batchNorm3D: scale must be
rank 3 or rank 1 ` +\n      `but got rank ${$scale.rank}.`);\n  }\n  if ($offset != null) {\n    util.assert(\n
$offset.rank === 3 || $offset.rank === 1,\n    () => `Error in batchNorm3D: offset must be rank 3 or rank 1 ` +\n
    `but got rank ${$offset.rank}.`);\n  }\n  return batchNorm($x, $mean, $variance, $offset, $scale,
varianceEpsilon);\n}

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varianceEpsilon);\n\nexport const batchNorm3d = op({batchNorm3d_});\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

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=====\n
*\nimport {Tensor1D, Tensor4D} from './tensor';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport * as util from './util';\nimport {batchNorm} from './batchnorm';\nimport {op} from './operation';\n\n/*\n * Batch normalization, strictly for 4D. For the more relaxed version, see\n * tf.batchNorm`.\n * @param x The input Tensor.\n * @param mean A mean Tensor.\n * @param variance A variance Tensor.\n * @param offset An offset Tensor.\n * @param scale A scale Tensor.\n * @param varianceEpsilon A small float number to avoid dividing by 0.\n */\nfunction batchNorm4d_(\n  x: Tensor4D|TensorLike, mean: Tensor4D|Tensor1D|TensorLike,\n  variance: Tensor4D|Tensor1D|TensorLike,\n  offset?: Tensor4D|Tensor1D|TensorLike, scale?:\n  Tensor4D|Tensor1D|TensorLike,\n  varianceEpsilon?: number): Tensor4D {\n  const $x = convertToTensor(x, 'x', 'batchNorm');\n  const $mean = convertToTensor(mean, 'mean', 'batchNorm');\n  const $variance =\n  convertToTensor(variance, 'variance', 'batchNorm');\n  let $scale: Tensor4D|Tensor1D;\n  if (scale != null) {\n    $scale = convertToTensor(scale, 'scale', 'batchNorm');\n  }\n  let $offset: Tensor4D|Tensor1D;\n  if (offset != null)\n  {\n    $offset = convertToTensor(offset,\n  'offset', 'batchNorm');\n  }\n  util.assert(\n    $x.rank === 4,\n    () => `Error in batchNorm4D: x must be rank 4 but got rank ` +\n    `${$x.rank}.`);\n  util.assert(\n    $mean.rank === 4 || $mean.rank === 1,\n    () => `Error in batchNorm4D: mean must be rank 4 or rank 1 but ` +\n    `got rank ${$mean.rank}.`);\n  util.assert(\n    $variance.rank === 4 || $variance.rank === 1,\n    () => `Error in batchNorm4D: variance must be rank 4 or rank 1 ` +\n    `but got rank ${$variance.rank}.`);\n  if ($scale != null) {\n    util.assert(\n      $scale.rank === 4 ||\n      $scale.rank === 1,\n      () => `Error in batchNorm4D: scale must be rank 4 or rank 1 ` +\n      `but got rank ${$scale.rank}.`);\n  }\n  if ($offset != null) {\n    util.assert(\n      $offset.rank === 4 || $offset.rank === 1,\n      () => `Error in batchNorm4D: offset must be rank 4 or rank 1 ` +\n      `but got rank ${$offset.rank}.`);\n  }\n  return batchNorm($x, $mean,\n  $variance, $offset, $scale, varianceEpsilon);\n}\n\nexport const batchNorm4d = op({batchNorm4d_});\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

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=====\n
*\nimport {ENGINE} from './engine';\nimport {Bincount, BincountAttrs, BincountInputs} from './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor1D} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport * as util from './util';\nimport {op} from './operation';\n\n/*\n * Outputs a vector with length `size` and the same dtype as `weights`.\n * If `weights` are empty, then index `i` stores the number of times the value\n * `i` is counted in `x`. If `weights` are non-empty, then index `i`\n * stores the\n * sum of the value in `weights` at each index where the corresponding value in\n * `x` is `i`.\n * Values in `x` outside of the range [0, size) are ignored.\n * @param x The input int tensor, rank 1.\n * @param weights The weights tensor, must have the same shape as x, or a\n * length-0 Tensor, in which case it acts as all weights equal to 1.\n * @param size Non-negative integer.\n * @doc {heading: 'Operations',

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subheading: 'Reduction')\n *\nfunction bincount_<T extends Tensor1D>(\n  x: T|TensorLike,
  weights: T|TensorLike, size: number): T {\n  const $x = convertToTensor(x, 'x', 'bincount');\n  const $weights =
convertToTensor(weights, 'weights', 'bincount');\n  util.assert(\n    $x.dtype === 'int32',\n    () => `Error in
bincount: input ` +\n      `dtype must be int32, but got ${$x.dtype}`);\n  util.assert(size >= 0, () => `size must be
non-negative, but got ${size}.`);\n  util.assert(\n    $weights.size === $x.size || $weights.size === 0,\n    () =>
`Error in bincount: weights must have the same size as input or ` +\n      `0-length, but got input shape:
${$x.shape}, weights shape: ` +\n      `${$weights.shape}.`);\n  const inputs: BincountInputs = {x: $x, weights:
$weights};\n  const attrs: BincountAttrs = {size};\n  return ENGINE.runKernel(\n    Bincount, inputs as {} as
NamedTensorMap, attrs as {} as NamedAttrMap);\n}\n\nexport const bincount = op({bincount_});\n"/**\n *
@license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with
the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is
distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *
=====
*\n\nimport {ENGINE} from '../engine';\nimport {Tile, TileAttrs, TileInputs} from '../kernel_names';\nimport
{NamedAttrMap} from '../kernel_registry';\nimport {Tensor} from '../tensor';\nimport {NamedTensorMap} from
 '../tensor_types';\nimport {convertToTensor} from '../tensor_util_env';\nimport {Rank, ShapeMap, TensorLike}
from '../types';\nimport {clone} from
 '../clone';\nimport {op} from '../operation';\nimport {reshape} from '../reshape';\n\n/**\n * Broadcast an array to a
compatible shape NumPy-style.\n * The tensor's shape is compared to the broadcast shape from end to
beginning.\n * Ones are prepended to the tensor's shape until it has the same length as\n * the broadcast
shape. If input.shape[i]==shape[i], the (i+1)-th axis is\n * already broadcast-compatible. If input.shape[i]==1
and shape[i]==N, then\n * the input tensor is tiled N times along that axis (using tf.tile).\n * @param input The
tensor that is to be broadcasted.\n * @param shape The input is to be broadcast to this shape.\n * @doc
{heading: 'Tensors', subheading: 'Transformations'}\n *\nfunction broadcastTo_<R extends Rank>(\n  x:
Tensor|TensorLike, shape: ShapeMap[R]): Tensor<R> {\n  let input = convertToTensor(x, 'broadcastTo', 'x');\n  const
xShape = input.shape;\n  if (shape.some(d => !(d > 0) || d % 1 !== 0)) {\n    throw new Error(`broadcastTo():
Invalid
broadcast shape [${shape}].`);\n  }\n  if (shape.length < input.rank) {\n    throw new Error(`broadcastTo():
shape.length=${shape.length} < input.rank=${\n      input.rank}.`);\n  }\n  if (shape.length > input.rank) {\n
const newShape = input.shape.slice();\n    while (newShape.length < shape.length) {\n      newShape.unshift(1);\n
    }\n    input = reshape(input, newShape);\n  }\n  const inputShape = input.shape;\n  const reps: number[] =
Array.from(shape);\n  for (let i = shape.length - 1; i >= 0; i--) {\n    if (inputShape[i] === shape[i]) {\n     
reps[i] = 1;\n    } else if (inputShape[i] !== 1) {\n      throw new Error(\n        `broadcastTo(): [${xShape}]
cannot be
broadcast to [${shape}].`);\n    }\n  }\n  const axes = reps.map((n, i) => n > 1 ? i : -1).filter(i => i >= 0);\n  if
(axes.length === 0) {\n    return clone(input) as Tensor<R>;\n  }\n  // TODO call broadcastTo kernel directly once
backends implement broadcastTo\n  const inputs: TileInputs = {x:
input};\n  const attrs: TileAttrs = {reps};\n  return ENGINE.runKernel(\n    Tile, inputs as {} as
NamedTensorMap, attrs as unknown as NamedAttrMap);\n}\n\nexport const broadcastTo =
op({broadcastTo_});\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with
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Unless required by applicable law or agreed to in writing, software\n * distributed under the License is
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express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the

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=====\n\n*\n\nimport {ENGINE} from './engine';\nimport {Ceil, CeilInputs} from './kernel_names';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\n\nimport {op} from './operation';\n\n/**\n * Computes ceiling of input `tf.Tensor` element-wise: `ceil(x)`\n *\n * const x = tf.tensor1d([.6, 1.1, -3.3]);\n *\n * x.ceil().print(); // or tf.ceil(x)\n *\n * @param x The input Tensor.\n *\n * @doc {heading: 'Operations', subheading: 'Basic math'}\n *\n *function ceil_<T extends Tensor>(x: T|TensorLike): T {\n  const $x = convertToTensor(x, 'x', 'ceil');\n  const inputs: CeilInputs = {x: $x};\n  return ENGINE.runKernel(Ceil, inputs as { } as NamedTensorMap);\n}\n\nexport const ceil = op({ceil_});\n", "/**\n *\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *\n
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=====\n\n*\n\nimport {ENGINE} from './engine';\nimport {ClipByValue, ClipByValueAttrs, ClipByValueInputs} from './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\n\nimport * as util from './util';\n\nimport {op} from './operation';\n\n/**\n * Clips values element-wise. `max(min(x, clipValueMax), clipValueMin)`\n *\n * const x = tf.tensor1d([-1, 2, -3, 4]);\n *\n * x.clipByValue(-2, 3).print(); // or tf.clipByValue(x, -2, 3)\n *\n * @param x The input tensor.\n * @param clipValueMin Lower-bound of range to be clipped to.\n * @param clipValueMax Upper-bound of range to be clipped to.\n *\n * @doc {heading: 'Operations', subheading: 'Basic math'}\n *\n *function clipByValue_<T extends Tensor>(x: T|TensorLike, clipValueMin: number, clipValueMax: number): T {\n  const $x = convertToTensor(x, 'x', 'clipByValue');\n  util.assert(\n    (clipValueMin <= clipValueMax),\n    () => `Error in clip: min (${clipValueMin}) must be ` +\n      `less than or equal to max (${clipValueMax}).`);\n  const inputs: ClipByValueInputs = {x: $x};\n  const attrs: ClipByValueAttrs = {clipValueMin, clipValueMax};\n  return ENGINE.runKernel(\n    ClipByValue, inputs as { } as NamedTensorMap, attrs as { } as NamedAttrMap);\n}\n\nexport const clipByValue = op({clipByValue_});\n", "/**\n *\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *\n
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=====\n\n*\n\nimport {Tensor1D} from './tensor';\nimport {TensorLike} from './types';\n\nimport {concat} from './concat';\nimport {op} from './operation';\n\n/**\n * Concatenates a list of tf.Tensor1D's along an axis. See `concat` for details.\n *\n * For example, if:\n * A: shape(3) = [r1, g1, b1]\n * B: shape(2) = [r2, g2]\n * C = tf.concat1d([A, B]) == [r1, g1, b1, r2, g2]\n *\n * @param tensors A list of tf.Tensor's to concatenate.\n * @return The concatenated array.\n *\n *function concat1d_(tensors: Array<Tensor1D|TensorLike>): Tensor1D {\n  return concat(tensors, 0 /* axis */);\n}\n\nexport const concat1d = op({concat1d_});\n", "/**\n *\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
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```
=====  
^import {Tensor2D} from './tensor';import {TensorLike} from './types';import {concat} from  
 './concat';import {op} from './operation';  
/** Concatenates a list of tf.Tensor2D's along an axis. See  
 `concat` for details.  
 * For example, if:  
 * A: shape(2, 3) = | r1, g1, b1 | r2, g2, b2  
 * B: shape(2, 3) = | r3, g3, b3 | r4, g4, b4  
 * C = tf.concat2d([A, B], axis)  
 * if axis = 0:  
 * C: shape(4, 3) = | r1, g1, b1 | r2, g2, b2 | r3, g3, b3 | r4, g4, b4  
 * if axis = 1:  
 * C = shape(2, 6) = | r1, g1, b1, r3, g3, b3 | r2, g2, b2, r4, g4, b4  
 * @param tensors A list of `tf.Tensor`'s to concatenate.  
 * @param axis The axis to concatenate along.  
 * @return The concatenated array.  
 */  
function concat2d_(  
  tensors: Array<Tensor2D|TensorLike>, axis: number):  
  Tensor2D {  
  return concat(tensors, axis);  
}  
export const concat2d = op({concat2d_});  
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 limitations under the License.  
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=====  
^import {Tensor3D} from './tensor';import {TensorLike} from './types';import {concat} from  
 './concat';import {op} from './operation';  
/** Concatenates a list of `tf.Tensor3D`'s  
 along an axis. See `concat` for details.  
 * For example, if:  
 * A: shape(2, 1, 3) = | r1, g1, b1 | r2, g2, b2  
 * B: shape(2, 1, 3) = | r3, g3, b3 | r4, g4, b4  
 * C = tf.concat3d([A, B],  
 axis)  
 * if axis = 0:  
 * C: shape(4, 1, 3) = | r1, g1, b1 | r2, g2, b2 | r3, g3, b3  
 * if axis = 1:  
 * C: shape(2, 2, 3) = | r1, g1, b1, r3, g3, b3 | r2,  
 g2, b2, r4, g4, b4  
 * if axis = 2:  
 * C = shape(2, 1, 6) = | r1, g1, b1, r3, g3, b3 | r2, g2, b2,  
 r4, g4, b4  
 * @param tensors A list of `tf.Tensor`'s to concatenate.  
 * @param axis The axis to concatenate  
 along.  
 * @return The concatenated array.  
 */  
function concat3d_(  
  tensors: Array<Tensor3D|TensorLike>,  
  axis: number): Tensor3D {  
  return concat(tensors, axis);  
}  
export const concat3d =  
  op({concat3d_});  
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 limitations under the  
 License.  
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```
=====  
^import {Tensor4D} from './tensor';import {TensorLike} from './types';import {concat} from  
 './concat';import {op} from './operation';  
/** Concatenates a list of `tf.Tensor4D`'s along an axis. See  
 `concat` for details.  
 * @param tensors  
 A list of `tf.Tensor`'s to concatenate.  
 * @param axis The axis to concatenate along.  
 * @return The concatenated  
 array.  
 */  
function concat4d_(  
  tensors: Array<Tensor4D|TensorLike>,  
  axis: number): Tensor4D {  
  return  
  concat(tensors, axis);  
}  
export const concat4d = op({concat4d_});  
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```
=====\n *\nimport {ENGINE} from '../engine';\nimport {Conv2D, Conv2DAttrs, Conv2DInputs} from\n '../kernel_names';\nimport {NamedAttrMap} from '../kernel_registry';\nimport {Tensor3D, Tensor4D} from\n '../tensor';\nimport {NamedTensorMap} from '../tensor_types';\nimport {convertToTensor} from\n '../tensor_util_env';\nimport {TensorLike} from '../types';\nimport * as util from '../util';\nimport * as conv_util\n from '../conv_util';\nimport {op} from '../operation';\nimport {reshape} from '../reshape';\n\n/**\n * Computes a 2D\n convolution over the input x.\n * @param x The input tensor, of rank 4 or rank 3, of shape\n *   `[batch, height,\n width, inChannels]`. If rank 3, batch of 1 is\n * assumed.\n * @param filter The filter, rank 4, of shape\n *   `[filterHeight, filterWidth, inDepth, outDepth]`.\n * @param strides The strides of the convolution: `[strideHeight,\n * strideWidth]`.\n * @param pad The type of padding algorithm.\n *   - `same` and stride 1: output will be of\n same size as input,\n *   regardless of filter size.\n *   - `valid`: output will be smaller than input if filter is\n larger\n *   than 1x1.\n *   - For more info, see this guide:\n *   [https://www.tensorflow.org/api_guides/python/nn#Convolution](\n * https://www.tensorflow.org/api_guides/python/nn#Convolution)\n * @param dataFormat: An optional string from:\n *   `\"NHWC\"`, `\"NCHW\"`. Defaults to\n *   `\"NHWC\"`. Specify the data format of the input and output data. With\n the\n *   default format `\"NHWC\"`, the data is stored in the order of: [batch,\n *   height, width, channels].\n * @param dilations The dilation rates: `[dilationHeight, dilationWidth]`\n *   in which we sample input values across\n the height and width dimensions\n *   in atrous convolution. Defaults to `[1, 1]`. If `dilations` is a single\n *   number, then `dilationHeight == dilationWidth`. If it is greater than\n *   1, then all values of `strides` must be 1.\n * @param dimRoundingMode A string\n from: 'ceil', 'round', 'floor'. If none is\n *   provided, it will default to truncate.\n */\n * @doc {heading:\n 'Operations', subheading: 'Convolution'}\n * @function conv2d<T extends Tensor3D|Tensor4D>(\n x:\n T|TensorLike, filter: Tensor4D|TensorLike,\n strides: [number, number]number,\n pad:\n 'valid'|'same'|number|conv_util.ExplicitPadding,\n dataFormat: 'NHWC'|'NCHW' = 'NHWC',\n dilations:\n [number, number]number = [1, 1],\n dimRoundingMode?: 'floor'|'round'|'ceil'): T {\n const $x =\n convertToTensor(x, 'x', 'conv2d');\n const $filter = convertToTensor(filter, 'filter', 'conv2d');\n let x4D = $x as\n Tensor4D;\n let reshapedTo4D = false;\n if ($x.rank === 3) {\n reshapedTo4D = true;\n x4D = reshape($x,\n [1, $x.shape[0], $x.shape[1], $x.shape[2]]);\n }\n util.assert(\n x4D.rank === 4,\n () => `Error in conv2d:\n input must be rank 4, but got rank ${x4D.rank}.`);\n util.assert(\n $filter.rank === 4,\n () => `Error in\n conv2d: filter\n must be rank 4, but got rank ` +\n ` ${$filter.rank}.`);\n if (dimRoundingMode != null) {\n util.assert(\n util.isInt(pad as number),\n () => `Error in conv2d: pad must be an integer when using, ` +\n `dimRoundingMode ${dimRoundingMode} but got pad ${pad}.`);\n }\n const inDepth = dataFormat ===\n 'NHWC' ? x4D.shape[3] : x4D.shape[1];\n util.assert(\n inDepth === $filter.shape[2],\n () => `Error in\n conv2d: depth of input (${inDepth}) must match ` +\n `input depth for filter ${$filter.shape[2]}.`);\n util.assert(\n conv_util.eitherStridesOrDilationsAreOne(strides, dilations),\n () => `Error in conv2D: Either\n strides or dilations must be 1.` +\n `Got strides ${strides} and dilations '${dilations}'`);\n const inputs:\n Conv2DInputs = {x: x4D, filter: $filter};\n const attrs:\n Conv2DAttrs = {strides, pad, dataFormat, dilations,\n dimRoundingMode};\n // tslint:disable-next-line: no-unnecessary-type-assertion\n const res = ENGINE.runKernel(\n Conv2D, inputs as {} as NamedTensorMap,\n attrs as {} as NamedAttrMap) as T;\n if (reshapedTo4D) {\n return reshape(res, [res.shape[1], res.shape[2], res.shape[3]])\n as T;\n }\n return res;\n }\n\nexport const conv2d = op({conv2d});\n\n", "*/\n * @license\n * Copyright 2020\n Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
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```
=====\n\n*\nimport {Tensor2D, Tensor3D, Tensor4D} from './tensor';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport * as util from './util';\nimport {conv2d} from './conv2d';\nimport * as conv_util from './conv_util';\nimport {op} from './operation';\nimport {reshape} from './reshape';\n\n/**\n * Computes a 1D convolution over the input x.\n * @param x The input tensor, of rank 3 or rank 2, of shape\n *   `[batch, width, inChannels]`. If rank 2, batch of 1 is assumed.\n * @param filter The filter, rank 3, of shape\n *   `[filterWidth, inDepth, outDepth]`.\n * @param stride The number of entries by which the filter is moved right at\n *   each step.\n * @param pad The type of padding algorithm.\n *   - `same` and stride 1: output will be of same size as input,\n *   regardless of filter size.\n *   - `valid`: output will be smaller than input if filter is larger\n *   than 1x1.\n * - For more info, see this guide: [https://www.tensorflow.org/api_guides/python/nn#Convolution](\n * https://www.tensorflow.org/api_guides/python/nn#Convolution)\n * @param dataFormat An optional string from \"NWC\", \"NCW\". Defaults to \"NWC\", the data is stored in the order of [batch, in_width, in_channels]. Only\n * \"NWC\" is currently supported.\n * @param dilation The dilation rate in which we sample input values in\n * atrous convolution. Defaults to `1`. If it is greater than 1, then\n * stride must be `1`.\n * @param dimRoundingMode A string from: 'ceil', 'round', 'floor'. If none is\n * provided, it will default to truncate.\n *\n * @doc {heading: 'Operations', subheading: 'Convolution'}\n */\nfunction conv1d<T extends Tensor2D|Tensor3D>(x: T|TensorLike, filter: Tensor3D|TensorLike, stride: number, pad: 'valid'|'same'|number|conv_util.ExplicitPadding, dataFormat: 'NWC'|'NCW' = 'NWC', dilation = 1, dimRoundingMode?: 'floor'|'round'|'ceil'): T {\n  const $x = convertToTensor(x, 'x', 'conv1d');\n  const $filter = convertToTensor(filter, 'filter', 'conv1d');\n\n  let x3D = $x as Tensor3D;\n  let reshapedTo3D = false;\n  if ($x.rank === 2) {\n    reshapedTo3D = true;\n    x3D = reshape($x, [1, $x.shape[0], $x.shape[1]]);\n  }\n\n  util.assert(x3D.rank === 3, () => `Error in conv1d: input must be rank 3, but got rank ${x3D.rank}.`);\n  util.assert($filter.rank === 3, () => `Error in conv1d: filter must be rank 3, but got rank ` +\n    `${$filter.rank}.`);\n  if (dimRoundingMode != null) {\n    util.assert(util.isInt(pad as number), () => `Error in conv1d: pad must be an integer when using, ` +\n      `dimRoundingMode ${dimRoundingMode} but got pad ${pad}.`);\n  }\n\n  util.assert(x3D.shape[2] === $filter.shape[1], () => `Error in conv1d: depth of input (${x3D.shape[2]}) must match ` +\n    `input depth for filter ${$filter.shape[1]}.`);\n  util.assert(conv_util.eitherStridesOrDilationsAreOne(stride, dilation), () => `Error in conv1D: Either stride or dilation must be 1.` +\n    `Got stride ${stride} and dilation '${dilation}'`);\n  util.assert(dataFormat === 'NWC', () => `Error in conv1d: got dataFormat of ${dataFormat} but only NWC is currently supported.`);\n\n  const filter4D = reshape($filter, [1, $filter.shape[0], $filter.shape[1], $filter.shape[2]]);\n  const input4D = reshape(x3D, [x3D.shape[0], 1, x3D.shape[1], x3D.shape[2]]);\n  const strides: [number, number] = [1, stride];\n  const dilations: [number, number] = [1, dilation];\n  const conv2dDataFormat = 'NHWC';\n  const res = conv2d(input4D as Tensor4D, (filter4D as Tensor4D), strides, pad, conv2dDataFormat, dilations, dimRoundingMode);\n  if (reshapedTo3D) {\n    return reshape(res, [res.shape[2], res.shape[3]]) as T;\n  }\n\n  return reshape(res, [res.shape[0], res.shape[2], res.shape[3]]) as T;\n}\n\nexport const conv1d = op({conv1d_});\n\n/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
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*\nimport {ENGINE} from './engine';\nimport {Conv2DBackpropInput, Conv2DBackpropInputAttrs,
Conv2DBackpropInputInputs} from './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport
{Tensor3D, Tensor4D} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport * as util from
 './util';\nimport * as conv_util from './conv_util';\nimport {op} from './operation';\nimport {reshape} from
 './reshape';\n\n/**\n * Computes the derivative of the input of a 2D convolution.\n * @param xShape The shape
of the input: [batch, height, width, inDepth].\n * If length of 3, batch of 1 is assumed.\n * @param dy The derivative
of the output, of rank 4 or rank 3 of shape\n * `[batch, outHeight, outWidth, outDepth]`. If rank 3, batch of 1 is\n *
assumed.\n * @param filter The filter, rank 4, of shape\n * `[filterHeight, filterWidth, inDepth, outDepth]`. \n *
@param strides The strides of the convolution: `[strideHeight,\n * strideWidth]`. \n * @param pad The type of
padding algorithm used:\n * - `same` and stride 1: output will be of same size as input,\n * regardless of filter
size.\n * - `valid`: output will be smaller than input if
filter is larger\n * than 1x1.\n * @param dataFormat: An optional string from: `"NHWC"`, `"NCHW"`. Defaults
to\n * `"NHWC"`. Specify the data format of the input and output data. With the\n * default format `"NHWC"`,
the data is stored in the order of: [batch,\n * height, width, channels].\n * @param dimRoundingMode A string
from: 'ceil', 'round', 'floor'. If none is\n * provided, it will default to truncate.\n */\nfunction
conv2DBackpropInput_<T extends Tensor3D|Tensor4D>(\n  xShape: [number, number, number,
number]|[number, number, number], dy: T,\n  filter: Tensor4D, strides: [number, number]|number,\n  pad:
'valid'|'same'|number|conv_util.ExplicitPadding,\n  dataFormat: 'NHWC'|'NCHW' = 'NHWC',\n  dimRoundingMode?: 'floor'|'round'|'ceil'): T {\n  util.assert(\n    xShape.length === dy.rank,\n    () => `Length of
inShape ` +\n    `${xShape.length}` and rank of dy (${dy.rank}) must match`);\n\n  let xShape4D = xShape as
[number, number, number,
number];\n  let dy4D = dy as Tensor4D;\n  let reshapedTo4D = false;\n  if (dy.rank === 3) {\n    reshapedTo4D =
true;\n    dy4D = reshape(dy, [1, dy.shape[0], dy.shape[1], dy.shape[2]]);\n    xShape4D = [1, xShape[0], xShape[1],
xShape[2]];\n  }\n\n  util.assert(\n    xShape4D.length === 4,\n    () =>\n    `Error in conv2dDerInput: inShape
must be length 4, but got length ` +\n    `${xShape4D.length}`);\n  util.assert(\n    dy4D.rank === 4,\n    () =>
`Error in conv2dDerInput: dy must be rank 4, but got ` +\n    `rank ${dy4D.rank}`);\n  util.assert(\n    filter.rank
=== 4,\n    () => `Error in conv2dDerInput: filter must be rank 4, but got ` +\n    `rank ${filter.rank}`);\n  const
inDepth = dataFormat === 'NHWC' ? xShape4D[3] : xShape4D[1];\n  const outDepth = dataFormat === 'NHWC' ?
dy4D.shape[3] : dy4D.shape[1];\n  util.assert(\n    inDepth === filter.shape[2],\n    () => `Error in
conv2dDerInput: depth of input (${inDepth}) must ` +\n    `\n    `match input depth for filter ${filter.shape[2]}.`);\n  util.assert(\n    outDepth === filter.shape[3],\n    () =>
`Error in conv2dDerInput: depth of output (${outDepth}) must ` +\n    `match output depth for filter
${filter.shape[3]}.`);\n  if (dimRoundingMode != null) {\n    util.assert(\n    util.isInt(pad as number),\n    () =>
`Error in conv2dDerInput: pad must be an integer when using, ` +\n    `dimRoundingMode
${dimRoundingMode} but got pad ${pad}`);\n  }\n\n  const inputs: Conv2DBackpropInputInputs = {dy: dy4D,
filter};\n\n  const attrs: Conv2DBackpropInputAttrs =\n    {strides, pad, dataFormat, dimRoundingMode,
inputShape: xShape4D};\n\n  // tslint:disable-next-line: no-unnecessary-type-assertion\n  const res =
ENGINE.runKernel(\n    Conv2DBackpropInput, inputs as { } as NamedTensorMap,\n    attrs as { }
as NamedAttrMap) as T;\n\n  if (reshapedTo4D) {\n    return reshape(res, [res.shape[1], res.shape[2], res.shape[3]])
as T;\n  }\n  return res;\n}\n\nexport const conv2DBackpropInput = op({conv2DBackpropInput_});\n\n/**\n *
@license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n */
=====

```

```

*\nimport {Tensor3D, Tensor4D} from './tensor';\nimport {convertToTensor} from './tensor_util_env';\nimport
{TensorLike} from './types';\n\nimport {conv2DBackpropInput} from './conv2d_backprop_input';\nimport
{op} from './operation';\n\n/**\n * Computes the transposed 2D convolution of an image, also known as a\n *
deconvolution.\n * \n * @param x The input image, of rank 4 or rank 3, of shape\n *   `[batch, height, width,
inDepth]`. If rank 3, batch of 1 is assumed.\n * @param filter The filter, rank 4, of shape\n *   `[filterHeight,
filterWidth, outDepth, inDepth]`. \n *   `inDepth` must match `inDepth` in `x`.\n * @param outputShape Output
shape, of rank 4 or rank 3:\n *   `[batch, height, width, outDepth]`. If rank 3, batch of 1 is assumed.\n * @param
strides The strides of the original convolution:\n *   `[strideHeight, strideWidth]`. \n * @param pad The type of
padding algorithm used in the non-transpose version\n *   of the op.\n * @param dimRoundingMode A string from:
'ceil', 'round', 'floor'. If none is\n *   provided, it will default to truncate.\n * \n * @doc {heading: 'Operations',
subheading: 'Convolution'}\n *\nfunction conv2dTranspose_(<n   x: T|TensorLike, filter: Tensor4D|TensorLike,\n   outputShape: [number,
number, number, number]|[number, number, number],\n   strides: [number, number]|number, pad:
'valid'|'same'|number,\n   dimRoundingMode?: 'floor'|'round'|'ceil'): T {\n   const $x = convertToTensor(x, 'x',
'conv2dTranspose');\n   const $filter = convertToTensor(filter, 'filter', 'conv2dTranspose');\n\n   return
conv2DBackpropInput(\n     outputShape, $x, $filter, strides, pad, 'NHWC', dimRoundingMode);\n\n}\n\nexport
const conv2dTranspose = op({conv2dTranspose_});\n\n",/**\n * @license\n * Copyright 2020 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====\\n
*\nimport {ENGINE} from './engine';\nimport {Conv3D, Conv3DAttrs, Conv3DInputs} from
 './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor4D, Tensor5D} from
 './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from
 './tensor_util_env';\nimport {TensorLike} from './types';\nimport * as util from './util';\n\nimport
{eitherStridesOrDilationsAreOne} from './conv_util';\nimport {op} from './operation';\nimport {reshape} from
 './reshape';\n\n/**\n * Computes a 3D convolution over the input x.\n * \n * @param x The input tensor, of rank 5 or
rank 4, of shape\n *   `[batch, depth, height, width, channels]`. If rank 4,\n *   batch
of 1 is assumed.\n * @param filter The filter, rank 5, of shape\n *   `[filterDepth, filterHeight, filterWidth,
inChannels, outChannels]`. \n *   `inChannels` must match between input and filter.\n * @param strides The strides
of the convolution: `[strideDepth, strideHeight,\n *   strideWidth]`. \n * @param pad The type of padding algorithm.\n *
- `same` and stride 1: output will be of same size as input,\n *   regardless of filter size.\n * - `valid`: output
will be smaller than input if filter is larger\n *   than 1x1.\n * - For more info, see this guide:\n *
https://www.tensorflow.org/api\_guides/python/nn#Convolution(\n *
https://www.tensorflow.org/api\_guides/python/nn#Convolution)\n * @param dataFormat: An optional string from:
"NDHWC", "NCDHW". Defaults to\n *   "NDHWC". Specify the data format of the input and output data.
With the\n *   default format "NDHWC", the data is stored in the order of: [batch,\n *   depth, height, width,
channels].\n * \n * Only "NDHWC" is currently supported.\n * @param dilations The dilation rates: `[dilationDepth,
dilationHeight,\n *   dilationWidth]` in which we sample input values across the height\n *   and width
dimensions in atrous convolution. Defaults to `[1, 1, 1]`. \n *   If `dilations` is a single number, then\n *
`dilationDepth == dilationHeight == dilationWidth`. If it is greater\n *   than 1, then all values of `strides` must be
1.\n * \n * @doc {heading: 'Operations', subheading: 'Convolution'}\n *\nfunction conv3d_(<n   x: T|TensorLike, filter: Tensor5D|TensorLike,\n   strides: [number, number,

```

```

number]]number, pad: 'valid'|'same',\n  dataFormat: 'NDHWC'|'NCDHW' = 'NDHWC',\n  dilations: [number,
number, number]]number = [1, 1, 1]): T {\n  const $x = convertToTensor(x, 'x', 'conv3d');\n  const $filter =
convertToTensor(filter, 'filter', 'conv3d');\n\n  let x5D = $x as Tensor5D;\n  let reshapedTo5D = false;\n\n  if
($x.rank === 4) {\n
    reshapedTo5D = true;\n    x5D = reshape($x, [1, $x.shape[0], $x.shape[1], $x.shape[2], $x.shape[3]]);\n  }\n
util.assert(\n  x5D.rank === 5,\n  () => `Error in conv3d: input must be rank 5, but got rank ${x5D.rank}.`);\n
util.assert(\n  $filter.rank === 5,\n  () => `Error in conv3d: filter must be rank 5, but got rank ` +\n
`${$filter.rank}.`);\n  util.assert(\n  x5D.shape[4] === $filter.shape[3],\n  () => `Error in conv3d: depth of input
($x5D.shape[4]) must match ` +\n
`input depth for filter ${$filter.shape[3]}.`);\n  util.assert(\n
eitherStridesOrDilationsAreOne(strides, dilations),\n  () => `Error in conv3D: Either strides or dilations must be 1.
` +\n
`Got strides ${strides} and dilations '${dilations}'`);\n  util.assert(\n  dataFormat === 'NDHWC',\n
() => `Error in conv3d: got dataFormat of ${\n  dataFormat} but only NDHWC is currently supported.`);\n\n
const inputs: Conv3DInputs = {x: x5D, filter:
$filter};\n\n  const attrs: Conv3DAttrs = {strides, pad, dataFormat, dilations};\n\n  // tslint:disable-next-line: no-
unnecessary-type-assertion\n  const res = ENGINE.runKernel(\n    Conv3D, inputs as {} as
NamedTensorMap,\n    attrs as {} as NamedAttrMap) as T;\n\n  if (reshapedTo5D) {\n    return reshape(\n
res, [res.shape[1], res.shape[2], res.shape[3], res.shape[4]]) as\n    T;\n  }\n  return res;\n}\n\nexport const
conv3d = op({conv3d_});\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * \n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND,\n * either express or implied.\n * See the License for the specific language governing permissions and\n * limitations
under the License.\n *
=====
*/\nimport {ENGINE} from './engine';\nimport {Conv3DBackpropInputV2, Conv3DBackpropInputV2Attrs,
Conv3DBackpropInputV2Inputs} from './kernel_names';\nimport {NamedAttrMap} from
'./kernel_registry';\nimport {Tensor4D, Tensor5D} from './tensor';\nimport {NamedTensorMap} from
'./tensor_types';\nimport * as util from './util';\nimport {op} from './operation';\nimport {reshape} from
'./reshape';\n\n/**\n * Computes the derivative of the input of a 3D convolution.\n * @param xShape The shape
of the input: [batch, depth, height, width,\n * in_channels]. If length of 4, batch of 1 is assumed.\n * @param dy The
derivative of the output, of rank 5 or rank 4 of shape\n * `[batch, outDepth, outHeight, outWidth, in_channels]`.\n *
If rank 4, batch of 1 is assumed.\n * @param filter The filter, rank 5, of shape\n * `[filterDepth, filterHeight, filterWidth, inDepth, outDepth]`.\n *
@param strides The strides of the convolution: `[strideDepth, strideHeight,\n * strideWidth]`.\n * @param pad The
type of padding algorithm used:\n * - `same` and stride 1: output will be of same size as input,\n * regardless
of filter size.\n * - `valid`: output will be smaller than input if filter is larger\n * than 1x1.\n */\nfunction
conv3DBackpropInput_<T extends Tensor4D|Tensor5D>(\n  xShape:\n    [number, number, number, number,
number]]\n    [number, number, number, number, number],\n  dy: T, filter: Tensor5D, strides: [number, number,
number]]\n    [number, number, number, number],\n  pad: 'valid'|'same'): T {\n  util.assert(\n  xShape.length === dy.rank,\n  () => `Length of
inShape ` +\n
`${xShape.length}` and rank of dy (${dy.rank}) must match`);\n\n  let xShape5D = xShape as
[number, number, number, number, number];\n  let dy5D = dy as Tensor5D;\n
let reshapedTo5D = false;\n  if (dy.rank === 4) {\n    reshapedTo5D = true;\n    dy5D = reshape(dy, [1,
dy.shape[0], dy.shape[1], dy.shape[2], dy.shape[3]]);\n    xShape5D = [1, xShape[0], xShape[1], xShape[2],
xShape[3]];\n  }\n\n  const inDepth = xShape5D[4];\n  const outDepth = dy5D.shape[4];\n  util.assert(\n
xShape5D.length === 5,\n  () =>\n    `Error in conv3dDerInput: inShape must be length 5, but got length ` +\n
`${xShape5D.length}.`);\n  util.assert(\n  dy5D.rank === 5,\n  () => `Error in conv3dDerInput: dy must be
rank 5, but got ` +\n
`rank ${dy5D.rank}`);\n  util.assert(\n  filter.rank === 5,\n  () => `Error in

```

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conv3dDerInput: filter must be rank 5, but got `+n      `rank ${filter.rank}`);\n  util.assert(\n    inDepth ===
filter.shape[3],\n    () => `Error in conv3dDerInput: depth of input (${inDepth}) must ` +\n      `match input
depth for filter ${filter.shape[3]}.`);\n  util.assert(\n    outDepth === filter.shape[4],\n    () => `Error in conv3dDerInput: depth of output (${outDepth}) must ` +\n      `match output depth for filter
${filter.shape[4]}.`);\n\n  const inputs: Conv3DBackpropInputV2Inputs = {dy: dy5D, filter};\n\n  const attrs:\n  Conv3DBackpropInputV2Attrs = {pad, strides, inputShape: xShape5D};\n\n  // tslint:disable-next-line: no-
unnecessary-type-assertion\n  const res = ENGINE.runKernel(\n    Conv3DBackpropInputV2, inputs as { }
as NamedTensorMap,\n    attrs as { } as NamedAttrMap as T;\n\n  if (reshapedTo5D) {\n    return
reshape(\n      res, [res.shape[1], res.shape[2], res.shape[3], res.shape[4]]) as\n      T;\n  }\n  return
res;\n}\n\n\nexport const conv3DBackpropInput = op({conv3DBackpropInput_});\n", "**\n * @license\n * Copyright
2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n *
you may not use this file except in compliance with the License.\n * You may obtain
a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by
applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\"
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\nimport {Tensor4D, Tensor5D} from './tensor';\nimport {convertToTensor} from './tensor_util_env';\nimport
{TensorLike} from './types';\nimport {conv3DBackpropInput} from './conv3d_backprop_input';\nimport {op}
from './operation';\n\n/**\n * Computes the transposed 3D convolution of a volume, also known as a\n *
deconvolution.\n * @param x The input image, of rank 5 or rank 4, of shape\n * `[batch, depth, height, width,
inDepth]`. If rank 4, batch of 1 is assumed.\n * @param filter The
filter, rank 4, of shape\n * `[depth, filterHeight, filterWidth, outDepth, inDepth]`. \n * `inDepth` must match
`inDepth` in `x`.\n * @param outputShape Output shape, of rank 5 or rank 4:\n * `[batch, depth, height, width,
outDepth]`. If rank 3, batch of 1 is\n * assumed.\n * @param strides The strides of the original convolution:\n *
`[strideDepth, strideHeight, strideWidth]`.\n * @param pad The type of padding algorithm used in the non-
transpose version\n * of the op.\n * @doc {heading: 'Operations', subheading: 'Convolution'}\n *\nfunction
conv3dTranspose_<T extends Tensor4D|Tensor5D>(\n  x: T|TensorLike, filter: Tensor5D|TensorLike,\n  outputShape:\n    [number, number, number, number, number],\n    number)[number, number, number, number],\n  strides: [number, number, number]number, pad: 'valid'|'same'): T {\n  const $x = convertToTensor(x, 'x',
'conv3dTranspose');\n  const $filter = convertToTensor(filter, 'filter', 'conv3dTranspose');\n\n  return
conv3DBackpropInput(outputShape, $x, $filter, strides, pad);\n}\n\n\nexport const conv3dTranspose =
op({conv3dTranspose_});\n", "**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * \n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====\n
*\n\nimport {ENGINE} from './engine';\nimport {Cos, CosInputs} from './kernel_names';\nimport {Tensor} from
'./tensor';\nimport {NamedTensorMap} from
'./tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from
'./types';\nimport {op} from './operation';\n\n/**\n * Computes cos of the input `tf.Tensor` element-wise:
`cos(x)`\n * *`js`\n * const x = tf.tensor1d([0, Math.PI / 2, Math.PI * 3 / 4]);\n * *`x.cos().print(); // or
tf.cos(x)`\n * *`*\n * @param x The input tensor.\n * *`*\n * @doc {heading: 'Operations', subheading: 'Basic math'}\n
*\nfunction cos_<T extends Tensor>(x: T|TensorLike): T {\n  const $x = convertToTensor(x, 'x', 'cos');\n\n  const
inputs: CosInputs = {x: $x};\n\n  return ENGINE.runKernel(Cos, inputs as { } as NamedTensorMap);\n}\n\n\nexport

```


const cos = op({cos_});\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```
=====\n*\n\nimport {ENGINE} from './engine';\nimport {Cosh, CoshInputs} from './kernel_names';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport {op} from './operation';\n\n/**\n * Computes hyperbolic cos of the input `tf.Tensor` element-wise: `cosh(x)`\n * const x = tf.tensor1d([0, 1, -1, .7]);\n * x.cosh().print(); // or tf.cosh(x)\n * @param x The input tensor.\n * @doc {heading: 'Operations', subheading: 'Basic math'}\n */\nfunction
```

```
  cosh_<T extends Tensor>(x: T|TensorLike): T {\n  const $x = convertToTensor(x, 'x', 'cosh');\n  const inputs: CoshInputs = {x: $x};\n  return ENGINE.runKernel(Cosh, inputs as { } as NamedTensorMap);\n}\n\nexport const cosh = op({cosh_});\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport {ENGINE} from './engine';\nimport {Cumsum, CumsumAttrs, CumsumInputs} from './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport {op} from './operation';\n\n/**\n * Computes the cumulative sum of a `tf.Tensor` along `axis`.\n * const x = tf.tensor([1, 2, 3, 4]);\n * x.cumsum().print();\n * const x = tf.tensor([[1, 2], [3, 4]]);\n * x.cumsum().print();\n * @param x The input tensor to be summed.\n * @param axis The axis along which to sum. Optional. Defaults to 0.\n * @param exclusive Whether to perform exclusive cumulative sum. Optional.\n * Defaults to false. If set to true then the sum of each tensor entry does not include its own value, but only the values previous to it along the specified axis.\n * @param reverse Whether to sum in the opposite direction. Optional.\n * Defaults to false.\n * @doc {heading: 'Operations', subheading: 'Scan'}\n */\nfunction cumsum_<T extends Tensor>(x: Tensor|TensorLike, axis = 0, exclusive = false, reverse = false): T {\n  const $x = convertToTensor(x, 'x', 'cumsum');\n  const inputs: CumsumInputs = {x: $x};\n  const attrs: CumsumAttrs = {axis, exclusive, reverse};\n  return ENGINE.runKernel(Cumsum, inputs as { } as NamedTensorMap, attrs as { } as NamedAttrMap);\n}\n\nexport const cumsum = op({cumsum_});\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport {ENGINE} from './engine';\nimport {DenseBincount, DenseBincountAttrs, DenseBincountInputs}
```

```

from './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor1D, Tensor2D} from
 './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from
 './tensor_util_env';\nimport {TensorLike} from './types';\nimport * as util from './util';\n\nimport {op} from
 './operation';\n\n/**\n * Outputs a vector with length `size` and the same dtype as `weights`. \n * If `weights` are
 empty, then index `i` stores the number of times the value \n * `i` is counted in `x`. If `weights` are non-empty, then
 index `i` stores the \n * sum of the value in `weights` at each index where the corresponding
 value in \n * `x` is `i`. \n * Values in `x` outside of the range [0, size) are ignored. \n * @param x The input
 int tensor, rank 1 or rank 2. \n * @param weights The weights tensor, must have the same shape as x, or a \n *
 length-0 Tensor, in which case it acts as all weights equal to 1. \n * @param size Non-negative integer. \n * @param
 binaryOutput Optional. Whether the kernel should count the appearance \n * or number of occurrences. Defaults to
 False. \n * @doc {heading: 'Operations', subheading: 'Reduction'}\n */\nfunction denseBincount_<T extends
 Tensor1D|Tensor2D>(\n  x: T|TensorLike, weights: T|TensorLike, size: number, \n  binaryOutput = false): T {\n
 const $x = convertToTensor(x, 'x', 'denseBincount');\n  const $weights = convertToTensor(weights, 'weights',
 'denseBincount');\n  \n  util.assert(\n    $x.dtype === 'int32', \n    () => `Error in denseBincount: input ` +\n
 `dtype must be int32, but got ${$x.dtype}`);\n  util.assert(\n    $x.rank
 <= 2, \n    () => `Error in denseBincount: input must be at most rank 2, but got ` +\n
 `rank ${$x.rank}.`);\n  util.assert(size >= 0, () => `size must be non-negative, but got ${size}.`);\n  util.assert(\n
 $weights.size === $x.size || $weights.size === 0, \n    () => `Error in denseBincount: weights must have the same shape as x or
 ` +\n
 `0-length, but got x shape: ${$x.shape}, weights shape: ` +\n
 `${$weights.shape}.`);\n  \n  const
 inputs: DenseBincountInputs = {x: $x, weights: $weights};\n  const attrs: DenseBincountAttrs = {size,
 binaryOutput};\n  \n  return ENGINE.runKernel(\n    DenseBincount, inputs as {} as NamedTensorMap, \n    attrs
 as {} as NamedAttrMap);\n  \n}\n\nexport const denseBincount = op({denseBincount_});\n\n/**\n * @license\n *
 Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
 \"License\");\n * you may not use this file except in compliance with the License.\n * You may
 obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by
 applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\"
 BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
 License for the specific language governing permissions and\n * limitations under the License.\n *
=====\n
\n\nimport {ENGINE} from './engine';\nimport {DepthToSpace, DepthToSpaceAttrs, DepthToSpaceInputs} from
 './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor4D} from './tensor';\nimport
 {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport
 {TensorLike4D} from './types';\nimport * as util from './util';\n\nimport {op} from './operation';\n\n/**\n *
 Rearranges data from depth into blocks of spatial data. More specifically,\n
 * this op outputs a copy of the input tensor where values from the `depth` \n * dimension are moved in spatial blocks
 to the `height` and `width` dimensions. \n * The attr `blockSize` indicates the input block size and how the data is \n *
 moved. \n * - Chunks of data of size `blockSize * blockSize` from depth are rearranged \n * into non-overlapping
 blocks of size `blockSize x blockSize` \n * - The width the output tensor is `inputWidth * blockSize`, whereas
 the \n * height is `inputHeight * blockSize` \n * - The Y, X coordinates within each block of the output image are
 determined \n * by the high order component of the input channel index \n * - The depth of the input tensor must
 be divisible by `blockSize * \n * blockSize` \n * - The `dataFormat` attr specifies the layout of the input and output
 tensors \n * with the following options: \"NHWC\": [ `batch, height, width, channels` ] \n * \"NCHW\": [ `batch,
 channels, height, width` ] \n * \n * ` `js\n * const x =
 tf.tensor4d([1, 2, 3, 4], [1, 1, 1, 4]);\n * const blockSize = 2;\n * const dataFormat = \"NHWC\";\n * \n *
 tf.depthToSpace(x, blockSize, dataFormat).print();\n * ` ` \n * @param x The input tensor of rank 4 \n * @param
 blockSize An `int` that is `>= 2`. The size of the spatial block \n * @param dataFormat An optional string from:
 \"NHWC\", \"NCHW\". Defaults to \"NHWC\" \n * @doc {heading: 'Tensors', subheading: 'Transformations'}\n
 */\n\nfunction depthToSpace_(\n  x: Tensor4D|TensorLike4D, blockSize: number, \n  dataFormat: 'NHWC'|'NCHW'

```

```

= 'NHWC'): Tensor4D {\n  const $x = convertToTensor(x, 'x', 'depthToSpace') as Tensor4D;\n\n  const inputHeight
= (dataFormat === 'NHWC') ? $x.shape[1] : $x.shape[2];\n  const inputWidth = (dataFormat === 'NHWC') ?
$x.shape[2] : $x.shape[3];\n  const inputDepth = (dataFormat === 'NHWC') ? $x.shape[3] : $x.shape[1];\n\n
util.assert(\n    inputHeight * blockSize >= 0,\n    () => `Negative dimension size caused by overflow when
multiplying\n

```

```

    ${inputHeight} and ${blockSize} for depthToSpace with input shape\n    ${$x.shape}`);\n\n  util.assert(\n
inputWidth * blockSize >= 0,\n    () => `Negative dimension size caused by overflow when multiplying\n
${inputWidth} and ${blockSize} for depthToSpace with input shape\n    ${$x.shape}`);\n\n  util.assert(\n
(inputDepth % (blockSize * blockSize) === 0),\n    () => `Dimension size must be evenly divisible by ${\n
blockSize * blockSize} but is ${\n    inputDepth} for depthToSpace with input shape ${$x.shape}`);\n\n  const
inputs: DepthToSpaceInputs = {x: $x};\n  const attrs: DepthToSpaceAttrs = {blockSize, dataFormat};\n\n  return
ENGINE.runKernel(\n    DepthToSpace, inputs as {} as NamedTensorMap,\n    attrs as {} as
NamedAttrMap);\n\n\nexport const depthToSpace = op({depthToSpace_});\n\n", /**\n * @license\n * Copyright
2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n *
you may not

```

```

use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

```

```

=====
*\nimport {ENGINE} from './engine';\nimport {DepthwiseConv2dNative, DepthwiseConv2dNativeAttrs,
DepthwiseConv2dNativeInputs} from './kernel_names';\nimport {NamedAttrMap} from
'./kernel_registry';\nimport {Tensor3D, Tensor4D} from './tensor';\nimport {NamedTensorMap} from
'./tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport
* as util from './util';\n\nimport {op}
from './operation';\nimport {reshape} from './reshape';\n\n/**\n * Depthwise 2D convolution.\n * \n * Given a 4D
`input` array and a `filter` array of shape\n * `[filterHeight, filterWidth, inChannels, channelMultiplier]`
containing\n * `inChannels` convolutional filters of depth 1, this op applies a\n * different filter to each input
channel (expanding from 1 channel to\n * `channelMultiplier` channels for each), then concatenates the results\n *
together. The output has `inChannels * channelMultiplier` channels.\n * \n * See\n *
[https://www.tensorflow.org/api_docs/python/tf/nn/depthwise_conv2d](\n *
https://www.tensorflow.org/api_docs/python/tf/nn/depthwise_conv2d)\n * for more details.\n * \n * @param x The
input tensor, of rank 4 or rank 3, of shape\n * `[batch, height, width, inChannels]`. If rank 3, batch of 1 is\n *
assumed.\n * @param filter The filter tensor, rank 4, of shape\n * `[filterHeight, filterWidth, inChannels,
channelMultiplier]`.\n * @param strides The
strides of the convolution: `[strideHeight,\n * strideWidth]`. If strides is a single number, then `strideHeight ==\n *
strideWidth`.\n * @param pad The type of padding algorithm.\n * - `same` and stride 1: output will be of same size
as input,\n * regardless of filter size.\n * - `valid`: output will be smaller than input if filter is larger\n *
than 1x1.\n * - For more info, see this guide:\n * [https://www.tensorflow.org/api_guides/python/nn#Convolution](\n *
https://www.tensorflow.org/api_guides/python/nn#Convolution)\n * @param dilations The dilation rates:
`[dilationHeight, dilationWidth]`\n * in which we sample input values across the height and width dimensions\n *
in atrous convolution. Defaults to `[1, 1]`. If `rate` is a single\n * number, then `dilationHeight ==
dilationWidth`. If it is greater than\n * 1, then all values of `strides` must be 1.\n * @param dataFormat: An
optional string from: "NHWC", "NCHW". Defaults to\n * "NHWC". Specify the data format of the input and output data. With the\n *
default format "NHWC", the data is stored in the order of: [batch,\n * height, width, channels]. Only "NHWC" is currently supported.\n *
@param dimRoundingMode A string from: 'ceil', 'round', 'floor'. If none is\n * provided, it will default to

```

```

truncate.\n *\n * @doc {heading: 'Operations', subheading: 'Convolution'}\n *\nfunction depthwiseConv2d_<T
extends Tensor3D|Tensor4D>(\n  x: T|TensorLike, filter: Tensor4D|TensorLike,\n  strides: [number,
number]|number, pad: 'valid'|'same'|number,\n  dataFormat: 'NHWC'|'NCHW' = 'NHWC',\n  dilations: [number,
number]|number = [1, 1],\n  dimRoundingMode?: 'floor'|'round'|'ceil'): T {\n  const $x = convertToTensor(x, 'x',
'depthwiseConv2d');\n  const $filter = convertToTensor(filter, 'filter', 'depthwiseConv2d');\n  let x4D = $x as
Tensor4D;\n  let reshapedTo4D = false;\n  if ($x.rank === 3) {\n    reshapedTo4D = true;\n    x4D = reshape($x,
[1, $x.shape[0], $x.shape[1], $x.shape[2]]);\n  }\n  util.assert(\n    x4D.rank === 4,\n    () => `Error in
depthwiseConv2d: input must be rank 4, but got ` +\n    `rank ${x4D.rank}.`);\n  util.assert(\n    $filter.rank
=== 4,\n    () => `Error in depthwiseConv2d: filter must be rank 4, but got rank ` +\n    `${$filter.rank}.`);\n  util.assert(\n    x4D.shape[3] === $filter.shape[2],\n    () => `Error in depthwiseConv2d: number of input channels
` +\n    `${x4D.shape[3]}`) must match the inChannels dimension in ` +\n    `filter ${$filter.shape[2]}.`);\n  if (dimRoundingMode != null) {\n    util.assert(\n      util.isInt(pad as number),\n      () => `Error in
depthwiseConv2d: pad must be an integer when using, ` +\n      `dimRoundingMode ${dimRoundingMode} but
got pad ${pad}.`);\n  }\n  const inputs: DepthwiseConv2dNativeInputs = {x: x4D, filter: $filter};\n  const attrs:
DepthwiseConv2dNativeAttrs =\n    {strides, pad, dataFormat,
dilations, dimRoundingMode};\n  // tslint:disable-next-line: no-unnecessary-type-assertion\n  const res =
ENGINE.runKernel(\n    DepthwiseConv2dNative, inputs as {} as NamedTensorMap,\n    attrs as
{} as NamedAttrMap) as T;\n  if (reshapedTo4D) {\n    return reshape(res, [res.shape[1], res.shape[2],
res.shape[3]]) as T;\n  }\n  return res;\n}\n\nexport const depthwiseConv2d = op({depthwiseConv2d_});\n"/**\n *
@license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific
language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {ENGINE} from './engine';\nimport {Diag, DiagInputs} from './kernel_names';\nimport {Tensor}
from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from
'./tensor_util_env';\nimport {op} from './operation';\n"/**\n * Returns a diagonal tensor with a given diagonal
values.\n *\n * Given a diagonal, this operation returns a tensor with the diagonal and\n * everything else padded
with zeros.\n *\n * Assume the input has dimensions `[D1,..., Dk]`, then the output is a tensor\n * of rank 2k with
dimensions `[D1,..., Dk, D1,..., Dk]`\n *\n * ```\n * const x = tf.tensor1d([1, 2, 3, 4]);\n * const y = tf.diag(x).print()\n * ```\n *\n * ```\n * const x = tf.tensor1d([1, 2, 3, 4, 5, 6, 6, 8], [4, 2]);\n * const y = tf.diag(x).print()\n * ```\n * @param x The
input tensor.\n *\nfunction diag_(x:
Tensor): Tensor {\n  const $x = convertToTensor(x, 'x', 'diag');\n  const inputs: DiagInputs = {x: $x};\n  return
ENGINE.runKernel(Diag, inputs as {} as NamedTensorMap);\n}\n\nexport const diag = op({diag_});\n"/**\n *
@license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {ENGINE} from './engine';\nimport {Dilation2D, Dilation2DAttrs,
Dilation2DInputs} from './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor3D,
Tensor4D} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from
'./tensor_util_env';\nimport {TensorLike} from './types';\nimport * as util from './util';\nimport {op} from

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./operation';\nimport {reshape} from './reshape';\n\n/**\n * Computes the grayscale dilation over the input `x`.\n *\n * @param x The input tensor, rank 3 or rank 4 of shape\n *   `[batch, height, width, inChannels]`. If rank 3, batch\n *   of 1 is assumed.\n * @param filter The filter tensor, rank 3, of shape\n *   `[filterHeight, filterWidth, depth]`.\n * @param strides The strides of the sliding window for each dimension of the\n *   input tensor: `[strideHeight, strideWidth]`.\n *   If `strides` is a single number,\n *   then `strideHeight == strideWidth`.\n * @param pad The type of padding algorithm.\n *   - `same` and stride 1: output\n *   will be of same size as input,\n *   regardless of filter size.\n *   - `valid`: output will be smaller than input if\n *   filter is larger\n *   than 1*1x1.\n * - For more info, see this guide:\n *   [https://www.tensorflow.org/api_guides/python/nn#Convolution](\n *   https://www.tensorflow.org/api_guides/python/nn#Convolution)\n * @param dataType Specify the data format of\n *   the input and output data.\n *   Defaults to 'NHWC'. Only 'NHWC' is currently supported. With the\n *   default\n *   format \"NHWC\", the data is stored in the order of: [batch,\n *   height, width, channels].\n * @param dilations\n *   The dilation rates: `[dilationHeight, dilationWidth]`\n *   in which we sample input values across the height and\n *   width dimensions\n *   for atrous morphological dilation. Defaults to `[1, 1]`. If `dilations`\n *   is a single\n *   number, then `dilationHeight == dilationWidth`. If it is\n *   greater than 1, then all values of `strides` must be 1.\n *\n * @doc

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{heading: 'Operations', subheading: 'Convolution'}\n\nfunction dilation2d<T extends Tensor3D|Tensor4D>(\n  x: T|TensorLike, filter: Tensor3D|TensorLike,\n  strides: [number, number]|number, pad: 'valid'|'same',\n  dilations: [number, number]|number = [1, 1],\n  dataType: 'NHWC' = 'NHWC'): T {\n  const $x =\n    convertToTensor(x, 'x', 'dilation2d');\n  const $filter = convertToTensor(filter, 'filter', 'dilation2d');\n  util.assert(\n    $x.rank === 3 || $x.rank === 4,\n    () => `Error in dilation2d: input must be rank 3 or 4, but got rank ` +\n    `${$x.rank}`);\n  util.assert(\n    $filter.rank === 3,\n    () => `Error in dilation2d: filter must be rank 3, but got\n    rank ` +\n    `${$filter.rank}`);\n  util.assert(\n    dataType === 'NHWC',\n    () => `Error in dilation2d:\n    Only NHWC is currently supported, ` +\n    `but got dataType of ${dataType}`);\n  let x4D = $x as\n    Tensor4D;\n  let reshapedTo4D = false;\n  if ($x.rank === 3) {\n    x4D = reshape($x, [1, $x.shape[0], $x.shape[1], $x.shape[2]]);\n    reshapedTo4D = true;\n  }\n  const inputs:\n    Dilation2DInputs = {x: x4D, filter: $filter};\n  const attrs: Dilation2DAttrs = {strides, pad, dilations};\n  //\n  tslint:disable-next-line: no-unnecessary-type-assertion\n  const res = ENGINE.runKernel(\n    Dilation2D,\n    inputs as {} as NamedTensorMap,\n    attrs as {} as NamedAttrMap) as T;\n  if (reshapedTo4D) {\n    return reshape(res, [res.shape[1], res.shape[2], res.shape[3]]) as T;\n  }\n  return res;\n}\n\nexport const dilation2d\n  = op({dilation2d});\n\n/**\n * Copyright 2017 Google LLC. All Rights Reserved.\n * Licensed\n * under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the\n * License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed\n * under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF\n * ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```

```

=====\n\n/**\n * Returns the dimensions in the input shape that are broadcasted to\n * produce the provided output\n * shape.\n *\n * The returned dimensions are 0-indexed and sorted. An example:\n * inShape = [4, 1, 3]\n * outShape = [5, 4, 3, 3]\n * result = [1]. Dimension 1 (2nd dimension of input) gets broadcasted 1 => 3.\n *\n * export function\n * getBroadcastDims(\n *   inShape: number[], outShape: number[]): number[] {\n *   const inRank = inShape.length;\n *   const dims: number[] = [];\n *   for (let i = 0; i < inRank; i++) {\n *     const dim = inRank - 1 - i;\n *     const a =\n *       inShape[dim] || 1;\n *     const b = outShape[outShape.length - 1 - i] || 1;\n *     if (b > 1 && a === 1)\n *       {\n *         dims.unshift(dim);\n *       }\n *   }\n *   return dims;\n * }\n\n/**\n * Returns the axes in the output space that should be\n * reduced to produce\n * the input space.\n *\n * export function getReductionAxes(\n *   inShape: number[], outShape:\n *   number[]): number[] {\n *   const result: number[] = [];\n *   for (let i = 0; i < outShape.length; i++) {\n *     const inDim =\n *       inShape[inShape.length - i - 1];\n *     const outAxis = outShape.length - i - 1;\n *     const outDim =

```

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outShape[outAxis];\n  if (inDim == null || (inDim === 1 && outDim > 1)) {\n    result.unshift(outAxis);\n  }\n}\n\nreturn result;\n}\n\nexport function assertAndGetBroadcastShape(\n  shapeA: number[], shapeB: number[]):\n  number[] {\n  const result: number[] = [];\n  const l = Math.max(shapeA.length, shapeB.length);\n\n  for (let i = 0; i\n    < l; i++) {\n    let a = shapeA[shapeA.length - i - 1];\n    if (a == null) {\n      a = 1;\n    }\n    let b =\n    shapeB[shapeB.length - i - 1];\n    if (b == null) {\n      b = 1;\n    }\n    if\n    (a === 1) {\n      result.unshift(b);\n    } else if (b === 1) {\n      result.unshift(a);\n    } else if (a !== b) {\n      const\n      errMsg = `Operands could not be broadcast together with shapes ` +\n      `${shapeA} and ${shapeB}`;\n      throw Error(errMsg);\n    } else {\n      result.unshift(a);\n    }\n  }\n}\n\nreturn result;\n}\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n */

```

```

=====\n\n*/\nimport {ENGINE} from './engine';\nimport {Equal, EqualInputs} from './kernel_names';\nimport {Tensor}\nfrom './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {makeTypesMatch} from\n './tensor_util';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport\n{assertAndGetBroadcastShape} from './broadcast_util';\nimport {op} from './operation';\n\n/**\n * Returns the truth\n * value of (a == b) element-wise. Supports broadcasting.\n *\n * ```js\n * const a = tf.tensor1d([1, 2, 3]);\n * const b =\n * tf.tensor1d([2, 2, 2]);\n * a.equal(b).print();\n * ```\n *\n * @param a The first input tensor.\n * @param b The\n * second input tensor. Must have the same dtype as `a`.\n *\n * @doc {heading: 'Operations', subheading: 'Logical'}\n */\n\nfunction equal_<T extends Tensor>(\n  a: Tensor|TensorLike, b: Tensor|TensorLike): T {\n  let $a =\n  convertToTensor(a, 'a', 'equal');\n  let\n  $b = convertToTensor(b, 'b', 'equal');\n  [$a, $b] = makeTypesMatch($a, $b);\n\n  assertAndGetBroadcastShape($a.shape, $b.shape);\n\n  const inputs: EqualInputs = {a: $a, b: $b};\n\n  return\n  ENGINE.runKernel(Equal, inputs as {} as NamedTensorMap);\n}\n\nexport const equal = op({equal_});\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n * 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a\n * copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable\n * law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n */

```

```

=====\n\n*/\nimport {ENGINE} from './engine';\nimport {Select, SelectInputs} from './kernel_names';\nimport {Tensor}\nfrom './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from\n './tensor_util_env';\nimport {TensorLike} from './types';\nimport {assert, assertShapesMatch} from\n './util';\nimport {broadcastTo} from './broadcast_to';\nimport {assertAndGetBroadcastShape} from\n './broadcast_util';\nimport {op} from './operation';\n\n/**\n * Returns the elements, either `a` or `b` depending on the\n * `condition`.\n *\n * If the condition is true, select from `a`, otherwise select from `b`.\n *\n * ```js\n * const cond =\n * tf.tensor1d([false, false, true], 'bool');\n * const a = tf.tensor1d([1, 2, 3]);\n * const b = tf.tensor1d([-1, -2, -3]);\n * a\n * .where(cond, b).print();\n * ```\n *\n * @param condition The input condition. Must be of dtype bool.\n *\n * @param a If `condition` is rank 1, `a` may have a higher rank but\n * its first dimension\n * must match the size of `condition`.\n *\n * @param b A tensor with the same dtype as `a` and with shape that is\n * compatible with `a`.\n *\n * @return A tensor with same dtype as `a` and `b`, and shape that is\n * broadcastable\n * from `a` and `b`.\n *\n * @doc {heading: 'Operations', subheading: 'Logical'}\n */\n\nfunction where_<T extends\n  Tensor>(\n  condition: Tensor|TensorLike, a: T|TensorLike, b: T|TensorLike): T {\n  const $a =\n  convertToTensor(a, 'a', 'where');\n  const $b = convertToTensor(b, 'b', 'where');\n  const $condition =

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convertToTensor(condition, 'condition', 'where', 'bool');\n // TODO: move this logic to forward function when the
broadcastTo op is\n // implemented in WASM.\n // Find the broadcastable shape for $a and $b.\n const
broadcastShape = assertAndGetBroadcastShape($a.shape, $b.shape);\n const $broadcastedA = broadcastTo($a,
broadcastShape);\n const $broadcastedB = broadcastTo($b, broadcastShape);\n if ($condition.rank === 1) {\n //
If condition rank is
1, then the first dimension must match the size of\n // condition.\n assert(\n $condition.shape[0] ===
$a.shape[0],\n () => "The first dimension of `a` must match the size of `condition`.");\n }\n\n if ($condition.rank
!:= 1) {\n // A must have the same shape as condition.\n assertShapesMatch(\n $condition.shape,
$broadcastedB.shape, 'Error in where: ');}\n\n const inputs: SelectInputs = {\n condition: $condition,\n t:
$broadcastedA,\n e: $broadcastedB\n };\n return ENGINE.runKernel(Select, inputs as unknown as
NamedTensorMap);\n}\n\nexport const where = op({where_});\n"/**\n * @license\n * Copyright 2018 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {ENGINE} from './engine';\nimport {ZerosLike, ZerosLikeInputs} from './kernel_names';\nimport
{Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from
 './tensor_util_env';\nimport {TensorLike} from './types';\nimport {op} from './operation';\n\n/**\n * Creates a
`tf.Tensor` with all elements set to 0 with the same shape as the\n * given tensor.\n *\n * ``js\n * const x =
tf.tensor([1, 2]);\n * tf.zerosLike(x).print();\n * ``\n *\n * @param x The tensor of required shape.\n *\n * @doc
{heading: 'Tensors', subheading: 'Creation'}\n */\nfunction zerosLike_<T extends Tensor>(x:
T|TensorLike): T {\n const $x = convertToTensor(x, 'x', 'zerosLike');\n const inputs: ZerosLikeInputs = {x: $x};\n
return ENGINE.runKernel(ZerosLike, inputs as {} as NamedTensorMap);\n}\n\nexport const zerosLike =
op({zerosLike_});\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under
the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====\n
*/\n\nimport {Tensor} from './tensor';\nimport
{makeTypesMatch} from './tensor_util';\nimport {convertToTensor} from './tensor_util_env';\nimport
{TensorLike} from './types';\nimport {div} from './div';\nimport {equal} from './equal';\nimport {op} from
 './operation';\nimport {where} from './where';\nimport {zerosLike} from './zeros_like';\n\n/**\n * Divides two
`tf.Tensor`s element-wise, A / B. Supports broadcasting. Return 0\n * if denominator is 0.\n *\n * ``js\n * const
a = tf.tensor1d([1, 4, 9, 16]);\n * const b = tf.tensor1d([1, 2, 3, 4]);\n * const c = tf.tensor1d([0, 0, 0, 0]);\n *
a.divNoNan(b).print(); // or tf.divNoNan(a, b)\n * a.divNoNan(c).print(); // or tf.divNoNan(a, c)\n * ``\n *\n *
``js\n * // Broadcast div a with b.\n * const a = tf.tensor1d([2, 4, 6, 8]);\n * const b = tf.scalar(2);\n * const c =
tf.scalar(0);\n * a.divNoNan(b).print(); // or tf.divNoNan(a, b)\n * a.divNoNan(c).print(); // or tf.divNoNan(a,
c)\n * ``\n *\n * @param a The first tensor as the numerator.\n * @param b
The second tensor as the denominator. Must have the same dtype as\n * `a`.\n *\n * @doc {heading: 'Operations',
subheading: 'Arithmetic'}\n */\nfunction divNoNan_<T extends Tensor>(a: Tensor|TensorLike, b:
Tensor|TensorLike): T {\n // TODO: Make this into its own kernel.\n let $a = convertToTensor(a, 'a', 'div');\n let
$b = convertToTensor(b, 'b', 'div');\n [$a, $b] = makeTypesMatch($a, $b);\n\n const divResult = div($a, $b);\n

```

const zeros = zerosLike(divResult);\n const bEqualsZero = equal(\$b, zeros);\n return where(bEqualsZero, zeros, divResult) as T;\n}\n\n\nexport const divNoNaN = op({divNoNaN_});\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n

* distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

=====\n\n*\n\nimport {Tensor,} from './tensor';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport * as util from './util';\n\nimport {matMul} from './mat_mul';\nimport {op} from './operation';\nimport {reshape} from './reshape';\n\n/**\n * Computes the dot product of two matrices and/or vectors, `t1` and `t2`.\n * \n * \n * \n * \n * const a = tf.tensor1d([1, 2]);\n * const b = tf.tensor2d([[1, 2], [3, 4]]);\n * const c = tf.tensor2d([[1, 2, 3], [4, 5, 6]]);\n * \n * \n * \n * \n * \n * a.dot(b).print(); // or tf.dot(a, b)\n * \n * \n * \n * \n * \n * \n * \n * \n * b.dot(a).print();\n * \n * \n * \n * \n * \n * @param t1 The first tensor in the dot operation.\n *

@param t2 The second tensor in the dot operation.\n *\n * \n * @doc {heading: 'Operations', subheading: 'Matrices'}\n\n*\n\nfunction dot_(t1: Tensor|TensorLike, t2: Tensor|TensorLike): Tensor {\n const \$t1 = convertToTensor(t1, 't1', 'dot');\n const \$t2 = convertToTensor(t2, 't2', 'dot');\n\n util.assert(\n (\$t1.rank === 1 || \$t1.rank === 2) && (\$t2.rank === 1 || \$t2.rank === 2),\n () => `Error in dot: inputs must all be rank 1 or 2, but got ranks ` +\n `\${\$t1.rank} and `\${\$t2.rank}`.`);\n\n const t1Inner = (\$t1.rank === 1 ? \$t1.size : \$t1.shape[1]);\n const t2Inner = (\$t2.rank === 1 ? \$t2.size : \$t2.shape[0]);\n\n util.assert(\n t1Inner === t2Inner,\n () => `Error in dot: inner dimensions of inputs must match, but got ` +\n `\${t1Inner} and `\${t2Inner}`.`);\n\n if (\$t1.rank === 1 && \$t2.rank === 1) {\n const t12D = reshape(\$t1, [1, -1]);\n const t22D = reshape(\$t2, [-1, 1]);\n const t1t2 = matMul(t12D, t22D);\n return reshape(t1t2, []);\n }\n\n } else if (\$t1.rank === 1 && \$t2.rank === 2) {\n const t12D = reshape(\$t1, [1, -1]);\n const t22D = reshape(\$t2, [\$t2.shape[0], \$t2.shape[1]]);\n const t1t2 = matMul(t12D, t22D);\n return reshape(t1t2, [t1t2.size]);\n }\n\n } else if (\$t1.rank === 2 && \$t2.rank === 1) {\n const t22D = reshape(\$t2, [-1, 1]);\n const t1t2 = matMul(\$t1, t22D);\n return reshape(t1t2, [t1t2.size]);\n }\n\n } else {\n const t22D = reshape(\$t2, [\$t2.shape[0], \$t2.shape[1]]);\n const t1t2 = matMul(\$t1, t22D);\n return t1t2;\n }\n}\n\n\n\nexport const dot = op({dot_});\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n

* distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

=====\n\n*\n\nimport {ENGINE} from './engine';\nimport {Elu, EluInputs} from './kernel_names';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\n\nimport {op} from './operation';\n\n/**\n * Computes exponential linear element-wise: $x > 0 ? e^x - 1 : 0$.\n * \n * \n * \n * \n * \n * const x = tf.tensor1d([-1, 1, -3, 2]);\n * \n * \n * \n * \n * \n * \n * \n * \n * \n * x.elu().print(); // or tf.elu(x)\n * \n * \n * \n * \n * \n * @param x The input tensor.\n * \n * \n * @doc {heading: 'Operations', subheading: 'Basic math'}\n\n*\n\nfunction elu_<T extends Tensor>(x: T|TensorLike): T {\n const \$x = convertToTensor(x, 'x', 'elu');\n\n const inputs: EluInputs = {x: \$x};\n\n return ENGINE.runKernel(Elu, inputs as {} as NamedTensorMap);\n}\n\n\n\nexport const elu = op({elu_});\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the

License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```
=====\n*\n\nimport {ENGINE} from './engine';\nimport {Erf, ErfInputs} from './kernel_names';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport * as util from './util';\nimport {cast} from './cast';\nimport {op} from './operation';\n\n/**\n * Computes gause error function of the input `tf.Tensor` element-wise:\n * `erf(x)`\n * ``js\n * const x = tf.tensor1d([0, .1, -1, .7]);\n * x.erf().print(); // or tf.erf(x);\n * ``\n * @param x The input tensor.\n * @doc {heading: 'Operations', subheading: 'Basic math'}\n */\nfunction erf_<T extends Tensor>(x: T|TensorLike): T {\n  let $x = convertToTensor(x, 'x', 'erf');\n  util.assert(\n    $x.dtype === 'int32' || $x.dtype === 'float32',\n    () => 'Input dtype must be `int32` or `float32`.');\n  if ($x.dtype === 'int32') {\n    $x = cast($x, 'float32');\n  }\n  const inputs: ErfInputs = {x: $x};\n  return ENGINE.runKernel(Erf, inputs as { } as NamedTensorMap);\n}\n\nexport const erf = op({erf_});\n", /**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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=====\n*\n\nimport {ENGINE} from './engine';\nimport {Exp, ExpInputs} from './kernel_names';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport {op} from './operation';\n\n/**\n * Computes exponential of the input `tf.Tensor` element-wise. `e ^ x`\n * ``js\n * const x = tf.tensor1d([1, 2, -3]);\n * x.exp().print(); // or tf.exp(x)\n * ``\n * @param x The input tensor.\n * @doc {heading: 'Operations', subheading: 'Basic math'}\n */\nfunction exp_<T extends Tensor>(x: T|TensorLike): T {\n  const $x = convertToTensor(x, 'x', 'exp');\n  const inputs: ExpInputs = {x: $x};\n  return ENGINE.runKernel(Exp, inputs as { } as NamedTensorMap);\n}\n\nexport const exp = op({exp_});\n", /**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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=====\n*\n\nimport {ENGINE} from './engine';\nimport {ExpandDims, ExpandDimsAttrs, ExpandDimsInputs} from './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport * as util from './util';\nimport {op} from './operation';\n\n/**\n * Returns a `tf.Tensor` that has expanded rank, by inserting a dimension\n * into the tensor's shape.\n * ``js\n * const x = tf.tensor1d([1, 2, 3, 4]);\n * const axis = 1;\n * x.expandDims(axis).print();\n * ``\n * @param x The input tensor whose dimensions to be expanded.\n * @param axis The dimension index at which to insert shape of `1`.
```

Defaults\n *

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to 0 (the first dimension).\n *\n * @doc {heading: 'Tensors', subheading: 'Transformations'}\n *\nfunction\nexpandDims_<T extends Tensor>(x: Tensor|TensorLike, axis = 0): T {\n const $x = convertToTensor(x, 'x',\n 'expandDims', 'string_or_numeric');\n util.assert(axis <= $x.rank, () => 'Axis must be <= rank of the tensor');\n const inputs: ExpandDimsInputs = {input: $x};\n const attrs: ExpandDimsAttrs = {dim: axis};\n return\nENGINE.runKernel(\n ExpandDims, inputs as {} as NamedTensorMap, attrs as {} as\nNamedAttrMap);\n}\n\nexport const expandDims = op({expandDims_});\n"/**\n * @license\n * Copyright 2018\n * Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the
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License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY\n * KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n *\nimport {ENGINE} from '../engine';\nimport {Expm1, Expm1Inputs} from '../kernel_names';\nimport {Tensor}\nfrom '../tensor';\nimport {NamedTensorMap} from '../tensor_types';\nimport {convertToTensor} from\n '../tensor_util_env';\nimport {TensorLike} from '../types';\nimport {op} from '../operation';\n\n/**\n * Computes\n * exponential of the input `tf.Tensor` minus one element-wise.\n *  $e^x - 1$ \n *  $\\j$ \n * const x = tf.tensor1d([1,\n * 2, -3]);\n * x.expm1().print(); // or tf.expm1(x)\n * @param x The input tensor.\n * @doc {heading:\n * 'Operations', subheading: 'Basic math'}\n *\nfunction expm1_<T extends Tensor>(x: T|TensorLike): T {\n const $x =\n * convertToTensor(x,
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'x', 'expm1');\n\n const inputs: Expm1Inputs = {x: $x};\n return ENGINE.runKernel(Expm1, inputs as {} as\nNamedTensorMap);\n}\n\nexport const expm1 = op({expm1_});\n"/**\n * @license\n * Copyright 2020 Google\n * LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not\n * use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n *
```

```
=====\n *\nimport {ENGINE} from '../engine';\nimport {Tile, TileAttrs, TileInputs} from '../kernel_names';\nimport\n {NamedAttrMap} from '../kernel_registry';\nimport {Tensor} from '../tensor';\nimport {NamedTensorMap} from\n '../tensor_types';\nimport {convertToTensor} from '../tensor_util_env';\nimport {TensorLike} from '../types';\nimport\n * as util from '../util';\nimport {op} from '../operation';\n\n/**\n * Construct a tensor by repeating it the number of\n * times given by reps.\n * This operation creates a new tensor by replicating `input` `reps`\n * times. The output\n * tensor's i'th dimension has `input.shape[i] * reps[i]` elements, and the values of `input`\n * are replicated\n * `reps[i]` times along the i'th dimension. For example, tiling\n * [a, b, c, d] by [2] produces [a, b, c, d, a, b, c,\n * d].\n *  $\\j$ \n * const a = tf.tensor1d([1, 2]);\n * a.tile([2]).print(); // or a.tile([2])\n *  $\\j$ \n * const a = tf.tensor2d([1, 2, 3, 4], [2, 2]);\n * a.tile([1, 2]).print(); // or a.tile([1, 2])\n * @param x The\n * tensor to tile.\n * @param reps Determines
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the number of replications per dimension.\n *\n * @doc {heading: 'Tensors', subheading: 'Slicing and Joining'}\n *\nfunction tile_<T extends Tensor>(x: T|TensorLike, reps: number[]): T {\n const $x = convertToTensor(x, 'x',\n 'tile', 'string_or_numeric');\n util.assert(\n $x.rank === reps.length,\n () => `Error in transpose: rank of input\n ${$x.rank} ` +\n `must match length of reps ${reps}.`);\n const inputs: TileInputs = {x: $x};\n const attrs:\n * TileAttrs = {reps};\n return ENGINE.runKernel(\n Tile, inputs as unknown as NamedTensorMap,\n attrs as\n * unknown as NamedAttrMap);\n}\n\nexport const tile = op({tile_});\n"/**\n * @license\n * Copyright 2020\n * Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
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may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```
=====\n*\n\nimport {Tensor2D} from './tensor';\nimport {DataType} from './types';\nimport {buffer} from './buffer';\nimport {expandDims} from './expand_dims';\nimport {op} from './operation';\nimport {reshape} from './reshape';\nimport {tile} from './tile';\n\n/**\n * Create an identity matrix.\n *\n * @param numRows Number of rows.\n * @param numColumns Number of columns. Defaults to `numRows`.\n * @param batchShape If provided, will add the batch shape to the beginning\n * of the shape of the returned `tf.Tensor` by repeating the identity\n * matrix.\n * @param dtype Data type.\n * @returns Identity matrix of the specified size and data type, possibly\n * with batch repetition if `batchShape` is specified.\n *\n * @doc {heading: 'Tensors', subheading: 'Creation'}\n */\nfunction eye_(\n  numRows: number, numColumns?: number, batchShape?:\n    [number, number][number, number][number, number][number, number, number],\n  dtype: DataType = 'float32'): Tensor2D {\n  if (numColumns == null) {\n    numColumns = numRows;\n  }\n  const buff = buffer([numRows, numColumns], dtype);\n  const n = numRows <= numColumns ? numRows : numColumns;\n  for (let i = 0; i < n; ++i) {\n    buff.set(1, i, i);\n  }\n  const out: Tensor2D = reshape(buff.toTensor(), [numRows, numColumns]);\n  if (batchShape == null) {\n    return out;\n  } else {\n    if (batchShape.length === 1) {\n      return tile(expandDims(out, 0), [batchShape[0], 1, 1]) as Tensor2D;\n    } else if (batchShape.length === 2) {\n      // tslint:disable-next-line:no-unnecessary-type-assertion\n      return tile(\n        expandDims(expandDims(out, 0), 0),\n        [batchShape[0], batchShape[1], 1, 1])\n      ) as Tensor2D;\n    } else if (batchShape.length === 3) {\n      // tslint:disable-next-line:no-unnecessary-type-assertion\n      return tile(expandDims(expandDims(expandDims(out, 0), 0), 0), [\n        batchShape[0], batchShape[1], batchShape[2], 1, 1\n      ]) as Tensor2D;\n    } else {\n      throw new Error(\n        `eye() currently supports only 1D and 2D` +\n        // tslint:disable-next-line:no-any\n        `batchShapes, but received ${\n          (batchShape as any).length\n        }D.`);\n    }\n  }\n}\n\nexport const eye = op({eye_});\n\n/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an\n * \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *\n *=====\n\nimport {ENGINE} from './engine';\nimport {Fill, FillAttrs} from './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport {DataType, Rank, ShapeMap} from './types';\n\n/**\n * Creates a `tf.Tensor` filled with a scalar value.\n *\n * ``js\n * tf.fill([2, 2], 4).print();\n *``\n *\n * @param shape An array of integers defining the output tensor shape.\n * @param value The scalar value to fill the tensor with.\n * @param dtype The type of an element in the resulting tensor. Defaults to\n * 'float'.\n *\n * @doc {heading: 'Tensors', subheading: 'Creation'}\n */\nfunction fill<R extends Rank>(\n  shape: ShapeMap[R], value: number|string, dtype?:\n    DataType): Tensor<R> {\n  const attrs: FillAttrs = {shape, value, dtype};\n  return ENGINE.runKernel(Fill, {}, attrs as {} as NamedAttrMap);\n}\n\nexport {fill};\n\n/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an\n * \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
```



```
tf.tensor1d([2, 2, 2]);\n *\n * a.greater(b).print();\n * ``\n *\n * @param a The first input tensor.\n * @param b The second input tensor. Must have the same dtype as `a`.\n *\n * @doc {heading: 'Operations', subheading: 'Logical'}\n *\n *\nfunction greater_<T extends Tensor>(\n  a: Tensor|TensorLike, b: Tensor|TensorLike): T {\n  let $a = convertToTensor(a,\n    'a', 'greater');\n  let $b = convertToTensor(b, 'b', 'greater');\n  [$a, $b] = makeTypesMatch($a, $b);\n  assertAndGetBroadcastShape($a.shape, $b.shape);\n  const inputs: GreaterInputs = {a: $a, b: $b};\n  return ENGINE.runKernel(Greater, inputs as {} as NamedTensorMap);\n}\n\nexport const greater =\n  op({greater_});\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n\n *\nimport {ENGINE} from './engine';\nimport {GreaterEqual, GreaterEqualInputs} from './kernel_names';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {makeTypesMatch} from './tensor_util';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport {assertAndGetBroadcastShape} from './broadcast_util';\nimport {op} from './operation';\n\n/**\n * Returns the truth value of (a >= b) element-wise. Supports broadcasting.\n *\n * ``js\n * const a = tf.tensor1d([1, 2, 3]);\n * const b = tf.tensor1d([2, 2, 2]);\n * a.greaterEqual(b).print();\n * ``\n *\n * @param a The first input tensor.\n * @param b The second input tensor. Must have the same dtype as `a`.\n *\n * @doc {heading: 'Operations', subheading: 'Logical'}\n *\n *\nfunction greaterEqual_<T extends Tensor>(\n  a: Tensor|TensorLike, b: Tensor|TensorLike): T {\n  let $a = convertToTensor(a, 'a', 'greaterEqual');\n  let $b = convertToTensor(b, 'b', 'greaterEqual');\n  [$a, $b] = makeTypesMatch($a, $b);\n  assertAndGetBroadcastShape($a.shape, $b.shape);\n  const inputs: GreaterEqualInputs = {a: $a, b: $b};\n  return ENGINE.runKernel(GreaterEqual, inputs as {} as NamedTensorMap);\n}\n\nexport const greaterEqual =\n  op({greaterEqual_});\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

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=====\n\n *\nimport {ENGINE} from './engine';\nimport {Imag, ImagInputs} from './kernel_names';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport {op} from './operation';\n\n/**\n * Returns the imaginary part of a complex (or real) tensor.\n *\n * Given a tensor input, this operation returns a tensor of type float that is\n * the imaginary part of each element in input considered as a complex number.\n * If input is real, a tensor of all zeros is returned.\n *\n * ``js\n * const x = tf.complex([-2.25, 3.25], [4.75, 5.75]);\n * tf.imag(x).print();\n * ``\n *\n * @doc {heading: 'Tensors', subheading: 'Creation'}\n *\n *\nfunction imag_<T extends Tensor>(input: T|TensorLike): T {\n  const $input = convertToTensor(input, 'input', 'imag');\n  const inputs: ImagInputs = {input: $input};\n  return ENGINE.runKernel(Imag, inputs as {} as NamedTensorMap);\n}\n\nexport const imag = op({imag_});\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable
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```
=====\n*\n\nimport {ENGINE} from './engine';\nimport {IsFinite, IsFiniteInputs} from './kernel_names';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport {op} from './operation';\n\n/**\n * Returns which elements of x are finite.\n *\n * ```js\n * const x = tf.tensor1d([NaN, Infinity, -Infinity, 0, 1]);\n * x.isFinite().print(); // or tf.isNaN(x)\n * ```\n * @param x The input Tensor.\n *\n * @doc {heading: 'Operations', subheading: 'Basic math'}\n */\nfunction isFinite_<T extends Tensor>(x: T|TensorLike): T {\n  const $x = convertToTensor(x, 'x', 'isFinite');\n  const inputs: IsFiniteInputs = {x: $x};\n  return ENGINE.runKernel(IsFinite, inputs as {} as NamedTensorMap);\n}\n\nexport const isFinite = op({isFinite_});\n\n/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless
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```
=====\n*\n\nimport {ENGINE} from './engine';\nimport {IsInf, IsInfInputs} from './kernel_names';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport {op} from './operation';\n\n/**\n * Returns which elements of x are Infinity or -Infinity.\n *\n * ```js\n * const x = tf.tensor1d([NaN, Infinity, -Infinity, 0, 1]);\n * x.isInf().print(); // or tf.isNaN(x)\n * ```\n * @param x The input Tensor.\n *\n * @doc {heading: 'Operations', subheading: 'Basic math'}\n */\nfunction isInf_<T extends Tensor>(x: T|TensorLike): T {\n  const $x = convertToTensor(x, 'x', 'isInf');\n  const inputs: IsInfInputs = {x: $x};\n  return ENGINE.runKernel(IsInf, inputs as {} as NamedTensorMap);\n}\n\nexport const isInf = op({isInf_});\n\n/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport {ENGINE}\nfrom './engine';\nimport {IsNaN, IsNaNInputs} from './kernel_names';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport {op} from './operation';\n\n/**\n * Returns which elements of x are NaN.\n *\n * ```js\n * const x = tf.tensor1d([NaN, Infinity, -Infinity, 0, 1]);\n * x.isNaN().print(); // or tf.isNaN(x)\n * ```\n * @param x The input Tensor.\n *\n * @doc {heading: 'Operations', subheading: 'Basic math'}\n */\nfunction isNaN_<T extends Tensor>(x: T|TensorLike): T {\n  const $x = convertToTensor(x, 'x', 'isNaN');\n  const inputs: IsNaNInputs = {x: $x};\n  return ENGINE.runKernel(IsNaN, inputs as {} as NamedTensorMap);\n}\n\nexport const isNaN = op({isNaN_});\n\n/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is
```

distributed on an "AS IS" BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied. See the License for the specific language governing permissions and limitations under the License.

```
=====
*/nimport {ENGINE} from './engine';nimport {LeakyRelu, LeakyReluAttrs, LeakyReluInputs} from
 './kernel_names';nimport {NamedAttrMap} from './kernel_registry';nimport {Tensor} from './tensor';nimport
 {NamedTensorMap} from './tensor_types';nimport {convertToTensor} from './tensor_util_env';nimport
 {TensorLike} from './types';nimport {op} from './operation';n/**n * Computes leaky rectified linear element-
 wise.n * See [http://web.stanford.edu/~awni/papers/relu_hybrid_icml2013_final.pdf](n
 * http://web.stanford.edu/~awni/papers/relu_hybrid_icml2013_final.pdf)n * ```)n * const x = tf.tensor1d([-
 1, 2, -3, 4]);n * x.leakyRelu(0.1).print(); // or tf.leakyRelu(x, 0.1)n * ```)n * @param x The input tensor.n *
 @param alpha The scaling factor for negative values, defaults to 0.2.n * @doc {heading: 'Operations',
 subheading: 'Basic math'}n *nfunction leakyRelu_<T extends Tensor>(x: T|TensorLike, alpha = 0.2): T {n const
 $x = convertToTensor(x, 'x', 'leakyRelu');n const inputs: LeakyReluInputs = {x: $x};n const attrs:
 LeakyReluAttrs = {alpha};n return ENGINE.runKernel(n LeakyRelu, inputs as { } as NamedTensorMap,
 attrs as { } as NamedAttrMap);n}nexport const leakyRelu = op({leakyRelu_});n",/**n * @licensen *
 Copyright 2020 Google LLC. All Rights Reserved.n * Licensed under the Apache License, Version 2.0 (the
 "License");n * you may not use this file except in compliance
 with the License.n * You may obtain a copy of the License atn *n * http://www.apache.org/licenses/LICENSE-
 2.0n *n * Unless required by applicable law or agreed to in writing, softwaren * distributed under the License is
 distributed on an "AS IS" BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
 express or implied.n * See the License for the specific language governing permissions andn * limitations under
 the License.n *
```

```
=====
*/nimport {ENGINE} from './engine';nimport {Less, LessInputs} from './kernel_names';nimport {Tensor} from
 './tensor';nimport {NamedTensorMap} from './tensor_types';nimport {makeTypesMatch} from
 './tensor_util';nimport {convertToTensor} from './tensor_util_env';nimport {TensorLike} from './types';nimport
 {assertAndGetBroadcastShape} from './broadcast_util';nimport {op} from './operation';n/**n * Returns the truth
 value of (a < b) element-wise.
 Supports broadcasting.n * ```)n * const a = tf.tensor1d([1, 2, 3]);n * const b = tf.tensor1d([2, 2, 2]);n *n *
 a.less(b).print();n * ```)n * @param a The first input tensor.n * @param b The second input tensor. Must have the
 same dtype as `a`.n * @doc {heading: 'Operations', subheading: 'Logical'}n *nfunction less_<T extends
 Tensor>(n a: Tensor|TensorLike, b: Tensor|TensorLike): T {n let $a = convertToTensor(a, 'a', 'less');n let $b =
 convertToTensor(b, 'b', 'less');n [$a, $b] = makeTypesMatch($a, $b);n assertAndGetBroadcastShape($a.shape,
 $b.shape);n const inputs: LessInputs = {a: $a, b: $b};n return ENGINE.runKernel(Less, inputs as { } as
 NamedTensorMap);n}nexport const less = op({less_});n",/**n * @licensen * Copyright 2020 Google LLC.
 All Rights Reserved.n * Licensed under the Apache License, Version 2.0 (the "License");n * you may not use this
 file except in compliance with the License.n * You may obtain a copy of the License atn
 *n * http://www.apache.org/licenses/LICENSE-2.0n *n * Unless required by applicable law or agreed to in
 writing, softwaren * distributed under the License is distributed on an "AS IS" BASIS, WITHOUT
 WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.n * See the License for the specific
 language governing permissions andn * limitations under the License.n *
```

```
=====
*/nimport {ENGINE} from './engine';nimport {LessEqual, LessEqualInputs} from './kernel_names';nimport
 {Tensor} from './tensor';nimport {NamedTensorMap} from './tensor_types';nimport {makeTypesMatch} from
 './tensor_util';nimport {convertToTensor} from './tensor_util_env';nimport {TensorLike} from './types';nimport
 {assertAndGetBroadcastShape} from './broadcast_util';nimport {op} from './operation';n/**n * Returns the truth
 value of (a <= b) element-wise. Supports broadcasting.n * ```)n * const a =
```

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tf.tensor1d([1, 2, 3]);\n * const b = tf.tensor1d([2, 2, 2]);\n *\n * a.lessEqual(b).print();\n * ```\n *\n * @param a
The first input tensor.\n * @param b The second input tensor. Must have the same dtype as `a`.\n *\n * @doc
{heading: 'Operations', subheading: 'Logical'}\n *\nfunction lessEqual_<T extends Tensor>(\n  a:
Tensor|TensorLike, b: Tensor|TensorLike): T {\n  let $a = convertToTensor(a, 'a', 'lessEqual');\n  let $b =
convertToTensor(b, 'b', 'lessEqual');\n  [$a, $b] = makeTypesMatch($a, $b);\n\n  assertAndGetBroadcastShape($a.shape, $b.shape);\n\n  const inputs: LessEqualInputs = {a: $a, b: $b};\n\n  return
ENGINE.runKernel(LessEqual, inputs as {} as NamedTensorMap);\n}\n\nexport const lessEqual =
op({lessEqual_});\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under
the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {ENGINE} from './engine';\nimport {LinSpace, LinSpaceAttrs} from './kernel_names';\nimport
{NamedAttrMap} from './kernel_registry';\nimport {Tensor1D} from './tensor';\n\n/**\n * Return an evenly spaced
sequence of numbers over the given interval.\n *\n * ````s\n * tf.linspace(0, 9, 10).print();\n * ````\n *\n * @param start
The start value of the sequence.\n *\n * @param stop The end value of the sequence.\n *\n * @param num The number of
values to generate.\n *\n * @doc {heading: 'Tensors', subheading: 'Creation'}\n *\nfunction linspace(start: number, stop: number, num: number): Tensor1D {\n  if (num <= 0) {\n    throw new
Error("The number of values should be positive.");\n  }\n\n  const attrs: LinSpaceAttrs = {start, stop, num};\n  return
ENGINE.runKernel(LinSpace, {}, attrs as {} as NamedAttrMap);\n}\n"/**\n * @license\n * Copyright 2020
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {ENGINE} from './engine';\nimport {LRN, LRNAttrs, LRNInputs} from './kernel_names';\nimport
{NamedAttrMap} from './kernel_registry';\nimport {Tensor3D, Tensor4D} from './tensor';\nimport
{NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport
{TensorLike} from './types';\nimport * as util from './util';\n\nimport {op} from './operation';\nimport {reshape}
from './reshape';\n\n/**\n * Normalizes the activation of a local neighborhood across or within\n * channels.\n *\n * @param x The input tensor. The 4-D input tensor is treated as a 3-D array\n *   of 1D vectors (along the last
dimension), and each vector is\n *   normalized independently.\n *\n * @param depthRadius The number of adjacent
channels in the 1D normalization\n *   window.\n *\n * @param bias A constant bias term for the basis.\n *\n * @param
alpha A scale factor, usually positive.\n *\n * @param beta An exponent.\n *\n * @doc {heading: 'Operations',
subheading:
'Normalization'}\n *\nfunction localResponseNormalization_<T extends Tensor3D|Tensor4D>(\n  x:
T|TensorLike, depthRadius = 5, bias = 1, alpha = 1, beta = 0.5): T {\n  const $x = convertToTensor(x, 'x',
'localResponseNormalization');\n  util.assert(\n    $x.rank === 4 || $x.rank === 3,\n    () => `Error in
localResponseNormalization: x must be rank 3 or 4 but got\n      rank ${$x.rank}.`);\n  util.assert(\n    util.isInt(depthRadius),\n    () => `Error in localResponseNormalization: depthRadius must be an\n
`integer but got depthRadius ${depthRadius}.`);\n\n  let x4D = $x as Tensor4D;\n  let reshapedTo4D = false;\n  if
($x.rank === 3) {\n    reshapedTo4D = true;\n    x4D = reshape($x, [1, $x.shape[0], $x.shape[1], $x.shape[2]]);\n  }\n\n  const inputs: LRNInputs = {x: x4D};\n  const attrs: LRNAttrs = {depthRadius, bias, alpha, beta};\n  //

```



```

f(x) = x ^ 2\n * const f = x => x.square();\n * // f'(x) = 2x\n * const g = tf.grad(f);\n *\n * const x = tf.tensor1d([2, 3]);\n
* g(x).print();\n * ```\n *\n * ```\n * // f(x) = x ^ 3\n * const f = x => x.pow(tf.scalar(3, 'int32'));\n * // f'(x) = 3x ^ 2\n * const g = tf.grad(f);\n * // f'(x) = 6x\n * const gg = tf.grad(g);\n *\n * const x = tf.tensor1d([2, 3]);\n * gg(x).print();\n * ```\n *\n * @param f The function f(x), to compute gradient for.\n *\n * @doc {heading: 'Training', subheading: 'Gradients'}\n */\nfunction grad(f: (x: Tensor) => Tensor): (\n  x: TensorLike|Tensor, dy?: TensorLike|Tensor) => Tensor {\n  util.assert(\n    util.isFunction(f), () => 'The f passed in grad(f) must be a function');\n  return (x: TensorLike|Tensor, dy?: TensorLike|Tensor): Tensor => {\n    // x can be of any dtype, thus null as the last argument.\n    const $x = convertToTensor(x, 'x', 'tf.grad', 'string_or_numeric');\n    const $dy: Tensor =\n      (dy != null) ? convertToTensor(dy, 'dy', 'tf.grad') : null;\n    return ENGINE.tidy(() => {\n      const {value, grads} = ENGINE.gradients(() => f($x), [$x], $dy);\n      if ($dy != null) {\n        util.assertShapesMatch(\n          value.shape, $dy.shape,\n          'The shape of dy passed in grad(f)(x, dy) must match the shape ' +\n            'returned by f(x)');\n        checkGrads(grads);\n        return grads[0];\n      };\n    });\n  }\n}\n\n/**\n * Provided `f(x1, x2,...)`, returns another function `g([x1, x2,...], dy?)`,\n * which gives an array of gradients of `f` with respect to each input\n * `[x1, x2, ...]`. If `dy` is passed when calling `g()`, the gradient of\n * `f(x1,...).mul(dy).sum()` with respect to each input is computed instead.\n * The provided `f` must take one or more tensors and return a single tensor\n * `y`. If `f` takes a single input, we recommend using `tf.grad` instead.\n *\n * // f(a, b) = a * b\n * const f = (a, b) => a.mul(b);\n * // df / da = b, df / db = a\n * const g = tf.grads(f);\n *\n * const a = tf.tensor1d([2, 3]);\n * const b = tf.tensor1d([-2, -3]);\n * const [da, db] = g([a, b]);\n * console.log('da');\n * da.print();\n * console.log('db');\n * db.print();\n * ```\n *\n * @param f The function `f(x1, x2,...)` to compute gradients for.\n *\n * @doc {heading: 'Training', subheading: 'Gradients'}\n */\nfunction grads(f: (...args: Tensor[]) => Tensor): (\n  args: Array<Tensor|TensorLike>, dy?: Tensor|TensorLike) => Tensor[] {\n  util.assert(\n    util.isFunction(f), () => 'The f passed in grads(f) must be a function');\n  return (args: Array<Tensor|TensorLike>, dy?: Tensor|TensorLike): Tensor[] => {\n    util.assert(\n      Array.isArray(args),\n      () => 'The args passed in grads(f)(args) must be an array ' +\n        'of `Tensor`s or `TensorLike`s');\n    // args can be of any dtype, thus null as the last argument.\n    const $args =\n      convertToTensorArray(args, 'args', 'tf.grads', 'string_or_numeric');\n    const $dy: Tensor =\n      (dy != null) ? convertToTensor(dy, 'dy', 'tf.grads') : null;\n    return ENGINE.tidy(() => {\n      const {value, grads} = ENGINE.gradients(() => f(...$args), $args, $dy);\n      if ($dy != null) {\n        util.assertShapesMatch(\n          value.shape, $dy.shape,\n          'The shape of dy passed in grads(f)([x1,...], dy) must ' +\n            'match the shape returned by f([x1,...])');\n        checkGrads(grads);\n        return grads;\n      };\n    });\n  }\n}\n\n/**\n * Like `tf.grad`, but also returns the value of `f`. Useful when `f`\n * returns a metric you want to show.\n *\n * The result is a rich object with the following properties:\n * - grad: The gradient of `f(x)` w.r.t `x` (result of `tf.grad`).\n * - value: The value returned by `f(x)`.\n *\n * // f(x) = x ^ 2\n * const f = x => x.square();\n * // f'(x) = 2x\n * const g = tf.valueAndGrad(f);\n *\n * const x = tf.tensor1d([2, 3]);\n * const {value, grad} = g(x);\n * console.log('value');\n * value.print();\n * console.log('grad');\n * grad.print();\n * ```\n *\n * @doc {heading: 'Training', subheading: 'Gradients'}\n */\nfunction valueAndGrad<I extends Tensor, O extends Tensor>(f: (x: I) => O): (\n  x: I, dy?: O) => {\n  value: O;\n  grad: I;\n} {\n  util.assert(\n    util.isFunction(f),\n    () => 'The f passed in valueAndGrad(f) must be a function');\n  return (x: I, dy?: O) => {\n    util.assert(\n      x instanceof Tensor,\n      () => 'The x passed in valueAndGrad(f)(x) must be a tensor');\n    util.assert(\n      dy == null || dy instanceof Tensor,\n      () => 'The dy passed in valueAndGrad(f)(x, dy) must be a tensor');\n    const {grads, value} = ENGINE.gradients(() => f(x), [x], dy);\n    checkGrads(grads);\n    return {grad: grads[0] as I, value};\n  };\n}\n\n/**\n * Like `tf.grads`, but returns also the value of `f`. Useful when `f`\n * returns a metric you want to show.\n *\n * The result is a rich object with the following properties:\n * - grads: The gradients of `f` w.r.t each input (result of `tf.grads`).\n * - value: The value returned

```

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by `f(x)`.\n *\n * ```\n * // f(a, b) = a * b\n * const f = (a, b) => a.mul(b);\n * // df/da = b, df/db = a\n * const g =
tf.valueAndGrads(f);\n *\n * const a = tf.tensor1d([2, 3]);\n * const b = tf.tensor1d([-2, -3]);\n * const {value, grads}
= g([a, b]);\n *\n * const [da, db] = grads;\n *\n * console.log('value');\n * value.print();\n *\n * console.log('da');\n *
da.print();\n * console.log('db');\n * db.print();\n * ```\n *\n * @doc {heading: 'Training', subheading: 'Gradients'}\n
*\n * \nfunction valueAndGrads<O extends Tensor>(f: (...args: Tensor[]) => O): (\n  args: Tensor[], dy?: O) => {\n
  grads: Tensor[];\n  value: O;\n  }\n  util.assert(\n    util.isFunction(f),\n    () => 'The f passed in valueAndGrads(f)
must be a function');\n  return (args: Tensor[], dy?: O) => {\n    util.assert(\n      Array.isArray(args) &&
args.every(arg => arg instanceof Tensor),\n      () => 'The args passed in valueAndGrads(f)(args) must be array of '
+\n      'tensors');\n    util.assert(\n      dy == null || dy instanceof Tensor,\n      () => 'The dy passed in valueAndGrads(f)(args, dy) must be a
tensor');\n    const res = ENGINE.gradients(() => f(...args), args, dy);\n    if (dy != null) {\n      util.assertShapesMatch(\n        res.value.shape, dy.shape,\n        'The shape of dy passed in
valueAndGrads(f)([x1,...], dy) must ' +\n        'match the shape returned by f([x1,...])');\n    }\n    checkGrads(res.grads);\n    return res;\n  };}\n\n/**\n * Computes and returns the gradient of f(x) with respect to
the list of\n * trainable variables provided by `varList`. If no list is provided, it\n * defaults to all trainable
variables.\n *\n * ```\n *\n * const a = tf.variable(tf.tensor1d([3, 4]));\n * const b = tf.variable(tf.tensor1d([5, 6]));\n *
const x = tf.tensor1d([1, 2]);\n *\n * // f(a, b) = a * x ^ 2 + b * x\n * const f = () =>
a.mul(x.square()).add(b.mul(x)).sum();\n *\n * // df/da = x ^ 2, df/db = x\n * const {value, grads} =
tf.variableGrads(f);\n
*\n * Object.keys(grads).forEach(varName => grads[varName].print());\n * ```\n *\n * @param f The function to
execute. f() should return a scalar.\n * @param varList The list of variables to compute the gradients with respect\n
* to. Defaults to all trainable variables.\n * @returns An object with the following keys and values:\n * - `value`:
The value of the function `f`.\n * - `grads`: A map from the names of the variables to the gradients.\n * If the
`varList` argument is provided explicitly and contains a subset of\n * non-trainable variables, this map in the
return value will contain keys\n * that map the names of the non-trainable variables to `null`.\n *\n * @doc
{heading: 'Training', subheading: 'Gradients'}\n *\n * \nfunction variableGrads(f: () => Scalar, varList?: Variable[]):\n
{value: Scalar, grads: NamedTensorMap} {\n  util.assert(\n    util.isFunction(f),\n    () => 'The f passed in
variableGrads(f) must be a function');\n  util.assert(\n    varList == null ||\n      Array.isArray(varList) && varList.every(v => v instanceof Variable),\n    () =>\n      'The varList passed in variableGrads(f, varList) must be an array ' +\n      'of variables');\n  const
specifiedVarList = varList != null;\n  if (!specifiedVarList) {\n    // Get all of the trainable variables.\n    varList =
[];\n    for (const varName in ENGINE.registeredVariables) {\n      varList.push(ENGINE.registeredVariables[varName]);\n    }\n  }\n  const specifiedNonTrainable: Variable[] =\n    specifiedVarList ? varList.filter(variable => !variable.trainable) : null;\n  // Prune non-trainable variables.\n  const
originalVarCount = varList.length;\n  varList = varList.filter(variable => variable.trainable);\n  util.assert(\n    varList.length > 0,\n    () => `variableGrads() expects at least one of the input variables to ` +\n      `be trainable,
but none of the ${originalVarCount} variables is ` +\n      `trainable.`);\n  const
allowNoGradients = true;\n  const {value, grads} = ENGINE.gradients(f, varList, null, allowNoGradients);\n  util.assert(\n    grads.some(g => g != null),\n    () => 'Cannot find a connection between any variable and the result
of ' +\n      'the loss function y=f(x). Please make sure the operations that ' +\n      'use variables are inside the
function f passed to minimize().');\n  util.assert(\n    value.rank === 0,\n    () => `The f passed in variableGrads(f)
must return a scalar, but it ` +\n      `returned a rank-${value.rank} tensor`);\n  const namedGrads:
NamedTensorMap = {};\n  varList.forEach((v, i) => {\n    if (grads[i] != null) {\n      namedGrads[v.name] =
grads[i];\n    }\n  });\n  if (specifiedNonTrainable != null) {\n    // If varList is explicitly provided and contains non-
trainable values,\n    // add them to the returned gradients with `null` values.\n    specifiedNonTrainable.forEach(v
=> namedGrads[v.name] = null);\n  }\n  return {value, grads:
namedGrads};}\n\n/**\n * Overrides the gradient computation of a function `f`.\n *\n * Takes a function\n *
`f(...inputs, save) => {value: Tensor, gradFunc: (dy, saved) => Tensor[]}`\n * and returns another function

```

```

`g(...inputs)` which takes the same inputs as `f`. When called, `g` returns `f().value`. In backward mode, custom
gradients with respect to each input of `f` are computed using `f().gradFunc`. The `save` function passed
to `f` should be used for saving tensors needed in the gradient. And the `saved` passed to the `gradFunc` is a
`NamedTensorMap`, which contains those saved tensors.
const customOp = tf.customGrad((x, save) => {
  // Save x to make sure it's available later for the gradient.
  save([x]);
  // Override gradient of our custom x^2 op to be dy * abs(x);
  return {
    value: x.square(),
    // Note `saved.x` which points to the `x` we saved earlier.
    gradFunc: (dy, saved) => [dy.mul(saved[0].abs())]
  };
});
const x = tf.tensor1d([-1, -2, 3]);
const dx = tf.grad(x => customOp(x));
console.log(`f(x):`);
customOp(x).print();
console.log(`f'(x):`);
dx(x).print();
@param f
The function to evaluate in forward mode, which should return {value: Tensor, gradFunc: (dy, saved) => Tensor[]},
where `gradFunc` returns the custom gradients of `f` with respect to its inputs.
@doc {heading: 'Training', subheading: 'Gradients'}
function customGrad<T extends Tensor>(f: CustomGradientFunc<T>): (...args: Tensor[]) => T {
  return ENGINE.customGrad(f);
}
function checkGrads(grads: Tensor[]) {
  const numNullGradients = grads.filter(g => g == null).length;
  if (numNullGradients > 0) {
    throw new Error(`Cannot compute gradient of y=f(x) with respect to x. Make sure that the f you passed encloses all operations that lead from x to y.`);
  }
}
export {
  customGrad,
  variableGrads,
  valueAndGrad,
  valueAndGrads,
  grad,
  grads,
};
/**
 * @license
 * Copyright 2018 Google LLC. All Rights Reserved.
 * Licensed under the Apache License, Version 2.0 (the "License");
 * you may not use this file except in compliance with the License.
 * You may obtain a copy of the License at
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 * Unless required by applicable law or agreed to in writing,
 * software distributed under the License is distributed on an "AS IS" BASIS,
 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
 * See the License for the specific language governing permissions and
 * limitations under the License.
 */
=====
import {ENGINE} from '../engine';
import {Neg, NegInputs} from '../kernel_names';
import {Tensor} from '../tensor';
import {NamedTensorMap} from '../tensor_types';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from '../types';
import {op} from '../operation';
/**
 * Computes  $-1 * x$  element-wise.
 */
const x = tf.tensor2d([1, 2, -2, 0], [2, 2]);
x.neg().print(); // or tf.neg(x)
@param x The input tensor.
@doc {heading: 'Operations', subheading: 'Basic math'}
function neg_<T extends Tensor>(x: T|TensorLike): T {
  const $x = convertToTensor(x, 'x', 'neg');
  const inputs: NegInputs = {x: $x};
  return ENGINE.runKernel(Neg, inputs as {} as NamedTensorMap);
}
export const neg = op({neg_});
/**
 * @license
 * Copyright 2018 Google LLC. All Rights Reserved.
 * Licensed under the Apache License, Version 2.0 (the "License");
 * you may not use this file except in compliance with the License.
 * You may obtain a copy of the License at
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 * Unless required by applicable law or agreed to in writing,
 * software distributed under the License is distributed on an "AS IS" BASIS,
 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
 * See the License for the specific language governing permissions and
 * limitations under the License.
 */
=====
import {ENGINE} from '../engine';
import {Softplus, SoftplusInputs} from '../kernel_names';
import {Tensor} from '../tensor';
import {NamedTensorMap} from '../tensor_types';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from '../types';
import {op} from '../operation';
/**
 * Computes softplus of the input `tf.Tensor` element-wise:  $\log(\exp(x) + 1)$ 
 */
const x = tf.tensor1d([0, 1, -1, .7]);
x.softplus().print(); // or tf.softplus(x)
@param x The input tensor.
@doc {heading: 'Operations', subheading: 'Basic math'}
function softplus_<T extends Tensor>(x: T|TensorLike): T {
  const $x = convertToTensor(x, 'x', 'softplus');
  const inputs: SoftplusInputs = {x: $x};
  return ENGINE.runKernel(Softplus, inputs as {} as NamedTensorMap);
}
export const softplus =

```

op({softplus_});\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```
=====\n*\n\nimport {customGrad} from '../gradients';\nimport {Tensor} from '../tensor';\nimport {convertToTensor} from '../tensor_util_env';\nimport {TensorLike} from '../types';\nimport {mul} from '../mul';\nimport {neg} from '../neg';\nimport {op} from '../operation';\nimport {sigmoid} from '../sigmoid';\nimport {softplus} from '../softplus';\n\n/**\n * Computes log sigmoid of the input `tf.Tensor` element-wise:\n * `logSigmoid(x)`. For numerical stability, we use `-tf.softplus(-x)`.\n * \n * const x = tf.tensor1d([0, 1, -1, .7]);\n * x.logSigmoid().print(); // or tf.logSigmoid(x)\n * \n * @param x The input tensor.\n * @doc {heading: 'Operations', subheading: 'Basic math'}\n */\nfunction logSigmoid_<T extends Tensor>(x: T|TensorLike): T {\n  const $x = convertToTensor(x, 'x', 'logSigmoid');\n  \n  // Use a custom gradient to maintain previous implementation.\n  // There is no LogSigmoid kernel in TF so we can't use engine.runKernel\n  // directly\n  const customOp = customGrad((x: Tensor) => {\n    // TODO(yassogba) we can remove the chained softplus call here only\n    // after backends have modularized softplus at which point we can call\n    // engine.runKernel(..., Softplus, ...) directly.\n    const value = neg(softplus(neg(x)));\n    const gradFunc = (dy: T) => {\n      const derX = mul(dy, sigmoid(neg(x)));\n      return derX;\n    }; \n    return {value, gradFunc};\n  });\n  \n  return customOp($x) as T;\n}\n\nexport const logSigmoid = op({logSigmoid_});\n\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport {ENGINE} from '../engine';\nimport {Max, MaxAttrs, MaxInputs} from '../kernel_names';\nimport {NamedAttrMap} from '../kernel_registry';\nimport {Tensor} from '../tensor';\nimport {NamedTensorMap} from '../tensor_types';\nimport {convertToTensor} from '../tensor_util_env';\nimport {TensorLike} from '../types';\nimport {op} from '../operation';\n\n/**\n * Computes the maximum of elements across dimensions of a `tf.Tensor`.\n * \n * Reduces the input along the dimensions given in `axes`. Unless `keepDims`\n * is true, the rank of the `tf.Tensor` is reduced by 1 for each entry in\n * `axes`. If `keepDims` is true, the reduced dimensions are retained with\n * length 1. If `axes` has no entries, all dimensions are reduced, and an\n * `tf.Tensor` with a single element is returned.\n * \n * const x = tf.tensor1d([1, 2, 3]);\n * x.max().print(); // or tf.max(x)\n * \n * const x = tf.tensor2d([1, 2, 3, 4], [2, 2]);\n * const axis = 1;\n * x.max(axis).print(); // or tf.max(x, axis)\n * \n * @param x The input tensor.\n * @param axis The dimension(s) to reduce. By default it reduces all dimensions.\n * @param keepDims If true, retains reduced dimensions with size 1.\n * @doc {heading: 'Operations', subheading: 'Reduction'}\n */\nfunction max_<T extends Tensor>(x: Tensor|TensorLike, axis: number|number[] = null, keepDims = false): T {\n  const $x = convertToTensor(x, 'x', 'max');\n  const inputs: MaxInputs = {x: $x};\n  const attrs: MaxAttrs = {reductionIndices: axis, keepDims};\n  \n  return ENGINE.runKernel(Max, inputs as {} as NamedTensorMap, attrs as {} as NamedAttrMap);\n}\n\nexport const max = op({max_});\n\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in
```

writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```
=====\n*\nimport {ENGINE} from './engine';\nimport {Sub, SubInputs} from './kernel_names';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {makeTypesMatch} from './tensor_util';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\n\nimport {op} from './operation';\n\n/**\n * Subtracts two `tf.Tensor`s element-wise, A - B. Supports broadcasting.\n *\n * ```js\n * const a = tf.tensor1d([10, 20, 30, 40]);\n * const b = tf.tensor1d([1, 2, 3, 4]);\n * a.sub(b).print();\n * // or tf.sub(a, b)\n * ```\n * Broadcast subtract a with b.\n * const a = tf.tensor1d([10, 20, 30, 40]);\n * const b = tf.scalar(5);\n * a.sub(b).print(); // or tf.sub(a, b)\n * @param a The first `tf.Tensor` to subtract from.\n * @param b The second `tf.Tensor` to be subtracted. Must have the same dtype as `a`.\n * @doc {heading: 'Operations', subheading: 'Arithmetic'}\n */\nfunction sub_<T extends Tensor>(a: Tensor|TensorLike, b: Tensor|TensorLike): T {\n  let $a = convertToTensor(a, 'a', 'sub');\n  let $b = convertToTensor(b, 'b', 'sub');\n  [$a, $b] = makeTypesMatch($a, $b);\n  const inputs: SubInputs = {a: $a, b: $b};\n  return ENGINE.runKernel(Sub, inputs as {} as NamedTensorMap);\n}\n\nexport const sub = op({sub_});\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\nimport {ENGINE} from './engine';\nimport {Sum, SumAttrs, SumInputs} from './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\n\nimport {cast} from './cast';\nimport {op} from './operation';\n\n/**\n * Computes the sum of elements across dimensions of a `tf.Tensor`.\n *\n * Reduces the input along the dimensions given in `axes`. Unless `keepDims` is true, the rank of the `tf.Tensor` is reduced by 1 for each entry in `axes`. If `keepDims` is true, the reduced dimensions are retained with length 1. If axes has no entries, all dimensions are reduced, and a `tf.Tensor` with a single element is returned.\n *\n * ```js\n * const x = tf.tensor1d([1, 2, 3]);\n * x.sum().print(); // or tf.sum(x)\n * ```\n * ```js\n * const x = tf.tensor2d([1, 2, 3, 4], [2, 2]);\n * const axis = 1;\n * x.sum(axis).print(); // or tf.sum(x, axis)\n * ```\n * @param x The input tensor to compute the sum over. If the dtype is `bool` it will be converted to `int32` and the output dtype will be `int32`.\n * @param axis The dimension(s) to reduce. By default it reduces all dimensions.\n * @param keepDims If true, retains reduced dimensions with size 1.\n * @doc {heading: 'Operations', subheading: 'Reduction'}\n */\nfunction sum_<T extends Tensor>(x: Tensor|TensorLike, axis: number|number[] = null, keepDims = false): T {\n  let $x = convertToTensor(x, 'x', 'sum');\n  if ($x.dtype === 'bool') {\n    $x = cast($x, 'int32');\n  }\n  const inputs: SumInputs = {x: $x};\n  const attrs: SumAttrs = {axis, keepDims};\n  return ENGINE.runKernel(Sum, inputs as {} as NamedTensorMap, attrs as {} as NamedAttrMap);\n}\n\nexport const sum = op({sum_});\n", "/*\n * @license\n * Copyright 2020 Google Inc. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
```

OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```
=====\n*\n\nimport {customGrad} from './gradients';\nimport {Tensor} from './tensor';\nimport {GradSaveFunc} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport {cast} from './cast';\nimport {exp} from './exp';\nimport {log} from './log';\nimport {max} from './max';\nimport {mul} from './mul';\nimport {op} from './operation';\nimport {sub} from './sub';\nimport {sum} from './sum';\n\n/**\n * Computes the log softmax.\n *\n * const a = tf.tensor1d([1, 2, 3]);\n * a.logSoftmax().print(); // or tf.logSoftmax(a)\n *\n * const a = tf.tensor2d([2, 4, 6, 1, 2, 3], [2, 3]);\n * a.logSoftmax().print(); // or tf.logSoftmax(a)\n *\n * @param logits The logits array.\n * @param axis The dimension softmax would be performed on. Defaults to -1\n * which indicates the last dimension.\n *\n * @doc {heading: 'Operations', subheading: 'Normalization'}\n *\n * @function logSoftmax<T extends Tensor>(logits: T|TensorLike, axis = -1): T {\n *   const $logits = convertToTensor(logits, 'logits', 'logSoftmax');\n *   if (axis === -1) {\n *     axis = $logits.rank - 1;\n *   }\n *   if (axis !== $logits.rank - 1) {\n *     throw Error(`Log Softmax along a non-last dimension is not yet supported. '\n *     `Logits was rank ${$logits.rank} and axis was ${axis}`);\n *   }\n *   // const forward: ForwardFunc<Tensor> = (backend, save) => {\n *     // const keepDims = true;\n *     // const xMax = max(logits, axis, true);\n *     // const shifted = sub(logits, xMax);\n *     // const value =\n *     //   sub(cast(shifted, 'float32'), log(sum(exp(shifted), axis,\n *     //   keepDims))); \n *     // save([value]);\n *     // return value;\n *     // };\n *   // Use a custom gradient for numerical stability.\n *   const customOp = customGrad((logits: Tensor, save: GradSaveFunc) => {\n *     const keepDims = true;\n *     const xMax = max(logits, axis, true);\n *     const shifted = sub(logits, xMax);\n *     const value =\n *       sub(cast(shifted, 'float32'), log(sum(exp(shifted), axis, keepDims))); \n *     save([value]);\n *     const gradFunc = (dy: Tensor, saved: Tensor[]) => {\n *       const [value] = saved;\n *       const keepDims = true;\n *       const softmax = exp(value);\n *       return sub(dy, mul(sum(dy, axis, keepDims), softmax));\n *     };\n *     return {value, gradFunc};\n *   });\n *   return customOp($logits) as T;\n *   // TODO Use Engine.runKernel when CPU/WebGL/WASM backends implement this.\n *   // const inputs: LogSoftmaxInputs = {logits: $logits};\n *   // const attrs: LogSoftmaxAttrs = {axis};\n *   // return ENGINE.runKernel(\n *     //   LogSoftmax, inputs as { } as NamedTensorMap,\n *     //   attrs as { } as NamedAttrMap);\n *   // }\n *   export const logSoftmax = op({logSoftmax_});\n * }\n *\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport * as util from './util';\n\n/**\n * Returns true if the axis specifies the inner most dimensions of the\n * array.\n *\n * @export function axesAreInnerMostDims(axes: number[], rank: number): boolean {\n *   for (let i = 0; i < axes.length; ++i) {\n *     if (axes[axes.length - i - 1] !== rank - 1 - i) {\n *       return false;\n *     }\n *   }\n *   return true;\n * }\n *\n * @export function combineLocations(\n *   outputLoc: number[], reduceLoc: number[], axes: number[]): number[] {\n *   const rank = outputLoc.length + reduceLoc.length;\n *   const loc = [];\n *   let outIdx = 0;\n *   let reduceIdx = 0;\n *   for (let dim = 0; dim < rank; dim++) {\n *     if (axes.indexOf(dim) === -1) {\n *       loc.push(outputLoc[outIdx++]);\n *     } else {\n *       loc.push(reduceLoc[reduceIdx++]);\n *     }\n *   }\n *   return loc;\n * }\n *\n * @export function computeOutAndReduceShapes(\n *   aShape: number[], axes: number[]): [number[], number[]] {\n *   const outShape = [];\n *   const rank = aShape.length;\n *   for (let dim = 0; dim < rank; dim++) {\n *     if (axes.indexOf(dim) === -1) {\n *       outShape.push(aShape[dim]);\n *     }\n *   }\n *   const reduceShape = axes.map(dim => aShape[dim]);\n *   return [outShape, reduceShape];\n * }\n *\n * @export function expandShapeToKeepDim(\n *   shape: number[], axes: number[]):
```

```

number[]
  {\n  const reduceSubShape = axes.map(x => 1);\n  return combineLocations(shape, reduceSubShape,
axes);\n}\n\n\nexport function assertAxesAreInnerMostDims(\n  msg: string, axes: number[], rank: number): void
{\n  util.assert(\n    axesAreInnerMostDims(axes, rank),\n    () => `${msg} supports only inner-most axes for now.`
+\n    `Got axes ${axes} and rank-${rank} input.`);\n}\n\n\n* Returns the axes permutation to be used with
`tf.transpose`, if such\n * permutation is necessary. Otherwise it returns null. This method is used by\n * operations
that operate only on inner-most axes.\n *\n\nexport function getAxesPermutation(axes: number[], rank: number):
number[]\n  null {\n  if (axesAreInnerMostDims(axes, rank)) {\n    return null;\n  }\n  const result: number[] = [];\n
for (let i = 0; i < rank; ++i) {\n    if (axes.indexOf(i) === -1) {\n      result.push(i);\n    }\n  }\n  axes.forEach(axis =>
result.push(axis));\n  return result;\n}\n\n\n* Returns the axes permutation
that undoes the original permutation. *\n\nexport function getUndoAxesPermutation(axes: number[]): number[] {\n
return axes.map((axis, i) => [i, axis])\n  .sort((a, b) => a[1] - b[1])\n  .map(x => x[0]);\n}\n\n\nexport function
getInnerMostAxes(numAxes: number, rank: number): number[] {\n  const res: number[] = [];\n  for (let i = rank -
numAxes; i < rank; ++i) {\n    res.push(i);\n  }\n  return res;\n}\n\n\n"/**\n * @license\n * Copyright 2020 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing
permissions and\n * limitations under the License.\n *
=====
*\n\nimport {Tensor} from './tensor';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike}
from './types';\nimport {parseAxisParam} from './util';\n\nimport {add} from './add';\nimport
{expandShapeToKeepDim} from './axis_util';\nimport {exp} from './exp';\nimport {log} from './log';\nimport {max}
from './max';\nimport {op} from './operation';\nimport {reshape} from './reshape';\nimport {sub} from
'/sub';\nimport {sum} from './sum';\n\n\n**\n * Computes the log(sum(exp(elements across the reduction
dimensions))).\n *\n * Reduces the input along the dimensions given in `axis`. Unless `keepDims`\n * is true, the
rank of the array is reduced by 1 for each entry in `axis`. \n *\n * If `keepDims` is true, the reduced dimensions are
retained with length 1.\n *\n * If `axis` has no entries, all dimensions are reduced, and an array with a\n * single
element is returned.\n *\n * ```js\n * const x = tf.tensor1d([1, 2, 3]);\n * x.logSumExp().print(); // or
tf.logSumExp(x)\n * ```\n *\n * ```js\n * const x = tf.tensor2d([1, 2, 3, 4], [2, 2]);\n * const axis = 1;\n *
x.logSumExp(axis).print(); // or tf.logSumExp(a, axis)\n * ```\n *\n * @param x The input tensor.\n * @param axis The
dimension(s) to reduce. If null (the default),\n * reduces all dimensions.\n * @param keepDims If true, retains
reduced dimensions with length\n * of 1. Defaults to false.\n *\n * @doc {heading: 'Operations', subheading:
'Reduction'}\n *\n\nfunction logSumExp<T extends Tensor>(\n  x: Tensor|TensorLike, axis: number|number[] =
null, keepDims = false): T {\n  const $x = convertToTensor(x, 'x', 'logSumExp');\n  const axes =
parseAxisParam(axis, $x.shape);\n  const xMax = max($x, axes, true /* keepDims */);\n  const a = sub($x, xMax);\n
const b = exp(a);\n  const c = sum(b, axes);\n  const d = log(c);\n  const res = add(reshape(xMax, d.shape),
d);\n  if (keepDims) {\n    const newShape = expandShapeToKeepDim(res.shape, axes);\n    return reshape(res,
newShape) as T;\n  }\n  return res as T;\n}\n\n\nexport const logSumExp = op({logSumExp_});\n\n"/**\n *
@license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
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```



```

*\nimport {ENGINE} from './engine';\nimport {LogicalAnd, LogicalAndInputs}
from './kernel_names';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from
 './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from
 './types';\n\nimport {assertAndGetBroadcastShape} from './broadcast_util';\nimport {op} from './operation';\n\n/**\n * Returns the truth value of `a AND b` element-wise. Supports broadcasting.\n *\n * ```js\n * const a =
tf.tensor1d([false, false, true, true], 'bool');\n * const b = tf.tensor1d([false, true, false, true], 'bool');\n *\n * a.logicalAnd(b).print();\n * ```\n *\n * @param a The first input tensor. Must be of dtype bool.\n * @param b The
second input tensor. Must be of dtype bool.\n *\n * @doc {heading: 'Operations', subheading: 'Logical'}\n
*\nfunction logicalAnd_<T extends Tensor>(\n  a: Tensor|TensorLike, b: Tensor|TensorLike): T {\n  const $a =
convertToTensor(a, 'a', 'logicalAnd', 'bool');\n  const $b = convertToTensor(b, 'b', 'logicalAnd', 'bool');\n
  assertAndGetBroadcastShape($a.shape,
  $b.shape);\n\n  const inputs: LogicalAndInputs = {a: $a, b: $b};\n\n  return ENGINE.runKernel(LogicalAnd, inputs
as { } as NamedTensorMap);\n}\n\nexport const logicalAnd = op({logicalAnd_});\n", "*/\n * @license\n *
Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
"License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {ENGINE} from './engine';\nimport {LogicalNot, LogicalNotInputs}
from './kernel_names';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from
 './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport
 {op} from './operation';\n\n/**\n * Returns the truth value of `NOT x` element-wise.\n *\n * ```js\n * const a =
tf.tensor1d([false, true], 'bool');\n *\n * a.logicalNot().print();\n * ```\n *\n * @param x The input tensor. Must be of
dtype 'bool'. \n *\n * @doc {heading: 'Operations', subheading: 'Logical'}\n *\nfunction logicalNot_<T extends
Tensor>(x: T|TensorLike): T {\n  const $x = convertToTensor(x, 'x', 'logicalNot', 'bool');\n  const inputs:
LogicalNotInputs = {x: $x};\n  return ENGINE.runKernel(LogicalNot, inputs as { } as
NamedTensorMap);\n}\n\nexport const logicalNot = op({logicalNot_});\n", "*/\n * @license\n * Copyright 2020
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
may not use this file except
in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {ENGINE} from './engine';\nimport {LogicalOr, LogicalOrInputs} from './kernel_names';\nimport
 {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from
 './tensor_util_env';\nimport {TensorLike} from './types';\nimport {assertAndGetBroadcastShape} from
 './broadcast_util';\nimport {op} from './operation';\n\n/**\n * Returns the truth value of `a OR b` element-wise.
Supports broadcasting.\n *\n * ```js\n * const a = tf.tensor1d([false, false, true, true], 'bool');\n * const b =
tf.tensor1d([false, true, false, true], 'bool');\n *\n * a.logicalOr(b).print();\n * ```\n *\n * @param a The first input tensor. Must be of dtype bool.\n *
@param b The second input tensor. Must be of dtype bool.\n *\n * @doc {heading: 'Operations', subheading:
'Logical'}\n *\nfunction logicalOr_<T extends Tensor>(\n  a: Tensor|TensorLike, b: Tensor|TensorLike): T {\n
  const $a = convertToTensor(a, 'a', 'logicalOr', 'bool');\n  const $b = convertToTensor(b, 'b', 'logicalOr', 'bool');\n
  assertAndGetBroadcastShape($a.shape, $b.shape);\n\n  const inputs: LogicalOrInputs = {a: $a, b: $b};\n  return

```

ENGINE.runKernel(LogicalOr, inputs as {} as NamedTensorMap);\n\nexport const logicalOr =
op({logicalOr_});\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under
the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with
the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is
distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n */

```
=====\n*\nimport {Tensor} from './tensor';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike}  
from './types';\nimport {assertAndGetBroadcastShape} from './broadcast_util';\nimport {logicalAnd} from  
./logical_and';\nimport {logicalNot} from './logical_not';\nimport {logicalOr} from './logical_or';\nimport {op} from  
./operation';\n/**\n * Returns the truth value of `a XOR b` element-wise. Supports broadcasting.\n *\n *`js`\n * const a = tf.tensor1d([false,  
false, true, true], 'bool');\n * const b = tf.tensor1d([false, true, false, true], 'bool');\n * a.logicalXor(b).print();\n *``\n * @param a The first input tensor. Must be of dtype bool.\n * @param b The second input tensor. Must be  
of dtype bool.\n * @doc {heading: 'Operations', subheading: 'Logical'}\n */\nfunction logicalXor<T extends  
Tensor>(a: Tensor|TensorLike, b: Tensor|TensorLike): T {\n  const $a = convertToTensor(a, 'a', 'logicalXor',  
'bool');\n  const $b = convertToTensor(b, 'b', 'logicalXor', 'bool');\n  assertAndGetBroadcastShape($a.shape,  
$b.shape);\n  // x ^ y = (x | y) & ~(x & y)\n  return logicalAnd(logicalOr(a, b), logicalNot(logicalAnd(a,  
b)));\n}\n\nexport const logicalXor = op({logicalXor_});\n", "/*\n * @license\n * Copyright 2020 Google LLC. All  
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this  
file except in compliance with the License.\n * You may obtain a copy of the  
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or  
agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *  
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for  
the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n*\nimport {ENGINE} from './engine';\nimport {MaxPool, MaxPoolAttrs, MaxPoolInputs} from  
./kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor3D, Tensor4D} from  
./tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from  
./tensor_util_env';\nimport {TensorLike} from './types';\nimport * as util from './util';\nimport * as conv_util  
from './conv_util';\nimport {op} from './operation';\nimport {reshape} from './reshape';\n/**\n * Computes the  
2D max pooling of an image.\n *\n * @param x The input tensor, of rank 4 or rank 3 of shape\n * `[batch, height,  
width, inChannels]`. If rank 3, batch of 1 is assumed.\n * @param filterSize The filter size: `[filterHeight,  
filterWidth]`. If\n * `filterSize` is a single number, then `filterHeight == filterWidth`\n * @param strides The  
strides of the pooling: `[strideHeight, strideWidth]`. If\n * `strides` is a single number, then `strideHeight ==  
strideWidth`\n * @param dilations The dilation rates: `[dilationHeight, dilationWidth]`\n * in which we sample  
input values across the height and width dimensions\n * in dilated pooling. Defaults to `[1, 1]`. If `dilations` is a  
single\n * number, then `dilationHeight == dilationWidth`. If it is greater than\n * 1, then all values of `strides`\n * must be 1.\n * @param pad The type of padding algorithm.\n * - `same` and stride 1: output will be of same size  
as input,\n * regardless of filter size.\n * - `valid`:  
output will be smaller than input if filter is larger\n * than 1x1.\n * - For more info, see this guide:\n * [https://www.tensorflow.org/api_guides/python/nn#Convolution](\n * https://www.tensorflow.org/api_guides/python/nn#Convolution)\n * @param dimRoundingMode A string from:  
'ceil', 'round', 'floor'. If none is\n * provided, it will default to truncate.\n */\nfunction maxPool<T extends  
Tensor3D|Tensor4D>(x: T|TensorLike, filterSize: [number, number]|number,\n  strides: [number,  
number]|number, pad: 'valid'|'same'|number,\n  dimRoundingMode?: 'floor'|'round'|'ceil'): T {\n  const $x =
```

```

convertToTensor(x, 'x', 'maxPool');\n const dilations = 1;\n\n let x4D = $x as Tensor4D;\n let reshapedTo4D =
false;\n if ($x.rank === 3) {\n   reshapedTo4D = true;\n   x4D = reshape($x, [1, $x.shape[0], $x.shape[1],
$x.shape[2]]);\n }\n\n util.assert(\n   x4D.rank === 4,\n   () => `Error in maxPool: input must be rank 4 but got
rank ${x4D.rank}`);\n
  util.assert(\n    conv_util.eitherStridesOrDilationsAreOne(strides, dilations),\n    () => `Error in maxPool: Either
strides or dilations must be 1.` +\n      `Got strides ${strides} and dilations ${dilations}`);\n  if
(dimRoundingMode != null) {\n    util.assert(\n      util.isInt(pad as number),\n      () => `Error in maxPool: pad
must be an integer when using, ` +\n        `dimRoundingMode ${dimRoundingMode} but got pad ${pad}`);\n  }\n\n
const inputs: MaxPoolInputs = {x: x4D};\n\n const attrs: MaxPoolAttrs = {filterSize, strides, pad,
dimRoundingMode};\n\n // tslint:disable-next-line: no-unnecessary-type-assertion\n const res =
ENGINE.runKernel(\n   MaxPool, inputs as {} as NamedTensorMap,\n   attrs as {} as
NamedAttrMap) as T;\n\n if (reshapedTo4D) {\n   return reshape(res, [res.shape[1], res.shape[2], res.shape[3]]) as
T;\n }\n return res;\n}\n\nexport const maxPool = op({maxPool_});\n\n"/**\n * @license\n * Copyright
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you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====*\n
*/\n\nimport {ENGINE} from '../engine';\nimport {MaxPool3D, MaxPool3DAttrs, MaxPool3DInputs} from
'../kernel_names';\nimport {NamedAttrMap} from '../kernel_registry';\nimport {Tensor4D, Tensor5D} from
'../tensor';\nimport {NamedTensorMap} from '../tensor_types';\nimport {convertToTensor} from
'../tensor_util_env';\nimport
{TensorLike} from '../types';\nimport * as util from '../util';\n\nimport {op} from './operation';\nimport {reshape}
from './reshape';\n\n/**\n * Computes the 3D max pooling.\n *\n * `x` is a 5D tensor of shape [batch, depth, height, width, inChannels].\n *
`filterSize` is a single number, or an array of three numbers [filterDepth, filterHeight, filterWidth].\n *
If `filterSize` is a single number, then `filterDepth == filterHeight == filterWidth`.\n *
`strides` is a single number, or an array of three numbers [strideDepth, strideHeight, strideWidth].\n *
If `strides` is a single number, then `strideDepth == strideHeight == strideWidth`.\n *
`pad` is the type of padding algorithm. - `same` and stride 1: output will be of same size as input, regardless of
filter size. - `valid`: output will be smaller than input if filter is larger than 1x1x1. - For more info, see this
guide: [https://www.tensorflow.org/api_guides/python/nn#Convolution](https://www.tensorflow.org/api_guides/python/nn#Convolution)\n *
`dimRoundingMode` A string from: 'ceil', 'round', 'floor'. If none is provided, it will default to truncate.\n *
`dataFormat` An optional string from: 'NDHWC', 'NCDHW'. Defaults to 'NDHWC'. Specify the data format of the input and output
data. With the default format 'NDHWC', the data is stored in the order of: [batch, depth, height, width, channels]. Only
'NDHWC' is currently supported.\n *
@doc {heading: 'Operations', subheading: 'Convolution'}\n */\nfunction maxPool3d<T extends Tensor4D|Tensor5D>(\n  x: T|TensorLike, filterSize:
[number, number, number]|number = [1, 1, 1],\n  strides: [number, number, number]|number, pad:
'valid'|'same'|number,\n  dimRoundingMode?: 'floor'|'round'|'ceil',\n  dataFormat: 'NDHWC'|'NCDHW' = 'NDHWC'): T {\n  const $x =
convertToTensor(x, 'x', 'maxPool3d');\n\n  let x5D = $x as Tensor5D;\n  let reshapedTo5D = false;\n  if ($x.rank
=== 4) {\n    reshapedTo5D = true;\n    x5D = reshape($x, [1, $x.shape[0], $x.shape[1], $x.shape[2], $x.shape[3]]);\n  }\n\n
util.assert(\n    x5D.rank === 5,\n    () => `Error in maxPool3d: x must be rank 5 but got
rank ${x5D.rank}`);\n  util.assert(\n    dataFormat === 'NDHWC',\n    () => `Error in maxPool3d: Only NDHWC

```

```

is currently supported, `+n` but got dataFormat of ${dataFormat}`);
if (dimRoundingMode != null) {
  util.assert(
    util.isInt(pad as number),
    () => `Error in maxPool3d: pad must be an integer when using, `
    +n`dimRoundingMode ${dimRoundingMode} but got pad ${pad}.`);
}
const inputs:
MaxPool3DInputs = {x: x5D};
const attrs:
  MaxPool3DAttrs = {filterSize, strides, pad,
  dimRoundingMode, dataFormat};
// tslint:disable-next-line: no-unnecessary-type-assertion
const res =
ENGINE.runKernel(
  MaxPool3D, inputs as {} as NamedTensorMap,
  attrs as {} as
  NamedAttrMap) as T;
if (reshapedTo5D) {
  return reshape(
    res, [res.shape[1], res.shape[2],
    res.shape[3], res.shape[4]]) as
  T;
}
return res;
}
export const maxPool3d =
op({maxPool3d_});
"/**
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 the Apache License, Version 2.0 (the "License");
 * you may not use this file except in compliance with the
 License.
 * You may obtain a copy of the License at
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 * Unless required by applicable law or agreed to in writing, software
 * distributed under the License is distributed
 on an "AS IS" BASIS,
 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
 implied.
 * See the
 License for the specific language governing permissions and
 * limitations under the License.
 */
=====
*/
import {ENGINE} from '../engine';
import {MaxPoolWithArgmax, MaxPoolWithArgmaxAttrs,
MaxPoolWithArgmaxInputs} from '../kernel_names';
import {NamedAttrMap} from '../kernel_registry';
import {Tensor, Tensor4D} from '../tensor';
import {NamedTensorMap} from '../tensor_types';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from '../types';
import {op} from
'/operation';
/**
 * Computes the 2D max pooling of an image with Argmax index.
 * The indices in argmax
 are flattened, so that a maximum value at position `[b, y, x, c]` becomes flattened index: `(y * width + x) *
 channels + c` if `include_batch_in_index` is False; `((b * height + y) * width + x) * channels + c` if
 `include_batch_in_index` is True.
 * The indices returned are always in `[0, height) x [0,
 width)` before flattening.
 * @param x The input tensor, of rank 4 or rank 3 of shape `[batch, height,
 width, inChannels]`. If rank 3, batch of 1 is assumed.
 * @param filterSize The filter size: `[filterHeight,
 filterWidth]`. If `filterSize` is a single number, then `filterHeight == filterWidth`.
 * @param strides The
 strides of the pooling: `[strideHeight, strideWidth]`. If `strides` is a single number, then `strideHeight ==
 strideWidth`.
 * @param dataFormat An optional string from: "NDHWC", "NCDHW". Defaults to "NDHWC". Specify the data format of the input and output data. With the default format "NDHWC", the
 data is stored in the order of: [batch, depth, height, width, channels]. Only "NDHWC" is currently
 supported.
 * @param pad The type of padding algorithm.
 * - `same` and stride 1: output will be of same size
 as input, regardless of filter size.
 * - `valid`: output will be smaller than
 input if filter is larger than 1x1.
 * - For more info, see this guide:
 [https://www.tensorflow.org/api_guides/python/nn#Convolution](https://www.tensorflow.org/api_guides/python/nn#Convolution)
 * @param includeBatchIndex Defaults to False.
 Whether to include batch dimension in flattened index of argmax.
 * @doc {heading: 'Operations',
 subheading: 'Convolution'}
 */
function maxPoolWithArgmax_<T extends Tensor4D>(
  x: T|TensorLike,
  filterSize: [number, number]|number,
  strides: [number, number]|number,
  pad: 'valid'|'same'|number,
  includeBatchInIndex = false): NamedTensorMap {
  const $x = convertToTensor(x, 'x',
'maxPoolWithArgmax');
  const inputs: MaxPoolWithArgmaxInputs = {x: $x};
  const attrs:
  MaxPoolWithArgmaxAttrs = {filterSize, strides, pad, includeBatchInIndex};
  // tslint:disable-next-line: no-unnecessary-type-assertion
  const result = ENGINE.runKernel(
    MaxPoolWithArgmax,
    inputs as {} as NamedTensorMap,
    attrs as {} as NamedAttrMap) as Tensor[];
  return {result:
result[0], indexes: result[1]};
}
export const maxPoolWithArgmax = op({maxPoolWithArgmax_});
"/**
 * @license
 * Copyright 2020 Google LLC. All Rights Reserved.
 * Licensed under the Apache License, Version
 2.0 (the "License");
 * you may not use this file except in compliance with the License.
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```
=====\n*\n\nimport {ENGINE} from './engine';\nimport {Maximum, MaximumInputs}\nfrom './kernel_names';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from\n './tensor_types';\nimport {makeTypesMatch} from './tensor_util';\nimport {convertToTensor} from\n './tensor_util_env';\nimport {TensorLike} from './types';\nimport {assertAndGetBroadcastShape} from\n './broadcast_util';\nimport {cast} from './cast';\nimport {op} from './operation';\n\n/**\n * Returns the max of a and b\n * (a > b ? a : b) element-wise.\n * Supports broadcasting.\n * We also expose `tf.maximumStrict` which has the\n * same signature as this op and\n * asserts that `a` and `b` are the same shape (does not broadcast).\n *\n * ```js\n * const a = tf.tensor1d([1, 4, 3, 16]);\n * const b = tf.tensor1d([1, 2, 9, 4]);\n * a.maximum(b).print(); // or\n * tf.maximum(a, b)\n * ```\n * // Broadcast maximum a with b.\n * const a = tf.tensor1d([2, 4, 6, 8]);\n * const b = tf.scalar(5);\n * a.maximum(b).print(); // or tf.maximum(a, b)\n *\n * @param a The first\n * tensor.\n * @param b The second tensor. Must have the same type as `a`.\n * @doc {heading: 'Operations',\n * subheading: 'Arithmetic'}\n */\nfunction maximum_<T extends Tensor>(\n  a: Tensor|TensorLike, b:\n  Tensor|TensorLike): T {\n  let $a = convertToTensor(a, 'a', 'maximum');\n  let $b = convertToTensor(b, 'b',\n  'maximum');\n  [$a, $b] = makeTypesMatch($a, $b);\n  if ($a.dtype === 'bool') {\n    $a = cast($a, 'int32');\n    $b = cast($b, 'int32');\n  }\n  assertAndGetBroadcastShape($a.shape, $b.shape);\n  const inputs: MaximumInputs =\n  {a: $a, b: $b};\n  return ENGINE.runKernel(Maximum, inputs as { } as NamedTensorMap);\n}\n\nexport const\nmaximum = op({maximum_});\n\n/**\n * @license\n * Copyright 2020 Google Inc. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in\n * compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless
```

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```
=====\n*\n\nimport {ENGINE} from './engine';\nimport {Mean, MeanAttrs, MeanInputs} from './kernel_names';\nimport\n{NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from\n './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from\n './types';\nimport {op} from './operation';\n\n/**\n * Computes the mean of elements across dimensions of a\n * `tf.Tensor`.\n * Reduces `x` along the dimensions given in `axis`. Unless `keepDims` is\n * true, the rank of the\n * `tf.Tensor` is reduced by 1 for each entry in `axis`.\n *\n * If `keepDims` is true, the reduced dimensions are retained with length 1.\n * If `axis` has no entries, all\n * dimensions are reduced, and a `tf.Tensor` with\n * a single element is returned.\n *\n * ```js\n * const x =\n * tf.tensor1d([1, 2, 3]);\n * x.mean().print(); // or tf.mean(a)\n * ```\n * const x = tf.tensor2d([1, 2, 3,\n * 4], [2, 2]);\n * const axis = 1;\n * x.mean(axis).print(); // or tf.mean(x, axis)\n *\n * @param x The input\n * tensor.\n * @param axis The dimension(s) to reduce. By default it reduces\n * all dimensions.\n * @param\n * keepDims If true, retains reduced dimensions with size 1.\n * @doc {heading: 'Operations', subheading:\n * 'Reduction'}\n */\nfunction mean_<T extends Tensor>(\n  x: Tensor|TensorLike, axis: number|number[] = null,\n  keepDims = false): T {\n  const $x = convertToTensor(x, 'x', 'mean');\n  const inputs: MeanInputs = {x: $x};\n  const attrs: MeanAttrs = {axis, keepDims};\n  return ENGINE.runKernel(\n    Mean, inputs\n  as { } as NamedTensorMap, attrs as { } as NamedAttrMap);\n}\n\nexport const\nmean = op({mean_});\n\n/**\n * @license\n * Copyright 2020 Google Inc. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0\n * (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of\n * the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
```

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```
=====
*\nimport {ENGINE} from './engine';\nimport {Min, MinAttrs, MinInputs} from './kernel_names';\nimport
{NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport
{NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport
{TensorLike} from './types';\n\nimport {op} from './operation';\n\n/**\n * Computes the minimum value from the
input.\n *\n * Reduces the input along the dimensions given in `axes`. Unless `keepDims`\n * is true, the rank of the
array is reduced by 1 for each entry in `axes`.\n *\n * If `keepDims` is true, the reduced dimensions are retained with
length 1.\n *\n * If `axes` has no entries, all dimensions are reduced, and an array with a\n * single element is
returned.\n *\n * ```js\n * const x = tf.tensor1d([1, 2, 3]);\n * x.min().print(); // or tf.min(x)\n * ```\n *\n * ```js\n * const x = tf.tensor2d([1, 2, 3, 4], [2, 2]);\n * const axis = 1;\n * x.min(axis).print(); // or tf.min(x, axis)\n *
```\n *\n * @param x The input Tensor.\n *\n * @param axis The dimension(s) to reduce. By default it reduces\n * all
dimensions.\n *\n * @param keepDims If true, retains reduced dimensions
with size 1.\n *\n * @doc {heading: 'Operations', subheading: 'Reduction'}\n *\nfunction min_<T extends
Tensor>(x: Tensor|TensorLike, axis: number|number[] = null, keepDims = false): T {\n const $x =
convertToTensor(x, 'x', 'min');\n const inputs: MinInputs = {x: $x};\n const attrs: MinAttrs = {axis,
keepDims};\n // tslint:disable-next-line: no-unnecessary-type-assertion\n return ENGINE.runKernel(\n
Min, inputs as {} as NamedTensorMap,\n attrs as {} as NamedAttrMap) as T;\n}\n\nexport const min =
op({min_});\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
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on an "AS
IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
=====
```

```
=====
*\nimport {ENGINE} from './engine';\nimport {Minimum, MinimumInputs} from './kernel_names';\nimport
{Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {makeTypesMatch} from
 './tensor_util';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\n\nimport
{assertAndGetBroadcastShape} from './broadcast_util';\nimport {cast} from './cast';\nimport {op} from
 './operation';\n\n/**\n * Returns the min of a and b ($a < b ? a : b$) element-wise.\n * Supports broadcasting.\n *\n * We also expose `minimumStrict` which has the same signature as this op and\n * asserts that `a` and `b` are the
same shape (does not broadcast).\n *\n * ```js\n * const
a = tf.tensor1d([1, 4, 3, 16]);\n * const b = tf.tensor1d([1, 2, 9, 4]);\n * a.minimum(b).print(); // or
tf.minimum(a, b)\n * ```\n *\n * ```js\n * // Broadcast minimum a with b.\n * const a = tf.tensor1d([2, 4, 6, 8]);\n *
const b = tf.scalar(5);\n * a.minimum(b).print(); // or tf.minimum(a, b)\n * ```\n *\n * @param a The first
tensor.\n *\n * @param b The second tensor. Must have the same type as `a`.\n *\n * @doc {heading: 'Operations',
subheading: 'Arithmetic'}\n *\nfunction minimum_<T extends Tensor>(a: Tensor|TensorLike, b:
Tensor|TensorLike): T {\n let $a = convertToTensor(a, 'a', 'minimum');\n let $b = convertToTensor(b, 'b',
'minimum');\n [$a, $b] = makeTypesMatch($a, $b);\n if ($a.dtype === 'bool') {\n $a = cast($a, 'int32');\n $b =
cast($b, 'int32');\n }\n assertAndGetBroadcastShape($a.shape, $b.shape);\n const inputs: MinimumInputs = {a:
$a, b: $b};\n return ENGINE.runKernel(Minimum, inputs as {} as NamedTensorMap);\n}\n\nexport const
minimum = op({minimum_});\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in
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```
=====
*\n\nimport {ENGINE} from './engine';\nimport {MirrorPad, MirrorPadAttrs, MirrorPadInputs} from
 './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport
 {NamedTensorMap} from './tensor_types';\nimport
 {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport * as util from
 './util';\nimport {op} from './operation';\n\n/**\n * Pads a `tf.Tensor` using mirror padding.\n *\n * This operation
 implements the `REFLECT` and `SYMMETRIC` modes of pad.\n *\n * `js\n * const x = tf.range(0, 9).reshape([1,
 1, 3, 3]);\n * x.mirrorPad([[0, 0], [0, 0], [2, 2], [2, 2]], 'reflect').print();\n * ``\n * @param x The tensor to pad.\n *
 @param paddings An array of length `R` (the rank of the tensor), where\n * each element is a length-2 tuple of ints
 `[padBefore, padAfter]`,\n * specifying how much to pad along each dimension of the tensor.\n * In `reflect`\n
 mode, the padded regions do not include the borders,\n * while in `symmetric` mode the padded regions do
 include the borders.\n * For example, if the input is `[1, 2, 3]` and paddings is `[0, 2]`,\n * then the output is
 `[1, 2, 3, 2, 1]` in `reflect` mode, and\n * `[1, 2, 3, 3, 2]` in `symmetric`\n
 mode.\n * If `mode` is `reflect` then both `paddings[D, 0]` and `paddings[D, 1]`\n * must be no greater than
 `x.shape[D] - 1`. If mode is `symmetric`\n * then both `paddings[D, 0]` and `paddings[D, 1]` must be no greater
 than\n * `x.shape[D]`\n * @param mode String to specify padding mode. Can be `reflect` | `symmetric`\n */\n\n**
 @doc {heading: 'Tensors', subheading: 'Transformations'} *\nfunction mirrorPad<T extends Tensor>(\n x:\n T|TensorLike,
 paddings: Array<[number, number]>,\n mode: 'reflect'|'symmetric'): T {\n util.assert(\n mode
 === 'reflect' || mode === 'symmetric',\n () => `Invalid mode. Mode must be either reflect or symmetric.` +\n
 `Got ${mode}.`);\n\n const $x = convertToTensor(x, 'x', 'mirrorPad');\n if ($x.rank === 0) {\n throw new Error(\n
 'mirrorPad(scalar) is not defined. '\n 'Pass non-scalar to mirrorPad');\n }\n util.assert(\n
 paddings.length === $x.rank,\n () => `Padding doesn't match input. Must
 be ${$x.rank}.` +\n `Got ${paddings.length}.`);\n const shapeOffset = mode === 'reflect' ? 1 : 0;\n for (let i
 = 0; i < $x.rank; i++) {\n util.assert(\n paddings[i].length === 2,\n () => `Invalid number of paddings.
 Must be length of 2 each.`);\n util.assert(\n paddings[i][0] >= 0 && paddings[i][0] <= $x.shape[i] -
 shapeOffset &&\n paddings[i][1] >= 0 && paddings[i][1] <= $x.shape[i] - shapeOffset,\n () => `Padding
 in dimension ${i} cannot be greater than or equal ` +\n `to ${$x.shape[i] - shapeOffset} or less than 0 for
 input of ` +\n `shape ${$x.shape}`);\n }\n\n const attrs: MirrorPadAttrs = {paddings, mode};\n const inputs:
 MirrorPadInputs = {x: $x};\n return ENGINE.runKernel(\n MirrorPad, inputs as {} as NamedTensorMap, attrs
 as {} as NamedAttrMap);\n}\n\nexport const mirrorPad = op({mirrorPad_});\n", "/**\n * @license\n * Copyright
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 License for the specific language governing permissions and\n * limitations under the License.\n *
=====
```

```
*\n\nimport {ENGINE} from './engine';\nimport {Mod, ModInputs} from './kernel_names';\nimport {Tensor}
 from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {makeTypesMatch} from
 './tensor_util';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport
 {op} from './operation';\n\n/**\n * Returns the mod of
 a and b element-wise.\n *
$$\text{floor}(x / y) * y + \text{mod}(x, y) = x$$
\n * Supports broadcasting.\n *\n * We also expose
 `tf.modStrict` which has the same signature as this op and\n * asserts that `a` and `b` are the same shape (does not
 broadcast).\n *\n * `js\n * const a = tf.tensor1d([1, 4, 3, 16]);\n * const b = tf.tensor1d([1, 2, 9, 4]);\n *\n * a.mod(b).print(); // or tf.mod(a, b)\n * ``\n * `js\n * // Broadcast a mod b.\n * const a = tf.tensor1d([2, 4, 6,
 8]);\n * const b = tf.scalar(5);\n *\n * a.mod(b).print(); // or tf.mod(a, b)\n * ``\n * @param a The first tensor.\n

```

```

* @param b The second tensor. Must have the same type as `a`.
* @doc {heading: 'Operations', subheading:
'Arithmetic'}
function mod_<T extends Tensor>(a: Tensor|TensorLike, b: Tensor|TensorLike): T {
 let $a = convertToTensor(a, 'a', 'mod');
 let $b = convertToTensor(b, 'b', 'mod');
 [$a, $b] = makeTypesMatch($a, $b);
 const inputs: ModInputs = {a: $a, b: $b};
 return ENGINE.runKernel(Mod,
 inputs as {} as NamedTensorMap);
}
export const mod = op({mod_});
*/
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* limitations under the License.

```

```

=====
*
import {ENGINE} from './engine';
import {Tensor} from './tensor';
import {convertToTensor} from
'./tensor_util_env';
import {TensorLike} from './types';
import {op} from './operation';
*/
* Computes square of `x` element-wise: `x ^ 2`.
* const x = tf.tensor1d([1, 2, Math.sqrt(2), -1]);
* x.square().print(); // or tf.square(x)
* @param x The input Tensor.
* @doc {heading: 'Operations',
subheading: 'Basic math'}
function square_<T extends Tensor>(x: T|TensorLike): T {
 const $x =
convertToTensor(x, 'x', 'square');
 const attrs = {};
 return ENGINE.runKernel('Square', {x: $x},
attrs);
}
export const square = op({square_});
*/
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```

```

=====
*
import {Tensor} from './tensor';
import {convertToTensor} from './tensor_util_env';
import {TensorLike}
from './types';
import {parseAxisParam} from './util';
import {expandShapeToKeepDim} from
'./axis_util';
import {cast} from './cast';
import {mean} from './mean';
import {op} from './operation';
import
{reshape} from './reshape';
import {square} from './square';
import {sub} from './sub';
*/
* Calculates the
mean and variance of `x`. The mean and variance are
* calculated by aggregating the contents of `x` across `axes`.
If `x` is
* 1-D and `axes = [0]` this is just the mean and variance of a vector.
* @param x The input tensor.
* @param axis The dimension(s) along with to compute mean and
* variance. By default
it reduces all dimensions.
* @param keepDims If true, the moments have the same dimensionality as the
* input.
* @return An object with two keys: `mean` and `variance`.
* @doc {heading: 'Operations',
subheading: 'Normalization'}
function moments_(
 x: Tensor|TensorLike, axis: number|number[] = null,
keepDims = false): {mean: Tensor, variance: Tensor} {
 x = convertToTensor(x, 'x', 'moments');
 const axes =
parseAxisParam(axis, x.shape);
 const xMean = mean(x, axes, keepDims);
 let keepDimsShape =
xMean.shape;
 if (!keepDims) {
 keepDimsShape = expandShapeToKeepDim(xMean.shape, axes);
 }
 const devSquared =
square(sub(cast(x, 'float32'), reshape(xMean, keepDimsShape)));
 const variance =
mean(devSquared, axes, keepDims);
 return {mean: xMean, variance};
}
export const moments =
op({moments_});
*/
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```
=====
*\nimport {Tensor2D} from './tensor';\nimport {convertToTensor, convertToTensorArray} from
 './tensor_util_env';\nimport {TensorLike} from './types';\nimport {op} from './operation';\n\n/**\n * @docalias
 (data: Tensor2D, c: Tensor2D, h: Tensor2D): [Tensor2D, Tensor2D]\n *\nexport type LSTMCellFunc = {\n (data:
 Tensor2D, c: Tensor2D, h: Tensor2D): [Tensor2D, Tensor2D];\n};\n\n/**\n * Computes the next
 states and outputs of a stack of LSTMCells.\n *\n * Each cell output is used as input to the next cell.\n *\n * Returns
 `[cellState, cellOutput]`.\n *\n * Derived from tf.contrib.rnn.MultiRNNCell.\n *\n * @param lstmCells Array of
 LSTMCell functions.\n *\n * @param data The input to the cell.\n *\n * @param c Array of previous cell states.\n *\n
 * @param h Array of previous cell outputs.\n *\n * @doc {heading: 'Operations', subheading: 'RNN'}\n *\nfunction
 multiRNNCell_(\n lstmCells: LSTMCellFunc[], data: Tensor2D|TensorLike,\n c:
 Array<Tensor2D|TensorLike>,\n h: Array<Tensor2D|TensorLike>): [Tensor2D[], Tensor2D[]] {\n const $data =
 convertToTensor(data, 'data', 'multiRNNCell');\n const $c = convertToTensorArray(c, 'c', 'multiRNNCell');\n const
 $h = convertToTensorArray(h, 'h', 'multiRNNCell');\n\n let input = $data;\n const newStates = [];\n for (let i = 0; i
 < lstmCells.length; i++) {\n const output = lstmCells[i](input, $c[i], $h[i]);\n newStates.push(output[0]);\n
 newStates.push(output[1]);\n\n input = output[1];\n }\n const newC: Tensor2D[] = [];\n const newH: Tensor2D[] = [];\n for (let i = 0; i <
 newStates.length; i += 2) {\n newC.push(newStates[i]);\n newH.push(newStates[i + 1]);\n }\n return [newC,
 newH];\n}\n\nexport const multiRNNCell = op({multiRNNCell_});\n\n"/**\n * @license\n * Copyright 2020 Google
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 OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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=====
```

```
*\nimport {ENGINE} from './engine';\nimport {Multinomial, MultinomialAttrs, MultinomialInputs} from
 './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor1D, Tensor2D} from
 './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from
 './tensor_util_env';\nimport {TensorLike} from './types';\nimport {op} from './operation';\nimport {reshape} from
 './reshape';\n\n/**\n * Creates a `tf.Tensor` with values drawn from a multinomial distribution.\n *\n * ``js\n * const
 probs = tf.tensor([.75, .25]);\n * tf.multinomial(probs, 3).print();\n * ``\n *\n * @param logits 1D array with
 unnormalized log-probabilities, or\n * 2D array of shape `[batchSize, numOutcomes]`. See the `normalized`\n *
 parameter.\n *\n * @param numSamples Number of samples to draw for each row slice.\n *\n * @param seed The seed
 number.\n *\n * @param normalized Whether the provided `logits` are normalized true\n * probabilities
 (sum to 1). Defaults to false.\n *\n * @return 1D array of shape `[numSamples]`, or 2D array of shape\n *
 `[batchSize, numSamples]`, depending on the rank of the input.\n *\n * @doc {heading: 'Tensors', subheading:
 'Random'}\n *\nfunction multinomial_(\n logits: Tensor1D|Tensor2D|TensorLike, numSamples: number, seed?:
 number,\n normalized = false): Tensor1D|Tensor2D {\n const $logits = convertToTensor(logits, 'logits',
 'multinomial');\n const numOutcomes = $logits.size;\n const origRank = $logits.rank;\n if (numOutcomes < 2) {\n
 throw new Error(\n `Error in multinomial: you need at least 2 outcomes, but got ` +\n
 `${numOutcomes}`.);\n }\n if (origRank > 2) {\n throw new Error(`Rank of probabilities must be 1 or 2, but is
 ${origRank}`);\n }\n // TODO(linal28): Investigate correct seed behavior. The code seems not allow\n // setting
 see to 0.\n seed = seed || Math.random();\n\n // The kernel only accepts (and returns) rank 2 tensors.\n const
 logits2D: Tensor2D =\n origRank === 1 ? reshape($logits, [1, -1]) : $logits as Tensor2D;\n\n const inputs:
 MultinomialInputs = {logits: logits2D};\n const attrs: MultinomialAttrs = {numSamples, seed, normalized};\n\n //
 tslint:disable-next-line: no-unnecessary-type-assertion\n const res = ENGINE.runKernel(\n\n Multinomial,\n
 inputs as {} as NamedTensorMap,\n\n attrs as {} as NamedAttrMap) as Tensor2D;\n\n // tslint:disable-
```

next-line:no-unnecessary-type-assertion\n return origRank === 1 ? reshape(res, [res.size]) as Tensor1D :  
res;\n)\n\nexport const multinomial = op({multinomial\_});\n", "/\*\n \* @license\n \* Copyright 2020 Google LLC.  
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```
=====\n*\nimport {ENGINE} from './engine';\nimport {NotEqual, NotEqualInputs} from './kernel_names';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {makeTypesMatch} from './tensor_util';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\n\nimport {assertAndGetBroadcastShape} from './broadcast_util';\nimport {op} from './operation';\n\n/**\n * Returns the truth value of (a != b) element-wise. Supports broadcasting.\n *\n * ```js\n * const a = tf.tensor1d([1, 2, 3]);\n * const b = tf.tensor1d([0, 2, 3]);\n * a.notEqual(b).print();\n * ```\n * @param a
The first input tensor.\n * @param b The second input tensor. Must have the same dtype as `a`.\n * @doc {heading: 'Operations', subheading: 'Logical'}\n */\nfunction notEqual_<T extends Tensor>(\n a: Tensor|TensorLike, b: Tensor|TensorLike): T {\n let $a = convertToTensor(a, 'a', 'notEqual');\n let $b = convertToTensor(b, 'b', 'notEqual');\n [$a, $b] = makeTypesMatch($a, $b);\n assertAndGetBroadcastShape($a.shape, $b.shape);\n const inputs: NotEqualInputs = {a: $a, b: $b};\n return ENGINE.runKernel(NotEqual, inputs as { } as NamedTensorMap);\n}\n\nexport const notEqual = op({notEqual_});\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
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```

```
=====\n*\nimport {ENGINE} from './engine';\nimport {Tensor} from './tensor';\nimport {DataType, Rank, ShapeMap} from './types';\nimport {makeZerosTypedArray, sizeFromShape} from './util';\nimport {complex} from './complex';\n\n/**\n * Creates a `tf.Tensor` with all elements set to 0.\n *\n * ```js\n * tf.zeros([2, 2]).print();\n * ```\n * @param shape An array of integers defining the output tensor shape.\n * @param dtype The type of an element in the resulting tensor. Can be 'float32', 'int32' or 'bool'. Defaults to 'float'.
@doc {heading: 'Tensors', subheading: 'Creation'}\n */\nexport function zeros<R extends Rank>(\n shape: ShapeMap[R], dtype: DataType = 'float32'): Tensor<R> {\n if (dtype === 'complex64') {\n const real = zeros(shape, 'float32');\n const imag = zeros(shape, 'float32');\n return complex(real, imag);\n }\n const values = makeZerosTypedArray(sizeFromShape(shape), dtype);\n return ENGINE.makeTensor(values, shape, dtype) as Tensor<R>;\n}\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
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```

```
=====\n*\nimport {ENGINE} from './engine';\nimport {Tensor} from './tensor';\nimport {DataType, Rank, ShapeMap} from './types';\nimport {makeOnesTypedArray, sizeFromShape} from './util';\nimport {complex} from
```



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```
=====
*
import {ENGINE} from './engine';
import {PadV2, PadV2Attrs, PadV2Inputs} from
 './kernel_names';
import {NamedAttrMap} from './kernel_registry';
import {Tensor} from './tensor';
import {NamedTensorMap} from './tensor_types';
import {convertToTensor} from './tensor_util_env';
import {TensorLike} from './types';
import {op} from './operation';
// Pads a `tf.Tensor` with a given value and
padding.
// This operation implements `CONSTANT` mode. For `REFLECT` and `SYMMETRIC`, refer
to `tf.mirrorPad`.
// Also available are stricter rank-specific methods with the same signature as this method
that assert that `padding` is of given
length.
- `tf.pad1d`
- `tf.pad2d`
- `tf.pad3d`
- `tf.pad4d`
const x = tf.tensor1d([1,
2, 3, 4]);
x.pad([[1, 2]]).print();
@param x The tensor to pad.
@param padding An array of
length `R` (the rank of the tensor), where each element is a length-2 tuple of ints `[padBefore, padAfter]`,
specifying how much to pad along each dimension of the tensor.
@param constantValue The pad value to use.
Defaults to 0.
@doc {heading: 'Tensors', subheading: 'Transformations'}
function pad<T extends
Tensor>(x: T|TensorLike, padding: Array<[number, number]>, constantValue = 0): T {
const $x =
convertToTensor(x, 'x', 'pad');
if ($x.rank === 0) {
throw new Error('pad(scalar) is not defined. Pass non-
scalar to pad');
}
const attrs: PadV2Attrs = {padding, constantValue};
const inputs: PadV2Inputs = {x:
$x};
return ENGINE.runKernel(
PadV2, inputs as unknown as NamedTensorMap,
attrs as unknown as NamedAttrMap);
}
export const pad = op({pad});
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limitations under the License.
=====
*
import {Tensor1D} from './tensor';
import {TensorLike} from './types';
import {assert} from './util';
import {op} from './operation';
import {pad} from './pad';
// Pads a `tf.Tensor1D`
with a given value and padding. See `pad` for details.
function pad1d(x: Tensor1D|TensorLike,
padding: [number, number], constantValue = 0): Tensor1D {
assert(padding.length === 2, () =>
'Invalid number of padding. Must be length of 2. ');
return pad(x, [padding], constantValue);
}
export const pad1d = op({pad1d});
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied. See the License for the specific language governing permissions and
limitations under the
License.
*
=====
*
import {Tensor2D} from './tensor';
import {TensorLike} from './types';
import {assert} from './util';
import {op} from './operation';
import {pad} from './pad';
// Pads a `tf.Tensor2D` with a given value and
padding. See `pad` for details.
function pad2d(x: Tensor2D|TensorLike, padding: [[number, number],
[number, number]], constantValue = 0): Tensor2D {
assert(padding.length === 2 &&
padding[0].length === 2 &&
padding[1].length === 2, () => 'Invalid number of padding. Must be
length of 2 each. ');
return pad(x, padding, constantValue);
}
export const pad2d = op({pad2d});
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```

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```
=====
*^nimport {Tensor3D} from './tensor';nimport {TensorLike} from './types';nimport {assert} from './util';nimport
{op} from './operation';nimport {pad} from './pad';n/**n * Pads a `tf.Tensor3D` with a given value and
paddings. See `pad` for details.n *^nfunction pad3d_(n x: Tensor3D|TensorLike,n paddings: [[number,
number], [number, number], [number, number]],n constantValue = 0): Tensor3D {n assert(n paddings.length
=== 3 && paddings[0].length === 2 &&n paddings[1].length === 2 &&
paddings[2].length === 2,n () => 'Invalid number of paddings. Must be length of 2 each.');"n return pad(x,
paddings, constantValue);n}n\nexport const pad3d = op({pad3d_});n",/**n * @licensen * Copyright 2020
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http://www.apache.org/licenses/LICENSE-2.0n * Unless required by applicable law or agreed to in writing,
softwaren * distributed under the License is distributed on an "AS IS" BASIS,n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.n * See the License for the specific language
governing permissions andn * limitations under the License.n *
```

```
=====
*^nimport {Tensor4D} from './tensor';nimport {TensorLike} from './types';nimport {assert}
from './util';nimport {op} from './operation';nimport {pad} from './pad';n/**n * Pads a `tf.Tensor4D` with a
given value and paddings. See `pad` for details.n *^nfunction pad4d_(n x: Tensor4D|TensorLike,n paddings:n
[n [number, number], [number, number], [number, number], [number, number]n],n constantValue
= 0): Tensor4D {n assert(n paddings.length === 4 && paddings[0].length === 2 &&n
paddings[1].length === 2 && paddings[2].length === 2 &&n paddings[3].length === 2,n () => 'Invalid
number of paddings. Must be length of 2 each.');"n return pad(x, paddings, constantValue);n}n\nexport const
pad4d = op({pad4d_});n",/**n * @licensen * Copyright 2020 Google LLC. All Rights Reserved.n * Licensed
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distributed on an "AS IS" BASIS,n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.n * See the License for the specific language governing permissions andn * limitations under
the License.n *
```

```
=====
*^nimport {ENGINE} from './engine';nimport {SpaceToBatchND, SpaceToBatchNDAttrs,
SpaceToBatchNDInputs} from './kernel_names';nimport {NamedAttrMap} from './kernel_registry';nimport
{Tensor} from './tensor';nimport {NamedTensorMap} from './tensor_types';nimport {convertToTensor} from
 './tensor_util_env';nimport {TensorLike} from './types';nimport * as util from './util';nimport {op} from
 './operation';n/**n * This operation divides "spatial" dimensions `[1, ..., M]` of the input into
blocks of shape `blockShape`, and interleaves
these blocks withn * the "batch" dimension (0) such that in the output, the spatialn * dimensions `[1, ..., M]`
correspond to the position within the grid,n * and the batch dimension combines both the position within a spatial
blockn * and the original batch position. Prior to division into blocks,n * the spatial dimensions of the input are
optionally zero paddedn * according to `paddings`. See below for a precise description.n *`n *`jsn * const x =
tf.tensor4d([1, 2, 3, 4], [1, 2, 2, 1]);n * const blockShape = [2, 2];n * const paddings = [[0, 0], [0, 0]];n *
x.spaceToBatchND(blockShape, paddings).print();n *`n *`n * @param x A `tf.Tensor`. N-D with `x.shape` =
```

`[batch] + spatialShape + \n * remainingShape``, where `spatialShape` has `M`` dimensions. `\n * @param blockShape` A 1-D array. Must have shape `[M]``, all values must `\n * be >= 1.` `\n * @param paddings` A 2-D array. Must have shape `[M, 2]``, all values must be `>= \n * 0.` `\n * paddings[i] = [padStart, padEnd]`` specifies the amount to zero-pad `\n * from input dimension `i + 1``, which corresponds to spatial dimension ``i``. It `\n * is required that \n * (inputShape[i + 1] + padStart + padEnd) % blockShape[i] === 0`` `\n * \n * This operation is equivalent to the following steps: \n * \n * 1. Zero-pad the start and end of dimensions `[1, ..., M]` of the input \n * according to `paddings` to produce `padded` of shape paddedShape. \n * \n * 2. Reshape `padded` to `reshapedPadded` of shape: \n * [batch] + [paddedShape[1] / blockShape[0], blockShape[0], ..., \n * paddedShape[M] / blockShape[M-1], blockShape[M-1]] + remainingShape` \n * \n * 3. Permute dimensions of `reshapedPadded` to produce `permutedReshapedPadded` \n * of shape: blockShape + [batch] + [paddedShape[1] / blockShape[0], ..., \n * paddedShape[M] / blockShape[M-1]] + remainingShape` \n * \n * 4. Reshape `permutedReshapedPadded` to flatten `blockShape` into the \n * batch dimension, producing an output tensor of shape: \n * [batch * prod(blockShape)] + [paddedShape[1] / blockShape[0], ..., \n * paddedShape[M] / blockShape[M-1]] + remainingShape` \n * \n * @doc {heading: 'Tensors', subheading: 'Transformations'}`

```

function spaceToBatchND_<T extends Tensor>(
 x: T|TensorLike,
 blockShape: number[],
 paddings: number[][]): T {
 const $x = convertToTensor(x, 'x', 'spaceToBatchND');
 util.assert(
 $x.rank >= 1 + blockShape.length,
 () => `input rank ${$x.rank} should be > than [blockShape]
 ${\n blockShape.length}`);
 util.assert(
 paddings.length === blockShape.length,
 () => `paddings.shape[0] ${\n paddings.length} must be equal to [blockShape]
 ${blockShape.length}`);
 util.assert(
 $x.shape.reduce(
 (a, b, i) => {
 if (i > 0 && i <= blockShape.length) {
 return a &&
 ((b + paddings[i - 1][0] + paddings[i - 1][1]) %
 blockShape[i - 1] === \n
 0);
 }
 return a;
 },
 \n true),
 () => `input spatial dimensions ${$x.shape.slice(1)} with paddings
 ${\n paddings.toString()} must be divisible by blockShapes
 ${\n blockShape.toString()}`);
 const inputs: SpaceToBatchNDInputs = {x: $x};
 const attrs: SpaceToBatchNDAttrs = {blockShape, paddings};
 return ENGINE.runKernel(
 SpaceToBatchND,
 inputs as {} as NamedTensorMap,
 attrs as {} as NamedAttrMap);
}
export const spaceToBatchND = op({spaceToBatchND_});

```

`/*` Performs an N-D pooling operation `\n * \n * @param input` The input tensor, of rank 4 or rank 3 of shape `\n * `[batch, height, width, inChannels]``. If rank 3, batch of 1 is assumed. `\n * @param windowShape` The filter size: `[filterHeight, filterWidth]``. If `\n * `filterSize`` is a single number, then `filterHeight == filterWidth``. `\n * @param poolingType` The type of pooling, either 'max' or 'avg'. `\n * @param pad` The type of padding algorithm: `\n * - `same` and stride 1: output will be of same size as input, \n * regardless of filter size. \n * - `valid`: output will be smaller than input if filter is larger \n * than 1x1. \n * - For more info, see this guide: \n * [https://www.tensorflow.org/api_guides/python/nn#Convolution]` \n * \n * https://www.tensorflow.org/api_guides/python/nn#Convolution` \n * @param dilations The dilation rates: [dilationHeight, dilationWidth]` in which we sample input values across the height and width dimensions \n *`

in dilated pooling. Defaults to `[1, 1]`. If `dilationRate` is a single number, then `dilationHeight == dilationWidth`. If it is greater than 1, then all values of `strides` must be 1.

`@param strides` The strides of the pooling: `[strideHeight, strideWidth]`. If `strides` is a single number, then `strideHeight == strideWidth`.

```

@doc {heading: 'Operations', subheading:
'Convolution'}
function pool_<T extends Tensor3D|Tensor4D>(
 input: T|TensorLike, windowShape:
[number, number]|number,
 poolingType: 'avg'|'max', pad: 'valid'|'same'|number,
 dilations?: [number, number]|number,
 strides?: [number, number]|number) {
 if (dilations == null) {
 dilations = [1, 1];
 }
 if (strides == null) {
 strides = 1;
 }
 if (pad === 0) {
 pad = 'valid';
 }
 const $x =
convertToTensor(input, 'x', 'maxPool');
 let x4D = $x as Tensor4D;
 let reshapedTo4D = false;
 if ($x.rank
=== 3) {
 reshapedTo4D = true;
 x4D = reshape($x, [1, $x.shape[0], $x.shape[1], $x.shape[2]]);
 }
 util.assert(
conv_util.eitherStridesOrDilationsAreOne(strides, dilations),
() => 'Error in pool: Either strides
or dilations must be 1.' +
`Got strides ${strides} and dilations '${dilations}'`);
 const
convInfo = conv_util.computePool2DInfo(
x4D.shape, windowShape, strides, dilations, pad);
 const dilation:
[number, number] =
[convInfo.dilationHeight, convInfo.dilationWidth];
 // The following implementation
does batchToSpace(pool(spaceToBatch(x)))
// whenever dilation > 1 since the TF kernels do not support dilation
> 1.
// tslint:disable-next-line:max-line-length
https://github.com/tensorflow/tensorflow/blob/50f6bb67dc98c9b74630b6047aae7a4f8a40fd02/tensorflow/python/ops/nn_ops.py#L1037
 let basePadding: number[][];
 if (pad === 'same') {
 basePadding =
withSpaceToBatchBasePaddings(
[convInfo.filterHeight, convInfo.filterWidth], dilation);
 } else {
 basePadding = [[0, 0], [0, 0]];
 }
 const isDilationOne = dilation[0] === 1 && dilation[1] === 1;
 const
[adjustedPadding, adjustedCrops] = requiredSpaceToBatchPaddings(
[convInfo.inHeight, convInfo.inWidth],
dilation, basePadding);
 const convertedPad = isDilationOne
? pad : 'valid';
 const convertedX =
isDilationOne ? x4D : spaceToBatchND(x4D, dilation,
adjustedPadding);
 const forwardOp = poolingType === 'avg' ?
() => avgPool(convertedX, windowShape,
strides, convertedPad) :
() => maxPool(convertedX, windowShape, strides, convertedPad);
 const y =
forwardOp();
 const res = isDilationOne ? y : batchToSpaceND(y, dilation, adjustedCrops);
 if (reshapedTo4D) {
 return reshape(res, [res.shape[1], res.shape[2], res.shape[3]]) as T;
 }
 return res as T;
}
// Helper function to compute crops and paddings for pool with dilation > 1.
// tslint:disable-next-line:max-line-length
https://github.com/tensorflow/tensorflow/blob/50f6bb67dc98c9b74630b6047aae7a4f8a40fd02/tensorflow/python/ops/array_ops.py#L2184
function requiredSpaceToBatchPaddings(
 inputShape: [number, number], blockShape:
[number, number],
 basePadding: number[][]) {
 const padStart = basePadding.map(b => b[0]);
 const
origPadEnd
= basePadding.map(b => b[1]);
 const fullInputShape = inputShape.concat(padStart, origPadEnd);
 const padEndExtra = blockShape.map((b, i) => (b - fullInputShape[i] % b) % b);
 const padEnd = origPadEnd.map((s, i) => s + padEndExtra[i]);
 const paddings = blockShape.map((_, i) => [padStart[i], padEnd[i]]);
 const crops =
blockShape.map((_, i) => [0, padEndExtra[i]]);
 return [paddings, crops];
}
// Helper function to compute base
paddings for pool with dilation > 1.
// tslint:disable-next-line:max-line-length
https://github.com/tensorflow/tensorflow/blob/50f6bb67dc98c9b74630b6047aae7a4f8a40fd02/tensorflow/python/ops/nn_ops.py#L524
function withSpaceToBatchBasePaddings(
 filterShape: [number, number], dilation:
[number, number]) {
 // Spatial dimensions of the filters and the upsampled filters in which we
 // introduce (rate
- 1) zeros between consecutive filter values.
 const dilatedFilterShape = filterShape.map((s, i) => {
 return s +
(s - 1)
* (dilation[i] - 1);
 });
 const padExtraShape = dilatedFilterShape.map(s => s - 1);
 // When padding is odd,
we pad more at end, following the same
// convention as conv2d.
 const padExtraStart = padExtraShape.map(s
=> Math.floor(s / 2));
 const padExtraEnd = padExtraShape.map((s, i) => s - padExtraStart[i]);
 return
padExtraShape.map((_, i) => {
 return [padExtraStart[i], padExtraEnd[i]];
 });
}
}
export const pool =
op({pool_});
"/**
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```

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```

=====
*/nimport {ENGINE} from './engine';nimport {Pow, PowInputs} from './kernel_names';nimport {Tensor} from
 './tensor';nimport {NamedTensorMap} from './tensor_types';nimport {makeTypesMatch} from
 './tensor_util';nimport {convertToTensor} from './tensor_util_env';nimport {TensorLike} from './types';nimport
 {op} from './operation';n/n**n * Computes the power of one `tf.Tensor` to another. Supports broadcasting.n *n *
 Given a `tf.Tensor` x and a `tf.Tensor` y, this operation computes x^y for
 * corresponding elements in x and y.
 The result's dtype will be the upcasted
 * type of the `base` and `exp` dtypes.n *n * ``jsn * const a =
 tf.tensor([[2, 3], [4, 5]])n * const b = tf.tensor([[1, 2], [3, 0]]).toInt();n *n * a.pow(b).print(); // or tf.pow(a, b)n *
 ``n *n * ``jsn * const
 a = tf.tensor([[1, 2], [3, 4]])n * const b = tf.tensor(2).toInt();n *n * a.pow(b).print(); // or tf.pow(a, b)n * ``n *
 We also expose `powStrict` which has the same signature as this op and
 * asserts that `base` and `exp` are the
 same shape (does not broadcast).n *n * @param base The base `tf.Tensor` to pow element-wise.n * @param exp
 The exponent `tf.Tensor` to pow element-wise.n *n * @doc {heading: 'Operations', subheading: 'Arithmetic'}n
 */nfunction pow_<T extends Tensor>(n base: Tensor|TensorLike, exp: Tensor|TensorLike): T {n let $base =
 convertToTensor(base, 'base', 'pow');n let $exp = convertToTensor(exp, 'exp', 'pow');n [$base, $exp] =
 makeTypesMatch($base, $exp);n\n const inputs: PowInputs = {a: $base, b: $exp};n\n return
 ENGINE.runKernel(Pow, inputs as { } as NamedTensorMap);n}\n\nexport const pow = op({pow_});n"/**n *
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 2.0 (the "License");n

```

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```

=====
*/nimport {ENGINE} from './engine';nimport {Prelu, PreluInputs} from './kernel_names';nimport {Tensor}
 from './tensor';nimport {NamedTensorMap} from './tensor_types';nimport {convertToTensor} from
 './tensor_util_env';nimport {TensorLike} from './types';nimport {op} from './operation';n/n**n * Computes
 leaky rectified linear element-wise with parametric alphas.n *n * `x < 0 ? alpha * x :
 f(x) = x`n *n * ``jsn * const x = tf.tensor1d([-1, 2, -3, 4]);n * const alpha = tf.scalar(0.1);n *n *
 x.prelu(alpha).print(); // or tf.prelu(x, alpha)n * ``n * @param x The input tensor.n * @param alpha Scaling
 factor for negative values.n *n * @doc {heading: 'Operations', subheading: 'Basic math'}n */nfunction prelu_<T
 extends Tensor>(x: T|TensorLike, alpha: T|TensorLike): T {n const $x = convertToTensor(x, 'x', 'prelu');n const
 $alpha = convertToTensor(alpha, 'alpha', 'prelu');n\n const inputs: PreluInputs = {x: $x, alpha: $alpha};n return
 ENGINE.runKernel(Prelu, inputs as { } as NamedTensorMap);n}\n\nexport const prelu = op({prelu_});n"/**n *
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 License for the specific language governing permissions andn * limitations under the License.n *

```

=====



```

*\n\nimport {ENGINE} from './engine';\nimport {Prod, ProdAttrs, ProdInputs} from './kernel_names';\nimport
{NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from
 './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from
 './types';\nimport {cast} from './cast';\nimport {op} from './operation';\n\n/**\n * Computes the product of
elements across dimensions of a `tf.Tensor`.\n *\n * Reduces the input along the dimensions given in `axes`. Unless
`keepDims`\n * is true, the rank of the `tf.Tensor` is reduced by
1 for each entry in\n * `axes`. If `keepDims` is true, the reduced dimensions are retained with\n * length 1. If `axes`
has no entries, all dimensions are reduced, and a\n * `tf.Tensor` with a single element is returned.\n *\n *
`js`\n *
const x = tf.tensor1d([1, 2, 3]);\n *\n * x.prod().print(); // or tf.prod(x)\n *\n * `js`\n *
const x =
tf.tensor2d([1, 2, 3, 4], [2, 2]);\n *\n * const axis = 1;\n * x.prod(axis).print(); // or tf.prod(x, axis)\n *\n *
`js`\n *
@param x The input tensor to compute the product over. If the dtype is `bool`\n * it will be converted to `int32`
and the output dtype will be `int32`.\n * @param axis The dimension(s) to reduce. By default it reduces\n * all
dimensions.\n * @param keepDims If true, retains reduced dimensions with size 1.\n *\n * @doc {heading:
'Operations', subheading: 'Reduction'}\n */\nfunction prod<T extends Tensor>(\n x: Tensor|TensorLike, axis:
number|number[] = null, keepDims = false): T {\n let $x = convertToTensor(x,\n 'x', 'prod');\n\n if ($x.dtype === 'bool') {\n // bool is not an allowed type for the underlying kernel.\n $x =
cast($x, 'int32');\n }\n\n const inputs: ProdInputs = {x: $x};\n const attrs: ProdAttrs = {axis, keepDims};\n\n return ENGINE.runKernel(\n Prod, inputs as {} as NamedTensorMap, attrs as {} as
NamedAttrMap);\n}\n\nexport const prod = op({prod_});\n", "/*\n * @license\n * Copyright 2020 Google LLC.
All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations
under the License.\n *
=====\n\n
*\n\nimport {ENGINE} from './engine';\nimport {Tensor} from './tensor';\nimport {DataType, Rank, ShapeMap}
from './types';\nimport {sizeFromShape} from './util';\nimport {op} from './operation';\n\n/**\n * Creates a
`tf.Tensor` with values sampled from a random number generator\n * function defined by the user.\n *\n * @param
shape An array of integers defining the output tensor shape.\n * @param randFunction A random number generator
function which is called\n * for each element in the output tensor.\n * @param dtype The data type of the output
tensor. Defaults to 'float32'.\n */\nfunction rand<R extends Rank>(\n shape: ShapeMap[R], randFunction: () =>
number,\n dtype?: DataType): Tensor<R> {\n const size = sizeFromShape(shape);\n let values = null;\n if (dtype
=== null || dtype === 'float32') {\n values = new Float32Array(size);\n } else if (dtype === 'int32') {\n
 values = new Int32Array(size);\n } else if (dtype === 'bool') {\n values = new Uint8Array(size);\n } else {\n
throw new Error(`Unknown data type ${dtype}`);\n }\n for (let i = 0; i < size; i++) {\n values[i] =
randFunction();\n }\n return ENGINE.makeTensor(values, shape, dtype) as Tensor<R>;\n}\n\nexport const rand =
op({rand_});\n", "/*\n * A port of an algorithm by Johannes Baagøe <baagoe@baagoe.com>, 2010\n//
http://baagoe.com/en/RandomMusings/javascript/\n// https://github.com/nquinlan/better-random-numbers-for-
javascript-mirror\n// Original work is under MIT license -\n// Copyright (C) 2010 by Johannes Baagøe
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```
(function(global, module, define)
{\n\nfunction Alea(seed) {\n var me = this, mash = Mash();\n me.next = function() {\n var t = 2091639 * me.s0
+ me.c * 2.3283064365386963e-10; // 2^-32\n me.s0 = me.s1;\n me.s1 = me.s2;\n
return me.s2 = t - (me.c = t | 0);\n }; // Apply the seeding algorithm from Baagoe.\n me.c = 1;\n me.s0 =
mash('');\n me.s1 = mash('');\n me.s2 = mash('');\n me.s0 -= mash(seed);\n if (me.s0 < 0) { me.s0 += 1; }\n
me.s1 -= mash(seed);\n if (me.s1 < 0) { me.s1 += 1; }\n me.s2 -= mash(seed);\n if (me.s2 < 0) { me.s2 += 1; }\n
mash = null;\n}\n\nfunction copy(f, t) {\n t.c = f.c;\n t.s0 = f.s0;\n t.s1 = f.s1;\n t.s2 = f.s2;\n return
t;\n}\n\nfunction impl(seed, opts) {\n var xg = new Alea(seed),\n state = opts && opts.state,\n prng =
xg.next;\n prng.int32 = function() { return (xg.next() * 0x100000000) | 0; }\n prng.double = function() {\n return
prng() + (prng() * 0x200000 | 0) * 1.1102230246251565e-16; // 2^-53\n }; \n prng.quick = prng;\n if (state) {\n if
(typeof(state) === 'object') copy(state, xg);\n prng.state = function() { return copy(xg, {}); }\n }\n return
prng;\n}\n\nfunction Mash() {\n var n = 0xefc8249d;\n var mash = function(data)
{\n data = data.toString();\n for (var i = 0; i < data.length; i++) {\n n += data.charCodeAt(i);\n var h =
0.02519603282416938 * n;\n n = h >>> 0;\n h -= n;\n h *= n;\n n = h >>> 0;\n h -= n;\n n += h *
0x100000000; // 2^32\n }\n return (n >>> 0) * 2.3283064365386963e-10; // 2^-32\n };\n return
mash;\n}\n\nif (module && module.exports) {\n module.exports = impl;\n} else if (define && define.amd) {\n
define(function() { return impl; });\n} else {\n this.alea = impl;\n}\n})(this, (typeof module) === 'object' &&
module, // present in node.js\n (typeof define) === 'function' && define // present with an AMD
loader);\n\n", "A Javascript implementaion of the \"xor128\" prng algorithm by\n// George Marsaglia. See
http://www.jstatsoft.org/v08/i14/paper\n\n(function(global, module, define) {\n\nfunction XorGen(seed) {\n var me
= this, strseed = \";\n me.x = 0;\n me.y = 0;\n me.z = 0;\n me.w = 0;\n\n
// Set up generator function.\n me.next = function() {\n var t = me.x ^ (me.x << 11);\n me.x = me.y;\n me.y =
me.z;\n me.z = me.w;\n return me.w ^= (me.w >>> 19) ^ t ^ (t >>> 8);\n }; \n if (seed === (seed | 0)) {\n //
Integer seed.\n me.x = seed;\n } else {\n // String seed.\n strseed += seed;\n }\n // Mix in string seed, then
discard an initial batch of 64 values.\n for (var k = 0; k < strseed.length + 64; k++) {\n me.x ^=
strseed.charCodeAt(k) | 0;\n me.next();\n }\n}\n\nfunction copy(f, t) {\n t.x = f.x;\n t.y = f.y;\n t.z = f.z;\n t.w =
f.w;\n return t;\n}\n\nfunction impl(seed, opts) {\n var xg = new XorGen(seed),\n state = opts && opts.state,\n
prng = function() { return (xg.next() >>> 0) / 0x100000000; }; \n prng.double = function() {\n do {\n var top =
xg.next() >>> 11,\n bot = (xg.next() >>> 0) / 0x100000000,\n result = (top + bot) / (1 << 21);\n } while
(result === 0);\n return
result;\n }; \n prng.int32 = xg.next;\n prng.quick = prng;\n if (state) {\n if (typeof(state) === 'object') copy(state,
xg);\n prng.state = function() { return copy(xg, {}); }\n }\n return prng;\n}\n\nif (module && module.exports)
{\n module.exports = impl;\n} else if (define && define.amd) {\n define(function() { return impl; });\n} else {\n
this.xor128 = impl;\n}\n})(this, (typeof module) === 'object' && module, // present in node.js\n (typeof
define) === 'function' && define // present with an AMD loader);\n\n", "A Javascript implementaion of the
\"xorwow\" prng algorithm by\n// George Marsaglia. See
http://www.jstatsoft.org/v08/i14/paper\n\n(function(global, module, define) {\n\nfunction XorGen(seed) {\n var me
= this, strseed = \";\n // Set up generator function.\n me.next = function() {\n var t = (me.x ^ (me.x >>> 2));\n
me.x = me.y;\n me.y = me.z;\n me.z = me.w;\n me.w = me.v;\n return (me.d = (me.d + 362437 | 0)) +\n (me.v =
(me.v
^ (me.v << 4)) ^ (t ^ (t << 1))) | 0;\n }; \n me.x = 0;\n me.y = 0;\n me.z = 0;\n me.w = 0;\n me.v = 0;\n if
(seed === (seed | 0)) {\n // Integer seed.\n me.x = seed;\n } else {\n // String seed.\n strseed += seed;\n }\n
// Mix in string seed, then discard an initial batch of 64 values.\n for (var k = 0; k < strseed.length + 64; k++) {\n
```

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me.x ^= strseed.charCodeAt(k) | 0;
if (k === strseed.length) {
 me.d = me.x << 10 ^ me.x >>> 4;
}
me.next();
}
function copy(f, t) {
 t.x = f.x;
 t.y = f.y;
 t.z = f.z;
 t.w = f.w;
 t.v = f.v;
 t.d = f.d;
return t;
}
function impl(seed, opts) {
 var xg = new XorGen(seed),
 state = opts && opts.state,
 prng = function() {
 return (xg.next() >>> 0) / 0x100000000;
 };
 prng.double = function() {
 do {
 var top =
xg.next() >>> 11,
 bot = (xg.next() >>> 0) / 0x100000000,
 result = (top + bot) / (1 << 21);
 } while
(result === 0);
return result;
};
prng.int32 = xg.next();
prng.quick = prng;
if (state) {
 if (typeof(state) === 'object')
copy(state, xg);
prng.state = function() {
 return copy(xg, {});
};
}
return prng;
}
if (module &&
module.exports) {
 module.exports = impl;
} else if (define && define.amd) {
 define(function() {
 return impl;
 });
} else {
 this.xorwow = impl;
}
})(this, (typeof module) === 'object' && module, // present in
node.js
(typeof define) === 'function' && define // present with an AMD loader
);
// A Javascript
implementaion of the "xorshift7" algorithm by
Fran ois Panneton and Pierre L'ecuyer
// "On the Xorgshift
Random Number Generators"
http://saluc.engr.uconn.edu/refs/crypto/rng/panneton05onthexorshift.pdf
(function(global, module, define)
{
function XorGen(seed) {
 var me = this;
// Set up generator function.
me.next = function() {
// Update xor generator.
var X = me.x, i = me.i, t,
 v, w;
t = X[i];
t ^= (t >>> 7);
v = t ^ (t << 24);
t = X[(i + 1) & 7];
v ^= t ^ (t >>> 10);
t = X[(i + 3) & 7];
v ^= t ^ (t >>> 3);
t = X[(i + 4) & 7];
v ^= t ^ (t << 7);
t = X[(i + 7) & 7];
t = t ^ (t << 13);
v ^= t ^ (t << 9);
X[i] = v;
me.i = (i + 1) & 7;
return v;
};
function init(me, seed) {
 var j, w, X = [];
if (seed
=== (seed | 0)) {
// Seed state array using a 32-bit integer.
w = X[0] = seed;
} else {
// Seed state
using a string.
seed = " + seed;
for (j = 0; j < seed.length; ++j) {
X[j & 7] = (X[j & 7] << 15) ^
(seed.charCodeAt(j) + X[(j + 1) & 7] << 13);
}
}
// Enforce an array length of 8, not all zeroes.
while (X.length < 8) X.push(0);
for (j = 0; j < 8 && X[j] === 0; ++j);
if (j === 8) w = X[7] = -1;
else w =
X[j];
me.x = X;
me.i = 0;
// Discard an initial 256 values.
for (j = 256; j > 0; --j) {
me.next();
}
}
init(me, seed);
}
function copy(f, t) {
 t.x = f.x.slice();
 t.i = f.i;
return
t;
}
function impl(seed, opts) {
 if (seed === null) seed = +(new Date);
 var xg = new XorGen(seed),
 state = opts && opts.state,
 prng = function() {
 return (xg.next() >>> 0) / 0x100000000;
 };
 prng.double =
function() {
 do {
 var top = xg.next() >>> 11,
 bot = (xg.next() >>> 0) / 0x100000000,
 result
= (top + bot) / (1 << 21);
 } while (result === 0);
return result;
};
prng.int32 = xg.next();
prng.quick =
prng;
if (state) {
 if (state.x) copy(state, xg);
prng.state = function() {
 return copy(xg, {});
};
}
return
prng;
}
if (module && module.exports) {
 module.exports = impl;
} else if (define && define.amd) {
 define(function() {
 return impl;
 });
} else {
 this.xorshift7 = impl;
}
})(this, (typeof module) === 'object'
&& module, // present in node.js
(typeof define) === 'function' && define // present with an AMD loader
);
// A Javascript implementaion of
Richard Brent's Xorgens xor4096 algorithm.
// This fast non-cryptographic random number generator is
designed for
use in Monte-Carlo algorithms. It combines a long-period xorshift
generator with a Weyl
generator, and it passes all common batteries
of stasticial tests for randomness while consuming only a few
nanoseconds
for each prng generated. For background on the generator, see Brent's
paper: "Some long-
period random number generators using shifts and xors."
http://arxiv.org/pdf/1004.3115v1.pdf
Usage:
var xor4096 = require('xor4096');
random = xor4096(1); // Seed with int32 or
string
assert.equal(random(), 0.1520436450538547); // (0, 1) range, 53 bits.
assert.equal(random.int32(),
1806534897); // signed int32, 32 bits.
// For nonzero numeric keys, this impelementation provides a
sequence
identical to that by Brent's xorgens 3 implementaion in C. This
implementation also provides for
initalizing the generator with
string seeds, or for saving and restoring the state of the generator.
On
Chrome, this prng benchmarks about 2.1 times slower than
Javascript's built-in
Math.random().
(function(global, module, define)
{
function XorGen(seed) {
 var me = this;
// Set up
generator function.
me.next = function() {
 var w = me.w,
 X = me.X, i = me.i, t, v;
// Update Weyl
generator.
me.w = w = (w + 0x61c88647) | 0;
// Update xor generator.
v = X[(i + 34) & 127];
t = X[i

```

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= ((i + 1) & 127)];\n v ^= v << 13;\n t ^= t << 17;\n v ^= v >>> 15;\n t ^= t >>> 12;\n // Update XOR
generator array state.\n v = X[i] = v ^ t;\n me.i = i;\n // Result is the combination.\n return (v + (w ^ (w >>>
16))) | 0;\n };\n\n function init(me, seed) {\n var t, v, i, j, w, X = [], limit = 128;\n if (seed === (seed | 0)) {\n // Numeric seeds initialize v, which is used to generate X.\n v = seed;\n seed
= null;\n } else {\n // String seeds are mixed into v and X one character at a time.\n seed = seed + '\\0';\n v = 0;\n limit = Math.max(limit, seed.length);\n }\n // Initialize circular array and weyl value.\n for (i = 0, j
= -32; j < limit; ++j) {\n // Put the unicode characters into the array, and shuffle them.\n if (seed) v ^=
seed.charCodeAtAt((j + 32) % seed.length);\n // After 32 shuffles, take v as the starting w value.\n if (j === 0) w
= v;\n v ^= v << 10;\n v ^= v >>> 15;\n v ^= v << 4;\n v ^= v >>> 13;\n if (j >= 0) {\n w = (w +
0x61c88647) | 0; // Weyl.\n t = (X[j & 127] ^ (v + w)); // Combine xor and weyl to init array.\n i = (0
=== t) ? i + 1 : 0; // Count zeroes.\n }\n }\n // We have detected all zeroes; make the key nonzero.\n if (i >= 128) {\n X[(seed && seed.length || 0) & 127] = -1;\n }\n // Run the generator 512 times to further
mix the state before using it.\n // Factoring this as a function slows the main generator, so it is just\n // unrolled
here. The weyl generator is not advanced while warming up.\n i = 127;\n for (j = 4 * 128; j > 0; --j) {\n v =
X[(i + 34) & 127];\n t = X[i = ((i + 1) & 127)];\n v ^= v << 13;\n t ^= t << 17;\n v ^= v >>> 15;\n t
^= t >>> 12;\n X[i] = v ^ t;\n }\n // Storing state as object members is faster than using closure variables.\n
me.w = w;\n me.X = X;\n me.i = i;\n }\n\n init(me, seed);\n\n\nfunction copy(f, t) {\n t.i = f.i;\n t.w = f.w;\n
t.X = f.X.slice();\n return t;\n};\n\nfunction impl(seed, opts) {\n if (seed == null) seed = +(new Date);\n var xg =
new XorGen(seed),\n state = opts && opts.state,\n prng = function() { return (xg.next() >>> 0) /
0x100000000; };\n prng.double
= function() {\n do {\n var top = xg.next() >>> 11,\n bot = (xg.next() >>> 0) / 0x100000000,\n
result = (top + bot) / (1 << 21);\n } while (result === 0);\n return result;\n }; \n prng.int32 = xg.next;\n
prng.quick = prng;\n if (state) {\n if (state.X) copy(state, xg);\n prng.state = function() { return copy(xg, {}); }\n
 }\n return prng;\n}\n\nif (module && module.exports) {\n module.exports = impl;\n} else if (define &&
define.amd) {\n define(function() { return impl; });\n} else {\n this.xor4096 = impl;\n}\n\n\n)\n this,
// window object or global\n (typeof module) === 'object' && module, // present in node.js\n (typeof
define) === 'function' && define // present with an AMD loader\n);\n\n", // A Javascript implementaion of the
"Tyche-i" prng algorithm by\n// Samuel Neves and Filipe Araujo.\n// See https://eden.dei.uc.pt/~sneves/pubs/2011-
snfa2.pdf\n\n(function(global, module, define) {\n\nfunction
XorGen(seed) {\n var me = this, strseed = "";\n // Set up generator function.\n me.next = function() {\n var b =
me.b, c = me.c, d = me.d, a = me.a;\n b = (b << 25) ^ (b >>> 7) ^ c;\n c = (c - d) | 0;\n d = (d << 24) ^ (d >>>
8) ^ a;\n a = (a - b) | 0;\n me.b = b = (b << 20) ^ (b >>> 12) ^ c;\n me.c = c = (c - d) | 0;\n me.d = (d << 16) ^
(c >>> 16) ^ a;\n return me.a = (a - b) | 0;\n };\n /* The following is non-inverted tyche, which has better
internal\n * bit diffusion, but which is about 25% slower than tyche-i in JS.\n me.next = function() {\n var a =
me.a, b = me.b, c = me.c, d = me.d;\n a = (me.a + me.b | 0) >>> 0;\n d = me.d ^ a; d = d << 16 ^ d >>> 16;\n c
= me.c + d | 0;\n b = me.b ^ c; b = b << 12 ^ d >>> 20;\n me.a = a + b | 0;\n d = d ^ a; me.d = d = d << 8 ^
d >>> 24;\n me.c = c = c + d | 0;\n b = b ^ c;\n return me.b = (b << 7 ^ b >>> 25);\n };\n *\n me.a = 0;\n
me.b = 0;\n me.c = 2654435769\n | 0;\n me.d = 1367130551;\n if (seed === Math.floor(seed)) {\n // Integer seed.\n me.a = (seed /
0x100000000) | 0;\n me.b = seed | 0;\n } else {\n // String seed.\n strseed += seed;\n }\n // Mix in string
seed, then discard an initial batch of 64 values.\n for (var k = 0; k < strseed.length + 20; k++) {\n me.b ^=
strseed.charCodeAtAt(k) | 0;\n me.next();\n }\n}\n\nfunction copy(f, t) {\n t.a = f.a;\n t.b = f.b;\n t.c = f.c;\n t.d =
f.d;\n return t;\n};\n\nfunction impl(seed, opts) {\n var xg = new XorGen(seed),\n state = opts && opts.state,\n
prng = function() { return (xg.next() >>> 0) / 0x100000000; };\n prng.double = function() {\n do {\n var top
= xg.next() >>> 11,\n bot = (xg.next() >>> 0) / 0x100000000,\n result = (top + bot) / (1 << 21);\n }
while (result === 0);\n return result;\n }; \n prng.int32 = xg.next;\n prng.quick = prng;\n if (state) {\n if
(typeof(state) === 'object') copy(state,

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 xg);\n prng.state = function() { return copy(xg, {}); }\n }\n return prng;\n}\n\nif (module && module.exports)
{\n module.exports = impl;\n} else if (define && define.amd) {\n define(function() { return impl; });\n} else {\n this.tychei = impl;\n}\n\n})(\n this,\n (typeof module) === 'object' && module, // present in node.js\n (typeof define) === 'function' && define // present with an AMD loader\n);\n\n"/*\nCopyright 2014 David
Bau.\n\nPermission is hereby granted, free of charge, to any person obtaining\na copy of this software and
associated documentation files (the\n\"Software\"), to deal in the Software without restriction, including\nwithout
limitation the rights to use, copy, modify, merge, publish,\ndistribute, sublicense, and/or sell copies of the Software,
and to\npermit persons to whom the Software is furnished to do so, subject to\nthe following conditions:\n\nThe
above copyright notice and this permission notice shall be\nincluded in all copies or substantial
portions of the Software.\n\nTHE SOFTWARE IS PROVIDED \"AS IS\", WITHOUT WARRANTY OF ANY
KIND,\nEXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES
OF\nMERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT.\n\nIN
EVENT SHALL THE AUTHORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY\nCLAIM, DAMAGES
OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT,\nTORT OR OTHERWISE, ARISING
FROM, OUT OF OR IN CONNECTION WITH THE\nSOFTWARE OR THE USE OR OTHER DEALINGS IN
THE SOFTWARE.\n\n*/\n\n(function (pool, math) {\n\n// The following constants are related to IEEE 754
limits.\n\nvar global = this,\n width = 256, // each RC4 output is 0 <= x < 256\n chunks = 6, // at least
six RC4 outputs for each double\n digits = 52, // there are 52 significant digits in a double\n rngname =
'random', // rngname: name for Math.random and Math.seedrandom\n startdenom = math.pow(width, chunks),\n significance = math.pow(2, digits),\n overflow
= significance * 2,\n mask = width - 1,\n nodecrypto; // node.js crypto module, initialized at the
bottom.\n\n\n// seedrandom()\n// This is the seedrandom function described above.\n\nfunction seedrandom(seed,
options, callback) {\n var key = [];\n options = (options === true) ? { entropy: true } : (options || {});\n\n // Flatten
the seed string or build one from local entropy if needed.\n var shortseed = mixkey(flatten(\n options.entropy ?
[seed, toString(pool)] :\n (seed === null) ? autoseed() : seed, 3), key);\n\n // Use the seed to initialize an ARC4
generator.\n var arc4 = new ARC4(key);\n\n // This function returns a random double in [0, 1) that contains\n //
randomness in every bit of the mantissa of the IEEE 754 value.\n var prng = function() {\n var n = arc4.g(chunks),
// Start with a numerator n < 2 ^ 48\n d = startdenom, // and denominator d = 2 ^ 48.\n x =
0; // and no
'extra last byte'.\n while (n < significance) { // Fill up all significant digits by\n n = (n + x) * width;
// shifting numerator and\n d *= width; // denominator and generating a\n x = arc4.g(1);
// new least-significant-byte.\n }\n while (n >= overflow) { // To avoid rounding up, before
adding\n n /= 2; // last byte, shift everything\n d /= 2; // right using integer
math until\n x >>>= 1; // we have exactly the desired bits.\n }\n return (n + x) / d; //
Form the number within [0, 1).\n };\n\n prng.int32 = function() { return arc4.g(4) | 0; }\n prng.quick = function() {
return arc4.g(4) / 0x100000000; }\n prng.double = prng;\n\n // Mix the randomness into accumulated entropy.\n mixkey(toString(arc4.S), pool);\n\n // Calling convention: what to return as a
function of prng, seed, is_math.\n return (options.pass || callback ||\n function(prng, seed, is_math_call, state)
{\n if (state) {\n // Load the arc4 state from the given state if it has an S array.\n if (state.S) {
copy(state, arc4); }\n // Only provide the .state method if requested via options.state.\n prng.state =
function() { return copy(arc4, {}); }\n }\n // If called as a method of Math (Math.seedrandom()), mutate\n
// Math.random because that is how seedrandom.js has worked since v1.0.\n if (is_math_call) {\n math[rngname] = prng; return seed; }\n // Otherwise, it is a newer calling convention, so return the\n
// prng directly.\n else return prng;\n })\n (\n prng,\n shortseed,\n 'global' in options ? options.global : (this ===
math),\n options.state);\n }\n\n math['seed' + rngname] = seedrandom;\n\n\n// ARC4\n\n// An ARC4
implementation. The constructor takes a key in the
form of\n// an array of at most (width) integers that should be 0 <= x < (width).\n\n// The g(count) method returns
a pseudorandom integer that concatenates\n// the next (count) outputs from ARC4. Its return value is a number x\n//

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that is in the range 0 <= x < (width ^ count).\n\nfunction ARC4(key) {\n var t, keylen = key.length,\n me = this, i = 0, j = me.i = me.j = 0, s = me.S = [];\n\n // The empty key [] is treated as [0].\n if (!keylen) { key = [keylen++]; }\n\n // Set up S using the standard key scheduling algorithm.\n while (i < width) {\n s[i] = i++;\n }\n for (i = 0; i < width; i++) {\n s[i] = s[j = mask & (j + key[i % keylen] + (t = s[i]));]\n s[j] = t;\n }\n\n // The 'g' method returns the next (count) outputs as one number.\n (me.g = function(count) {\n // Using instance members instead of closure state nearly doubles speed.\n var t, r = 0,\n i = me.i, j = me.j, s = me.S;\n while (count--)\n t = s[i = mask & (i + 1)];\n\n r = r * width + s[mask & ((s[i] = s[j = mask & (j + t)) + (s[j] = t)));\n })\n me.i = i; me.j = j;\n return r;\n\n // For robust unpredictability, the function call below automatically\n // discards an initial batch of values. This is called RC4-drop[256].\n // See http://google.com/search?q=rsa+fluhrer+response&btnI\n })(width);\n\n // Copies internal state of ARC4 to or from a plain object.\n function copy(f, t) {\n t.i = f.i;\n t.j = f.j;\n t.S = f.S.slice();\n return t;\n }\n\n // flatten()\n // Converts an object tree to nested arrays of strings.\n function flatten(obj, depth) {\n var result = [], typ = (typeof obj), prop;\n if (depth && typ === 'object')\n for (prop in obj)\n try { result.push(flatten(obj[prop], depth - 1)); } catch (e) {} }\n return (result.length ? result : typ === 'string' ? obj : '\\0');\n }\n\n // mixkey()\n // Mixes a string seed into a key that is an array of integers, and\n // returns a shortened string seed that is equivalent to the result key.\n function mixkey(seed, key) {\n var stringseed = seed + '', smear, j = 0;\n while (j < stringseed.length)\n key[mask & j] = mask & ((smear ^= key[mask & j] * 19) + stringseed.charCodeAt(j++));\n return toString(key);\n }\n\n // autoseed()\n // Returns an object for autoseeding, using window.crypto and Node crypto\n // module if available.\n function autoseed()\n {\n try {\n var out;\n if (nodecrypto && (out = nodecrypto.randomBytes))\n // The use of 'out' to remember randomBytes makes tight minified code.\n out = out(width);\n else\n out = new Uint8Array(width);\n (global.crypto || global.msCrypto).getRandomValues(out);\n } catch (e) {\n var browser = global.navigator,\n plugins = browser && browser.plugins;\n return [+new Date, global, plugins, global.screen, toString(pool)];\n }\n }\n\n // toString()\n // Converts an array of charcodes to a string\n function toString(a) {\n return String.fromCharCode.apply(0, a);\n }\n\n // When seedrandom.js is loaded, we immediately mix a few bits\n // from the built-in RNG into the entropy pool. Because we do\n // not want to interfere with deterministic PRNG state later,\n // seedrandom will not call math.random on its own again after\n // initialization.\n mixkey(math.random(), pool);\n\n // Nodejs and AMD support: export the implementation as a module using\n // either convention.\n if ((typeof module) === 'object' && module.exports)\n module.exports = seedrandom;\n // When in node.js, try using crypto package for autoseeding.\n try {\n nodecrypto = require('crypto');\n } catch (ex) {} else if ((typeof define) === 'function' && define.amd)\n define(function() { return seedrandom; });\n\n // End anonymous scope, and pass initial values.\n (function() {\n [], // pool: entropy pool starts empty\n Math, // math: package containing random, pow, and seedrandom\n })("\n\n// A library of seedable RNGs implemented in Javascript.\n\nUsage:\n\nvar seedrandom = require('seedrandom');\nvar random = seedrandom(1); // or any seed.\nvar x = random(); // 0 <= x < 1. Every bit is random.\nvar x = random.quick(); // 0 <= x < 1. 32 bits of randomness.\n\nalea, a 53-bit multiply-with-carry generator by Johannes Baagøe.\nPeriod: ~2^116\nReported to pass all BigCrush tests.\nvar alea = require('./lib/alea');\n\nxor128, a pure xor-shift generator by George Marsaglia.\nPeriod: 2^128-1.\nReported to fail: MatrixRank and LinearComp.\nvar xor128 = require('./lib/xor128');\n\nxorwow, George Marsaglia's 160-bit xor-shift combined plus weyl.\nPeriod: 2^192-2^32\nReported to fail: CollisionOver, SimpPoker, and LinearComp.\nvar xorwow = require('./lib/xorwow');\n\nxorshift7, by François Panneton and Pierre L'ecuyer, takes\n// a different approach: it adds robustness by allowing more shifts\n// than Marsaglia's original three. It is a 7-shift generator\n// with 256 bits, that passes BigCrush with no systematic failures.\n// Period 2^256-1.\n// No systematic BigCrush failures reported.\nvar xorshift7 = require('./lib/xorshift7');\n\nxor4096, by Richard Brent, is a 4096-bit xor-shift with a\n// very long period that also adds a Weyl generator. It also passes\n// BigCrush with no systematic failures. Its long period may\n// be useful if you have many generators and need to avoid\n// collisions.\n// Period: 2^4128-2^32.\n// No systematic BigCrush

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failures reported.\nvar xor4096 = require('./lib/xor4096');\n\n// Tyche-i, by Samuel Neves and Filipe Araujo, is a bit-shifting random\n// number generator derived from ChaCha, a modern stream cipher.\n//  
<https://eden.dei.uc.pt/~sneves/pubs/2011-snfa2.pdf>\n// Period:  $\sim 2^{127}$ \n// No systematic BigCrush failures reported.\nvar tychei = require('./lib/tychei');\n\n// The original ARC4-based prng included in this library.\n// Period:  $\sim 2^{1600}$ \nvar sr = require('./seedrandom');\n\nsr.alea = alea;\n\nsr.xor128 = xor128;\n\nsr.xorwow = xorwow;\n\nsr.xorshift7 = xorshift7;\n\nsr.xor4096 = xor4096;\n\nsr.tychei = tychei;\n\nmodule.exports = sr;\n", "/\*\n \* @license\n \* Copyright 2018 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the "License");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \* http://www.apache.org/licenses/LICENSE-2.0\n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an "AS IS" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*/

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*\n\nimport * as seedrandom from 'seedrandom';\n\nimport {expectNumbersClose, testEpsilon} from './test_util';\n\nimport {TypedArray} from './types';\n\nexport interface RandomBase {\n nextValue(): number;\n}\n\nexport interface RandomGamma {\n nextValue(): number;\n}\n\nexport interface RandNormalDataTypes {\n float32: Float32Array;\n int32: Int32Array;\n}\n\nexport interface RandGammaDataTypes {\n float32: Float32Array;\n int32: Int32Array;\n}\n\n//

https://en.wikipedia.org/wiki/Marsaglia_polar_method\n\nexport class MPRandGauss implements RandomBase {\n private mean: number;\n private stdDev: number;\n private nextVal: number;\n private dtype?: keyof RandNormalDataTypes;\n private truncated?: boolean;\n private upper?: number;\n private lower?: number;\n private random: seedrandom.prng;\n\n constructor(\n mean: number, stdDeviation: number, dtype?: keyof RandNormalDataTypes,\n truncated?: boolean, seed?: number) {\n this.mean = mean;\n this.stdDev = stdDeviation;\n this.dtype = dtype;\n this.nextVal = NaN;\n this.truncated = truncated;\n if (this.truncated) {\n this.upper = this.mean + this.stdDev * 2;\n this.lower = this.mean - this.stdDev * 2;\n }\n const seedValue = seed ? seed : Math.random();\n this.random = seedrandom.alea(seedValue.toString());\n }\n\n /** Returns next sample from a Gaussian distribution. */\n public nextValue(): number {\n if (!isNaN(this.nextVal)) {\n const value = this.nextVal;\n this.nextVal = NaN;\n return value;\n }\n let resultX: number, resultY: number;\n let isValid = false;\n while (!isValid) {\n let v1: number, v2: number, s: number;\n do {\n v1 = 2 * this.random() - 1;\n v2 = 2 * this.random() - 1;\n s = v1 * v1 + v2 * v2;\n } while (s >= 1 || s === 0);\n\n const mul = Math.sqrt(-2.0 * Math.log(s) / s);\n resultX = this.mean + this.stdDev * v1 * mul;\n resultY = this.mean + this.stdDev * v2 * mul;\n\n if (!this.truncated || this.isValidTruncated(resultX)) {\n isValid = true;\n }\n }\n if (!this.truncated || this.isValidTruncated(resultY)) {\n this.nextVal = this.convertValue(resultY);\n }\n return this.convertValue(resultX);\n }\n\n /** Handles proper rounding for non-floating-point numbers. */\n private convertValue(value: number): number {\n if (this.dtype == null || this.dtype === 'float32') {\n return value;\n }\n return Math.round(value);\n }\n\n /** Returns true if less than 2-standard-deviations from the mean. */\n private isValidTruncated(value: number): boolean {\n return value <= this.upper && value >= this.lower;\n }\n}\n\n// Marsaglia, George, and Wai Wan Tsang. 2000. "A Simple Method for Generating\n// Gamma Variables." \n\nexport class RandGamma implements RandomGamma {\n private alpha: number;\n private beta: number;\n private d: number;\n private c: number;\n private dtype?: keyof RandGammaDataTypes;\n private randu: seedrandom.prng;\n private randn:\n\n MPRandGauss;\n\n constructor(\n alpha: number, beta: number, dtype: keyof RandGammaDataTypes,\n seed?: number) {\n this.alpha = alpha;\n this.beta = 1 / beta; // convert rate to scale parameter\n this.dtype = dtype;\n const seedValue = seed ? seed : Math.random();\n this.randu = seedrandom.alea(seedValue.toString());\n this.randn = new MPRandGauss(0, 1, dtype, false, this.randu());\n\n if (alpha < 1) {\n this.d = alpha + (2 / 3);\n } else {\n this.d = alpha - (1 / 3);\n }\n this.c = 1 / Math.sqrt(9 * this.d);\n }\n\n /** Returns next sample from a gamma distribution. */\n public nextValue(): number {\n let x2:

```

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number, v0: number, v1: number, x: number, u: number, v: number;\n while (true) {\n do {\n x =
this.randn.nextValue();\n v = 1 + (this.c * x);\n } while (v <= 0);\n v *= v * v;\n x2 = x * x;\n v0 =
1 - (0.331 * x2 * x2);\n v1 = (0.5 * x2) + (this.d * (1 - v + Math.log(v)));\n
 u = this.randu();\n if (u < v0 || Math.log(u) < v1) {\n break;\n }\n }\n v = (1 / this.beta) * this.d *
v;\n if (this.alpha < 1) {\n v *= Math.pow(this.randu(), 1 / this.alpha);\n }\n return this.convertValue(v);\n
}\n /** Handles proper rounding for non-floating-point numbers. */\n private convertValue(value: number):
number {\n if (this.dtype === 'float32') {\n return value;\n }\n return Math.round(value);\n }\n}\n\nexport
class UniformRandom implements RandomBase {\n private min: number;\n private range: number;\n private
random: seedrandom.prng;\n private dtype?: keyof RandNormalDataTypes;\n\n constructor(\n min = 0, max =
1, dtype?: keyof RandNormalDataTypes,\n seed?: string|number) {\n this.min = min;\n this.range = max -
min;\n this.dtype = dtype;\n if (seed == null) {\n seed = Math.random();\n }\n if (typeof seed ===
'number') {\n seed = seed.toString();\n }\n\n if (!this.canReturnFloat()
 && this.range <= 1) {\n throw new Error(\n `The difference between ${min} - ${max} <= 1 and dtype is
not float`);\n }\n this.random = seedrandom.alea(seed);\n }\n\n /** Handles proper rounding for non floating
point numbers. */\n private canReturnFloat = () =>\n (this.dtype == null || this.dtype === 'float32');\n\n private
convertValue(value: number): number {\n if (this.canReturnFloat()) {\n return value;\n }\n return
Math.round(value);\n }\n\n nextValue() {\n return this.convertValue(this.min + this.range * this.random());\n
}\n}\n\nexport function jarqueBeraNormalityTest(values: TypedArray|number[]) {\n //
https://en.wikipedia.org/wiki/Jarque%E2%80%93Bera_test\n const n = values.length;\n const s =
skewness(values);\n const k = kurtosis(values);\n const jb = n / 6 * (Math.pow(s, 2) + 0.25 * Math.pow(k - 3, 2));\n
// JB test requires 2-degrees of freedom from Chi-Square @ 0.95:\n //
http://www.itl.nist.gov/div898/handbook/eda/section3/eda3674.htm\n
 const CHI_SQUARE_2DEG = 5.991;\n if (jb > CHI_SQUARE_2DEG) {\n throw new Error(`Invalid p-value
for JB: ${jb}`);\n }\n}\n\nexport function expectArrayInMeanStdRange(\n actual: TypedArray|number[],
expectedMean: number, expectedStdDev: number,\n epsilon?: number) {\n if (epsilon == null) {\n epsilon =
testEpsilon();\n }\n const actualMean = mean(actual);\n expectNumbersClose(actualMean, expectedMean,
epsilon);\n expectNumbersClose(\n standardDeviation(actual, actualMean), expectedStdDev,
epsilon);\n}\n\nfunction mean(values: TypedArray|number[]) {\n let sum = 0;\n for (let i = 0; i < values.length;
i++) {\n sum += values[i];\n }\n return sum / values.length;\n}\n\nfunction standardDeviation(values:
TypedArray|number[], mean: number) {\n let squareDiffSum = 0;\n for (let i = 0; i < values.length; i++) {\n const
diff = values[i] - mean;\n squareDiffSum += diff * diff;\n }\n return Math.sqrt(squareDiffSum
/ values.length);\n}\n\nfunction kurtosis(values: TypedArray|number[]) {\n //
https://en.wikipedia.org/wiki/Kurtosis\n const valuesMean = mean(values);\n const n = values.length;\n let sum2 =
0;\n let sum4 = 0;\n for (let i = 0; i < n; i++) {\n const v = values[i] - valuesMean;\n sum2 += Math.pow(v,
2);\n sum4 += Math.pow(v, 4);\n }\n return (1 / n) * sum4 / Math.pow((1 / n) * sum2, 2);\n}\n\nfunction
skewness(values: TypedArray|number[]) {\n // https://en.wikipedia.org/wiki/Skewness\n const valuesMean =
mean(values);\n const n = values.length;\n let sum2 = 0;\n let sum3 = 0;\n for (let i = 0; i < n; i++) {\n const v =
values[i] - valuesMean;\n sum2 += Math.pow(v, 2);\n sum3 += Math.pow(v, 3);\n }\n return (1 / n) * sum3 /
Math.pow((1 / (n - 1)) * sum2, 3 / 2);\n}\n\n"/>**\n * @license\n * Copyright 2020 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance
with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-
2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is
distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *
=====
*/\n\nimport {Tensor} from './tensor';\nimport {Rank, ShapeMap} from './types';\nimport {buffer} from

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```
./buffer';\nimport {op} from './operation';\nimport {RandGamma} from './rand_util';\n\n/**\n * Creates a `tf.Tensor` with values sampled from a gamma distribution.\n *\n * ```js\n * tf.randomGamma([2, 2], 1).print();\n * ```\n *\n * @param shape An array of integers defining the output tensor shape.\n * @param alpha The shape parameter of the gamma distribution.\n * @param beta The inverse scale parameter of the gamma distribution. Defaults to 1.\n * @param dtype The data type of the output. Defaults to float32.\n * @param seed The seed for the random number generator.\n *\n * @doc {heading: 'Tensors', subheading: 'Random'}\n */\nfunction randomGamma_<R extends Rank>(\n shape: ShapeMap[R], alpha: number, beta = 1,\n dtype: 'float32'|'int32' = 'float32', seed?: number): Tensor<R> {\n if (beta == null) {\n beta = 1;\n }\n if (dtype == null) {\n dtype = 'float32';\n }\n if (dtype !== 'float32' && dtype !== 'int32') {\n throw new Error(`Unsupported data type ${dtype}`);\n }\n const rgamma = new RandGamma(alpha, beta, dtype, seed);\n const res = buffer(shape, dtype);\n for (let i = 0; i < res.values.length; i++) {\n res.values[i] = rgamma.nextValue();\n }\n return res.toTensor();\n}\n\nexport const randomGamma = op({randomGamma_});\n", "**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *\n * =====\n */\n\nimport {Tensor} from './tensor';\nimport {DataType, Rank, ShapeMap} from './types';\nimport {buffer} from './buffer';\nimport {op} from './operation';\nimport {MPRandGauss} from './rand_util';\n\n/**\n * Creates a `tf.Tensor` with values sampled from a normal distribution.\n *\n * ```js\n * tf.randomNormal([2, 2]).print();\n * ```\n *\n * @param shape An array of integers defining the output tensor shape.\n * @param mean The mean of the normal distribution.\n * @param stdDev The standard deviation of the normal distribution.\n * @param dtype The data type of the output.\n * @param seed The seed for the random number generator.\n *\n * @doc {heading: 'Tensors', subheading: 'Random'}\n */\nfunction randomNormal_<R extends Rank>(\n shape: ShapeMap[R], mean = 0, stdDev = 1, dtype?: 'float32'|'int32',\n seed?: number): Tensor<R> {\n if (dtype != null && (dtype as DataType) !== 'bool') {\n throw new Error(`Unsupported data type ${dtype}`);\n }\n const randGauss = new MPRandGauss(mean, stdDev, dtype, false /* truncated */, seed);\n const res = buffer(shape, dtype);\n for (let i = 0; i < res.values.length; i++) {\n res.values[i] = randGauss.nextValue();\n }\n return res.toTensor();\n}\n\nexport const randomNormal = op({randomNormal_});\n", "**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *\n * =====\n */\n\nimport {Tensor} from './tensor';\nimport {DataType, Rank, ShapeMap} from './types';\nimport {buffer} from './buffer';\nimport {op} from './operation';\nimport {UniformRandom} from './rand_util';\n\n/**\n * Creates a `tf.Tensor` with values sampled from a uniform distribution.\n *\n * The generated values follow a uniform distribution in the range [minval, maxval). The lower bound minval is included in the range, while the upper bound maxval is excluded.\n *\n * ```js\n * tf.randomUniform([2, 2]).print();\n * ```\n *\n * @param shape An array of integers defining the output tensor shape.\n * @param minval The lower bound on the range of random values to generate.\n */
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* Defaults to 0.\n * @param maxval The upper bound on the range of random values to generate.\n * Defaults to
1.\n * @param dtype The data type of the output tensor. Defaults to 'float32'.\n *\n * @doc {heading: 'Tensors',
subheading: 'Random'}\n *\nfunction randomUniform<R extends Rank>(\n shape: ShapeMap[R], minval = 0,
maxval = 1, dtype: DataType = 'float32',\n seed?: number|string): Tensor<R> {\n const res = buffer(shape,
dtype);\n const random = new UniformRandom(minval, maxval, null, seed);\n for (let i = 0; i < res.values.length;
i++) {\n res.values[i] = random.nextValue();\n }\n return res.toTensor();\n}\n\nexport const
randomUniform = op({randomUniform_});\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

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*\n\nimport {ENGINE} from '../engine';\nimport {Range, RangeAttrs} from '../kernel_names';\nimport
{NamedAttrMap} from '../kernel_registry';\nimport {Tensor1D} from '../tensor';\n\n/*\n * Creates a new
`tf.Tensor1D` filled with the numbers
in the range provided.\n *\n * The tensor is a is half-open interval meaning it includes start, but\n *
excludes stop. Decrementing ranges and negative step values are also\n * supported.\n *\n * `js\n *
tf.range(0, 9, 2).print();\n * `*\n *\n * @param start An integer start value\n * @param stop An integer
stop value\n * @param step An integer increment (will default to 1 or -1)\n * @param dtype The data type
of the output tensor. Defaults to 'float32'.\n *\n * @doc {heading: 'Tensors', subheading: 'Creation'}\n
*\nexport function range(\n start: number, stop: number, step = 1,\n dtype: 'float32'|'int32' = 'float32'):
Tensor1D {\n if (step === 0) {\n throw new Error('Cannot have a step of zero');\n }\n\n const
attrs: RangeAttrs = {start, stop, step, dtype};\n\n return ENGINE.runKernel(Range, { } /* inputs */,
attrs as { } as NamedAttrMap);\n}\n\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in
writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT
WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *

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*\n\nimport {ENGINE} from '../engine';\nimport {Real, RealInputs} from '../kernel_names';\nimport {Tensor}
from '../tensor';\nimport {NamedTensorMap} from '../tensor_types';\nimport {convertToTensor} from
 '../tensor_util_env';\nimport {TensorLike} from '../types';\nimport {op} from './operation';\n\n/*\n * Returns the
real part of a complex (or real) tensor.\n *\n * Given a tensor input, this
operation returns a tensor of type float that is\n * the real part of each element in input considered as a
complex number.\n *\n * If the input is real, it simply makes a clone.\n *\n * `js\n * const x =
tf.complex([-2.25, 3.25], [4.75, 5.75]);\n * tf.real(x).print();\n * `*\n *\n * @doc {heading: 'Tensors',
subheading: 'Creation'}\n *\nfunction real<T extends Tensor>(\n input: T|TensorLike): T {\n const $input =
convertToTensor(input, 'input', 'real');\n\n const inputs: RealInputs = {input: $input};\n return
ENGINE.runKernel(Real, inputs as { } as NamedTensorMap);\n}\n\nexport const real = op({real_});\n", "/*\n *
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Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n *
You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in
writing, software\n *\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT
WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing

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permissions and\n \* limitations under the License.\n \*

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=====\n\n*\n\nimport {ENGINE} from './engine';\nimport {Reciprocal, ReciprocalInputs} from './kernel_names';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\n\nimport {op} from './operation';\n\n**\n * Computes reciprocal of x element-wise: $1/x$ \n * js\n * const x = tf.tensor1d([0, 1, 2]);\n * x.reciprocal().print(); //\n * or tf.reciprocal(x)\n * @param x The input tensor.\n * @doc {heading: 'Operations', subheading: 'Basic math'}\n\nfunction reciprocal_<T extends Tensor>(x: T|TensorLike): T {\n const $x = convertToTensor(x, 'x', 'reciprocal');\n\n const inputs: ReciprocalInputs = {x: $x};\n return ENGINE.runKernel(Reciprocal, inputs as { } as NamedTensorMap);\n}\n\nexport const reciprocal =\nop({reciprocal_});\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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```
=====\n\n*\n\nimport {ENGINE} from './engine';\nimport {Relu, ReluInputs} from './kernel_names';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\n\nimport {op} from './operation';\n\n**\n * Computes rectified linear element-wise: $\max(x, 0)$ \n * js\n * const x = tf.tensor1d([-1, 2, -3, 4]);\n * x.relu().print(); // or tf.relu(x)\n * @param x The input tensor. If the dtype is `bool`, the output dtype will be\n * int32.\n * @doc {heading: 'Operations', subheading: 'Basic math'}\n\nfunction relu_<T extends Tensor>(x: T|TensorLike): T {\n const $x = convertToTensor(x, 'x', 'relu');\n\n const inputs: ReluInputs = {x: $x};\n return ENGINE.runKernel(Relu, inputs as { } as NamedTensorMap);\n}\n\nexport const relu = op({relu_});\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n\n*\n\nimport {ENGINE} from './engine';\nimport {Relu6, Relu6Inputs} from './kernel_names';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\n\nimport {op} from './operation';\n\n**\n * Computes rectified linear 6 element-wise: $\min(\max(x, 0), 6)$ \n * js\n * const x = tf.tensor1d([-1, 2, -3, 8]);\n * x.relu6().print();\n * // or tf.relu6(x)\n * @param x The input tensor. If the dtype is `bool`, the output dtype will be\n * int32.\n * @doc {heading: 'Operations', subheading: 'Basic math'}\n\nfunction relu6_<T extends Tensor>(x: T|TensorLike): T {\n const $x = convertToTensor(x, 'x', 'relu6');\n\n const inputs: Relu6Inputs = {x: $x};\n return ENGINE.runKernel(Relu6, inputs as { } as NamedTensorMap);\n}\n\nexport const relu6 =\nop({relu6_});\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
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```
=====\n*\n\nimport {ENGINE} from './engine';\nimport {Reverse, ReverseAttrs, ReverseInputs} from\n './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport\n {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport\n {TensorLike} from './types';\nimport {op} from './operation';\n\n/**\n * Reverses a `tf.Tensor` along a specified\n axis.\n *\n * Also available are stricter rank-specific methods that assert that `x` is\n * of the given rank:\n *\n * - `tf.reverse1d`\n * - `tf.reverse2d`\n * - `tf.reverse3d`\n * - `tf.reverse4d`\n *\n * Except `tf.reverse1d` (which\n does not have axis param), all methods have\n * same signature as this method.\n *\n * ```js\n * const x =\n tf.tensor1d([1, 2, 3, 4]);\n *\n * x.reverse().print();\n *\n * ```\n *\n * ```js\n * const x = tf.tensor2d([1, 2, 3, 4], [2, 2]);\n *\n * const axis = 1;\n *\n * x.reverse(axis).print();\n *\n * ```\n *\n * @param x The input tensor to be reversed.\n * @param axis The set of dimensions to reverse. Must be in\n the\n * range [-rank(x), rank(x)]. Defaults to all axes.\n *\n * @doc {heading: 'Tensors', subheading: 'Slicing and\n Joining'}\n *\n * @function reverse_<T extends Tensor>(x: T|TensorLike, axis?: number|number[]): T {\n * const $x =\n * convertToTensor(x, 'x', 'reverse');\n *\n * const inputs: ReverseInputs = {x: $x};\n * const attrs: ReverseAttrs = {dims:\n * axis};\n *\n * return ENGINE.runKernel(\n * Reverse, inputs as {}, as NamedTensorMap, attrs as {}) as\n * NamedAttrMap);\n *}\n\nexport const reverse = op({reverse_});\n\n/**\n * @license\n * Copyright 2020 Google\n LLC. All Rights Reserved.\n *\n * Licensed under the Apache License, Version 2.0 (the\n * "License");\n *\n * you may not use this file except in compliance with the License.\n *\n * You may obtain a copy of\n the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or\n agreed to in writing, software\n * distributed under the License is distributed on an\n * "AS IS" BASIS,\n *\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n *\n * See the License for\n the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport {Tensor1D} from './tensor';\nimport {convertToTensor} from './tensor_util_env';\nimport\n {TensorLike} from './types';\nimport * as util from './util';\nimport {op} from './operation';\nimport {reverse} from\n './reverse';\n\n/**\n * Reverses a `tf.Tensor1D`.\n *\n * @param x The input tensor.\n *\n * @function reverse1d_(x:\n * Tensor1D|TensorLike): Tensor1D {\n * const $x =\n * convertToTensor(x, 'x', 'reverse');\n *\n * util.assert(\n * $x.rank ===\n * 1,\n * () => `Error in reverse1D: x must be rank 1 but got rank\n * ${$x.rank}.`);\n *\n * return reverse($x, 0);\n *}\n\nexport const reverse1d = op({reverse1d_});\n\n/**\n * @license\n * Copyright 2020 Google\n LLC. All Rights Reserved.\n *\n * Licensed under the Apache License, Version 2.0 (the\n * "License");\n *\n * you may not use this file except in compliance with the License.\n *\n * You may obtain a copy of the\n License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or\n agreed to in writing, software\n * distributed under the License is distributed on an\n * "AS IS" BASIS,\n *\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n *\n * See the License for\n the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport {Tensor2D} from './tensor';\nimport {convertToTensor} from './tensor_util_env';\nimport\n {TensorLike} from './types';\nimport * as util from './util';\nimport {op} from\n './operation';\nimport {reverse} from './reverse';\n\n/**\n * Reverses a `tf.Tensor2D` along a specified axis.\n *\n * @param x The input tensor.\n * @param axis The set of dimensions to reverse. Must be in the\n * range [-\n * rank(x), rank(x)]. Defaults to all axes.\n *\n * @function reverse2d_(x: Tensor2D|TensorLike, axis?: number|number[]):\n * Tensor2D {\n * const $x =\n * convertToTensor(x, 'x', 'reverse');\n *\n * util.assert(\n * $x.rank === 2,\n * () => `Error in\n * reverse2D: x must be rank 2 but got rank\n * ${$x.rank}.`);\n *\n * return reverse($x, axis);\n *}\n\nexport const reverse2d =\n op({reverse2d_});\n\n/**\n * @license\n * Copyright 2020 Google\n LLC. All Rights Reserved.\n *\n * Licensed under\n the Apache License, Version 2.0 (the\n * "License");\n *\n * you may not use this file except in compliance with the\n License.\n *\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * \n *
```

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limitations under the License.

```
=====
*\n\nimport {Tensor3D} from './tensor';\nimport {convertToTensor} from './tensor_util_env';\nimport\n{TensorLike} from './types';\nimport * as util from './util';\nimport {op} from './operation';\nimport {reverse} from\n './reverse';\n\n/**\n * Reverses a `tf.Tensor3D` along a specified axis.\n * @param x The input tensor.\n * @param axis The set of dimensions to reverse. Must be in the\n * range [-rank(x), rank(x)]. Defaults to all axes.\n */\nfunction reverse3d(x: Tensor3D|TensorLike, axis?: number|number[]): Tensor3D {\n const $x =\n convertToTensor(x, 'x', 'reverse');\n util.assert($x.rank === 3, () => `Error in reverse3D: x must be rank\n 3 but got rank ${$x.rank}.`);\n return reverse($x, axis);\n}\n\nexport const reverse3d = op({reverse3d});\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a\n copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable\n law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n the specific language governing permissions and\n * limitations under the License.\n */\n
```

```
=====
*\n\nimport {Tensor4D} from './tensor';\nimport {convertToTensor} from './tensor_util_env';\nimport\n{TensorLike} from './types';\nimport * as util from './util';\nimport\n{op} from './operation';\nimport {reverse} from './reverse';\n\n/**\n * Reverses a `tf.Tensor4D` along a specified\n axis.\n * @param x The input tensor.\n * @param axis The set of dimensions to reverse. Must be in the\n * range [-rank(x), rank(x)]. Defaults to all axes.\n */\nfunction reverse4d(x: Tensor4D|TensorLike, axis?:\n number|number[]): Tensor4D {\n const $x = convertToTensor(x, 'x', 'reverse');\n util.assert($x.rank === 4,\n () => `Error in reverse4D: x must be rank 4 but got rank ${$x.rank}.`);\n return reverse($x, axis);\n}\n\nexport\n const reverse4d = op({reverse4d});\n\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in\n compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n software\n
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```
=====
*\n\nimport {ENGINE} from './engine';\nimport {Round, RoundInputs} from './kernel_names';\nimport {Tensor}\n from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from\n './tensor_util_env';\nimport {TensorLike} from './types';\nimport {op} from './operation';\n\n/**\n * Computes\n round of input `tf.Tensor` element-wise: `round(x)`.\n * It implements banker's rounding.\n * ``js\n * const x =\n tf.tensor1d([.6, 1.1, -3.3]);\n * x.round().print(); // or tf.round(x)\n * @param x The input tensor.\n * @doc {heading: 'Operations', subheading: 'Basic math'}\n */\nfunction round_<T extends Tensor>(x:\n T|TensorLike): T {\n const $x = convertToTensor(x, 'x', 'round');\n const inputs: RoundInputs = {x: $x};\n return ENGINE.runKernel(Round, inputs as { } as NamedTensorMap);\n}\n\nexport const round =\n op({round});\n\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the\n Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the\n License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
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```
=====
import {ENGINE} from './engine';import {Rsqrt, RsqrtInputs}
from './kernel_names';import {Tensor} from './tensor';import {NamedTensorMap} from
 './tensor_types';import {convertToTensor} from './tensor_util_env';import {TensorLike} from
 './types';import {op} from './operation';
/** Computes reciprocal of square root of the input `tf.Tensor`
element-wise:
 * y = 1 / sqrt(x)
 *`js`
 * const x = tf.tensor1d([1, 2, 4, -1]);
 * x.rsqrt().print(); // or
 * tf.rsqrt(x)
 *`
 * @param x The input tensor.
 * @doc {heading: 'Operations', subheading: 'Basic math'}
 *`
function rsqrt_
T extends Tensor>(x: T|TensorLike): T {
 const $x = convertToTensor(x, 'x', 'rsqrt');
 const inputs: RsqrtInputs = {x: $x};
 return ENGINE.runKernel(Rsqrt, inputs as {} as NamedTensorMap);
}
export const rsqrt = op({rsqrt_});
",**
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 * express or implied.
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 * limitations under the License.
 *`
=====
import {Scalar} from './tensor';import {DataType} from './types';import {isTypedArray} from
 './util';import {makeTensor} from './tensor_ops_util';
/** Creates rank-0 `tf.Tensor` (scalar) with the
provided value and dtype.
 * The same functionality can be achieved with `tf.tensor`, but in general
 * we recommend using `tf.scalar` as it makes the code more readable.
 *`js`
 * tf.scalar(3.14).print();
 *`
 * @param value
The value of the scalar.
 * @param dtype The data type.
 * @doc {heading: 'Tensors', subheading:
'Creation'}
 *`
export function scalar(
 value: number|boolean|string|Uint8Array, dtype?: DataType): Scalar {
 if (((isTypedArray(value) && dtype !== 'string') || Array.isArray(value)) &&
 dtype !== 'complex64') {
 throw new Error(
 'Error creating a new Scalar: value must be a primitive '+
(number|boolean|string);
 });
 if (dtype === 'string' && isTypedArray(value) &&
 !(value instanceof
 Uint8Array)) {
 throw new Error(
 'When making a scalar from encoded string, '+
 'the value must be
'Uint8Array');
 };
 const shape: number[] = [];
 const inferredShape: number[] = [];
 return
 makeTensor(value, shape, inferredShape, dtype) as Scalar;
 }
}
",**
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 * limitations under the License.
 *`
=====
import {ENGINE} from './engine';import {Selu, SeluInputs} from './kernel_names';import {Tensor} from
 './tensor';import {NamedTensorMap} from './tensor_types';import {convertToTensor} from
 './tensor_util_env';import {TensorLike} from './types';import {op} from './operation';
/** Computes
scaled exponential linear element-wise.
 *`
 * x < 0 ? scale * alpha * (exp(x) - 1) : x`
 *`js`
 * const x =
tf.tensor1d([-1,
 2, -3, 4]);
 * x.selu().print(); // or tf.selu(x)
 *`
 * @param x The input tensor.
 * @doc {heading:
'Operations', subheading: 'Basic math'}
 *`
function selu_
T extends Tensor>(x: T|TensorLike): T {
 const $x = convertToTensor(x, 'x', 'selu');
 const inputs: SeluInputs = {x: $x};
 return ENGINE.runKernel(Selu, inputs
```

as { } as NamedTensorMap);  
 \n\n\nexport const selu = op({selu\_});  
 \n", "/\*  
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 \n \*

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=====
*\nimport {Tensor3D, Tensor4D} from './tensor';\nimport {convertToTensor} from './tensor_util_env';\nimport
{TensorLike} from './types';\nimport * as util from './util';\n\nimport {conv2d} from './conv2d';\nimport
{depthwiseConv2d} from './depthwise_conv2d';\nimport {op} from './operation';\nimport {reshape} from
 './reshape';
*\n\n/**
 * 2-D convolution with separable filters.
 *
 * Performs a depthwise convolution that acts separately on channels followed by a pointwise convolution that mixes channels. Note that this is separability between dimensions [1, 2] and 3, not spatial separability between dimensions 1 and 2. See https://www.tensorflow.org/api_docs/python/tf/nn/separable_conv2d for more details.
 *
 * @param x The input tensor, of rank 4 or rank 3, of shape [batch, height, width, inChannels]. If rank 3, batch of 1 is assumed.
 * @param depthwiseFilter The depthwise filter tensor, rank 4, of shape [filterHeight, filterWidth, inChannels, channelMultiplier]. This is the filter used in the first step.
 * @param pointwiseFilter The pointwise filter tensor, rank 4, of shape [1, 1, inChannels * channelMultiplier, outChannels]. This is the filter used in the second step.
 * @param strides The strides of the convolution: [strideHeight, strideWidth]. If strides is a single number, then strideHeight == strideWidth.
 * @param pad The type of padding algorithm.
 * - 'same' and stride 1: output will be of same size as input, regardless of filter size.
 * - 'valid': output will be smaller than input if filter is larger than 1x1.
 * - For more info, see this guide: https://www.tensorflow.org/api_guides/python/nn#Convolution
 *
 * https://www.tensorflow.org/api_guides/python/nn#Convolution
 * @param dilations The dilation rates: [dilationHeight, dilationWidth] in which we sample input values across the height and width dimensions in atrous convolution. Defaults to [1, 1]. If 'rate' is a single number, then dilationHeight == dilationWidth. If it is greater than 1, then all values of 'strides' must be 1.
 * @param dataType: An optional string from: "NHWC", "NCHW". Defaults to "NHWC". Specify the data format of the input and output data. With the default format "NHWC", the data is stored in the order of: [batch, height, width, channels]. Only "NHWC" is currently supported.
 *
 * @doc {heading: 'Operations', subheading: 'Convolution'}
 */
function separableConv2d<T extends Tensor3D|Tensor4D>(x: T|TensorLike, depthwiseFilter: Tensor4D|TensorLike, pointwiseFilter: Tensor4D|TensorLike, strides: [number, number]|number, pad: 'valid'|'same', dilation: [number, number]|number = [1, 1], dataType: 'NHWC'|'NCHW' = 'NHWC'): T {
 const $x = convertToTensor(x, 'x', 'separableConv2d');
 const $depthwiseFilter = convertToTensor(depthwiseFilter, 'depthwiseFilter', 'separableConv2d');
 const $pointwiseFilter = convertToTensor(pointwiseFilter, 'pointwiseFilter', 'separableConv2d');
 let x4D = $x as Tensor4D;
 let reshapedTo4D = false;
 if ($x.rank === 3) {
 reshapedTo4D = true;
 x4D = reshape($x, [1, $x.shape[0], $x.shape[1], $x.shape[2]]);
 }
 if (dataType === 'NCHW') {
 throw new Error('separableConv2d currently does not support dataType NCHW; only ' + 'NHWC is supported');
 }
 util.assert(x4D.rank === 4, () => `Error in separableConv2d: input must be rank 4, but got ` + rank ${x4D.rank}.`);
 util.assert($depthwiseFilter.rank === 4, () => `Error in separableConv2d: depthwise filter must be rank 4, but ` + got rank ${$depthwiseFilter.rank}.`);
 util.assert($pointwiseFilter.rank === 4, () => `Error in separableConv2d: pointwise filter must be rank 4, but ` + got rank ${$pointwiseFilter.rank}.`);
 util.assert($pointwiseFilter.shape[0] === 1, () => `Error in

```

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separableConv2d: the first dimension of pointwise filter `+` must be 1, but got
${$pointwiseFilter.shape[0]}.`);
util.assert(\n $pointwiseFilter.shape[1] === 1,\n () => `Error in
separableConv2d: the second dimension of pointwise `+` filter must be 1, but got
${$pointwiseFilter.shape[1]}.`);
const inChannels = $depthwiseFilter.shape[2];
const channelMultiplier =
$depthwiseFilter.shape[3];
util.assert(\n $pointwiseFilter.shape[2] === inChannels * channelMultiplier,\n ()
=>\n `Error in separableConv2d: the third dimension of pointwise filter `+` must be
${inChannels * channelMultiplier}, `+` but got ${$pointwiseFilter.shape[2]}.`);
const depthwise =
depthwiseConv2d(\n x4D, $depthwiseFilter, strides, pad, dataFormat, dilation);
const pointwiseStride = 1;
const res =\n conv2d(depthwise, $pointwiseFilter, pointwiseStride, 'valid', dataFormat);
if (reshapedTo4D)
{\n return reshape(res, [res.shape[1], res.shape[2], res.shape[3]]) as T;\n }
return res as T;\n }
export const
separableConv2d = op({separableConv2d_});
"/**
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 * limitations under the License.

```

```

=====
*/
import {Tensor, TensorBuffer} from './tensor';
import {convertToTensor} from './tensor_util_env';
import
{TensorLike} from './types';
import * as util from './util';
/**
 * Computes the difference between two lists of
numbers.
 * Given a Tensor `x` and a Tensor `y`, this operation returns a Tensor `out`
 * that represents all
values that are in `x` but not in `y`. The returned
 * Tensor `out` is sorted in the same order that the numbers appear
in `x`
 * (duplicates are preserved). This operation also returns a Tensor indices that
 * represents the position of
each out element in `x`. In other words:
 * `out[i] = x[idx[i]]` for i in [0, 1, ..., out.length - 1]
 * `js`
 * const x = [1, 2, 3, 4, 5, 6];
 * const y = [1, 3,
5];
 * const [out, indices] = await tf.setdiff1dAsync(x, y);
 * out.print(); // [2, 4, 6]
 * indices.print(); // [1, 3,
5]
 * @param x 1-D Tensor. Values to keep.
 * @param y 1-D Tensor. Must have the same type as x.
Values to exclude in the
 * output.
 * @returns Promise of Tensor tuple [out, indices].
 * out: Tensor with the
same type as x.
 * indices: A Tensor of type int32.
 * @doc {heading: 'Tensors', subheading:
'Transformations'}
*/
@async function setdiff1dAsync(\n x: Tensor|TensorLike, y: Tensor|TensorLike):
Promise<[Tensor, Tensor]> {\n const $x = convertToTensor(x, 'x', 'setdiff1d');
const $y = convertToTensor(y, 'y',
'setdiff1d');
util.assert(\n $x.dtype === $y.dtype,\n () => `x and y should have the same dtype, but got x
(${$x.dtype}) and y (${$y.dtype}).`);
util.assert(\n $x.rank === 1, () => `x should be 1D tensor, but
got x (${$x.shape}).`);
util.assert(\n $y.rank === 1, () =>
`y should be 1D tensor, but got y (${$y.shape}).`);
const xVals = await $x.data();
const yVals = await
$y.data();
const ySet = new Set(yVals);
let outputSize = 0;
for (let i = 0; i < xVals.length; i++) {\n if
(!ySet.has(xVals[i])) {\n outputSize++;
}\n }
const buffer = new TensorBuffer([outputSize],
$x.dtype);
const indices = new TensorBuffer([outputSize], 'int32');
for (let i = 0, p = 0; i < xVals.length; i++)
{\n if (!ySet.has(xVals[i])) {\n buffer.values[p] = xVals[i];
indices.values[p] = i;
p++;
}\n }
return [buffer.toTensor(), indices.toTensor()];
}
export const setdiff1dAsync = setdiff1dAsync_;
"/**
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```

=====
*\n\nimport {ENGINE} from './engine';\nimport {Sign, SignInputs} from './kernel_names';\nimport {Tensor}
from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from
 './tensor_util_env';\nimport {TensorLike} from './types';\n\nimport {op} from './operation';\n\n/**\n * Returns an
element-wise indication of the sign of a number.\n *\n * ``js\n * const x = tf.tensor1d([.6, 1.1, -3.3, NaN, 0]);\n *\n
 * x.sign().print(); // or tf.sign(x)\n * ``\n * @param x The input Tensor.\n *\n * @doc {heading: 'Operations',
subheading: 'Basic math'}\n *\nfunction
 sign_<T extends Tensor>(x: T|TensorLike): T {\n const $x = convertToTensor(x, 'x', 'sign');\n const inputs:
SignInputs = {x: $x};\n return ENGINE.runKernel(Sign, inputs as { } as NamedTensorMap);\n}\n\nexport const sign
= op({sign_});\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

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```

=====
*\n\nimport {ENGINE} from './engine';\nimport
 {Sin, SinInputs} from './kernel_names';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from
 './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from
 './types';\n\nimport {op} from './operation';\n\n/**\n * Computes sin of the input Tensor element-wise: `sin(x)`\n *\n
 * ``js\n * const x = tf.tensor1d([0, Math.PI / 2, Math.PI * 3 / 4]);\n *\n * x.sin().print(); // or tf.sin(x)\n *\n
 * @param x The input tensor.\n *\n * @doc {heading: 'Operations', subheading: 'Basic math'}\n *\nfunction sin_<T
extends Tensor>(x: T|TensorLike): T {\n const $x = convertToTensor(x, 'x', 'sin');\n const inputs: SinInputs = {x:
$x};\n return ENGINE.runKernel(Sin, inputs as { } as NamedTensorMap);\n}\n\nexport const sin =
 op({sin_});\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

```

```

=====
*\n\nimport {ENGINE} from './engine';\nimport {Sinh, SinhInputs} from './kernel_names';\nimport {Tensor}
from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from
 './tensor_util_env';\nimport {TensorLike} from './types';\n\nimport {op} from './operation';\n\n/**\n * Computes
hyperbolic sin of the input `tf.Tensor` element-wise: `sinh(x)`\n *\n * ``js\n * const x = tf.tensor1d([0, 1, -1, .7]);\n
*\n * x.sinh().print(); // or tf.sinh(x)\n *\n * @param x The input tensor.\n *\n * @doc {heading: 'Operations',
subheading: 'Basic math'}\n *\nfunction sinh_<T extends Tensor>(x: T|TensorLike): T {\n const $x = convertToTensor(x,
'x', 'sinh');\n const inputs: SinhInputs = {x: $x};\n return ENGINE.runKernel(Sinh, inputs as { } as NamedTensorMap);\n}\n\nexport const
sinh = op({sinh_});\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

```

```

=====
*\n\nimport {Tensor1D} from './tensor';\nimport {convertToTensor} from './tensor_util_env';\nimport
{TensorLike} from './types';\nimport * as util from './util';\n\nimport {op} from './operation';\nimport {slice} from
 './slice';\n\n/**\n * Extracts a 1D slice from 1D array starting at coordinates `begin` and is\n * of length `size`. See
 `slice` for details.\n *\nfunction slice1d_(\n x: Tensor1D|TensorLike, begin: number, size: number): Tensor1D {\n
const $x = convertToTensor(x, 'x', 'slice1d');\n util.assert(\n $x.rank === 1,\n () =>\n `slice1d expects a
rank-1 tensor, but got a rank-${$x.rank} tensor`);\n return slice($x, [begin], [size]);\n}\n\nexport const slice1d =
op({slice1d_});\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance
with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-
2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is
distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *

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=====
*\n\nimport {Tensor2D} from './tensor';\nimport {convertToTensor} from './tensor_util_env';\nimport
{TensorLike} from './types';\nimport * as util from './util';\n\nimport {op} from './operation';\nimport {slice} from
 './slice';\n\n/**\n * Extracts a 2D slice from a 2D array starting at coordinates `begin` and\n * is of size `size`. See
 `slice` for details.\n *\nfunction slice2d_(\n x: Tensor2D|TensorLike, begin: [number, number],\n size: [number,
number]):\n Tensor2D {\n const $x = convertToTensor(x, 'x', 'slice2d');\n util.assert(\n $x.rank === 2,\n () =>\n `slice2d
expects a rank-2 tensor, but got a rank-${$x.rank} tensor`);\n return slice($x, begin, size);\n}\n\nexport const slice2d =
op({slice2d_});\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless
required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

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=====
*\n\nimport
{Tensor3D} from './tensor';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from
 './types';\nimport * as util from './util';\n\nimport {op} from './operation';\nimport {slice} from './slice';\n\n/**\n
 * Extracts a 3D slice from a 3D array starting at coordinates `begin` and\n * is of size `size`. See `slice` for
 details.\n *\nfunction slice3d_(\n x: Tensor3D|TensorLike, begin: [number, number, number],\n size: [number,
number, number]): Tensor3D {\n const $x = convertToTensor(x, 'x', 'slice3d');\n util.assert(\n $x.rank === 3,\n ()
=>\n `slice3d expects a rank-3 tensor, but got a rank-${$x.rank} tensor`);\n return slice($x, begin,
size);\n}\n\nexport const slice3d = op({slice3d_});\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of
the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the
specific language governing permissions and\n * limitations under the License.\n *

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=====
*\n\nimport {Tensor4D} from './tensor';\nimport {convertToTensor} from './tensor_util_env';\nimport
{TensorLike} from './types';\nimport * as util from './util';\n\nimport {op} from './operation';\nimport {slice} from
 './slice';\n\n/**\n * Extracts a 4D slice from a 4D array starting at coordinates `begin` and\n * is of size `size`. See

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`slice` for details.\n *\nfunction slice4d_(\n x: Tensor4D|TensorLike, begin: [number, number, number,
number],\n size: [number, number, number, number]): Tensor4D {\n
 const $x = convertToTensor(x, 'x', 'slice4d');\n util.assert(\n $x.rank === 4,\n () =>\n `slice4d expects a
rank-4 tensor, but got a rank-${$x.rank} tensor`);\n return slice($x, begin, size);\n}\n\nexport const slice4d =
op({slice4d_});\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

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=====\n
*\n\nimport {ENGINE}
from './engine';\nimport {Softmax, SoftmaxAttrs, SoftmaxInputs} from './kernel_names';\nimport
{NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from
'./tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from
'./types';\n\nimport {op} from './operation';\n\n/**\n * Computes the softmax normalized vector given the logits.\n
*\n * ``js\n * const a = tf.tensor1d([1, 2, 3]);\n * a.softmax().print(); // or tf.softmax(a)\n * ``\n * ``js\n *
const a = tf.tensor2d([2, 4, 6, 1, 2, 3], [2, 3]);\n * a.softmax().print(); // or tf.softmax(a)\n * ``\n * @param
logits The logits array.\n * @param dim The dimension softmax would be performed on. Defaults to -1\n *
which indicates the last dimension.\n * @doc {heading: 'Operations', subheading: 'Normalization'}\n
*\nfunction softmax_<T extends Tensor>(logits: T|TensorLike, dim = -1): T {\n const $logits =
convertToTensor(logits,
'logits', 'softmax', 'float32');\n if (dim === -1) {\n dim = $logits.rank - 1;\n }\n if (dim !== $logits.rank - 1) {\n
throw Error(\n 'Softmax along a non-last dimension is not yet supported.' +\n `Logits was rank
${$logits.rank} and dim was ${dim}`);\n }\n const inputs: SoftmaxInputs = {logits: $logits};\n const attrs:
SoftmaxAttrs = {dim};\n return ENGINE.runKernel(\n Softmax, inputs as {} as NamedTensorMap, attrs as {}
as NamedAttrMap);\n}\n\nexport const softmax = op({softmax_});\n", "/*\n * @license\n * Copyright 2020 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT
WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *

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=====\n
*\n\nimport {ENGINE} from './engine';\nimport {FFT, FFTInputs} from './kernel_names';\nimport {Tensor}
from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {assert} from './util';\nimport
{op} from './operation';\n\n/**\n * Fast Fourier transform.\n *\n * Computes the 1-dimensional discrete Fourier
transform over the inner-most\n * dimension of input.\n *\n * ``js\n * const real = tf.tensor1d([1, 2, 3]);\n * const
imag = tf.tensor1d([1, 2, 3]);\n * const x = tf.complex(real, imag);\n * x.fft().print(); // tf.spectral.fft(x).print();\n
*\n * @param input The complex input to compute an fft over.\n *\n * @doc {heading: 'Operations', subheading:
'Spectral', namespace: 'spectral'}\n *\nfunction
fft_(input: Tensor): Tensor {\n assert(\n input.dtype === 'complex64',\n () => `The dtype for tf.spectral.fft()
must be complex64` +\n `but got ${input.dtype}.`);\n const inputs: FFTInputs = {input};\n return
ENGINE.runKernel(FFT, inputs as {} as NamedTensorMap);\n}\n\nexport const fft = op({fft_});\n", "/*\n * @license\n *
Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable

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law or agreed to in writing, software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n *\n\nimport {ENGINE} from './engine';\nimport {IFFT, IFFTInputs} from './kernel_names';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {assert} from './util';\nimport {op} from './operation';\n\n/**\n * Inverse fast Fourier transform.\n *\n * Computes the inverse 1-dimensional discrete Fourier transform over the\n * inner-most dimension of input.\n *\n * ``js\n * const real = tf.tensor1d([1, 2, 3]);\n * const imag = tf.tensor1d([1, 2, 3]);\n * const x = tf.complex(real, imag);\n *\n * x.ifft().print(); // tf.spectral.ifft(x).print();\n *``\n *\n * @param input The complex input to compute an ifft over.\n *\n * @doc {heading: 'Operations', subheading: 'Spectral', namespace: 'spectral'}\n *\n * @function ifft_(input: Tensor): Tensor {\n * assert(\n * input.dtype === 'complex64',\n * () => `The dtype for tf.spectral.ifft() must be complex64`\n *)\n * `but got\n * ${input.dtype}`);\n *\n * const inputs: IFFTInputs = {input};\n *\n * return ENGINE.runKernel(IFFT, inputs as { } as NamedTensorMap);\n *}\n\nexport const ifft = op({ifft_});\n\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n *\n\nimport {Tensor, Tensor2D} from './tensor';\nimport {complex} from './complex';\nimport {concat} from './concat';\nimport {imag} from './imag';\nimport {mul} from './mul';\nimport {op} from './operation';\nimport {real} from './real';\nimport {reshape} from './reshape';\nimport {reverse} from './reverse';\nimport {scalar} from './scalar';\nimport {slice} from './slice';\n\nimport {ifft} from './ifft';\n\n/**\n * Inversed real value input fast Fourier transform.\n *\n * Computes the 1-dimensional inversed discrete Fourier transform over the\n * inner-most dimension of the real input.\n *\n * ``js\n * const real = tf.tensor1d([1, 2, 3]);\n * const imag = tf.tensor1d([0, 0, 0]);\n * const x = tf.complex(real, imag);\n *\n * x.irfft().print();\n *``\n *\n * @param input The real value input to compute an irfft over.\n *\n * @doc {heading: 'Operations', subheading: 'Spectral', namespace: 'spectral'}\n *\n * @function irfft_(input: Tensor): Tensor {\n * const innerDimensionSize = input.shape[input.shape.length - 1];\n * const batch = input.size / innerDimensionSize;\n * let ret: Tensor;\n *\n * if (innerDimensionSize <= 2) {\n * const complexInput = reshape(input, [batch, innerDimensionSize]);\n * ret = ifft(complexInput);\n * } else {\n * // The length of unique components of the DFT of a real-valued signal\n * // is 2 * (input_len - 1)\n * const outputShape = [batch, 2 * (innerDimensionSize - 1)];\n * const realInput = reshape(real(input), [batch, innerDimensionSize]);\n * const imagInput = reshape(imag(input), [batch, innerDimensionSize]);\n *\n * const realConjugate =\n * reverse(slice(realInput, [0, 1], [batch, innerDimensionSize - 2]), 1);\n * const imagConjugate: Tensor2D = mul(\n * reverse(slice(imagInput, [0, 1], [batch, innerDimensionSize - 2]), 1),\n * scalar(-1));\n *\n * const r = concat([realInput, realConjugate], 1);\n * const i = concat([imagInput, imagConjugate], 1);\n * const complexInput =\n * reshape(complex(r, i), [outputShape[0], outputShape[1]]);\n *\n * ret = ifft(complexInput);\n * }\n *\n * ret = real(ret);\n *\n * // reshape the result\n *\n * if the input is 3D tensor.\n * if (input.rank === 3 && input.shape[0] !== 0) {\n * const temp = ret;\n * const batch = input.shape[0];\n * ret = reshape(temp, [batch, ret.shape[0] / batch, ret.shape[1]]);\n * temp.dispose();\n * }\n *\n * return ret;\n *}\n\nexport const irfft = op({irfft_});\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
```

OR CONDITIONS OF ANY KIND, either express or implied. See the License for the specific language governing permissions and limitations under the License.

```
=====
*/\nimport {ENGINE} from './engine';\nimport {SplitV, SplitVAttrs, SplitVInputs} from './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\n\nimport {op} from './operation';\n\n/**\n * Splits a `tf.Tensor` into sub tensors.\n *\n * If `numOrSizeSplits` is a number, splits `x` along dimension `axis` into `numOrSizeSplits` smaller tensors.\n *\n * Requires that `numOrSizeSplits` evenly divides `x.shape[axis]`.\n *\n * If `numOrSizeSplits` is a number array, splits `x` into `numOrSizeSplits.length` pieces. The shape of the `i`-th piece has the same size as `x` except along dimension `axis` where the size is `numOrSizeSplits[i]`.\n *\n * `const x = tf.tensor2d([1, 2, 3, 4, 5, 6, 7, 8], [2, 4]);\n * const [a, b] = tf.split(x, 2, 1);\n * a.print();\n * b.print();\n *\n * const [c, d, e] = tf.split(x, [1, 2, 1], 1);\n * c.print();\n * d.print();\n * e.print();`\n *\n * @param x The input tensor to split.\n * @param numOrSizeSplits Either an integer indicating the number of splits along the axis or an array of integers containing the sizes of each output tensor along the axis. If a number then it must evenly divide `x.shape[axis]`; otherwise the sum of sizes must match `x.shape[axis]`.\n * Can contain one -1 indicating that dimension is to be inferred.\n * @param axis The dimension along which to split. Defaults to 0 (the first dim).\n *\n * @doc {heading: 'Tensors', subheading: 'Slicing and Joining'}\n */\nfunction split<T extends Tensor>(x: Tensor|TensorLike, numOrSizeSplits: number[]|number, axis = 0): T[] {\n const $x = convertToTensor(x, 'x', 'split');\n const inputs: SplitVInputs = {x: $x};\n const attr: SplitVAttrs = {numOrSizeSplits, axis};\n return ENGINE.runKernel(SplitV, inputs as {x: Tensor, attr: SplitVAttrs}) as NamedTensorMap;\n}\n\nexport const split = op({split});\n\n"/**\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and limitations under the License.\n */\n
```

```
=====
*/\nimport {Tensor} from './tensor';\nimport {assert} from './util';\nimport {complex} from './complex';\nimport {concat} from './concat';\nimport {imag} from './imag';\nimport {op} from './operation';\nimport {real} from './real';\nimport {reshape} from './reshape';\nimport {slice} from './slice';\nimport {split} from './split';\nimport {zeros} from './zeros';\nimport {zerosLike} from './zeros_like';\n\nimport {fft} from './fft';\n\n/**\n * Real value input fast Fourier transform.\n *\n * Computes the 1-dimensional discrete Fourier transform over the inner-most dimension of the real input.\n *\n * `const real = tf.tensor1d([1, 2, 3]);\n * real.rfft().print();`\n *\n * @param input The real value input to compute an rfft over.\n *\n * @doc {heading: 'Operations', subheading: 'Spectral', namespace: 'spectral'}\n */\nfunction rfft(input: Tensor, fftLength?: number): Tensor {\n assert(input.dtype === 'float32', 'The dtype for rfft() must be real value but got ${input.dtype}');\n let innerDimensionSize = input.shape[input.shape.length - 1];\n const batch = input.size / innerDimensionSize;\n let adjustedInput: Tensor;\n if (fftLength != null && fftLength < innerDimensionSize) {\n // Need to crop\n const begin = input.shape.map(v => 0);\n const size = input.shape.map(v => v);\n size[input.shape.length - 1] = fftLength;\n adjustedInput = slice(input, begin, size);\n innerDimensionSize = fftLength;\n } else if (fftLength != null && fftLength > innerDimensionSize) {\n // Need to pad with zeros\n const zerosShape = input.shape.map(v => v);\n zerosShape[input.shape.length - 1] = fftLength - innerDimensionSize;\n adjustedInput = concat([input, zeros(zerosShape)], input.shape.length - 1);\n innerDimensionSize = fftLength;\n } else {\n adjustedInput = input;\n }\n // Complement the input with zero imaginary numbers.\n const zerosInput\n
```

```

= zerosLike(adjustedInput);\n const complexInput =\n reshape(complex(adjustedInput, zerosInput), [batch,\ninnerDimensionSize]);\n\n const ret = fft(complexInput);\n\n // Exclude complex conjugations.\n These conjugations are put symmetrically.\n const half = Math.floor(innerDimensionSize / 2) + 1;\n const\nrealValues = real(ret);\n const imagValues = imag(ret);\n const realComplexConjugate = split(\n realValues,\n [half, innerDimensionSize - half],\n realValues.shape.length - 1);\n const imagComplexConjugate = split(\n imagValues, [half, innerDimensionSize - half],\n imagValues.shape.length - 1);\n\n const outputShape =\nadjustedInput.shape.slice();\n outputShape[adjustedInput.shape.length - 1] = half;\n\n return reshape(\n complex(realComplexConjugate[0], imagComplexConjugate[0]), outputShape);\n}\n\nexport const rfft =\nop({rfft_});\n", "/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the\nApache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the\nLicense.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless\nrequired by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an\n\"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *\n\n=====\n*\n\nimport {ENGINE} from '../engine';\nimport {Sqrt, SqrtInputs} from './kernel_names';\nimport {Tensor} from\n '../tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from\n '../tensor_util_env';\nimport {TensorLike} from './types';\nimport {op} from './operation';\n\n/**\n * Computes\nsquare root of the input `tf.Tensor` element-wise: `y = sqrt(x)`\n * \n * ```js\n * const x = tf.tensor1d([1, 2, 4, -1]);\n *\n * x.sqrt().print(); // or tf.sqrt(x)\n * ```\n * \n * @param x The input tensor.\n * \n * @doc {heading: 'Operations',\nsubheading: 'Basic math'}\n */\nfunction\nsqrt_<T extends Tensor>(x: T|TensorLike): T {\n const $x = convertToTensor(x, 'x', 'sqrt');\n\n const inputs:\nSqrtInputs = {x: $x};\n\n return ENGINE.runKernel(Sqrt, inputs as { }) as NamedTensorMap);\n}\n\nexport const sqrt\n = op({sqrt_});\n", "/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the\nApache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the\nLicense.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless\nrequired by applicable law or agreed to in writing, software\n * distributed under the License is distributed\non an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\nimplied.\n * See the License for the specific language governing permissions and\n * limitations under the\nLicense.\n *\n\n=====\n*\n\nimport {ENGINE} from '../engine';\nimport\n {SquaredDifference, SquaredDifferenceInputs} from './kernel_names';\nimport {Tensor} from '../tensor';\nimport\n {NamedTensorMap} from './tensor_types';\nimport {makeTypesMatch} from './tensor_util';\nimport\n {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\n\nimport\n {assertAndGetBroadcastShape} from './broadcast_util';\nimport {op} from './operation';\n\n/**\n * Returns (a - b) *\n(a - b) element-wise.\n * Supports broadcasting.\n * \n * ```js\n * const a = tf.tensor1d([1, 4, 3, 16]);\n * const b =\ntf.tensor1d([1, 2, 9, 4]);\n *\n * a.squaredDifference(b).print(); // or tf.squaredDifference(a, b)\n * ```\n * \n * ```js\n * // Broadcast squared difference a with b.\n * const a = tf.tensor1d([2, 4, 6, 8]);\n * const b = tf.scalar(5);\n *\n * a.squaredDifference(b).print(); // or tf.squaredDifference(a, b)\n * ```\n * \n * @param a The first tensor.\n * \n * @param b The second tensor. Must have the same type as `a`.\n * \n * @doc {heading:\n'Operations', subheading: 'Arithmetic'}\n */\nfunction squaredDifference_<T extends Tensor>(a:\nTensor|TensorLike, b: Tensor|TensorLike): T {\n let $a = convertToTensor(a, 'a', 'squaredDifference');\n let $b =\nconvertToTensor(b, 'b', 'squaredDifference');\n\n [$a, $b] = makeTypesMatch($a, $b);\n\n assertAndGetBroadcastShape($a.shape, $b.shape);\n\n const inputs: SquaredDifferenceInputs = {a: $a, b: $b};\n\n const attrs = {};\n\n return ENGINE.runKernel(\n SquaredDifference, inputs as unknown as NamedTensorMap,\n attrs);\n}\n\nexport const squaredDifference = op({squaredDifference_});\n", "/**\n * @license\n * Copyright 2020

```

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under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n *\n\nimport {Tensor} from './tensor';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport {squeezeShape} from './util';\nimport {op} from './operation';\nimport {reshape} from './reshape';\n\n/**\n * Removes dimensions of size 1 from the shape of a `tf.Tensor`.\n *\n * ```js\n * const x = tf.tensor([1, 2, 3, 4], [1, 1, 4]);\n * x.squeeze().print();\n * ```\n *\n * @param x The input tensor to be squeezed.\n *\n * @param axis An optional list of numbers. If specified, only\n * squeezes the dimensions listed. The dimension index starts at 0. It\n * is an error to squeeze a dimension that is not 1.\n *\n * @doc {heading:
```

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'Tensors', subheading: 'Transformations'}\n\nfunction squeeze_<T extends Tensor>(x: Tensor|TensorLike, axis?: number[]): T {\n const $x = convertToTensor(x, 'x', 'squeeze');\n return reshape($x, squeezeShape($x.shape, axis).newShape) as T;\n}\n\nexport const squeeze = op({squeeze_});\n\n\"/>\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n *\n\nimport {ENGINE} from './engine';\nimport {Pack, PackAttrs, PackInputs} from './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensorArray} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport * as util from './util';\nimport {op} from './operation';\n\n/**\n * Stacks a list of rank-`R` `tf.Tensor`s into one rank-`(R+1)` `tf.Tensor`.\n *\n * ```js\n * const a = tf.tensor1d([1, 2]);\n * const b = tf.tensor1d([3, 4]);\n * const c = tf.tensor1d([5, 6]);\n * tf.stack([a, b, c]).print();\n * ```\n *\n * @param tensors A list of tensor objects with the same shape and dtype.\n *\n * @param axis The axis to stack along. Defaults to 0 (the first dim).\n *\n * @doc {heading: 'Tensors', subheading: 'Slicing and Joining'}\n\nfunction stack_<T extends Tensor>(tensors: Array<T|TensorLike>, axis = 0): Tensor {\n const $tensors =\n convertToTensorArray(tensors, 'tensors', 'stack', 'string_or_numeric');\n util.assert($tensors.length >= 1, () => 'Pass at least one tensor to tf.stack');\n if ($tensors.length > 0) {\n util.assert(axis <= $tensors[0].rank, () => 'Axis must be <= rank of the tensor');\n }\n const inputs: PackInputs = $tensors;\n const attrs: PackAttrs = {axis};\n return ENGINE.runKernel($ Pack, inputs as {} as NamedTensorMap, attrs as {} as NamedAttrMap);\n}\n\nexport const stack = op({stack_});\n\n\"/>\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n *\n\nimport {ENGINE} from './engine';\nimport {Step, StepAttrs, StepInputs} from './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from
```

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./types';\n\nimport {op} from './operation';\n\n/**\n * Computes step of the input `tf.Tensor` element-wise: `x > 0 ?
1 : alpha * x`\n *\n * ```\n * const x = tf.tensor1d([0, 2, -1, -3]);\n *\n * x.step(.5).print(); // or tf.step(x, .5)\n *\n * ```\n * @param x The input tensor.\n * @param alpha The gradient when input is negative.\n *\n * @doc {heading:
'Operations', subheading: 'Basic math'}\n *\nfunction step_<T extends Tensor>(x:
T|TensorLike, alpha = 0.0): T {\n const $x = convertToTensor(x, 'x', 'step');\n\n const inputs: StepInputs = {x:
$x};\n\n const attrs: StepAttrs = {alpha};\n\n return ENGINE.runKernel(\n Step, inputs as {} as
NamedTensorMap, attrs as {} as NamedAttrMap);\n}\n\nexport const step = op({step_});\n"/**\n * @license\n *
Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
"License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *\n
=====\n
*\n\nimport {ENGINE} from './engine';\n\nimport {StridedSlice, StridedSliceAttrs, StridedSliceInputs} from
 './kernel_names';\n\nimport {NamedAttrMap} from './kernel_registry';\n\nimport {Tensor} from './tensor';\n\nimport
{NamedTensorMap} from './tensor_types';\n\nimport {convertToTensor} from './tensor_util_env';\n\nimport
{TensorLike} from './types';\n\nimport {op} from './operation';\n\n/**\n * Extracts a strided slice of a tensor.\n *\n *
Roughly speaking, this op extracts a slice of size (end-begin)/stride from\n * the given input tensor (x). Starting at
the location specified by begin the\n * slice continues by adding stride to the index until all dimensions are not\n *
less than end. Note that a stride can be negative, which causes a reverse\n * slice.\n *\n * ```\n * const t =
tf.tensor3d([1, 1, 1, 2, 2, 2, 3, 3, 3, 4, 4, 4, 5, 5, 5, 6, 6, 6],\n * [3, 2, 3]);\n *\n * t.stridedSlice([1, 0, 0], [2, 1, 3], [1, 1,
1]).print() // [[[3, 3, 3]]]\n *\n * t.stridedSlice([1,
0, 0], [2, 2, 3], [1, 1, 1]).print() // [[[3, 3, 3],\n * // [4, 4, 4]]]\n *\n * t.stridedSlice([1, -
1, 0], [2, -3, 3], [1, -1, 1]).print() // [[[4, 4, 4],\n * // [3, 3, 3]]]\n *\n * ```\n *\n *
@param x The tensor to stride slice.\n * @param begin The coordinates to start the slice from.\n * @param end:
The coordinates to end the slice at.\n * @param strides: The size of the slice.\n * @param beginMask: If the ith bit
of beginMask is set, begin[i] is ignored\n * and the fullest possible range in that dimension is used instead.\n *
@param endMask: If the ith bit of endMask is set, end[i] is ignored\n * and the fullest possible range in that
dimension is used instead.\n * @param shrinkAxisMask: a bitmask where bit i implies that\n * the ith specification
should shrink the dimensionality. begin and end must\n * imply a slice of size 1 in the dimension.\n *\n * @doc
{heading:
'Operations', subheading: 'Slicing and Joining'}\n *\nfunction stridedSlice_(\n x: Tensor|TensorLike, begin:
number[], end: number[], strides?: number[],\n beginMask = 0, endMask = 0, ellipsisMask = 0, newAxisMask =
0,\n shrinkAxisMask = 0): Tensor {\n const $x = convertToTensor(x, 'x', 'stridedSlice');\n\n const inputs:
StridedSliceInputs = {x: $x};\n\n const attrs: StridedSliceAttrs = {\n begin,\n end,\n strides,\n beginMask,\n
endMask,\n ellipsisMask,\n newAxisMask,\n shrinkAxisMask\n };\n\n return ENGINE.runKernel(\n StridedSlice,
inputs as {} as NamedTensorMap,\n attrs as {} as NamedAttrMap);\n}\n\nexport const stridedSlice =
op({stridedSlice_});\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is
distributed on an "AS IS" BASIS,\n *\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *\n
=====\n
*\n\nimport {ENGINE} from './engine';\n\nimport {Tan, TanInputs} from './kernel_names';\n\nimport {Tensor} from
 './tensor';\n\nimport {NamedTensorMap} from './tensor_types';\n\nimport {convertToTensor} from

```



```

'./tensor_util_env';\nimport {TensorLike} from './types';\nimport {op} from './operation';\n\n/**\n * Computes
tan of the input `tf.Tensor` element-wise, `tan(x)`\n *\n * ```js\n * const x = tf.tensor1d([0, Math.PI / 2, Math.PI * 3 /
4]);\n *\n * x.tan().print(); // or tf.tan(x)\n * ```\n * @param x The input tensor.\n *\n * @doc {heading:
'Operations', subheading:
'Basic math'}\n *\nfunction tan_<T extends Tensor>(x: T|TensorLike): T {\n const $x = convertToTensor(x, 'x',
'tan');\n\n const inputs: TanInputs = {x: $x};\n\n return ENGINE.runKernel(Tan, inputs as { } as
NamedTensorMap);\n}\n\nexport const tan = op({tan_});\n"/**\n * @license\n * Copyright 2018 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport
{Tensor1D} from './tensor';\nimport {inferShape} from './tensor_util_env';\nimport {TensorLike1D} from
'./types';\nimport {DataType} from './types';\nimport {assertNonNull} from './util';\nimport {makeTensor} from
'./tensor_ops_util';\n\n/**\n * Creates rank-1 `tf.Tensor` with the provided values, shape and dtype.\n *\n * The
same functionality can be achieved with `tf.tensor`, but in general\n * we recommend using `tf.tensor1d` as it makes
the code more readable.\n *\n * ```js\n * tf.tensor1d([1, 2, 3]).print();\n * ```\n *\n * @param values The values of
the tensor. Can be array of numbers,\n * or a `TypedArray`.\n *\n * @param dtype The data type.\n *\n * @doc
{heading: 'Tensors', subheading: 'Creation'}\n *\nexport function tensor1d(values: TensorLike1D, dtype?:
DataType): Tensor1D {\n assertNonNull(values);\n const inferredShape = inferShape(values, dtype);\n if
(inferredShape.length !== 1) {\n throw new Error('tensor1d() requires values to be a flat/TypedArray');\n }\n const shape: number[] = null;\n return makeTensor(values, shape, inferredShape, dtype) as
Tensor1D;\n}\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====\n
*\n\nimport {Tensor2D} from './tensor';\nimport {inferShape} from './tensor_util_env';\nimport {TensorLike2D}
from './types';\nimport {DataType} from './types';\nimport
{assertNonNull} from './util';\nimport {makeTensor} from './tensor_ops_util';\n\n/**\n * Creates rank-2 `tf.Tensor`
with the provided values, shape and dtype.\n *\n * The same functionality can be achieved with `tf.tensor`, but in
general\n * we recommend using `tf.tensor2d` as it makes the code more readable.\n *\n * ```js\n * // Pass a nested
array.\n * tf.tensor2d([[1, 2], [3, 4]]).print();\n * ```\n *\n * ```js\n * // Pass a flat array and specify a shape.\n *
tf.tensor2d([1, 2, 3, 4], [2, 2]).print();\n * ```\n *\n * @param values The values of the tensor. Can be nested array of
numbers,\n * or a flat array, or a `TypedArray`.\n *\n * @param shape The shape of the tensor. If not provided, it is
inferred from\n * `values`.\n *\n * @param dtype The data type.\n *\n * @doc {heading: 'Tensors', subheading:
'Creation'}\n *\nexport function tensor2d(\n values: TensorLike2D, shape?: [number, number],\n dtype?:
DataType): Tensor2D {\n assertNonNull(values);\n if (shape
 !== null && shape.length !== 2) {\n throw new Error('tensor2d() requires shape to have two numbers');\n }\n const inferredShape = inferShape(values, dtype);\n if (inferredShape.length !== 2 && inferredShape.length !== 1)
{\n throw new Error(\n 'tensor2d() requires values to be number[][] or flat/TypedArray');\n }\n if
(inferredShape.length === 1 && shape == null) {\n throw new Error(\n 'tensor2d() requires shape to be

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provided when `values` are a flat/TypedArray');\n }\n return makeTensor(values, shape, inferredShape, dtype) as Tensor2D;\n}\n",/\*\*\n \* @license\n \* Copyright 2018 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the "License");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \* http://www.apache.org/licenses/LICENSE-2.0\n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an "AS IS" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\n\nimport {Tensor4D} from './tensor';\nimport {inferShape} from './tensor_util_env';\nimport {TensorLike4D} from './types';\nimport {DataType} from './types';\nimport {assertNonNull} from './util';\nimport {makeTensor} from './tensor_ops_util';\n\n/**\n * Creates rank-4 `tf.Tensor` with the provided values, shape and dtype.\n * The same functionality can be achieved with `tf.tensor`, but in general\n * we recommend using `tf.tensor4d` as it makes the code more readable.\n * ``js\n * // Pass a nested array.\n * tf.tensor4d([[[[1], [2]], [[3], [4]]]]).print();\n * ``\n * ``js\n * // Pass a flat array and specify a shape.\n * tf.tensor4d([1, 2, 3, 4], [1, 2, 2, 1]).print();\n * ``\n * @param values The values of the tensor. Can be nested array of numbers,\n * or a flat array, or a `TypedArray`.\n * @param shape The shape of the tensor. Optional. If not provided,\n * it is inferred from `values`.\n * @param dtype The data type.\n * @doc {heading: 'Tensors', subheading: 'Creation'}\n */\nexport function tensor4d(\n values: TensorLike4D, shape?: [number, number, number, number],\n dtype?: DataType): Tensor4D {\n assertNonNull(values);\n if (shape != null && shape.length !== 4) {\n throw new Error('tensor4d() requires shape to have four numbers');\n }\n const inferredShape = inferShape(values, dtype);\n if (inferredShape.length !== 4 && inferredShape.length !== 1) {\n throw new Error(\n 'tensor4d() requires values to be number[][][] or flat/TypedArray');\n }\n if (inferredShape.length === 1 && shape == null) {\n throw new Error(\n 'tensor4d() requires shape to be provided when `values` '\n
```

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are a flat array');\n }\n return makeTensor(values, shape, inferredShape, dtype) as Tensor4D;\n}\n",/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport {Tensor5D} from './tensor';\nimport {inferShape} from './tensor_util_env';\nimport {TensorLike5D} from './types';\nimport {DataType} from './types';\nimport {assertNonNull} from './util';\nimport {makeTensor} from './tensor_ops_util';\n\n/**\n * Creates rank-5 `tf.Tensor` with the provided values, shape and dtype.\n * The same functionality can be achieved with `tf.tensor`, but in\n * general\n * we recommend using `tf.tensor5d` as it makes the code more readable.\n * ``js\n * // Pass a nested array.\n * tf.tensor5d([[[[1],[2]],[[3],[4]]],[[5],[6]],[[7],[8]]]).print();\n * ``\n * ``js\n * // Pass a flat array and specify a shape.\n * tf.tensor5d([1, 2, 3, 4, 5, 6, 7, 8], [1, 2, 2, 2, 1]).print();\n * ``\n * @param values The values of the tensor. Can be nested array of numbers,\n * or a flat array, or a `TypedArray`.\n * @param shape The shape of the tensor. Optional. If not provided,\n * it is inferred from `values`.\n * @param dtype The data type.\n * @doc {heading: 'Tensors', subheading: 'Creation'}\n */\nexport function tensor5d(\n values: TensorLike5D, shape?: [number, number, number, number, number],\n
```

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dtype?: DataType): Tensor5D {\n assertNonNull(values);\n if (shape != null && shape.length !== 5) {\n throw new Error('tensor5d() requires shape to have five numbers');\n }\n const inferredShape = inferShape(values, dtype);\n if (inferredShape.length !== 5 && inferredShape.length !== 1) {\n throw new Error(\n 'tensor5d() requires values to be '\n +\n 'number[][][] or flat/TypedArray');\n }\n if (inferredShape.length === 1 && shape == null) {\n throw new Error(\n 'tensor5d() requires shape to be provided when `values` '\n +\n 'are a
```

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flat array');\n }
return makeTensor(values, shape, inferredShape, dtype) as Tensor5D;\n}\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless\n * required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an\n * \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {Tensor6D} from './tensor';\nimport {inferShape} from './tensor_util_env';\nimport {TensorLike6D}\nfrom './types';\nimport {DataType} from './types';\nimport {assertNonNull} from './util';\nimport {makeTensor}\nfrom './tensor_ops_util';\n\n/**\n * Creates rank-6 `tf.Tensor` with the provided values, shape and dtype.\n *\n * The same functionality can be achieved with `tf.tensor`, but in general\n * we recommend using `tf.tensor6d` as it makes\n * the code more readable.\n *\n * ```js\n * // Pass a nested array.\n *\ntf.tensor6d([[[[[[1],[2]],[[3],[4]]],[[5],[6]],[[7],[8]]]]]).print();\n *\n * ```\n *\n * // Pass a flat array and specify a shape.\n *\ntf.tensor6d([1, 2, 3, 4, 5, 6, 7, 8], [1, 1, 2, 2, 2,\n1]).print();\n *\n * @param values The values of the tensor. Can be nested array of numbers,\n * or a flat array, or a `TypedArray`.\n * @param shape The shape of the tensor. Optional. If not provided,\n * it is inferred from `values`.\n * @param dtype The data type.\n * @doc {heading: 'Tensors', subheading: 'Creation'}\n\n*/\nexport function tensor6d(\n values: TensorLike6D,\n shape?: [number, number, number, number, number,\nnumber],\n dtype?: DataType): Tensor6D {\n assertNonNull(values);\n if (shape != null && shape.length !== 6)\n {\n throw new Error('tensor6d() requires shape to have six numbers');\n }\n const inferredShape =\ninferShape(values, dtype);\n if (inferredShape.length !== 6 && inferredShape.length !== 1) {\n throw new\nError(\n 'tensor6d() requires values to be number[] or '\n + 'flat/TypedArray');\n }\n if (inferredShape.length === 1 && shape == null) {\n throw new Error(\n 'tensor6d() requires shape to\n be provided when `values` '\n + 'are a flat array');\n }\n shape = shape ||\n inferredShape as [number,\nnumber, number, number, number, number];\n return makeTensor(values, shape, inferredShape, dtype) as\nTensor6D;\n}\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the\n * Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the\n * License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless\n * required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n * on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n * implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n * License.\n *
=====
*\n\nimport {ENGINE} from './engine';\nimport {TopK, TopKAttrs, TopKInputs} from './kernel_names';\nimport\n{NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from\n './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from\n './types';\nimport {op} from './operation';\n\n/**\n * Finds the values and indices of the `k` largest entries along\n * the last\n * dimension.\n *\n * If the input is a vector (rank=1), finds the k largest entries in the vector\n * and\n * outputs their values and indices as vectors. Thus values[j] is the j-th\n * largest entry in input, and its index is\n * indices[j].\n *\n * For higher rank inputs, computes the top k entries along the last dimension.\n *\n * If two elements\n * are equal, the lower-index element appears first.\n *\n * ```js\n * const a = tf.tensor2d([[1, 5], [4, 3]]);\n * const\n * {values,\n * indices} = tf.topk(a);\n * values.print();\n * indices.print();\n *\n * ```\n *\n * @param x 1-D or higher `tf.Tensor` with last\n * dimension being at least `k`.\n * @param k Number of top elements to look for along the last dimension.\n *\n * @param sorted If true, the resulting `k` elements will be sorted by the\n * values in descending order.\n *\n * @doc {heading: 'Operations', subheading: 'Evaluation'}\n\n*/\nfunction topk<T extends Tensor>(\n x:\n T|TensorLike, k = 1, sorted = true): {values: T, indices: T} {\n const $x = convertToTensor(x, 'x', 'topk');\n if

```

```

($x.rank === 0) {\n throw new Error('topk() expects the input to be of rank 1 or higher');\n }\n const lastDim =
$x.shape[$x.shape.length - 1];\n if (k > lastDim) {\n throw new Error(\n `k` passed to topk() must be <= the
last dimension (${lastDim})` +\n `but got ${k}`);\n }\n\n const inputs: TopKInputs = {x: $x};\n const attrs:
TopKAttrs = {k, sorted};\n\n const [values, indices] = ENGINE.runKernel(\n
 TopK, inputs as {} as NamedTensorMap, attrs as {} as NamedAttrMap);\n\n return {values, indices} as
{values: T, indices: T};\n}\n\nexport const topk = op({topk_});\n", "/*\n * @license\n * Copyright 2020 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
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http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {Tensor} from './tensor';\nimport {DataType, Rank, ShapeMap} from './types';\nimport
{buffer} from './buffer';\nimport {op} from './operation';\nimport {MPRandGauss} from './rand_util';\n\n/**\n *
Creates a `tf.Tensor` with values sampled from a truncated normal\n * distribution.\n *\n * ``js\n *
tf.truncatedNormal([2, 2]).print();\n * ``\n *\n * The generated values follow a normal distribution with specified
mean and\n * standard deviation, except that values whose magnitude is more than 2\n * standard deviations from
the mean are dropped and re-picked.\n *\n * @param shape An array of integers defining the output tensor shape.\n
* @param mean The mean of the normal distribution.\n * @param stdDev The standard deviation of the normal
distribution.\n * @param dtype The data type of the output tensor.\n * @param seed The seed for the random
number generator.\n *\n * @doc {heading: 'Tensors', subheading: 'Creation'}\n */\nfunction truncatedNormal_<R
extends Rank>(\n shape: ShapeMap[R], mean = 0, stdDev = 1, dtype?: 'float32'|'int32',\n seed?: number):
Tensor<R>\n {\n if (dtype != null && (dtype as DataType) === 'bool') {\n throw new Error(`Unsupported data type $ { dtype
}`);\n }\n const randGauss =\n new MPRandGauss(mean, stdDev, dtype, true /* truncated */, seed);\n const res
= buffer(shape, dtype);\n for (let i = 0; i < res.values.length; i++) {\n res.values[i] = randGauss.nextValue();\n }\n return res.toTensor();\n }\n\nexport const truncatedNormal = op({truncatedNormal_});\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the\n * specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {ENGINE} from './engine';\nimport {Unique, UniqueAttrs, UniqueInputs} from
'./kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor, Tensor1D} from
'./tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from
'./tensor_util_env';\nimport {TensorLike} from './types';\nimport {assert} from './util';\n\nimport {op} from
'./operation';\n\n/**\n * Finds unique elements along an axis of a tensor.\n *\n * It returns a tensor `values`
containing all of the unique elements along the\n * `axis` of the given tensor `x` in the same order that they occur
along the\n * `axis` in `x`; `x` does not need to be sorted. It also returns a tensor\n * `indices` the same size as
the number of the elements in `x` along the `axis`\n * dimension. It contains the index in the
unique output `values`.\n *\n * ``js\n * // A 1-D tensor\n * const a = tf.tensor1d([1, 1, 2, 4, 4, 7, 8, 8]);\n * const
{values, indices} = tf.unique(a);\n * values.print(); // [1, 2, 4, 7, 8,]\n * indices.print(); // [0, 0, 1, 2, 2, 3, 4, 4]\n
* ``\n *\n * ``js\n * // A 2-D tensor with axis=0\n * // 'a' is: [[1, 0, 0],\n * // [1, 0, 0],\n * // [2, 0,
0]]\n * const a = tf.tensor2d([[1, 0, 0], [1, 0, 0], [2, 0, 0]]);\n * const {values, indices} = tf.unique(a, 0)\n *

```





```
{convertToTensor} from './tensor_util_env';
import {TensorLike} from './types';

/**
 * Returns the
 * coordinates of true elements of condition.
 * The coordinates are returned in a 2-D tensor where the first
 * dimension (rows) represents the number of true elements, and the second dimension (columns)
 * represents the coordinates of the true elements. Keep in mind, the shape of
 * the output tensor can vary depending on how many
 * true values there are in
 * input. Indices are output in row-major order. The resulting tensor has the
 * shape
 * [numTrueElems, condition.rank].
 * This is analogous to calling the
 * python `tf.where(cond)` without an x or y.
 */
const cond = tf.tensor1d([false, false, true], 'bool');
const result = await tf.whereAsync(cond);
result.print();

@doc {heading: 'Operations',
subheading: 'Logical'}
/**
 * Async function whereAsync_(condition: Tensor|TensorLike): Promise<Tensor2D> {
 * const $condition =
 * convertToTensor(condition, 'condition', 'whereAsync', 'bool');
 * const vals = await
 * $condition.data();
 * const res = whereImpl($condition.shape, vals);
 * if (condition !== $condition) {
 * $condition.dispose();
 * }
 * return res;
 * }
 */
export const whereAsync = whereAsync_;

"*/
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limitations under the License.
```

```
=====
import {Tensor} from './tensor';
import {convertToTensor} from './tensor_util_env';
import {TensorLike}
from './types';
import * as util from './util';
import {gather} from './gather';
import {reshape} from
 './reshape';
import {squeeze} from './squeeze';
import {whereAsync} from './where_async';

/**
 * Apply
 * boolean mask to tensor.
 */
const tensor = tf.tensor2d([1, 2, 3, 4, 5, 6], [3, 2]);
const mask =
tf.tensor1d([1, 0, 1], 'bool');
const result = await tf.booleanMaskAsync(tensor, mask);
result.print();

@param tensor N-D tensor.
@param mask K-D boolean
tensor, K <= N and K must be known statically.
@param axis A 0-D int Tensor representing the axis in tensor
to mask from.
By default, axis is 0 which will mask from the first dimension.
Otherwise K + axis <=
N.
@doc {heading: 'Tensors', subheading: 'Slicing and Joining'}
/**
 * Async function
 * booleanMaskAsync_(
 * tensor: Tensor|TensorLike, mask: Tensor|TensorLike,
 * axis?: number):
 * Promise<Tensor> {
 * const $tensor = convertToTensor(tensor, 'tensor', 'boolMask');
 * const $mask =
 * convertToTensor(mask, 'mask', 'boolMask', 'bool');
 * const axisFrom = axis == null ? 0 : axis;
 * const maskDim
 * = $mask.rank;
 * const tensorShape = $tensor.shape;
 * util.assert(maskDim > 0, () => 'mask cannot be scalar');
 * util.assertShapesMatch(
 * tensorShape.slice(axisFrom, axisFrom + maskDim), $mask.shape,
 * `mask's shape
 * must match the first K dimensions of tensor's shape.`);
 * let leadingSize = 1;
 * for (let i = axisFrom; i < axisFrom
 * + maskDim; i++)
 * {
 * leadingSize *= tensorShape[i];
 * }
 * const targetTensorShape =
 * tensorShape.slice(0, axisFrom)
 * .concat([leadingSize, tensorShape.slice(axisFrom + maskDim)]);
 * const reshapedTensor = reshape($tensor,
 * targetTensorShape);
 * const reshapedMask = reshape($mask, [-1]);
 * const positivePositions = await
 * whereAsync(reshapedMask);
 * const indices = squeeze(positivePositions, [1]);
 * const res =
 * gather(reshapedTensor, indices, axisFrom);
 * // Ensure no memory leak.
 * if (tensor !== $tensor) {
 * $tensor.dispose();
 * }
 * if (mask !== $mask) {
 * $mask.dispose();
 * }
 * indices.dispose();
 * reshapedTensor.dispose();
 * reshapedMask.dispose();
 * positivePositions.dispose();
 * return res;
 * }
 */
export
const booleanMaskAsync = booleanMaskAsync_;

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```

```

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* limitations under the License.
=====
*/
import {Tensor} from './tensor';
import {convertToTensor} from './tensor_util_env';
import {TensorLike}
from './types';
import {parseAxisParam} from './util';
import {abs} from './abs';
import * as axis_util from
 './axis_util';
import {max} from './max';
import {min} from './min';
import {op} from './operation';
import
 {pow} from './pow';
import {reshape} from './reshape';
import {scalar} from './scalar';
import {sqrt} from
 './sqrt';
import {square} from
 './square';
import {sum} from './sum';
/**
 * Computes the norm of scalar, vectors, and matrices.
 * This
 function can compute several different vector norms (the 1-norm, the
 * Euclidean or 2-norm, the inf-norm, and in
 general the p-norm for p > 0)
 * and matrix norms (Frobenius, 1-norm, and inf-norm).
 *
 * @param x =
 tf.tensor1d([1, 2, 3, 4]);
 * x.norm().print(); // or tf.norm(x)
 *
 * @param ord Optional. Order of the norm. Supported norm types are
 * following:
 *
 * | ord | norm for
 matrices | norm for vectors
 * |-----|-----|-----|
 * | 'euclidean' | Frobenius
 norm | 2-norm
 * | 'fro' | Frobenius norm
 * | Infinity | max(sum(abs(x), axis=1))
 * | -Infinity | min(sum(abs(x), axis=1))
 * | 1 | min(abs(x))
 * | 2 | max(sum(abs(x), axis=0))
 * | sum(abs(x))^2
 *
 * @param axis Optional. If axis is null (the default), the input is
 * considered a vector
 and a single vector norm is computed over the entire
 * set of values in the Tensor, i.e. norm(x, ord) is equivalent
 * to norm(x.reshape([-1]), ord). If axis is a integer, the input
 * is considered a batch of vectors, and axis
 determines the axis in x
 * over which to compute vector norms. If axis is a 2-tuple of integer it is
 * considered a
 batch of matrices and axis determines the axes in NDArray
 * over which to compute a matrix norm.
 *
 * @param
 keepDims Optional. If true, the norm have the same dimensionality
 * as the input.
 *
 * @doc {heading:
 'Operations', subheading: 'Matrices'}
 */
function norm_(x: Tensor|TensorLike, ord: number|'euclidean'|'fro' =
 'euclidean',
 axis: number|number[] = null, keepDims = false): Tensor {
 x = convertToTensor(x, 'x',
 'norm');
 const norm = normImpl(x, ord, axis);
 let keepDimsShape = norm.shape;
 if (keepDims) {
 const axes = parseAxisParam(axis, x.shape);
 keepDimsShape =
 axis_util.expandShapeToKeepDim(norm.shape, axes);
 }
 return reshape(norm,
 keepDimsShape);
}

function normImpl(x: Tensor, p: number|string, axis: number|number[] = null): Tensor
 {
 if (x.rank === 0) {
 return abs(x);
 }
 // consider vector when no axis is specified
 if (x.rank !== 1 &&
 axis === null) {
 return normImpl(reshape(x, [-1]), p, axis);
 }
 // vector
 if (x.rank === 1 || typeof axis
 === 'number' ||
 Array.isArray(axis) && axis.length === 1) {
 if (p === 1) {
 return sum(abs(x), axis);
 }
 if (p === Infinity) {
 return max(abs(x), axis);
 }
 if (p === -Infinity) {
 return min(abs(x),
 axis);
 }
 if (p === 'euclidean' || p === 2) {
 // norm(x, 2) = sum(abs(xi) ^ 2) ^ 1/2
 return
 sqrt(sum(pow(abs(x), scalar(2, 'int32')), axis));
 }
 throw new Error(`Error in norm: invalid ord value:
 ${p}`);
 }
 // matrix (assumption axis[0] < axis[1])
 if (Array.isArray(axis) && axis.length === 2) {
 if (p
 === 1) {
 return max(sum(abs(x), axis[0]), axis[1] - 1);
 }
 if (p === Infinity) {
 return
 max(sum(abs(x), axis[1]), axis[0]);
 }
 if (p === -Infinity) {
 return min(sum(abs(x), axis[1]), axis[0]);
 }
 if (p === 'fro' || p === 'euclidean') {
 // norm(x) = sqrt(sum(pow(x, 2)))
 return sqrt(sum(square(x),
 axis));
 }
 throw new Error(`Error in norm: invalid ord value: ${p}`);
 }
 throw new Error(`Error in
 norm: invalid axis: ${axis}`);
}

export const norm = op({norm_});
/**
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 * limitations under the License.
 */
=====
*/
import {Scalar, Tensor} from './tensor';
import {assertTypesMatch} from './tensor_util';
import

```



```

{convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport * as util from
 './util';\nimport {add} from './add';\nimport {div} from './div';\nimport {mul} from './mul';\nimport {op} from
 './operation';\nimport {pow} from './pow';\nimport {scalar} from './scalar';\nimport {sub} from './sub';\n\n/**\n * Compute the moving average of a variable.\n * \n * Without zeroDebias, the moving average operation is defined
 by:\n * $v += \delta$ where $\delta = (1 -$
 decay) * (x - v)\n * \n * With zeroDebias (default), the δ term is scaled to debias the\n * effect of the
 (assumed) zero-initialization of v .\n * $\delta /= (1 - \text{decay}^{\text{step}})$ \n * \n * For more details on the zero-debiasing
 algorithm, see:\n * https://arxiv.org/abs/1412.6980\n * \n * Note that this function is completely stateless and does
 not keep track of\n * step count. The step count needs to be maintained by the caller and passed\n * in as `step`.\n
 *\n * @param v The current moving average value.\n * @param x New input value, must have the same shape and
 dtype as `v`.\n * @param decay The decay factor. Typical values are 0.95 and 0.99.\n * @param step Step count.\n
 * @param zeroDebias: Whether zeroDebias is to be performed (default: `true`).\n * @returns The new moving
 average value.\n *\n * @doc {heading: 'Operations', subheading: 'Moving Average'}\n *\nfunction
 movingAverage_<T extends Tensor>(\n v: T|TensorLike, x: T|TensorLike, decay: number|Scalar,\n step?:
 number|Scalar, zeroDebias = true): T {\n const $v = convertToTensor(v, 'v', 'movingAverage');\n const $x =
 convertToTensor(x, 'x', 'movingAverage');\n const $decay = convertToTensor(decay, 'decay', 'movingAverage');\n
 assertTypesMatch($v, $x);\n util.assert(\n util.arraysEqual($v.shape, $x.shape), () => 'Shape mismatch in v and
 x');\n const one = scalar(1);\n const oneMinusDecay = sub(one, $decay);\n let update = mul(sub($x, $v),
 oneMinusDecay);\n if (zeroDebias) {\n util.assert(\n step != null, () => 'When using zeroDebias: true, step is
 required.);\n const $step = convertToTensor(step, 'step', 'movingAverage');\n update = div(update, sub(one,
 pow($decay, $step));\n }\n return add($v, update);\n}\n\nexport const movingAverage =
op({movingAverage_});\n\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed
 under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with
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 express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
 the License.\n *
=====\n
*\nimport {ENGINE} from './engine';\nimport {ScatterNd, ScatterNdAttrs, ScatterNdInputs} from
 './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport
 {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {Rank,
 ShapeMap, TensorLike} from './types';\nimport {op} from './operation';\nimport * as scatter_nd_util from
 './scatter_nd_util';\n\n/**\n * Creates a new tensor
 by applying sparse updates to individual\n * values or slices within a zero tensor of the given shape tensor
 according to\n * indices. This operator is the inverse of the `tf.gatherND` operator which\n * extracts values or slices
 from a given tensor.\n * \n * const indices = tf.tensor2d([4, 3, 1, 7], [4, 1], 'int32');\n * const updates =
 tf.tensor1d([9, 10, 11, 12]);\n * const shape = [8];\n * tf.scatterND(indices, updates, shape).print() // [0, 11, 0, 10, 9,
 0, 0, 12]\n * \n * @param indices The tensor contains the indices into the output tensor.\n * @param updates
 The tensor contains the value for the indices.\n * @param shape: The shape of the output tensor.\n *\n * @doc
 {heading: 'Operations', subheading: 'Slicing and Joining'}\n *\nfunction scatterND_<R extends Rank>(\n indices:
 Tensor|TensorLike, updates: Tensor|TensorLike,\n shape: ShapeMap[R]): Tensor<R> {\n const $indices =
 convertToTensor(indices, 'indices', 'scatterND', 'int32');\n const $updates
 = convertToTensor(updates, 'updates', 'scatterND');\n scatter_nd_util.validateInput($updates, $indices, shape);\n
 const inputs: ScatterNdInputs = {indices: $indices, updates: $updates};\n const attrs: ScatterNdAttrs = {shape};\n
 \n // tslint:disable-next-line: no-unnecessary-type-assertion\n return ENGINE.runKernel(\n ScatterNd, inputs
 as {} as NamedTensorMap,\n attrs as {} as NamedAttrMap) as Tensor<R>;\n}\n\nexport const scatterND =
op({scatterND_});\n\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under

```

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```
=====
*^/nimport {Tensor} from './tensor';
*^/n**/n * Validate sparseToDense inputs.
*^/n * @param sparseIndices A 0-D, 1-D, or 2-D Tensor of type int32.
*^/n * sparseIndices[i] contains the complete index where sparseValues[i] will be placed.
*^/n * @param sparseValues A 0-D or 1-D Tensor. Values corresponding to each row of sparseIndices, or a scalar value to be used for all sparse indices.
*^/n * @param outputShape number[]. Shape of the dense output tensor.
*^/n * @param validateIndices boolean. indice validation is not supported, error will be thrown if it is set.
*^/nexport function validateInput(
 sparseIndices: Tensor, sparseValues: Tensor,
 outputShape: number[],
 defaultValues: Tensor) {
 if (sparseIndices.dtype !== 'int32') {
 throw new Error(
 `tf.sparseToDense()
 expects the indices to be int32 type,` +
 ` but the dtype was ${sparseIndices.dtype}.`);
 }
 if (sparseIndices.rank > 2) {
 throw new Error(
 `sparseIndices should be a scalar, vector, or matrix,` +
 ` but got shape ${sparseIndices.shape}.`);
 }
 const numElems = sparseIndices.rank > 0 ? sparseIndices.shape[0] : 1;
 const numDims = sparseIndices.rank > 1 ? sparseIndices.shape[1] : 1;
 if (outputShape.length !== numDims) {
 throw new Error(
 `outputShape has incorrect number of elements,` +
 ` ${outputShape.length}, should be: ${numDims}.`);
 }
 const numValues = sparseValues.size;
 if (!(sparseValues.rank === 0 ||
 sparseValues.rank === 1 && numValues === numElems)) {
 throw new Error(
 `sparseValues has incorrect shape ` +
 `${sparseValues.shape}, should be [] or
 [${numElems}]`);
 }
 if (sparseValues.dtype !== defaultValues.dtype) {
 throw new Error(
 `sparseValues.dtype
 must match defaultValues.dtype`);
 }
}
}

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=====
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=====
*^/nimport {ENGINE} from './engine';
*^/nimport {SparseToDense, SparseToDenseAttrs, SparseToDenseInputs}
*^/nfrom './kernel_names';
*^/nimport {NamedAttrMap} from './kernel_registry';
*^/nimport * as sparse_to_dense from './ops/sparse_to_dense_util';
*^/nimport {Scalar, Tensor} from './tensor';
*^/nimport {NamedTensorMap} from './tensor_types';
*^/nimport {convertToTensor} from './tensor_util_env';
*^/nimport {Rank, ScalarLike, ShapeMap, TensorLike} from './types';
*^/nimport {op} from './operation';
*^/n**/n * Converts a sparse representation into a dense tensor.
*^/n * Builds an array dense with shape outputShape such that:
*^/n * // If sparseIndices is scalar
*^/n * dense[i] = (i == sparseIndices ? sparseValues : defaultValue)
*^/n * // If sparseIndices is a vector, then for each i
*^/n * dense[sparseIndices[i]] = sparseValues[i]
*^/n * // If sparseIndices is an n by d matrix, then for each i in [0, n)
*^/n * dense[sparseIndices[i][0], ..., sparseIndices[i][d-1]] = sparseValues[i]
*^/n * All other values in dense are set to defaultValue.
*^/n * If sparseValues is a scalar, all sparse indices are set to this single value.
*^/n * If indices are repeated the final value is summed over all values for those indices.
*^/n * ````js
*^/n * const indices = tf.tensor1d([4, 5, 6, 1, 2, 3], 'int32');
*^/n * const values = tf.tensor1d([10, 11, 12, 13, 14, 15], 'float32');
*^/n * const shape = [8];
*^/n * tf.sparseToDense(indices, values, shape).print();
*^/n * ````
*^/n * @param sparseIndices A 0-D, 1-D, or 2-D Tensor of type int32.
*^/n * sparseIndices[i] contains the complete index where
=====
```

```

sparseValues[i] will be placed. @param sparseValues A 0-D or 1-D Tensor. Values corresponding to
each row of sparseIndices, or a scalar value to be used for all sparse indices. @param outputShape Shape of
the dense output tensor. the type is inferred. @param defaultValue Scalar. Value to set for indices not specified
in sparseIndices. Defaults to zero.
*/
@doc {heading: 'Operations', subheading: 'Normalization'}
function sparseToDense<R extends Rank>(
 sparseIndices: Tensor|TensorLike, sparseValues:
 Tensor|TensorLike,
 outputShape: ShapeMap[R], defaultValue: Scalar|ScalarLike = 0): Tensor<R> {
 const $sparseIndices =
 convertToTensor(sparseIndices, 'sparseIndices', 'sparseToDense', 'int32');
 const $sparseValues =
 convertToTensor(sparseValues, 'sparseValues', 'sparseToDense');
 const $defaultValue =
 convertToTensor(
 defaultValue, 'defaultValue', 'sparseToDense', $sparseValues.dtype);
 sparse_to_dense.validateInput(
 $sparseIndices, $sparseValues, outputShape, $defaultValue);
 const inputs:
 SparseToDenseInputs = {
 sparseIndices: $sparseIndices,
 sparseValues: $sparseValues,
 defaultValue:
 $defaultValue
 };
 const attrs: SparseToDenseAttrs = {outputShape};
 return ENGINE.runKernel(
 SparseToDense, inputs as {} as NamedTensorMap,
 attrs as {} as NamedAttrMap);
}
export const
sparseToDense = op({sparseToDense});
*/
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=====
*/
import {ENGINE} from './engine';
import {GatherNd, GatherNdInputs} from './kernel_names';
import
{Tensor} from './tensor';
import {NamedTensorMap} from './tensor_types';
import {convertToTensor} from
 './tensor_util_env';
import {TensorLike} from './types';
import {op} from './operation';
*/
Gather slices
from input tensor into a Tensor with shape specified by
`indices`.
`indices` is a K-dimensional integer
tensor, best thought of as
a (K-1)-dimensional tensor of indices into input, where each element defines a slice of input:
output[i_0, ..., i_{K-2}] = input[indices[i_0, ..., i_{K-2}]]
Whereas in `tf.gather`, `indices`
defines slices into the first dimension of input, in `tf.gatherND`, `indices` defines slices into the first N
dimensions of input, where N = indices.shape[-1].
The last dimension of indices can be at most the rank
of input: indices.shape[-1] <= input.rank
The last dimension of `indices` corresponds to elements
(if indices.shape[-1] == input.rank) or slices
(if indices.shape[-1] < input.rank) along dimension indices.shape[-1]
of input.
The output tensor has shape indices.shape[:-1] + input.shape[indices.shape[-1]:]
Note
that on CPU, if an out of bound index is found, an error is returned. On GPU, if an out of bound index is found,
a 0 is stored in the corresponding output value.
*/
const indices = tf.tensor2d([0, 1, 1, 0], [2,2], 'int32');
const input = tf.tensor2d([9, 10, 11, 12], [2, 2]);
tf.gatherND(input, indices).print() // [10, 11]
*/
@param x The tensor from which to gather values.
@param indices Index tensor, must be of type int32.
@doc {heading: 'Operations', subheading: 'Slicing and
Joining'}
function gatherND_(x: Tensor|TensorLike, indices: Tensor|TensorLike): Tensor {
 const $indices =
 convertToTensor(indices, 'indices', 'gatherND', 'int32');
 const $x = convertToTensor(x, 'x', 'gatherND');
 const inputs: GatherNdInputs = {
 params: $x,
 indices: $indices
 };
 return ENGINE.runKernel(GatherNd, inputs as {} as
 NamedTensorMap);
}
export const gatherND = op({gatherND});
*/
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```
=====\n*\n\nimport {Tensor} from './tensor';\nimport * as util from './util';\n\n/**\n * Normalize noise shape based on\n * provided tensor and noise shape.\n * @param x Tensor.\n * @param noiseShape The shape for the randomly\n * generated keep/drop flags, as\n * an array of numbers. Optional.\n * @returns Normalized noise shape.\n */\nexport function getNoiseShape(x: Tensor, noiseShape?: number[]): number[] {\n if (noiseShape == null) {\n return x.shape.slice();\n }\n if (util.arraysEqual(x.shape, noiseShape))\n {\n return noiseShape;\n }\n if (x.shape.length === noiseShape.length) {\n const newDimension: number[] =\n [];\n for (let i = 0; i < x.shape.length; i++) {\n if (noiseShape[i] == null && x.shape[i] != null) {\n newDimension.push(x.shape[i]);\n } else {\n newDimension.push(noiseShape[i]);\n }\n }\n return\n newDimension;\n }\n return noiseShape;\n}\n\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights\n * Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file\n * except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions\n * and\n * limitations under the License.\n */\n\n=====\n\nimport {Tensor} from './tensor';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike}\n * from './types';\nimport * as util from './util';\n\nimport {add} from './add';\nimport {div} from './div';\nimport\n * {getNoiseShape} from './dropout_util';\nimport {floor} from './floor';\nimport {mul} from './mul';\nimport {op}\n * from './operation';\nimport {randomUniform} from './random_uniform';\n\n/**\n * Computes dropout.\n * @param x\n * const x = tf.tensor1d([1, 2, 2, 1]);\n * const rate = 0.75;\n * const output = tf.dropout(x, rate);\n * output.print();\n * ```\n * @param x A floating point Tensor or TensorLike.\n * @param rate A float in the range [0, 1). The\n * probability that each element\n * of x is discarded.\n * @param noiseShape An array of numbers of type int32,\n * representing the\n * shape for randomly generated keep/drop flags. If the\n * noiseShape has null\n * value, it will be automatically replaced with the x's relative dimension\n * size. Optional.\n * @param seed Used to create random seeds. Optional.\n * @returns A Tensor of the same shape of x.\n */\n * @doc\n * {heading: 'Operations', subheading: 'Dropout'}\n */\nfunction dropout_(\n x: Tensor|TensorLike, rate: number,\n noiseShape?: number[],\n seed?: number|string): Tensor {\n const $x = convertToTensor(x, 'x', 'dropout');\n util.assert(\n $x.dtype === 'float32',\n () => `x has to be a floating point tensor since it's going to be`\n +`\n `scaled, but got a ${$x.dtype} tensor instead.`);\n util.assert(\n rate >= 0 && rate < 1,\n () => `rate must be a\n float in the range [0, 1), but got ${rate}.`);\n if (rate === 0) {\n return x instanceof Tensor ? $x.clone() : $x;\n }\n const $noiseShape = getNoiseShape($x, noiseShape);\n const keepProb = 1 - rate;\n const multiplier = div(\n floor(add(randomUniform($noiseShape,\n 0, 1, 'float32', seed), keepProb)),\n keepProb);\n return mul($x, multiplier);\n}\n\nexport const dropout =\n * op({dropout_});\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the\n * Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the\n * License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n * on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n * implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n * License.\n */\n\n=====\n\nimport {Tensor1D} from './tensor';\nimport {tensor1d} from './tensor1d';\nexport function\n * enclosingPowerOfTwo(value: number) {\n // Return
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2**N for integer N such that 2**N >= value.\n return Math.floor(Math.pow(2, Math.ceil(Math.log(value) /
Math.log(2.0)));)\n}\n\nexport function cosineWindow(\n windowLength: number, a: number, b: number):
Tensor1D {\n const even = 1 - windowLength % 2;\n const newValues = new Float32Array(windowLength);\n for
(let i = 0; i < windowLength; ++i) {\n const cosArg = (2.0 * Math.PI * i) / (windowLength + even - 1);\n
newValues[i] = a - b * Math.cos(cosArg);\n }\n return tensor1d(newValues, 'float32');\n}\n\n"/**\n * @license\n *
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=====
*\n\nimport {Tensor} from './tensor';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike}
from './types';\nimport {assert, assertShapesMatch, getTypedArrayFromDType} from './util';\nimport {tensor}
from './tensor';\n\n/**\n * Returns whether the targets are in the top K predictions.\n * @param predictions
2-D or higher `tf.Tensor`
with last dimension being\n * at least `k`.\n * @param targets 1-D or higher `tf.Tensor`.\n * @param k Optional
Number of top elements to look at for computing precision,\n
* default to 1.\n * @doc {heading: 'Operations', subheading: 'Evaluation'}\n */\n\ninTopKAsync_<T extends Tensor, U extends Tensor>(\n predictions: T|TensorLike, targets: U|TensorLike, k = 1):
Promise<U> {\n const $predictions = convertToTensor(predictions, 'predictions', 'inTopK');\n const $targets =
convertToTensor(targets, 'targets', 'inTopK');\n assert(\n $predictions.rank > 1,\n () => 'inTopK() expects
the predictions to be of rank 2 or higher, ' +\n `but got ${$predictions.rank}`);\n assert(\n $predictions.rank
- 1 === $targets.rank,\n () => `predictions rank should be 1 larger than ` +\n `targets rank, but got
predictions rank ` +\n `${$predictions.rank} and targets rank ${$targets.rank}`);\n assertShapesMatch(\n
 $predictions.shape.slice(0, $predictions.shape.length - 1),\n $targets.shape,\n `predictions's shape should be
align with the targets' shape, ` +\n `except the
last dimension.`);\n const lastDim = $predictions.shape[$predictions.shape.length - 1];\n assert(\n k > 0 && k
<= lastDim,\n () => `k' passed to inTopK() must be > 0 && <= the predictions last ` +\n `dimension
(${lastDim}), but got ${k}`);\n const predictionsVals = await $predictions.data();\n const targetsVals = await
$targets.data();\n // Reshape predictionsVals into a 2d tensor [batch, lastDim]\n // and look up topK along
lastDim.\n const [batch, size] = [predictionsVals.length / lastDim, lastDim];\n const precision =
getTypedArrayFromDType('bool', batch);\n for (let b = 0; b < batch; b++) {\n const offset = b * size;\n const
vals = predictionsVals.subarray(offset, offset + size);\n const valAndInd: Array<{value: number, index: number}>
= [];\n for (let i = 0; i < vals.length; i++) {\n valAndInd.push({value: vals[i], index: i});\n }\n valAndInd.sort((a, b) => b.value - a.value);\n precision[b] = 0;\n for (let i = 0;
i < k; i++) {\n if (valAndInd[i].index === targetsVals[b]) {\n precision[b] = 1;\n break;\n }\n }\n }\n if (predictions !== $predictions) {\n $predictions.dispose();\n }\n if (targets !== $targets) {\n
 $targets.dispose();\n }\n // Output precision has the same shape as targets.\n return tensor(precision,
$targets.shape, 'bool') as U;\n}\n\nexport const inTopKAsync = inTopKAsync_;\n\n"/**\n * @license\n *
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```
=====\n\n*\nimport {ENGINE} from './engine';\nimport {Conv2DBackpropFilter, Conv2DBackpropFilterAttrs,\nConv2DBackpropFilterInputs} from './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor3D, Tensor4D} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport * as util from './util';\nimport * as conv_util from './conv_util';\nimport {op} from './operation';\nimport {reshape} from './reshape';\n\n\n**\n * Computes the derivative of the filter of a 2D convolution.\n *\n * @param x The input tensor,\n of rank 4 or rank 3 of shape\n * [batch, height, width, inChannels]. If rank 3, batch of 1 is assumed.\n * @param dy The dy image, of rank 4 or rank 3, of shape\n * [batch, height, width, outDepth]. If rank 3, batch of 1 is\n assumed.\n * @param filterShape The shape of the filter, length 4,\n * [filterHeight, filterWidth, inDepth, outDepth].\n * @param strides The strides of the convolution:\n [strideHeight,\n * strideWidth].\n * @param pad A string from: 'same', 'valid'. The type of padding algorithm\n * used in the forward prop of the op.\n * @param dataFormat: An optional string from: \"NHWC\", \"NCHW\".\n Defaults to\n * \"NHWC\". Specify the data format of the input and output data. With the\n * default format\n \"NHWC\", the data is stored in the order of: [batch,\n * height, width, channels].\n * @param\n dimRoundingMode A string from: 'ceil', 'round', 'floor'. If none is\n * provided, it will default to truncate.\n\n*\nfunction conv2DBackpropFilter_<T extends Tensor3D|Tensor4D>(\n x: T, dy: T, filterShape: [number,\n number, number, number],\n strides: [number, number]|number,\n pad:\n 'valid'|'same'|number|conv_util.ExplicitPadding,\n dataFormat: 'NHWC'|'NCHW' = 'NHWC',\n dimRoundingMode?: 'floor'|'round'|'ceil'): Tensor4D {\n let x4D =\n x as Tensor4D;\n if (x.rank === 3) {\n x4D = reshape(x, [1, x.shape[0], x.shape[1], x.shape[2]]);\n }\n let dy4D =\n dy as Tensor4D;\n if (dy4D.rank === 3) {\n dy4D = reshape(dy, [1, dy.shape[0], dy.shape[1], dy.shape[2]]);\n }\n util.assert(\n x4D.rank === 4,\n () => `Error in conv2dDerFilter: input must be rank 4, but got shape ` +\n `${x4D.shape}.`);\n util.assert(\n dy4D.rank === 4,\n () => `Error in conv2dDerFilter: dy must be rank\n 4, but got shape ` +\n `${dy4D.shape}.`);\n util.assert(\n filterShape.length === 4,\n () => `Error in\n conv2dDerFilter: filterShape must be length 4, but got ` +\n `${filterShape}.`);\n const inDepth = dataFormat\n === 'NHWC' ? x4D.shape[3] : x4D.shape[1];\n const outDepth = dataFormat === 'NHWC' ? dy4D.shape[3] :\n dy4D.shape[1];\n util.assert(\n inDepth === filterShape[2],\n () => `Error in conv2dDerFilter: depth of input\n ${inDepth}) must ` +\n `match input depth in\n filter (${filterShape[2]}).`);\n util.assert(\n outDepth === filterShape[3],\n () => `Error in conv2dDerFilter:\n depth of dy (${outDepth}) must ` +\n `match output depth for filter (${filterShape[3]}).`);\n if\n (dimRoundingMode != null) {\n util.assert(\n util.isInt(pad as number),\n () => `Error in conv2dDerFilter:\n pad must be an integer when using, ` +\n `dimRoundingMode ${dimRoundingMode} but got pad\n ${pad}.`);\n }\n\n const inputs: Conv2DBackpropFilterInputs = {x: x4D, dy: dy4D};\n const attrs:\n Conv2DBackpropFilterAttrs = {\n strides, pad, dataFormat, dimRoundingMode, filterShape};\n\n //\n tslint:disable-next-line: no-unnecessary-type-assertion\n return ENGINE.runKernel(\n Conv2DBackpropFilter, inputs as {} as NamedTensorMap,\n attrs as {} as NamedAttrMap) as\n Tensor4D;\n}\n\nexport const conv2DBackpropFilter = op({conv2DBackpropFilter_});\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n *\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in\n compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n governing permissions and\n * limitations under the License.\n *\n\n=====\n\n*\nimport {Tensor} from './tensor';\nimport * as broadcast_util from './broadcast_util';\nimport {elu} from './elu';\nimport {Activation} from './fused_types';\nimport {leakyRelu} from './leaky_relu';\nimport {mul} from
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./mul';\nimport {prelu} from './prelu';\nimport {relu} from './relu';\nimport {relu6} from './relu6';\nimport {reshape}
from './reshape';\nimport {step} from './step';\nimport {sum} from './sum';\n\n// Returns gradient for fused
activation.\nexport function getFusedDyActivation(\n dy: Tensor, y: Tensor, activation: Activation): Tensor {\n if
(activation == null || activation === 'linear') {\n return dy;\n }\n if (activation === 'relu') {\n return mul(dy,
step(y));\n }\n throw new Error(\n `Cannot compute gradient for fused activation ${activation}.`);\n}\n\n//
Returns gradient for fused bias.\nexport function getFusedBiasGradient(\n bias: Tensor, dyActivation: Tensor):
Tensor {\n let res = dyActivation;\n const reduceAxes =\n broadcast_util.getReductionAxes(bias.shape,
dyActivation.shape);\n if (reduceAxes.length > 0) {\n res = sum(res, reduceAxes);\n }\n return reshape(res,
bias.shape);\n}\n\nexport function applyActivation(\n x: Tensor, activation: Activation, preluActivationWeights?:
Tensor,\n leakyreluAlpha?: number): Tensor {\n if (activation === 'linear')
{\n return x;\n } else if (activation === 'relu') {\n return relu(x);\n } else if (activation === 'elu') {\n return
elu(x);\n } else if (activation === 'relu6') {\n return relu6(x);\n } else if (activation === 'prelu') {\n return
prelu(x, preluActivationWeights);\n } else if (activation === 'leakyrelu') {\n return leakyRelu(x,
leakyreluAlpha);\n }\n throw new Error(`Unknown fused activation ${activation}.`);\n}\n\n// Whether we should
call fused ops.\nexport const shouldFuse = (gradientDepth: number, activation: Activation) => {\n const
gradientMode = gradientDepth > 0;\n return !gradientMode || activation === 'linear';\n};\n\n", "/*\n * @license\n *
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=====\n
*\n\nimport {ENGINE} from '../engine';\nimport {customGrad} from '../gradients';\nimport {FusedConv2D,
FusedConv2DAttrs, FusedConv2DInputs} from '../kernel_names';\nimport {NamedAttrMap} from
'../kernel_registry';\nimport {Tensor, Tensor3D, Tensor4D} from '../tensor';\nimport {GradSaveFunc,
NamedTensorMap} from '../tensor_types';\nimport {makeTypesMatch} from '../tensor_util';\nimport
{convertToTensor} from '../tensor_util_env';\nimport {TensorLike} from '../types';\nimport * as util from
'../util';\nimport {add} from './add';\nimport * as broadcast_util from './broadcast_util';\nimport
{conv2d as unfusedConv2d} from './conv2d';\nimport {conv2DBackpropFilter} from
'./conv2d_backprop_filter';\nimport {conv2DBackpropInput} from './conv2d_backprop_input';\nimport * as
conv_util from './conv_util';\nimport {Activation} from './fused_types';\nimport {applyActivation,
getFusedBiasGradient, getFusedDyActivation, shouldFuse} from './fused_util';\nimport {op} from
'./operation';\nimport {reshape} from './reshape';\n\n/**\n * Computes a 2D convolution over the input x, optionally
fused with adding a\n * bias and applying an activation.\n * \n * const inputDepth = 2;\n * const inShape =
[2, 2, 2, inputDepth];\n * const outputDepth = 2;\n * const fSize = 1;\n * const pad = 0;\n * const strides = 1;\n * \n *
const x = tf.tensor4d([1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15,\n * 16], inShape);\n * const w = tf.tensor4d([-1,
1, -2, 0.5], [fSize, fSize, inputDepth,\n * outputDepth]);\n * \n * tf.fused.conv2d({ x, filter: w, strides, pad,
dataFormat:
'NHWC',\n * dilations: [1, 1], bias: tf.scalar(5), activation: 'relu' }).print();\n * \n * @param obj An object
with the following properties:\n * @param x The input tensor, of rank 4 or rank 3, of shape\n *
`[batch, height, width, inChannels]`. If rank 3, batch of 1 is\n * assumed.\n * @param filter The filter, rank 4, of shape\n *
`[filterHeight, filterWidth, inDepth, outDepth]`.\n * @param strides The strides of the convolution: `[strideHeight,\n *
strideWidth]`.\n * @param pad The type of padding algorithm.\n * - `same` and stride 1: output will be of same
size as input,\n * regardless of filter size.\n * - `valid` output will be smaller than input if filter is larger\n *
than 1x1.\n * - For more info, see this guide:\n *
[https://www.tensorflow.org/api_guides/python/nn#Convolution](\n *
https://www.tensorflow.org/api_guides/python/nn#Convolution)\n * @param dataFormat An optional string from:

```

`"NHWC"`, `"NCHW"`. Defaults to `"NHWC"`.

Specify the data format of the input and output data. With the default format `"NHWC"`, the data is stored in the order of: [batch, height, width, channels]. Only `"NHWC"` is currently supported. @param dilations The dilation rates: `[dilationHeight, dilationWidth]` in which we sample input values across the height and width dimensions in atrous convolution. Defaults to `[1, 1]`. If `dilations` is a single number, then `dilationHeight == dilationWidth`. If it is greater than 1, then all values of `strides` must be 1. @param dimRoundingMode A string from: 'ceil', 'round', 'floor'. If none is provided, it will default to truncate. @param bias Tensor to be added to the result. @param activation Name of activation kernel (defaults to 'linear') to be applied after biasAdd. @param preluActivationWeights Tensor of prelu weights to be applied as part of a 'prelu' activation, typically

the same shape as `x`. @param leakyreluAlpha Optional. Alpha to be applied as part of a 'leakyrelu' activation. @function fusedConv2d<T extends Tensor3D|Tensor4D>({x: TensorLike, filter: Tensor4D|TensorLike, strides: [number, number]|number, pad: 'valid'|'same'|number|conv\_util.ExplicitPadding, dataFormat: 'NHWC'|'NCHW', dilations: [number, number]|number, dimRoundingMode?: 'floor'|'round'|'ceil', bias?: Tensor|TensorLike, activation?: Activation, preluActivationWeights?: Tensor, leakyreluAlpha?: number})  
T {activation = activation || 'linear'; if (shouldFuse(ENGINE.state.gradientDepth, activation) === false) {let result = unfusedConv2d(x, filter, strides, pad, dataFormat, dilations, dimRoundingMode); if (bias != null) {result = add(result, bias); } return applyActivation(result, activation, preluActivationWeights, leakyreluAlpha) as T; } const \$x = convertToTensor(x, 'x', 'conv2d'); const \$filter = convertToTensor(filter, 'filter', 'conv2d'); let x4D = \$x as Tensor4D; let reshapedTo4D = false; if (\$x.rank === 3) {reshapedTo4D = true; x4D = reshape(\$x, [1, \$x.shape[0], \$x.shape[1], \$x.shape[2]]); } util.assert(x4D.rank === 4, () => `Error in fused conv2d: input must be rank 4, but got rank ` + x4D.rank); util.assert(\$filter.rank === 4, () => `Error in fused conv2d: filter must be rank 4, but got rank ` + \$filter.rank); if (dimRoundingMode != null) {util.assert(util.isInt(pad as number), () => `Error in fused conv2d: pad must be an integer when using, ` + dimRoundingMode + ` but got pad \${pad}`); } util.assert(x4D.shape[3] === \$filter.shape[2], () => `Error in conv2d: depth of input (\${x4D.shape[3]}) must match ` + `input depth for filter \${\$filter.shape[2]}`); util.assert(conv\_util.eitherStridesOrDilationsAreOne(strides, dilations), () => `Error in conv2D: Either strides or dilations must be 1.` + `Got strides \${strides} and dilations \${dilations}`); util.assert(dataFormat === 'NHWC', () => `Error in conv2d: got dataFormat of \${dataFormat} but only NHWC is currently supported.`); const convInfo = conv\_util.computeConv2DInfo(x4D.shape, \$filter.shape, strides, dilations, pad, dimRoundingMode); let \$bias: Tensor; if (bias != null) {\$bias = convertToTensor(bias, 'bias', 'fused conv2d'); [\$bias] = makeTypesMatch(\$bias, \$x); } broadcast\_util.assertAndGetBroadcastShape(convInfo.outShape, \$bias.shape); let \$preluActivationWeights: Tensor; if (preluActivationWeights != null) {\$preluActivationWeights = convertToTensor(preluActivationWeights, 'prelu weights', 'fused conv2d'); } const grad = (dy: Tensor4D, saved: Tensor[]) => {const [\$filter, x4D, y, \$bias] = saved as [Tensor4D, Tensor4D, Tensor4D, Tensor]; const dyActivation = getFusedDyActivation(dy, y, activation) as Tensor4D; util.assert(conv\_util.tupleValuesAreOne(dilations), () => `Error in gradient of fused conv2D: ` + `dilation rates greater than 1 ` + `are not yet supported in gradients. Got dilations \${dilations}`); const xDer = conv2DBackpropInput(x4D.shape, dyActivation, \$filter, strides, pad); const filterDer = conv2DBackpropFilter(x4D, dyActivation, \$filter.shape, strides, pad); const der: Tensor[] = [xDer, filterDer]; if (\$bias != null) {const biasDer = getFusedBiasGradient(\$bias, dyActivation); der.push(biasDer); }



```

 }
 return der;
 };
 const inputs: FusedConv2DInputs = {
 x: x4D,
 filter: $filter,
 bias: $bias,
 preluActivationWeights: $preluActivationWeights
 };
 const attrs: FusedConv2DAttrs = {
 strides,
 pad,
 dataFormat,
 dilations,
 dimRoundingMode,
 activation,
 leakyreluAlpha
 };
 // Depending on the the params passed in we will have different number of
 // inputs and thus a different number of elements in the gradient.
 if (bias == null) {
 const customOp = customGrad((x4D: Tensor4D, filter: Tensor4D,
 save: GradSaveFunc) => {
 let res: Tensor4D|Tensor3D = ENGINE.runKernel(
 FusedConv2D, inputs as { } as NamedTensorMap,
 attrs as { } as NamedAttrMap);
 save([filter, x4D, res]);
 if (reshapedTo4D) {
 // tslint:disable-next-line: no-unnecessary-type-assertion
 res = reshape(res, [res.shape[1], res.shape[2], res.shape[3]]) as
 Tensor3D;
 }
 return {value: res, gradFunc: grad};
 });
 return customOp(x4D, $filter) as T;
 } else {
 const customOpWithBias = customGrad((x4D: Tensor4D, filter: Tensor4D,
 bias: Tensor, save: GradSaveFunc) => {
 let res: Tensor4D|Tensor3D = ENGINE.runKernel(
 FusedConv2D, inputs as { } as NamedTensorMap,
 attrs as { } as NamedAttrMap);
 save([filter, x4D, res, bias]);
 if (reshapedTo4D) {
 // tslint:disable-next-line: no-unnecessary-type-assertion
 res = reshape(res, [res.shape[1], res.shape[2], res.shape[3]]) as
 Tensor3D;
 }
 return {value: res, gradFunc: grad};
 });
 return customOpWithBias(x4D, $filter, $bias) as T;
 }
}
export const conv2d = op({fusedConv2d_});
"/**
 * @license
 * Copyright 2020 Google LLC. All Rights Reserved.
 * Licensed under the Apache License, Version 2.0 (the "License");
 * you may not use this file except in compliance with the License.
 * You may obtain a copy of the License at
 * http://www.apache.org/licenses/LICENSE-2.0
 * Unless required by applicable law or agreed to in writing, software
 * distributed under the License is distributed on an "AS IS" BASIS,
 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
 * See the License for the specific language governing permissions and
 * limitations under the License.
 */
=====
*/
import {ENGINE} from '../engine';
import {DepthwiseConv2dNativeBackpropFilter,
DepthwiseConv2dNativeBackpropFilterAttrs,
DepthwiseConv2dNativeBackpropFilterInputs} from
 '../kernel_names';
import {NamedAttrMap} from '../kernel_registry';
import {Tensor3D, Tensor4D} from
 '../tensor';
import {NamedTensorMap} from '../tensor_types';
import {op} from '../operation';
import {reshape} from
 '../reshape';
function depthwiseConv2dNativeBackpropFilter_<T extends Tensor3D|Tensor4D>(
 x: T, dy: T, filterShape: [number, number, number, number],
 strides: [number, number]number, pad: 'valid'|'same'|number,
 dilations: [number, number]number = [1, 1],
 dimRoundingMode?: 'floor'|'round'|'ceil'): Tensor4D {
 let x4D = x as Tensor4D;
 if (x4D.rank === 3) {
 x4D = reshape(x, [1, x4D.shape[0], x4D.shape[1], x4D.shape[2]]);
 }
 let dy4D = dy as Tensor4D;
 if (dy4D.rank === 3) {
 dy4D = reshape(dy, [1, dy4D.shape[0], dy4D.shape[1],
 dy4D.shape[2]]);
 }
 const inputs: DepthwiseConv2dNativeBackpropFilterInputs = {
 x: x4D, dy: dy4D
 };
 const attrs: DepthwiseConv2dNativeBackpropFilterAttrs = {
 strides, pad, dimRoundingMode, dilations,
 filterShape
 };
 // tslint:disable-next-line: no-unnecessary-type-assertion
 return ENGINE.runKernel(
 DepthwiseConv2dNativeBackpropFilter,
 inputs as { } as NamedTensorMap, attrs as { } as
 NamedAttrMap) as Tensor4D;
}
export const depthwiseConv2dNativeBackpropFilter =
op({depthwiseConv2dNativeBackpropFilter_});
"/**
 * @license
 * Copyright 2020 Google LLC. All Rights Reserved.
 * Licensed under the Apache License, Version 2.0 (the "License");
 * you may not use this file except in compliance with the License.
 * You may obtain a copy of the License at
 * http://www.apache.org/licenses/LICENSE-2.0
 * Unless required by applicable law or agreed to in writing, software
 * distributed under the License is distributed on an "AS IS" BASIS,
 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
 * See the License for the specific language governing permissions and
 * limitations under the License.
 */
=====

```

```

*\nimport {ENGINE} from './engine';\nimport
{DepthwiseConv2dNativeBackpropInput, DepthwiseConv2dNativeBackpropInputAttrs,
DepthwiseConv2dNativeBackpropInputInputs} from './kernel_names';\nimport {NamedAttrMap} from
 './kernel_registry';\nimport {Tensor3D, Tensor4D} from './tensor';\nimport {NamedTensorMap} from
 './tensor_types';\nimport {op} from './operation';\nimport {reshape} from './reshape';\n\nfunction
depthwiseConv2dNativeBackpropInput_<T extends Tensor3D|Tensor4D>(\n xShape: [number, number, number,
number], dy: T, filter: Tensor4D,\n strides: [number, number]|number, pad: 'valid'|'same'|number,\n dilations:
[number, number]|number = [1, 1],\n dimRoundingMode?: 'floor'|'round'|'ceil'): T {\n let dy4D = dy as
Tensor4D;\n let reshapedTo4D = false;\n if (dy.rank === 3) {\n reshapedTo4D = true;\n dy4D = reshape(dy, [1,
dy.shape[0], dy.shape[1], dy.shape[2]]);\n }\n const inputs: DepthwiseConv2dNativeBackpropInputInputs = {dy:
dy4D, filter};\n const attrs: DepthwiseConv2dNativeBackpropInputAttrs
= {\n strides, pad, dimRoundingMode, dilations, inputShape: xShape};\n const res =\n // tslint:disable-next-
line: no-unnecessary-type-assertion\n ENGINE.runKernel(\n DepthwiseConv2dNativeBackpropInput,
inputs as {} as NamedTensorMap,\n attrs as {} as NamedAttrMap) as T;\n if (reshapedTo4D) {\n return
reshape(res, [res.shape[1], res.shape[2], res.shape[3]]) as T;\n }\n return res;\n}\n\nexport const
depthwiseConv2dNativeBackpropInput =\n op({depthwiseConv2dNativeBackpropInput_});\n"/**\n *
@license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n
 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License
for the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {ENGINE} from './engine';\nimport {customGrad} from './gradients';\nimport
{FusedDepthwiseConv2D, FusedDepthwiseConv2DAttrs, FusedDepthwiseConv2DInputs} from
 './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor, Tensor3D, Tensor4D}
from './tensor';\nimport {GradSaveFunc, NamedTensorMap} from './tensor_types';\nimport
{makeTypesMatch} from './tensor_util';\nimport {convertToTensor} from './tensor_util_env';\nimport
{TensorLike} from './types';\nimport * as util from './util';\nimport {add} from './add';\nimport * as
broadcast_util from './broadcast_util';\nimport * as conv_util from './conv_util';\nimport {depthwiseConv2d as
unfusedDepthwiseConv2d}
from './depthwise_conv2d';\nimport {depthwiseConv2dNativeBackpropFilter} from
 './depthwise_conv2d_native_backprop_filter';\nimport {depthwiseConv2dNativeBackpropInput} from
 './depthwise_conv2d_native_backprop_input';\nimport {Activation} from './fused_types';\nimport
{applyActivation, getFusedBiasGradient, getFusedDyActivation, shouldFuse} from './fused_util';\nimport {op}
from './operation';\nimport {reshape} from './reshape';\n\n/**\n * Computes depthwise 2D convolution, optionally
fused with adding a\n * bias and applying an activation.\n * Given a 4D `input` array and a `filter` array of
shape\n * `[filterHeight, filterWidth, inChannels, channelMultiplier]` containing\n * `inChannels` convolutional
filters of depth 1, this op applies a\n * different filter to each input channel (expanding from 1 channel to\n *
`channelMultiplier` channels for each), then concatenates the results\n * together. The output has `inChannels` *
channelMultiplier` channels.\n *\n * See\n * [https://www.tensorflow.org/api_docs/python/tf/nn/depthwise_conv2d](\n *
https://www.tensorflow.org/api_docs/python/tf/nn/depthwise_conv2d)\n * for more details.\n *\n * @param obj An
object with the following properties:\n * @param x The input tensor, of rank 4 or rank 3, of shape\n * `[batch,
height, width, inChannels]`. If rank 3, batch of 1 is\n * assumed.\n * @param filter The filter tensor, rank 4, of
shape\n * `[filterHeight, filterWidth, inChannels, channelMultiplier]`. \n * @param strides The strides of the
convolution: `[strideHeight,\n * strideWidth]`. If strides is a single number, then `strideHeight ==\n *
strideWidth`. \n * @param pad The type of padding algorithm.\n * - `same` and stride 1: output will be of same size

```

as input, regardless of filter size. - `valid`: output will be smaller than input if filter is larger than 1x1. - For more info, see this guide: [https://www.tensorflow.org/api\_guides/python/nn#Convolution](https://www.tensorflow.org/api\_guides/python/nn#Convolution)

`@param dilations` The dilation rates: `[dilationHeight, dilationWidth]` in which we sample input values across the height and width dimensions in atrous convolution. Defaults to `[1, 1]`. If `rate` is a single number, then dilationHeight == dilationWidth` . If it is greater than 1, then all values of strides` must be 1.`

`@param dataType` An optional string from: `"NHWC", "NCHW"`. Defaults to `"NHWC"`. Specify the data format of the input and output data. With the default format `"NHWC"`, the data is stored in the order of: `[batch, height, width, channels]`. Only `"NHWC"` is currently supported.

`@param dimRoundingMode` A string from: `'ceil', 'round', 'floor'`. If none is provided, it will default to `truncate`.

`@param bias` Tensor to be added to the result.

`@param activation` Name of activation kernel (defaults to `'linear'`).

`@param preluActivationWeights` Tensor of prelu weights to be applied as part of a `'prelu'` activation, typically the same shape as `x`.`

`@param leakyreluAlpha` Optional. Alpha to be applied as part of a `'leakyrelu'` activation.

```

function fusedDepthwiseConv2d<T extends Tensor3D|Tensor4D>({
 x: Tensor4D|TensorLike,
 filter: Tensor4D|TensorLike,
 strides: [number, number],
 pad: 'valid'|'same'|number,
 dataType?: 'NHWC'|'NCHW',
 dilations?: [number, number],
 dimRoundingMode?: 'floor'|'round'|'ceil',
 bias?: Tensor|TensorLike,
 activation?: Activation,
 preluActivationWeights?: Tensor,
 leakyreluAlpha?: number
}): T {
 if (shouldFuse(ENGINE.state.gradientDepth, activation) === false) {
 let result = unfusedDepthwiseConv2d(
 x,
 filter,
 strides,
 pad,
 dataType,
 dilations,
 dimRoundingMode);
 if (bias != null) {
 result = add(result, bias);
 }
 return applyActivation(
 result,
 activation,
 preluActivationWeights,
 leakyreluAlpha) as T;
 }
 const $x = convertToTensor(x, 'x', 'depthwiseConv2d');
 const $filter = convertToTensor(filter, 'filter', 'depthwiseConv2d');
 let x4D = $x as Tensor4D;
 let reshapedTo4D = false;
 if ($x.rank === 3) {
 reshapedTo4D = true;
 x4D = reshape($x, [1, $x.shape[0], $x.shape[1], $x.shape[2]]);
 }
 util.assert(x4D.rank === 4, () => `Error in fused depthwiseConv2d: input must be rank 4, but got ` + rank($x4D.rank).`);
 util.assert($filter.rank === 4, () => `Error in fused depthwiseConv2d: filter must be rank 4, ` + `but got rank ${$filter.rank}.`);
 util.assert(x4D.shape[3] === $filter.shape[2], () => `Error in fused depthwiseConv2d: number of input channels ` + `(${x4D.shape[3]}) must match the inChannels dimension in ` + `filter ${$filter.shape[2]}.`);
 if (dilations == null) {
 dilations = [1, 1];
 }
 util.assert(conv_util.eitherStridesOrDilationsAreOne(strides, dilations), () => `Error in fused depthwiseConv2d: Either strides or dilations must ` + `be 1. Got strides ${strides} and dilations ${dilations}`);
 if (dimRoundingMode != null) {
 util.assert(util.isInt(pad as number), () => `Error in fused depthwiseConv2d: pad must be an integer when ` + `using dimRoundingMode ${dimRoundingMode} but got pad ${pad}.`);
 }
 const convInfo = conv_util.computeConv2DInfo(x4D.shape, $filter.shape, strides, dilations, pad, dimRoundingMode, true /* depthwise */);
 let $bias: Tensor;
 if (bias != null) {
 $bias = convertToTensor(bias, 'bias', 'fused conv2d');
 [$bias] = makeTypesMatch($bias, $x);
 broadcast_util.assertAndGetBroadcastShape(convInfo.outShape, $bias.shape);
 }
 let $preluActivationWeights: Tensor;
 if (preluActivationWeights != null) {
 $preluActivationWeights = convertToTensor(
 preluActivationWeights,
 'prelu weights',
 'fused depthwiseConv2d');
 }
 const grad = (dy: Tensor4D, saved: Tensor[]) => {
 util.assert(conv_util.tupleValuesAreOne(dilations), () => `Error in gradient of fused depthwiseConv2d: dilation rates ` + `greater than 1 are not yet supported. Got dilations ` + `${dilations}`);
 const [$filter, x4D, y, bias] = saved;
 const dyActivation = getFusedDyActivation(dy, y, activation) as Tensor4D;
 const xDer = depthwiseConv2dNativeBackpropInput(
 (x4D as Tensor4D).shape,
 dyActivation,
 $filter as Tensor4D,
 strides,
 pad,
 dilations,
 dimRoundingMode);
 const filterDer = depthwiseConv2dNativeBackpropFilter(
 x4D as Tensor4D,

```

```

dyActivation, ($filter
 as Tensor4D).shape, strides,\n pad, dilations, dimRoundingMode);\n if (bias != null) {\n const biasDer =
getFusedBiasGradient($bias, dyActivation);\n return [xDer, filterDer, biasDer];\n }\n return [xDer,
filterDer];\n };\n\n const inputs: FusedDepthwiseConv2DInputs = {\n x: x4D,\n filter: $filter,\n bias: $bias,\n preluActivationWeights: $preluActivationWeights\n };\n const attrs: FusedDepthwiseConv2DAttrs = {\n
strides,\n pad,\n dataFormat,\n dilations,\n dimRoundingMode,\n activation,\n leakyreluAlpha\n };\n\n
// Depending on the the params passed in we will have different number of\n // inputs and thus a a different number
of elements in the gradient.\n if (bias == null) {\n const customOp =\n customGrad((x4D: Tensor4D, filter:
Tensor4D, save: GradSaveFunc) => {\n // tslint:disable-next-line: no-unnecessary-type-assertion\n let
res: Tensor4D|Tensor3D = ENGINE.runKernel(\n
 FusedDepthwiseConv2D, inputs as {} as NamedTensorMap,\n attrs as {} as NamedAttrMap);\n\n
save([filter, x4D, res]);\n\n if (reshapedTo4D) {\n // tslint:disable-next-line: no-unnecessary-type-
assertion\n res = reshape(res, [res.shape[1], res.shape[2], res.shape[3]]) as\n Tensor3D;\n }\n\n
return {value: res, gradFunc: grad};\n });\n return customOp(x4D, $filter) as T;\n } else {\n const
customOpWithBias = customGrad(\n (x4D: Tensor4D, filter: Tensor4D, bias: Tensor, save: GradSaveFunc) =>
{\n // tslint:disable-next-line: no-unnecessary-type-assertion\n let res: Tensor4D|Tensor3D =
ENGINE.runKernel(\n FusedDepthwiseConv2D, inputs as {} as NamedTensorMap,\n attrs as {} as
NamedAttrMap);\n\n save([filter, x4D, res, bias]);\n\n if (reshapedTo4D) {\n // tslint:disable-next-
line: no-unnecessary-type-assertion\n
 res = reshape(res, [res.shape[1], res.shape[2], res.shape[3]]) as\n Tensor3D;\n }\n\n
return {value: res, gradFunc: grad};\n });\n return customOpWithBias(x4D, $filter, $bias) as T;\n }\n
})\n\nexport const depthwiseConv2d = op({fusedDepthwiseConv2d});\n\n"/**\n * @license\n * Copyright 2019
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n */
\n\n
=====
\n
*/\n\nimport {ENGINE} from '../engine';\nimport {customGrad} from '../gradients';\nimport {_FusedMatMul,
_FusedMatMulAttrs, _FusedMatMulInputs} from '../kernel_names';\nimport {NamedAttrMap} from
'../kernel_registry';\nimport {Tensor, Tensor3D} from '../tensor';\nimport {GradSaveFunc, NamedTensorMap}
from '../tensor_types';\nimport {makeTypesMatch} from '../tensor_util';\nimport {convertToTensor} from
'../tensor_util_env';\nimport {TensorLike} from '../types';\nimport * as util from '../util';\n\nimport {add} from
'./add';\nimport * as broadcast_util from './broadcast_util';\nimport {Activation} from './fused_types';\nimport
{applyActivation, getFusedBiasGradient, getFusedDyActivation, shouldFuse} from './fused_util';\nimport {matMul
as unfusedMatMul} from './mat_mul';\nimport {op} from './operation';\nimport {reshape} from
'./reshape';\n\n/**\n * Computes the dot product of two matrices with optional activation and
bias.\n * \n * `a` const a = tf.tensor2d([-1, -2], [1, 2]);\n * const b = tf.tensor2d([1, 2, 3, 4], [2, 2]);\n * const
bias = tf.tensor2d([1, 2], [1, 2]);\n * \n * tf.fused.matMul({a, b, bias, activation: 'relu'}).print();\n * \n * \n *
\n * \n * @param obj An object with the following properties:\n * - `a` First matrix in dot product operation.\n * - `b` Second
matrix in dot product operation.\n * - `transposeA` If true, `a` is transposed before multiplication.\n * - `transposeB`
If true, `b` is transposed before multiplication.\n * - `bias` Matrix to be added to the result.\n * - `activation` Name
of activation kernel (defaults to `linear`).\n * - `preluActivationWeights` Tensor of prelu weights.\n * -
`leakyreluAlpha` Alpha of leakyrelu.\n */\n\nfunction fusedMatMul<T>(a: Tensor|TensorLike, b: Tensor|TensorLike,
transposeA = false, transposeB = false, bias: Tensor|TensorLike, activation = 'linear', preluActivationWeights: Tensor|TensorLike,
leakyreluAlpha: number): Tensor|TensorLike {\n return ENGINE.runKernel(\n FusedDepthwiseConv2D, {\n x: a,\n filter: b,\n bias: bias,\n activation: activation,\n preluActivationWeights: preluActivationWeights,\n leakyreluAlpha: leakyreluAlpha\n }, {\n dataFormat: 'channels_last'\n });\n}\n\nexport {fusedMatMul};

```

```

transposeB?: boolean,\n bias?: Tensor|TensorLike,\n activation?: Activation,\n preluActivationWeights?:
Tensor\n leakyreluAlpha?: number\n}): T {\n if (shouldFuse(ENGINE.state.gradientDepth, activation) === false)
{\n let result = unfusedMatMul(a, b, transposeA, transposeB);\n if (bias != null) {\n result = add(result,
bias);\n }\n return applyActivation(\n result, activation, preluActivationWeights, leakyreluAlpha
as\n T;\n)\n }\n let $a = convertToTensor(a, 'a', 'fused matMul');\n let $b = convertToTensor(b, 'b', 'fused
matMul');\n [$a, $b] = makeTypesMatch($a, $b);\n const innerShapeA =\n transposeA ? $a.shape[$a.rank
- 2] : $a.shape[$a.rank - 1];\n const innerShapeB =\n transposeB ? $b.shape[$b.rank - 1] : $b.shape[$b.rank -
2];\n const outerShapeA =\n transposeA ? $a.shape[$a.rank - 1] : $a.shape[$a.rank - 2];\n const
outerShapeB =\n transposeB ? $b.shape[$b.rank
- 2] : $b.shape[$b.rank - 1];\n const outerDimsA = $a.shape.slice(0, -2);\n const outerDimsB =
$b.shape.slice(0, -2);\n const batchDimA = util.sizeFromShape(outerDimsA);\n const batchDimB =
util.sizeFromShape(outerDimsB);\n util.assert(\n $a.rank >= 2 && $b.rank >= 2 && $a.rank === $b.rank,\n () => `Error in fused matMul: inputs must have the same rank of at ` +\n `least 2, got ranks ${$a.rank}
and ${$b.rank}.`);\n util.assert(\n util.arraysEqual(outerDimsA, outerDimsB),\n () => `Error in fused
matMul: outer dimensions (${outerDimsA}) and ` +\n `${outerDimsB}) of Tensors with shapes ${$a.shape}
and ` +\n `${$b.shape} must match.`);\n util.assert(\n innerShapeA === innerShapeB,\n () =>
`Error in fused matMul: inner shapes (${innerShapeA}) and ` +\n `${innerShapeB}) of Tensors with shapes
${$a.shape} and ` +\n `${$b.shape} and transposeA=${transposeA}` +\n
 ` and transposeB=${transposeB} must match.`);\n const outShape = $a.shape.slice(0, -
2).concat([outerShapeA, outerShapeB]);\n const a3D: Tensor3D = transposeA ?\n reshape($a, [batchDimA,
innerShapeA, outerShapeA]) : \n reshape($a, [batchDimA, outerShapeA, innerShapeA]);\n const b3D:
Tensor3D = transposeB ?\n reshape($b, [batchDimB, outerShapeB, innerShapeB]) : \n reshape($b,
[batchDimB, innerShapeB, outerShapeB]);\n let $bias: Tensor;\n if (bias != null) {\n $bias =
convertToTensor(bias, 'bias', 'fused matMul');\n [$bias] = makeTypesMatch($bias, $a);\n }\n broadcast_util.assertAndGetBroadcastShape(outShape, $bias.shape);\n }\n let $preluActivationWeights:
Tensor;\n if (preluActivationWeights != null) {\n $preluActivationWeights = convertToTensor(\n
preluActivationWeights, 'prelu weights', 'fused matMul');\n }\n const grad = (dy: Tensor3D, saved: Tensor[])
=> {\n const [a3D, b3D,\n y, $bias] = saved;\n // we reshape dy because the result of the forward is not\n // necessarily going to be a 3d
tensor due to a reshape done at the end of\n // the customOp.\n const dyActivation =\n getFusedDyActivation(reshape(dy, y.shape), y, activation);\n let aDer: Tensor;\n let bDer: Tensor;\n if
(!transposeA && !transposeB) {\n aDer = unfusedMatMul(dyActivation, b3D, false, true);\n bDer =
unfusedMatMul(a3D, dyActivation, true, false);\n } else if (!transposeA && transposeB) {\n aDer =
unfusedMatMul(dyActivation, b3D, false, false);\n bDer = unfusedMatMul(dyActivation, a3D, true, false);\n
 } else if (transposeA && !transposeB) {\n aDer = unfusedMatMul(b3D, dyActivation, false, true);\n bDer =
unfusedMatMul(a3D, dyActivation, false, false);\n } else {\n aDer = unfusedMatMul(b3D, dyActivation,
true, true);\n bDer = unfusedMatMul(dyActivation, a3D, true, true);\n }\n }\n if (bias != null) {\n const biasDer = getFusedBiasGradient($bias, dyActivation);\n return [aDer,
bDer, biasDer];\n } else {\n return [aDer, bDer];\n }\n };\n const inputs: _FusedMatMulInputs = {\n
a: a3D,\n b: b3D,\n bias: $bias,\n preluActivationWeights: $preluActivationWeights\n };\n const
attrs: _FusedMatMulAttrs =\n {transposeA, transposeB, activation, leakyreluAlpha};\n // Depending on the
the params passed in we will have different number of\n // inputs and thus a a different number of elements in the
gradient.\n if (bias == null) {\n const customOp =\n customGrad((a3D: Tensor3D, b3D: Tensor3D, save:
GradSaveFunc) => {\n const res =\n // tslint:disable-next-line: no-unnecessary-type-assertion\n
ENGINE.runKernel(\n _FusedMatMul, inputs as { } as NamedTensorMap,\n attrs as { }
as NamedAttrMap) as
T;\n save([a3D, b3D, res]);\n return { value: reshape(res, outShape), gradFunc: grad};\n });\n return customOp(a3D, b3D) as T;\n } else {\n const customOpWithBias = customGrad(\n (a3D:

```

```

Tensor3D, b3D: Tensor3D, $bias: Tensor, save: GradSaveFunc) => {\n const res =\n //
tslint:disable-next-line: no-unnecessary-type-assertion\n ENGINE.runKernel(\n
_FusedMatMul, inputs as { } as NamedTensorMap,\n attrs as { } as NamedAttrMap) as T;\n\n
save([a3D, b3D, res, $bias]);\n\n return {value: reshape(res, outShape), gradFunc: grad};\n });\n\n
return customOpWithBias(a3D, b3D, $bias) as T;\n }\n }\n\n export const matMul =
op({fusedMatMul_});\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance
with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-
2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is
distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *
=====
*\n\nimport {conv2d} from './fused/conv2d';\nimport {depthwiseConv2d} from
 './fused/depthwise_conv2d';\nimport {matMul} from './fused/mat_mul';\nimport {Activation} from
 './fused_types';\n\nexport {Activation, conv2d, depthwiseConv2d, matMul};\n", "/*\n * @license\n * Copyright
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BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {Tensor1D} from '../tensor';\nimport {op} from './operation';\nimport {cosineWindow} from
 './signal_ops_util';\n\n/**\n * Generate a hamming window.\n *\n * See:
https://en.wikipedia.org/wiki/Window_function#Hann_and_Hamming_windows\n *\n * ``js\n *
tf.signal.hammingWindow(10).print();\n * ``\n * @param The length of window\n *\n * @doc {heading:
'Operations', subheading: 'Signal', namespace: 'signal'}\n *\nfunction hammingWindow_(windowLength: number):
Tensor1D {\n return
 cosineWindow(windowLength, 0.54, 0.46);\n}\n\nexport const hammingWindow =
op({hammingWindow_});\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n *
Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {Tensor1D} from '../tensor';\nimport {op} from './operation';\nimport {cosineWindow} from
 './signal_ops_util';\n\n/**\n * Generate a Hann window.\n *\n * See:
https://en.wikipedia.org/wiki/Window_function#Hann_and_Hamming_windows\n
*\n * ``js\n *
tf.signal.hannWindow(10).print();\n * ``\n * @param The length of window\n *\n * @doc {heading:
'Operations', subheading: 'Signal', namespace: 'signal'}\n *\nfunction hannWindow_(windowLength: number):
Tensor1D {\n return cosineWindow(windowLength, 0.5, 0.5);\n}\n\nexport const hannWindow =
op({hannWindow_});\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with
the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
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```

on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\n\nimport {Tensor, Tensor1D} from '../tensor';\nimport {concat} from '../concat';\nimport {fill} from '../fill';\nimport {op} from '../operation';\nimport {reshape} from '../reshape';\nimport {slice} from '../slice';\nimport {tensor2d} from '../tensor2d';\n\n/**\n * Expands input into frames of frameLength.\n * Slides a window size with frameStep.\n *\n * @param signal The input tensor to be expanded\n * @param frameLength Length of each frame\n * @param frameStep The frame hop size in samples.\n * @param padEnd Whether to pad the end of signal with padValue.\n * @param padValue An number to use where the input signal does\n * not exist when padEnd is True.\n *\n * @doc {heading: 'Operations', subheading: 'Signal', namespace: 'signal'}\n */\nfunction frame_(\n signal: Tensor1D, frameLength:\n number, frameStep: number, padEnd = false,\n padValue = 0): Tensor {\n let start = 0;\n const output: Tensor[] = [];\n while (start + frameLength <= signal.size) {\n output.push(slice(signal, start, frameLength));\n start += frameStep;\n }\n if (padEnd) {\n while (start < signal.size) {\n const padLen = (start + frameLength) - signal.size;\n const pad = concat([\n slice(signal, start, frameLength - padLen),\n fill([padLen], padValue)\n]);\n output.push(pad);\n start += frameStep;\n }\n }\n if (output.length === 0) {\n return tensor2d([], [0, frameLength]);\n }\n return reshape(concat(output), [output.length, frameLength]);\n}\n\nexport const frame = op({frame_});\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n
```

```
=====\n*\n\nimport {Tensor, Tensor1D} from '../tensor';\nimport {concat} from '../concat';\nimport {mul} from '../mul';\nimport {op} from '../operation';\nimport {enclosingPowerOfTwo} from '../signal_ops_util';\nimport {slice} from '../slice';\nimport {rfft} from '../spectral/rfft';\nimport {frame} from '../frame';\nimport {hannWindow} from '../hann_window';\n\n/**\n * Computes the Short-time Fourier Transform of signals\n * See: https://en.wikipedia.org/wiki/Short-time_Fourier_transform\n *\n * @param input = tf.tensor1d([1, 1, 1, 1])\n * @param signal 1-dimensional real value tensor.\n * @param frameLength The window length of samples.\n * @param frameStep The number of samples to step.\n * @param fftLength The size of the FFT to apply.\n * @param windowFn A callable that takes a window length and returns 1-d tensor.\n *\n * @doc {heading: 'Operations', subheading: 'Signal', namespace: 'signal'}\n */\nfunction stft_(\n signal: Tensor1D, frameLength: number, frameStep: number,\n fftLength?: number, windowFn: (length: number) => Tensor1D = hannWindow): Tensor {\n if (fftLength == null) {\n fftLength = enclosingPowerOfTwo(frameLength);\n }\n const framedSignal = frame(signal, frameLength, frameStep);\n const windowedSignal = mul(framedSignal, windowFn(frameLength));\n const output: Tensor[] = [];\n for (let i = 0; i < framedSignal.shape[0]; i++) {\n output.push(\n rfft(slice(windowedSignal, [i, 0], [1, frameLength]),\n fftLength);\n);\n }\n return concat(output);\n}\n\nexport const stft = op({stft_});\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n
```

```

=====
*\n\nimport {ENGINE} from '../engine';\nimport {CropAndResize, CropAndResizeAttrs, CropAndResizeInputs}
from '../kernel_names';\nimport {NamedAttrMap} from '../kernel_registry';\nimport {Tensor1D, Tensor2D,
Tensor4D} from '../tensor';\nimport {NamedTensorMap} from '../tensor_types';\nimport {convertToTensor}
from '../tensor_util_env';\nimport {TensorLike} from '../types';\nimport * as util from '../util';\n\nimport {op}
from './operation';\n\n/**\n * Extracts crops from the input image tensor and resizes them using bilinear\n *
sampling or nearest neighbor sampling (possibly with aspect ratio change)\n * to a common output size specified by
cropSize.\n * @param image 4d tensor of shape `[batch,imageHeight,imageWidth, depth]`,\n * where
imageHeight and imageWidth must be positive, specifying the\n * batch of images from which to take crops\n *
@param boxes 2d float32 tensor of shape `[numBoxes, 4]`. Each entry is\n * `[y1, x1, y2, x2]`, where `(y1, x1)`
and `(y2, x2)` are the normalized\n * coordinates of the box in the boxInd[i]'th image in the batch\n * @param
boxInd 1d int32 tensor of shape `[numBoxes]` with values in range\n * `[0, batch)`
that specifies the image that the `i`-th box refers to.\n * @param cropSize 1d int32 tensor of 2 elements
`[cropHeigh, cropWidth]`\n * specifying the size to which all crops are resized to.\n * @param method Optional
string from `bilinear`|`nearest`,\n * defaults to bilinear, which specifies the sampling method for resizing\n *
@param extrapolationValue A threshold for deciding when to remove boxes based\n * on score. Defaults to 0.\n *
@return A 4D tensor of the shape `[numBoxes,cropHeight,cropWidth,depth]`\n * @doc {heading: 'Operations',
subheading: 'Images', namespace: 'image'}\n */\nfunction cropAndResize_(\n image: Tensor4D|TensorLike,\n
boxes: Tensor2D|TensorLike,\n boxInd: Tensor1D|TensorLike,\n cropSize: [number, number],\n method:
'bilinear'|'nearest' = 'bilinear',\n extrapolationValue = 0,\n): Tensor4D {\n const $image =
convertToTensor(image, 'image', 'cropAndResize');\n const $boxes = convertToTensor(boxes, 'boxes',
'cropAndResize',
'float32');\n const $boxInd = convertToTensor(boxInd, 'boxInd', 'cropAndResize', 'int32');\n\n const numBoxes =
$boxes.shape[0];\n\n util.assert(\n $image.rank === 4,\n () => `Error in cropAndResize: image must be rank
4,` +\n `but got rank ${$image.rank}.`);\n util.assert(\n $boxes.rank === 2 && $boxes.shape[1] === 4,\n
() => `Error in cropAndResize: boxes must be have size [${numBoxes},4]` +\n `but had shape
${$boxes.shape}.`);\n util.assert(\n $boxInd.rank === 1 && $boxInd.shape[0] === numBoxes,\n () => `Error
in cropAndResize: boxInd must be have size [${numBoxes}]` +\n `but had shape ${$boxes.shape}.`);\n\n
util.assert(\n cropSize.length === 2,\n () => `Error in cropAndResize: cropSize must be of length 2, but got `
+\n `length ${cropSize.length}.`);\n util.assert(\n cropSize[0] >= 1 && cropSize[1] >= 1,\n () =>
`cropSize must be atleast [1,1], but was ${cropSize}`);\n\n util.assert(\n
method === 'bilinear' || method === 'nearest',\n () => `method must be bilinear or nearest, but was
${method}`);\n\n const inputs:\n CropAndResizeInputs = {image: $image, boxes: $boxes, boxInd: $boxInd};\n
const attrs: CropAndResizeAttrs = {method, extrapolationValue, cropSize};\n const res = ENGINE.runKernel(\n
CropAndResize, inputs as {} as NamedTensorMap,\n attrs as {} as NamedAttrMap);\n return res as
Tensor4D;\n}\n\nexport const cropAndResize = op({cropAndResize_});\n\n"/**\n * @license\n * Copyright 2020
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF
ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n *
limitations under the License.\n */
=====

```

```

*\n\nimport {ENGINE} from '../engine';\nimport {FlipLeftRight, FlipLeftRightInputs} from
'../kernel_names';\nimport {Tensor4D} from '../tensor';\nimport {NamedTensorMap} from
'../tensor_types';\nimport {convertToTensor} from '../tensor_util_env';\nimport {TensorLike} from
'../types';\nimport * as util from '../util';\nimport {op} from './operation';\n\n/**\n * Flips the image left to right.

```



```

Currently available in the CPU, WebGL, and
 * WASM backends.
 * @param image 4d tensor of shape
`[batch, imageHeight, imageWidth, depth]`.
 * @doc {heading: 'Operations', subheading: 'Images',
namespace: 'image'}
 * \nfunction flipLeftRight_(image: Tensor4D|TensorLike): Tensor4D {
 \n const $image =
 convertToTensor(image, 'image', 'flipLeftRight',
 'float32');
 \n \n util.assert(\n $image.rank === 4, \n () => 'Error in flipLeftRight: image must be rank 4,' + \n
 `but got rank ${$image.rank}.`);
 \n \n const inputs: FlipLeftRightInputs = {image: $image};
 \n const res = \n
 ENGINE.runKernel(FlipLeftRight, inputs as {} as NamedTensorMap, {});
 \n return res as Tensor4D;
 \n}
 \n\nexport
 const flipLeftRight = op({flipLeftRight_});
 \n", "/*
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 \n * WITHOUT WARRANTIES
 OR CONDITIONS OF ANY KIND, either express or implied.
 \n * See the License for the specific language
 governing permissions
 and
 \n * limitations under the License.
 \n *
 =====\n
 * \n\nimport {ENGINE} from '../engine';
 \nimport {RotateWithOffset, RotateWithOffsetAttrs,
 RotateWithOffsetInputs} from '../kernel_names';
 \nimport {NamedAttrMap} from '../kernel_registry';
 \nimport
 {Tensor4D} from '../tensor';
 \nimport {NamedTensorMap} from '../tensor_types';
 \nimport {convertToTensor}
 from '../tensor_util_env';
 \nimport {TensorLike} from '../types';
 \nimport * as util from '../util';
 \n\nimport {op}
 from './operation';
 \n\n/*
 \n * Rotates the input image tensor counter-clockwise with an optional offset
 \n * center of
 rotation. Currently available in the CPU, WebGL, and WASM backends.
 \n *
 * @param image 4d tensor of shape
 `[batch, imageHeight, imageWidth, depth]`.
 \n * @param radians The amount of rotation.
 \n * @param fillValue The
 value to fill in the empty space leftover
 \n * after rotation. Can be either a single grayscale
 value (0-255), or an
 \n * array of three numbers `[red, green, blue]` specifying the red, green,
 \n * and blue
 channels. Defaults to `0` (black).
 \n * @param center The center of rotation. Can be either a single value (0-1), or
 \n *
 an array of two numbers `[centerX, centerY]`. Defaults to `0.5` (rotates
 \n * the image around its center).
 \n *
 * @doc {heading: 'Operations', subheading: 'Images', namespace: 'image'}
 \n * \nfunction rotateWithOffset_(
 \n image: Tensor4D|TensorLike, radians: number,
 \n fillValue: number|[number, number, number] = 0,
 \n center:
 number|[number, number] = 0.5): Tensor4D {
 \n const $image = convertToTensor(image, 'image',
 'rotateWithOffset', 'float32');
 \n \n util.assert(\n $image.rank === 4, \n () => 'Error in rotateWithOffset: image
 must be rank 4,' + \n
 `but got rank ${$image.rank}.`);
 \n \n const inputs: RotateWithOffsetInputs = {image:
 $image};
 \n const attrs: RotateWithOffsetAttrs = {radians, fillValue, center};
 \n const
 res = ENGINE.runKernel(\n RotateWithOffset, inputs as {} as NamedTensorMap, \n
 attrs as {} as
 NamedAttrMap);
 \n return res as Tensor4D;
 \n}
 \n\nexport const rotateWithOffset =
 op({rotateWithOffset_});
 \n", "/*
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 \n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
 implied.
 \n * See the License for the specific language governing permissions and
 \n * limitations under the
 License.
 \n *
 =====\n
 * \n\nimport {Tensor1D, Tensor2D} from '../tensor';
 \nimport * as util
 from '../util';
 \n\nfunction nonMaxSuppSanityCheck(\n boxes: Tensor2D, scores: Tensor1D, maxOutputSize:
 number,
 \n iouThreshold: number, scoreThreshold: number, softNmsSigma?: number): {
 \n maxOutputSize:
 number,
 \n iouThreshold: number,
 \n scoreThreshold: number,
 \n softNmsSigma: number
 \n} {
 \n if (iouThreshold
 == null) {
 \n iouThreshold = 0.5;
 \n }
 \n if (scoreThreshold == null) {
 \n scoreThreshold =

```

```

Number.NEGATIVE_INFINITY;\n }\n if (softNmsSigma == null) {\n softNmsSigma = 0.0;\n }\n\n const
numBoxes = boxes.shape[0];\n maxOutputSize = Math.min(maxOutputSize, numBoxes);\n\n util.assert(\n 0 <=
iouThreshold && iouThreshold <= 1,\n () => `iouThreshold must be in [0, 1], but was '${iouThreshold}`);\n
util.assert(\n boxes.rank === 2,\n () => `boxes must be a 2D tensor, but was of rank '${boxes.rank}`);\n
util.assert(\n boxes.shape[1] === 4,\n () =>\n `boxes must have 4 columns, but 2nd dimension was
${boxes.shape[1]}`);\n
util.assert(scores.rank === 1, () => `scores must be a 1D tensor`);\n util.assert(\n scores.shape[0] ===
numBoxes,\n () => `scores has incompatible shape with boxes. Expected ${numBoxes}, ` +\n `but was
${scores.shape[0]}`);\n util.assert(\n 0 <= softNmsSigma && softNmsSigma <= 1,\n () => `softNmsSigma
must be in [0, 1], but was '${softNmsSigma}`);\n return {maxOutputSize, iouThreshold, scoreThreshold,
softNmsSigma};\n}\n\nexport {nonMaxSuppSanityCheck};\n", /*\n * @license\n * Copyright 2020 Google LLC.
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file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *
=====\n
*/\n\nimport {ENGINE} from '../engine';\nimport {NonMaxSuppressionV3} from '../kernel_names';\nimport
{Tensor1D, Tensor2D} from '../tensor';\nimport {convertToTensor} from '../tensor_util_env';\nimport
{TensorLike} from '../types';\nimport {nonMaxSuppSanityCheck} from './nonmax_util';\nimport {op} from
 './operation';\n\n/**\n * Performs non maximum suppression of bounding boxes based on\n * iou (intersection over
union).\n *\n * @param boxes a 2d tensor of shape `[numBoxes, 4]`. Each entry is\n * `[y1, x1, y2, x2]`, where
`y1, x1` and `y2, x2` are the corners of\n * the bounding box.\n *\n * @param scores a 1d tensor providing the
box scores of shape `[numBoxes]`.\n *\n * @param maxOutputSize The maximum number of boxes to be selected.\n *\n
* @param iouThreshold\n
A float representing the threshold for deciding whether\n * boxes overlap too much with respect to IOU. Must be
between [0, 1].\n * Defaults to 0.5 (50% box overlap).\n *\n * @param scoreThreshold A threshold for deciding when
to remove boxes based\n * on score. Defaults to -inf, which means any score is accepted.\n *\n * @return A 1D
tensor with the selected box indices.\n *\n * @doc {heading: 'Operations', subheading: 'Images', namespace:
'image'}\n */\nfunction nonMaxSuppression_(\n boxes: Tensor2D|TensorLike, scores: Tensor1D|TensorLike,\n
maxOutputSize: number, iouThreshold = 0.5,\n scoreThreshold = Number.NEGATIVE_INFINITY): Tensor1D
{\n const $boxes = convertToTensor(boxes, 'boxes', 'nonMaxSuppression');\n const $scores =
convertToTensor(scores, 'scores', 'nonMaxSuppression');\n\n const inputs = nonMaxSuppSanityCheck(\n
$boxes, $scores, maxOutputSize, iouThreshold, scoreThreshold);\n\n maxOutputSize = inputs.maxOutputSize;\n
iouThreshold = inputs.iouThreshold;\n\n scoreThreshold = inputs.scoreThreshold;\n\n const attrs = {maxOutputSize,
iouThreshold, scoreThreshold};\n\n return ENGINE.runKernel(\n NonMaxSuppressionV3, {boxes: $boxes, scores: $scores},
attrs);\n}\n\nexport
const nonMaxSuppression = op({nonMaxSuppression_});\n", /*\n * @license\n * Copyright 2019 Google LLC.
All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n

```

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 */\n\n/**\n * Inserts a value into a sorted array. This method allows duplicate, meaning it\n * allows inserting
duplicate value, in which case, the element will be inserted\n * at the lowest index of the value.\n * @param arr The
array to modify.\n * @param element The element to insert.\n * @param comparator Optional. If no comparator is
specified, elements are\n * compared using array_util.defaultComparator, which is suitable for Strings\n * and
Numbers in ascending arrays. If the array contains multiple instances of\n * the target value, the left-most instance
will be returned. To provide a\n * comparator, it should take 2 arguments to compare and return a negative,\n * zero,
or a positive number.\n */\nexport function binaryInsert<T>(arr: T[], element: T, comparator?: (a: T, b: T) =>
number) {\n const index = binarySearch(arr, element, comparator);\n const insertionPoint = index < 0 ? -(index +
1) : index;\n arr.splice(insertionPoint, 0, element);\n}\n\n/**\n * Searches
the array for the target using binary search, returns the index\n * of the found element, or position to insert if
element not found. If no\n * comparator is specified, elements are compared using array_\n *
util.defaultComparator, which is suitable for Strings and Numbers in\n * ascending arrays. If the array contains
multiple instances of the target\n * value, the left-most instance will be returned.\n * @param arr The array to be
searched in.\n * @param target The target to be searched for.\n * @param comparator Should take 2 arguments to
compare and return a negative,\n * zero, or a positive number.\n * @return Lowest index of the target value if
found, otherwise the insertion\n * point where the target should be inserted, in the form of\n * (-insertionPoint -
1).\n */\nexport function binarySearch<T>(arr: T[], target: T, comparator?: (a: T, b: T) => number) {\n return
binarySearch_(arr, target, comparator || defaultComparator);\n}\n\n/**\n * Compares its two
arguments for order.\n * @param a The first element to be compared.\n * @param b The second element to be
compared.\n * @return A negative number, zero, or a positive number as the first\n * argument is less than, equal
to, or greater than the second.\n */\nfunction defaultComparator<T>(a: T, b: T): number {\n return a > b ? 1 : a < b
? -1 : 0;\n}\n\nfunction binarySearch_<T>(arr: T[], target: T, comparator: (a: T, b: T) => number) {\n let left =
0;\n let right = arr.length;\n let middle = 0;\n let found = false;\n while (left < right) {\n middle = left + ((right -
left) >>> 1);\n const compareResult = comparator(target, arr[middle]);\n if (compareResult > 0) {\n left =
middle + 1;\n } else {\n right = middle;\n // If compareResult is 0, the value is found. We record it is
found,\n // and then keep looking because there may be duplicate.\n found = !compareResult;\n }\n }\n return found ? left : -left - 1;\n}\n\n", "/**\n * @license\n
* Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n\n*/\n\nimport { TypedArray } from './types';\nimport { binaryInsert } from './non_max_suppression_util';\n\n/**\n *
Implementation of the NonMaxSuppression kernel shared between webgl and cpu.\n */\ninterface Candidate {\n score: number;\n boxIndex: number;\n suppressBeginIndex: number;\n}\n\ninterface
NonMaxSuppressionResult {\n selectedIndices: number[];\n selectedScores?: number[];\n validOutputs?:
number;\n}\n\nexport function nonMaxSuppressionV3Impl(\n boxes: TypedArray, scores: TypedArray,\n maxOutputSize: number,\n iouThreshold: number, scoreThreshold: number): NonMaxSuppressionResult {\n return nonMaxSuppressionImpl_(\n boxes, scores, maxOutputSize, iouThreshold, scoreThreshold,\n 0 /*
softNmsSigma */);\n}\n\nexport function nonMaxSuppressionV4Impl(\n boxes: TypedArray, scores: TypedArray,\n maxOutputSize: number,\n iouThreshold: number, scoreThreshold: number,\n padToMaxOutputSize: boolean):
NonMaxSuppressionResult {\n return nonMaxSuppressionImpl_(\n boxes, scores, maxOutputSize,\n iouThreshold, scoreThreshold,\n 0 /* softNmsSigma */, false /* returnScoresTensor */,\n padToMaxOutputSize /* padToMaxOutputSize */, true\n /* returnValidOutputs */);\n}\n\nexport function
nonMaxSuppressionV5Impl(\n boxes: TypedArray, scores:

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TypedArray, maxOutputSize: number,\n iouThreshold: number, scoreThreshold: number,\n softNmsSigma:
number): NonMaxSuppressionResult {\n return nonMaxSuppressionImpl_(\n boxes, scores, maxOutputSize,
iouThreshold, scoreThreshold, softNmsSigma,\n true /* returnScoresTensor */);\n}\n\nfunction
nonMaxSuppressionImpl_(\n boxes: TypedArray, scores: TypedArray, maxOutputSize: number,\n
iouThreshold: number, scoreThreshold: number, softNmsSigma: number,\n returnScoresTensor = false,
padToMaxOutputSize = false,\n returnValidOutputs = false): NonMaxSuppressionResult {\n // The list is sorted
in ascending order, so that we can always pop the\n // candidate with the largest score in O(1) time.\n const
candidates = [];\n\n for (let i = 0; i < scores.length; i++) {\n if (scores[i] > scoreThreshold) {\n
candidates.push({score: scores[i], boxIndex: i, suppressBeginIndex: 0});\n }\n }\n\n candidates.sort(ascendingComparator);\n\n // If softNmsSigma is 0,
the outcome of this algorithm is exactly same as\n // before.\n const scale = softNmsSigma > 0 ? (-0.5 /
softNmsSigma) : 0.0;\n\n const selectedIndices: number[] = [];\n const selectedScores: number[] = [];\n\n while
(selectedIndices.length < maxOutputSize && candidates.length > 0) {\n const candidate = candidates.pop();\n
const {score: originalScore, boxIndex, suppressBeginIndex} = candidate;\n\n if (originalScore < scoreThreshold)
{\n break;\n }\n\n // Overlapping boxes are likely to have similar scores, therefore we\n // iterate through
the previously selected boxes backwards in order to\n // see if candidate's score should be suppressed. We use\n
// suppressBeginIndex to track and ensure a candidate can be suppressed\n // by a selected box no more than once.
Also, if the overlap exceeds\n // iouThreshold, we simply ignore the candidate.\n let ignoreCandidate = false;\n
for (let j = selectedIndices.length - 1; j >= suppressBeginIndex; --j)
{\n const iou = intersectionOverUnion(boxes, boxIndex, selectedIndices[j]);\n\n if (iou >= iouThreshold) {\n
 ignoreCandidate = true;\n break;\n }\n\n candidate.score =\n candidate.score *
suppressWeight(iouThreshold, scale, iou);\n\n if (candidate.score <= scoreThreshold) {\n break;\n }\n
}\n\n // At this point, if `candidate.score` has not dropped below\n // `scoreThreshold`, then we know that we
went through all of the\n // previous selections and can safely update `suppressBeginIndex` to the\n // end of the
selected array. Then we can re-insert the candidate with\n // the updated score and suppressBeginIndex back in the
candidate list.\n // If on the other hand, `candidate.score` has dropped below the score\n // threshold, we will not
add it back to the candidates list.\n candidate.suppressBeginIndex = selectedIndices.length;\n\n if
(!ignoreCandidate) {\n // Candidate has passed all the
tests, and is not suppressed, so\n // select the candidate.\n if (candidate.score === originalScore) {\n
selectedIndices.push(boxIndex);\n selectedScores.push(candidate.score);\n } else if (candidate.score >
scoreThreshold) {\n // Candidate's score is suppressed but is still high enough to be\n // considered, so add
back to the candidates list.\n binaryInsert(candidates, candidate, ascendingComparator);\n }\n }\n\n }\n\n // NonMaxSuppressionV4 feature: padding output to maxOutputSize.\n const validOutputs = selectedIndices.length;\n
const elemsToPad = maxOutputSize - validOutputs;\n\n if (padToMaxOutputSize && elemsToPad > 0) {\n selectedIndices.push(...new Array(elemsToPad).fill(0));\n selectedScores.push(...new
Array(elemsToPad).fill(0.0));\n }\n\n const result: NonMaxSuppressionResult = {selectedIndices};\n\n if
(returnScoresTensor) {\n result['selectedScores'] = selectedScores;\n }\n\n if (returnValidOutputs)
{\n result['validOutputs'] = validOutputs;\n }\n\n return result;\n}\n\nfunction intersectionOverUnion(boxes:
TypedArray, i: number, j: number) {\n const iCoord = boxes.subarray(i * 4, i * 4 + 4);\n const jCoord =
boxes.subarray(j * 4, j * 4 + 4);\n const yminI = Math.min(iCoord[0], iCoord[2]);\n const xminI =
Math.min(iCoord[1], iCoord[3]);\n const ymaxI = Math.max(iCoord[0], iCoord[2]);\n const xmaxI =
Math.max(iCoord[1], iCoord[3]);\n const yminJ = Math.min(jCoord[0], jCoord[2]);\n const xminJ =
Math.min(jCoord[1], jCoord[3]);\n const ymaxJ = Math.max(jCoord[0], jCoord[2]);\n const xmaxJ =
Math.max(jCoord[1], jCoord[3]);\n const areaI = (ymaxI - yminI) * (xmaxI - xminI);\n const areaJ = (ymaxJ -
yminJ) * (xmaxJ - xminJ);\n if (areaI <= 0 || areaJ <= 0) {\n return 0.0;\n }\n const intersectionYmin =
Math.max(yminI, yminJ);\n const intersectionXmin = Math.max(xminI, xminJ);\n const intersectionYmax =
Math.min(ymaxI, ymaxJ);\n const intersectionXmax = Math.min(xmaxI,

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xmaxJ);\n const intersectionArea = Math.max(intersectionYmax - intersectionYmin, 0.0) *\n
Math.max(intersectionXmax - intersectionXmin, 0.0);\n return intersectionArea / (areaI + areaJ -
intersectionArea);\n}\n\n// A Gaussian penalty function, this method always returns values in [0, 1].\n// The weight
is a function of similarity, the more overlap two boxes are, the\n// smaller the weight is, meaning highly overlapping
boxe will be significantly\n// penalized. On the other hand, a non-overlapping box will not be penalized.\nfunction
suppressWeight(iouThreshold: number, scale: number, iou: number) {\n const weight = Math.exp(scale * iou *
iou);\n return iou <= iouThreshold ? weight : 0.0;\n}\n\nfunction ascendingComparator(c1: Candidate, c2:
Candidate) {\n // For objects with same scores, we make the object with the larger index go\n // first. In an array
that pops from the end, this means that the object with\n // the smaller index will be popped first. This ensures
the same output as\n // the TensorFlow python version.\n return (c1.score - c2.score) ||\n ((c1.score ===
c2.score) && (c2.boxIndex - c1.boxIndex));\n}\n\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *\n
=====\n
*\n\nimport {nonMaxSuppressionV3Impl} from '../backends/non_max_suppression_impl';\nimport {Tensor1D,
Tensor2D}
from '../tensor';\nimport {convertToTensor} from '../tensor_util_env';\nimport {TensorLike} from
'../types';\nimport {nonMaxSuppSanityCheck} from '../nonmax_util';\nimport {tensor1d} from
'../tensor1d';\n\n/**\n * Performs non maximum suppression of bounding boxes based on\n * iou (intersection over
union).\n *\n * This is the async version of `nonMaxSuppression`\n *\n * @param boxes a 2d tensor of shape
`[numBoxes, 4]`. Each entry is\n * `[y1, x1, y2, x2]`, where `(y1, x1)` and `(y2, x2)` are the corners of\n * the
bounding box.\n * @param scores a 1d tensor providing the box scores of shape `[numBoxes]`.\n * @param
maxOutputSize The maximum number of boxes to be selected.\n * @param iouThreshold A float representing the
threshold for deciding whether\n * boxes overlap too much with respect to IOU. Must be between [0, 1].\n *
Defaults to 0.5 (50% box overlap).\n * @param scoreThreshold A threshold for deciding when to remove boxes
based\n * on score. Defaults
to -inf, which means any score is accepted.\n * @return A 1D tensor with the selected box indices.\n *\n * @doc
{heading: 'Operations', subheading: 'Images', namespace: 'image'}\n */\n\nfunction
nonMaxSuppressionAsync_(\n boxes: Tensor2D|TensorLike, scores: Tensor1D|TensorLike,\n maxOutputSize:
number, iouThreshold = 0.5,\n scoreThreshold = Number.NEGATIVE_INFINITY): Promise<Tensor1D> {\n
const $boxes = convertToTensor(boxes, 'boxes', 'nonMaxSuppressionAsync');\n const $scores =
convertToTensor(scores, 'scores', 'nonMaxSuppressionAsync');\n\n const inputs = nonMaxSuppSanityCheck(\n
$boxes, $scores, maxOutputSize, iouThreshold, scoreThreshold);\n maxOutputSize = inputs.maxOutputSize;\n
iouThreshold = inputs.iouThreshold;\n scoreThreshold = inputs.scoreThreshold;\n\n const boxesAndScores = await
Promise.all([$boxes.data(), $scores.data()]);\n const boxesVals = boxesAndScores[0];\n const scoresVals =
boxesAndScores[1];\n\n // We call a cpu based impl directly
with the typedarray data here rather\n // than a kernel because all kernels are synchronous (and thus cannot await\n
// .data()).\n const {selectedIndices} = nonMaxSuppressionV3Impl(\n boxesVals, scoresVals, maxOutputSize,
iouThreshold, scoreThreshold);\n if ($boxes !== boxes) {\n $boxes.dispose();\n }\n if ($scores !== scores) {\n
$scores.dispose();\n }\n\n return tensor1d(selectedIndices, 'int32');\n}\n\nexport const nonMaxSuppressionAsync =
nonMaxSuppressionAsync_;\n\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n *
Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,

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software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND,  
either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\n\nimport {ENGINE} from '../engine';\nimport {NonMaxSuppressionV5, NonMaxSuppressionV5Attrs,\nNonMaxSuppressionV5Inputs} from '../kernel_names';\nimport {NamedAttrMap} from\n '../kernel_registry';\nimport {Tensor, Tensor1D, Tensor2D} from '../tensor';\nimport {NamedTensorMap} from\n '../tensor_types';\nimport {convertToTensor} from '../tensor_util_env';\nimport {TensorLike} from\n '../types';\nimport {nonMaxSupSanityCheck} from './nonmax_util';\nimport {op} from './operation';\n\n\n * Performs non maximum suppression of bounding boxes based on\n * iou (intersection over union).\n * This op\n * also supports a Soft-NMS mode (c.f.\n * Bodla et al, https://arxiv.org/abs/1704.04503) where boxes reduce the\n * score\n * of other overlapping boxes, therefore\n * favoring different regions of the image\n * with high scores. To enable this Soft-NMS mode, set the\n * `softNmsSigma`\n * parameter to be larger than 0.\n * @param boxes a 2d tensor of shape `[numBoxes, 4]`.\n * Each entry is\n * `[y1, x1, y2, x2]`, where `(y1, x1)` and `(y2, x2)` are the corners of\n * the bounding box.\n * @param scores a 1d tensor providing the box scores of shape `[numBoxes]`.\n * @param maxOutputSize The\n * maximum number of boxes to be selected.\n * @param iouThreshold A float representing the threshold for deciding\n * whether\n * boxes overlap too much with respect to IOU. Must be between [0, 1].\n * Defaults to 0.5 (50% box\n * overlap).\n * @param scoreThreshold A threshold for deciding when to remove boxes based\n * on score.\n * Defaults to -inf, which means any score is accepted.\n * @param softNmsSigma A float representing the sigma\n * parameter for Soft NMS.\n * When sigma is 0, it falls back to nonMaxSuppression.\n * @return A map with the\n * following
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properties:\n * - selectedIndices: A 1D tensor with the selected box indices.\n * - selectedScores: A 1D tensor\n * with the corresponding scores for each\n * selected box.\n * @doc {heading: 'Operations', subheading:\n * 'Images', namespace: 'image'}\n\nfunction nonMaxSuppressionWithScore_(\n * boxes: Tensor2D|TensorLike,\n * scores: Tensor1D|TensorLike,\n * maxOutputSize: number, iouThreshold = 0.5,\n * scoreThreshold =\n * Number.NEGATIVE_INFINITY,\n * softNmsSigma = 0.0): NamedTensorMap {\n * const $boxes =\n * convertToTensor(boxes, 'boxes', 'nonMaxSuppression');\n * const $scores = convertToTensor(scores, 'scores',\n * 'nonMaxSuppression');\n * const params = nonMaxSupSanityCheck(\n * $boxes, $scores, maxOutputSize,\n * iouThreshold, scoreThreshold,\n * softNmsSigma);\n * maxOutputSize = params.maxOutputSize;\n * iouThreshold =\n * params.iouThreshold;\n * scoreThreshold = params.scoreThreshold;\n * softNmsSigma = params.softNmsSigma;\n * const inputs: NonMaxSuppressionV5Inputs\n * = {boxes: $boxes, scores: $scores};\n * const attrs: NonMaxSuppressionV5Attrs =\n * {maxOutputSize,\n * iouThreshold, scoreThreshold, softNmsSigma};\n * // tslint:disable-next-line: no-unnecessary-type-assertion\n * const result = ENGINE.runKernel(\n * NonMaxSuppressionV5, inputs as {} as NamedTensorMap,\n * attrs as {} as NamedAttrMap) as Tensor[];\n * return {selectedIndices: result[0], selectedScores:\n * result[1]};\n *}\n\nexport const nonMaxSuppressionWithScore = op({nonMaxSuppressionWithScore_});\n\n\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n * 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a\n * copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable\n * law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT
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WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\n\nimport {nonMaxSuppressionV5Impl} from '../backends/non_max_suppression_impl';\nimport {Tensor1D,\nTensor2D} from '../tensor';\nimport {NamedTensorMap} from '../tensor_types';\nimport {convertToTensor}
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from '././tensor_util_env';\nimport {TensorLike} from '././types';\nimport {nonMaxSuppSanityCheck} from
 '././nonmax_util';\nimport {tensor1d} from '././tensor1d';\n\n/**\n * Asynchronously performs non maximum
 suppression of bounding boxes based on\n * iou (intersection over union).\n *\n * This op also supports a Soft-NMS
 mode (c.f.\n * Bodla et al, https://arxiv.org/abs/1704.04503) where boxes reduce the score\n * of other overlapping
 boxes, therefore favoring different regions of the image\n * with high scores. To enable
 this Soft-NMS mode, set the `softNmsSigma`\n * parameter to be larger than 0.\n *\n * @param boxes a 2d tensor
 of shape `[numBoxes, 4]`. Each entry is\n * `[y1, x1, y2, x2]`, where `(y1, x1)` and `(y2, x2)` are the corners of\n
 * the bounding box.\n * @param scores a 1d tensor providing the box scores of shape `[numBoxes]`\n * @param
 maxOutputSize The maximum number of boxes to be selected.\n * @param iouThreshold A float representing the
 threshold for deciding whether\n * boxes overlap too much with respect to IOU. Must be between [0, 1].\n *
 Defaults to 0.5 (50% box overlap).\n * @param scoreThreshold A threshold for deciding when to remove boxes
 based\n * on score. Defaults to -inf, which means any score is accepted.\n * @param softNmsSigma A float
 representing the sigma parameter for Soft NMS.\n * When sigma is 0, it falls back to nonMaxSuppression.\n *
 @return A map with the following properties:\n * - selectedIndices: A 1D tensor with the selected
 box indices.\n * - selectedScores: A 1D tensor with the corresponding scores for each\n * selected box.\n *\n
 * @doc {heading: 'Operations', subheading: 'Images', namespace: 'image'}\n */\n\nfunction
 nonMaxSuppressionWithScoreAsync(\n boxes: Tensor2D|TensorLike, scores: Tensor1D|TensorLike,\n
 maxOutputSize: number, iouThreshold = 0.5,\n scoreThreshold = Number.NEGATIVE_INFINITY,\n
 softNmsSigma = 0.0): Promise<NamedTensorMap> {\n const $boxes = convertToTensor(boxes, 'boxes',
 'nonMaxSuppressionAsync');\n const $scores = convertToTensor(scores, 'scores', 'nonMaxSuppressionAsync');\n
 const params = nonMaxSuppSanityCheck(\n $boxes, $scores, maxOutputSize, iouThreshold, scoreThreshold,\n
 softNmsSigma);\n maxOutputSize = params.maxOutputSize;\n iouThreshold = params.iouThreshold;\n
 scoreThreshold = params.scoreThreshold;\n softNmsSigma = params.softNmsSigma;\n\n const boxesAndScores =
 await Promise.all([$boxes.data(), $scores.data()]);\n const
 boxesVals = boxesAndScores[0];\n const scoresVals = boxesAndScores[1];\n\n // We call a cpu based impl
 directly with the typedarray data here rather\n // than a kernel because all kernels are synchronous (and thus cannot
 await\n // .data()).\n const {selectedIndices, selectedScores} = nonMaxSuppressionV5Impl(\n boxesVals,
 scoresVals, maxOutputSize, iouThreshold, scoreThreshold,\n softNmsSigma);\n\n if ($boxes !== boxes) {\n
 $boxes.dispose();\n }\n if ($scores !== scores) {\n $scores.dispose();\n }\n\n return {\n selectedIndices:
 tensor1d(selectedIndices, 'int32'),\n selectedScores: tensor1d(selectedScores)\n };\n}\n\nexport const
 nonMaxSuppressionWithScoreAsync = nonMaxSuppressionWithScoreAsync;\n\n"/**\n * @license\n * Copyright
 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n *
 you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n
 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in
 writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT
 WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
 language governing permissions and\n * limitations under the License.\n *
\n\n
=====
*\n\nimport {ENGINE} from '././engine';\nimport {NonMaxSuppressionV4, NonMaxSuppressionV4Attrs,
 NonMaxSuppressionV4Inputs} from '././kernel_names';\nimport {NamedAttrMap} from
 '././kernel_registry';\nimport {Tensor, Tensor1D, Tensor2D} from '././tensor';\nimport {NamedTensorMap} from
 '././tensor_types';\nimport {convertToTensor} from '././tensor_util_env';\nimport {TensorLike} from
 '././types';\nimport {nonMaxSuppSanityCheck} from '././nonmax_util';\nimport {op} from '././operation';\n\n/**\n
 * Asynchronously performs
 non maximum suppression of bounding boxes based on\n * iou (intersection over union), with an option to pad
 results.\n *\n * @param boxes a 2d tensor of shape `[numBoxes, 4]`. Each entry is\n * `[y1, x1, y2, x2]`, where
 `(y1, x1)` and `(y2, x2)` are the corners of\n * the bounding box.\n * @param scores a 1d tensor providing the
 box scores of shape `[numBoxes]`\n * @param maxOutputSize The maximum number of boxes to be selected.\n *

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@param iouThreshold A float representing the threshold for deciding whether
boxes overlap too much with respect to IOU. Must be between [0, 1].
Defaults to 0.5 (50% box overlap).
@param scoreThreshold A threshold for deciding when to remove boxes based
on score. Defaults to -inf, which means any score is accepted.
@param padToMaxOutputSize Defaults to false. If true, size of output
`selectedIndices` is padded to maxOutputSize.
@return A map with the following properties:
- selectedIndices: A 1D tensor with the selected box indices.
- validOutputs: A scalar denoting how many elements in
`selectedIndices` are valid. Valid elements occur first, then padding.
@doc {heading: 'Operations', subheading: 'Images', namespace: 'image'}
function nonMaxSuppressionPadded_(boxes:
Tensor2D|TensorLike, scores: Tensor1D|TensorLike,
maxOutputSize: number, iouThreshold = 0.5,
scoreThreshold = Number.NEGATIVE_INFINITY,
padToMaxOutputSize = false): NamedTensorMap {
const $boxes = convertToTensor(boxes, 'boxes', 'nonMaxSuppression');
const $scores = convertToTensor(scores, 'scores', 'nonMaxSuppression');
const params = nonMaxSuppSanityCheck($boxes, $scores,
maxOutputSize, iouThreshold, scoreThreshold,
null /* softNmsSigma */);
const $maxOutputSize =
params.maxOutputSize;
const $iouThreshold = params.iouThreshold;
const $scoreThreshold =
params.scoreThreshold;
const inputs: NonMaxSuppressionV4Inputs = {boxes:
$boxes, scores: $scores};
const attrs: NonMaxSuppressionV4Attrs = {
maxOutputSize: $maxOutputSize,
iouThreshold: $iouThreshold,
scoreThreshold: $scoreThreshold,
padToMaxOutputSize};
// tslint:disable-next-line: no-unnecessary-type-assertion
const result = ENGINE.runKernel(
NonMaxSuppressionV4, inputs as {} as NamedTensorMap,
attrs as {} as NamedAttrMap) as
Tensor[];
return {selectedIndices: result[0], validOutputs: result[1]};
}
export const
nonMaxSuppressionPadded = op({nonMaxSuppressionPadded_});
/**
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 */
=====
import {nonMaxSuppressionV4Impl} from '../backends/non_max_suppression_impl';
import {Tensor1D, Tensor2D} from '../tensor';
import {NamedTensorMap} from '../tensor_types';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from '../types';
import {nonMaxSuppSanityCheck} from '../nonmax_util';
import {scalar} from '../scalar';
import {tensor1d} from '../tensor1d';
/**
 * Asynchronously performs non maximum suppression of bounding boxes based on
 * iou (intersection over union), with an option to pad results.
 * @param boxes a 2d tensor of shape `[numBoxes, 4]`. Each entry is
 * `[y1, x1, y2, x2]`, where `(y1, x1)`
 * and `(y2, x2)` are the corners of the bounding box.
 * @param scores a 1d tensor providing the box scores of shape
 * `[numBoxes]`.
 * @param maxOutputSize The maximum number of boxes to be selected.
 * @param iouThreshold A float representing the threshold for deciding whether
 * boxes overlap too much with respect to IOU. Must be between [0, 1].
 * Defaults to 0.5 (50% box overlap).
 * @param scoreThreshold A threshold for deciding when to remove boxes based
 * on score. Defaults to -inf, which means any score is accepted.
 * @param padToMaxOutputSize Defaults to false. If true, size of output
 * `selectedIndices` is padded to maxOutputSize.
 * @return A map with the following properties:
 * - selectedIndices: A 1D tensor with the selected box indices.
 * - validOutputs: A scalar denoting how many elements in `selectedIndices`
 * are valid. Valid elements occur first, then padding.
 * @doc {heading: 'Operations', subheading: 'Images', namespace: 'image'}
 */
function nonMaxSuppressionPaddedAsync_(boxes: Tensor2D|TensorLike,
scores: Tensor1D|TensorLike,
maxOutputSize: number, iouThreshold = 0.5,
scoreThreshold = Number.NEGATIVE_INFINITY,
padToMaxOutputSize = false): Promise<NamedTensorMap> {
const

```



```

$boxes = convertToTensor(boxes, 'boxes', 'nonMaxSuppressionAsync');
const $scores = convertToTensor(scores, 'scores', 'nonMaxSuppressionAsync');
const params = nonMaxSuppSanityCheck(
 $boxes, $scores,
 maxOutputSize, iouThreshold, scoreThreshold,
 null /* softNmsSigma */);
const $maxOutputSize =
 params.maxOutputSize;
const $iouThreshold = params.iouThreshold;
const $scoreThreshold =
 params.scoreThreshold;
const [boxesVals, scoresVals] =
 await Promise.all([$boxes.data(),
 $scores.data()]);
// We call a cpu based impl directly with the typedarray data here rather
// than a kernel because all kernels are synchronous (and thus cannot await
.data()).
const {selectedIndices, validOutputs} = nonMaxSuppressionV4Impl(
 boxesVals, scoresVals,
 $maxOutputSize, $iouThreshold, $scoreThreshold,
 padToMaxOutputSize);
if ($boxes !== boxes) {
 $boxes.dispose();
}
if ($scores !== scores) {
 $scores.dispose();
}
return {
 selectedIndices:
 tensorId(selectedIndices, 'int32'),
 validOutputs: scalar(validOutputs, 'int32')
};
export const
nonMaxSuppressionPaddedAsync = nonMaxSuppressionPaddedAsync_;
"/**
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 * WITHOUT WARRANTIES
 OR CONDITIONS
 OF ANY KIND, either express or implied.
 * See the License for the specific language governing permissions
 and
 * limitations under the License.
 */
=====
*/
import {ENGINE} from '../engine';
import {ResizeBilinear, ResizeBilinearAttrs, ResizeBilinearInputs}
from '../kernel_names';
import {NamedAttrMap} from '../kernel_registry';
import {Tensor3D, Tensor4D}
from '../tensor';
import {NamedTensorMap} from '../tensor_types';
import {convertToTensor} from
 '../tensor_util_env';
import {TensorLike} from '../types';
import * as util from '../util';
import {op} from
 '../operation';
import {reshape} from './reshape';
/**
 * Bilinear resize a single 3D image or a batch of 3D
 images to a new shape.
 * @param images The images, of rank 4 or rank 3, of shape
 * [batch, height,
 width, inChannels]. If rank 3, batch of 1 is assumed.
 * @param size The new shape [newHeight,
 newWidth] to resize the
 images to. Each channel is resized individually.
 * @param alignCorners Defaults
 to false. If true, rescale
 input by (new_height - 1) / (height - 1), which exactly aligns the 4
 corners of
 images and resized images. If false, rescale by
 new_height / height. Treat similarly the width dimension.
 * @param halfPixelCenters Defaults to false. Whether to assume pixel centers
 are at 0.5, which would make
 the floating point coordinates of the top
 left pixel 0.5, 0.5.
 */
@doc {heading: 'Operations', subheading:
'Images', namespace: 'image'}
function resizeBilinear<T extends Tensor3D|Tensor4D>(
 images:
T|TensorLike, size: [number, number], alignCorners = false,
 halfPixelCenters = false): T {
 const $images =
 convertToTensor(images, 'images', 'resizeBilinear');
 util.assert(
 $images.rank === 3 || $images.rank ===
 4,
 () => `Error in resizeBilinear: x must be rank 3 or 4,
 but got ` +
 `rank ${$images.rank}.`);
 util.assert(
 size.length === 2,
 () => `Error in
 resizeBilinear: new shape must 2D, but got shape ` +
 `${size}.`);
 util.assert(
 halfPixelCenters ===
 false || alignCorners === false,
 () => `Error in resizeBilinear: If halfPixelCenters is true, ` +
 `alignCorners must be false.`);
 let batchImages = $images as Tensor4D;
 let reshapedTo4D = false;
 if ($images.rank === 3) {
 reshapedTo4D = true;
 batchImages = reshape(
 $images, [1, $images.shape[0],
 $images.shape[1], $images.shape[2]]);
 }
 const [] = size;
 const inputs: ResizeBilinearInputs = {images:
 batchImages};
 const attrs: ResizeBilinearAttrs = {alignCorners, halfPixelCenters, size};
 // tslint:disable-next-line: no-unnecessary-type-assertion
 const res = ENGINE.runKernel(
 ResizeBilinear, inputs as {
 } as
 NamedTensorMap,
 attrs as {
 } as NamedAttrMap) as
 T;
 if (reshapedTo4D) {
 return reshape(res, [res.shape[1], res.shape[2], res.shape[3]]) as T;
 }
 return
 res;
}
export const resizeBilinear = op({resizeBilinear_});
"/**
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 * you may not

```

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```

=====
import {ENGINE} from '../engine';
import {ResizeNearestNeighbor, ResizeNearestNeighborAttrs,
ResizeNearestNeighborInputs} from '../kernel_names';
import {NamedAttrMap} from
 '../kernel_registry';
import {Tensor3D, Tensor4D} from '../tensor';
import {NamedTensorMap} from
 '../tensor_types';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from
 '../types';
import * as util from '../util';
import {op} from './operation';
import {reshape} from
 './reshape';
/** NearestNeighbor resize a batch of 3D images to a new shape.
@param images The images, of rank 4 or rank 3, of shape
 [batch, height, width, inChannels]. If rank 3, batch of 1 is assumed.
@param size The new shape [newHeight, newWidth] to resize the
 images to. Each channel is resized individually.
@param alignCorners Defaults to False. If true, rescale
 input by (new_height - 1) / (height - 1), which exactly aligns the
 corners of images and resized images. If false, rescale by
 new_height / height.
 Treat similarly the width dimension.
@param halfPixelCenters Defaults to `false`. Whether to assume pixels
 are half the actual dimensions, and yields more accurate resizes. This flag
 would also make the floating point coordinates of the top left pixel
 0.5, 0.5.
@doc {heading: 'Operations', subheading:
 'Images', namespace: 'image'}
function resizeNearestNeighbor<T extends Tensor3D|Tensor4D>(
 images: T|TensorLike, size: [number, number], alignCorners = false,
 halfPixelCenters = false): T {
 const $images =
 convertToTensor(images, 'images', 'resizeNearestNeighbor');
 util.assert($images.rank === 3 ||
 $images.rank === 4,
 () => `Error in resizeNearestNeighbor: x must be rank 3 or 4, but got ` +
 `rank ${$images.rank}`);
 util.assert(size.length === 2,
 () => `Error in resizeNearestNeighbor: new
 shape must 2D, but got shape ` +
 `${size}`);
 util.assert($images.dtype === 'float32' || $images.dtype === 'int32',
 () => `images` must have `int32` or `float32` as
 dtype);
 util.assert(halfPixelCenters === false || alignCorners === false,
 () => `Error in
 resizeNearestNeighbor: If halfPixelCenters is true, ` +
 `alignCorners must be false.`);
 let batchImages =
 $images as Tensor4D;
 let reshapedTo4D = false;
 if ($images.rank === 3) {
 reshapedTo4D = true;
 batchImages = reshape($images, [1, $images.shape[0], $images.shape[1], $images.shape[2]]);
 }
 const [] = size;
 const inputs: ResizeNearestNeighborInputs = {images: batchImages};
 const attrs:
 ResizeNearestNeighborAttrs = {alignCorners, halfPixelCenters, size};
 // tslint:disable-next-line: no-unnecessary-type-assertion
 const res = ENGINE.runKernel(
 ResizeNearestNeighbor, inputs as {},
 NamedTensorMap,
 attrs as {} as NamedAttrMap) as T;
 if (reshapedTo4D) {
 return reshape(res, [res.shape[1], res.shape[2], res.shape[3]]) as T;
 }
 return res;
 }
export const
resizeNearestNeighbor = op({resizeNearestNeighbor});
*/
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limitations under the License.
=====
import {Tensor} from '../tensor';
import {convertToTensor} from '../tensor_util_env';
import
{TensorLike}
from '../types';
import {assert} from '../util';
import {greaterEqual} from './greater_equal';
import
{lessEqual}
from './less_equal';
import {logicalAnd} from './logical_and';
import {op} from

```

```

../operation';\nimport {range} from '../range';\nimport {reshape} from '../reshape';\nimport {scalar} from
../scalar';\nimport {stack} from '../stack';\nimport {sub} from '../sub';\nimport {unstack} from '../unstack';\nimport
{where} from '../where';\nimport {zeros} from '../zeros';\n\n**\n * Copy a tensor setting everything outside a
central band in each innermost\n * matrix to zero.\n *\n * The band part is computed as follows: Assume input has
`k` dimensions\n * `[I, J, K, ..., M, N]`, then the output is a tensor with the same shape where\n * `band[i, j, k, ..., m,
n] = in_band(m, n) * input[i, j, k, ..., m, n]`.\n * The indicator function\n * `in_band(m, n) = (num_lower < 0 || (m-n)
<= num_lower))` \n * `&& (num_upper < 0 || (n-m) <= num_upper)` \n *\n * ``js\n *
const x = tf.tensor2d([[0, 1, 2, 3],\n * [-1, 0, 1, 2],\n * [-2, -1, 0, 1],\n * [-3, -2, -1, 0]]);\n * let y = tf.linalg.bandPart(x, 1, -1);\n * y.print(); // [[0, 1, 2, 3],\n * // [-1, 0, 1, 2],\n * // [0, -1, 0, 1],\n * // [0, 0, -1, 0]]\n * let z = tf.linalg.bandPart(x, 2, 1);\n * z.print(); // [[0, 1, 0, 0],\n * // [-1, 0, 1, 0],\n * // [-2, -1, 0, 1],\n * // [0, -2, -1, 0]]\n *\n * @param x Rank `k`
tensor\n * @param numLower Number of subdiagonals to keep.\n * If negative, keep entire lower triangle.\n *
@param numUpper Number of subdiagonals to keep.\n * If negative, keep entire upper triangle.\n * @returns
Rank `k` tensor of the same shape as input.\n * The extracted banded tensor.\n *\n * @doc {heading:'Operations',
subheading:'Linear Algebra', namespace:'linalg'}\n *\nfunction bandPart<T extends Tensor>(\n
 a: T|TensorLike, numLower: number, numUpper: number): T {\n assert(\n numLower % 1 === 0,\n () =>
`bandPart(): numLower must be an integer, got ${numLower}.`);\n assert(\n numUpper % 1 === 0,\n () =>
`bandPart(): numUpper must be an integer, got ${numUpper}.`);\n\n const $a = convertToTensor(a, 'a',
'bandPart');\n\n assert(\n $a.rank >= 2,\n () => `bandPart(): Rank must be at least 2, got ${$a.rank}.`);\n\n const shape = $a.shape;\n const [M, N] = $a.shape.slice(-2);\n if (!(numLower <= M)) {\n throw new Error(\n
 `bandPart(): numLower (${numLower})` +\n ` must not be greater than the number of rows (${M}).`);\n }\n if (!(numUpper <= N)) {\n throw new Error(\n
 `bandPart(): numUpper (${numUpper})` +\n ` must not be greater than the number of columns (${N}).`);\n }\n if (numLower < 0) {\n numLower = M;\n }\n if
(numUpper < 0) {\n numUpper = N;\n }\n\n const i = reshape(range(0, M, 1, 'int32'),
[-1, 1]);\n const j = range(0, N, 1, 'int32');\n const ij = sub(i, j);\n const inBand = logicalAnd(\n lessEqual(ij,
scalar(+numLower, 'int32')),\n greaterEqual(ij, scalar(-numUpper, 'int32')));\n const zero = zeros([M, N],
$a.dtype);\n\n return reshape(\n stack(unstack(reshape($a, [-1, M, N]))\n .map(mat =>
where(inBand, mat, zero))),\n shape) as T;\n}\n\nexport const bandPart = op({bandPart_});\n\n"/**\n *
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=====\n
*\nimport {ENGINE} from '../engine';\nimport {Tensor1D, Tensor2D} from '../tensor';\nimport {assert} from
../util';\nimport {div} from '../div';\nimport {mul} from '../mul';\nimport {norm} from '../norm';\nimport {op}
from '../operation';\nimport {split} from '../split';\nimport {squeeze} from '../squeeze';\nimport {stack} from
../stack';\nimport {sub} from '../sub';\nimport {sum} from '../sum';\n\n**\n * Gram-Schmidt orthogonalization.\n *\n * ``js\n * const x = tf.tensor2d([[1, 2], [3, 4]]);\n * let y = tf.linalg.gramSchmidt(x);\n * y.print();\n *
console.log('Orthogonalized:');\n * y.dot(y.transpose()).print(); // should be nearly the identity matrix.\n *
console.log('First row direction maintained:');\n * const data = await y.array();\n * console.log(data[0][1] /
data[0][0]);\n *\n * // should be nearly 2.\n *\n * @param xs The vectors to be orthogonalized, in one of the two following\n *
formats:\n * - An Array of `tf.Tensor1D`.\n * - A `tf.Tensor2D`, i.e., a matrix, in which case the vectors are the
rows\n * of `xs`.\n * In each case, all the vectors must have the same length and the length\n * must be greater
than or equal to the number of vectors.\n * @returns The orthogonalized and normalized vectors or matrix.\n *
Orthogonalization means that the vectors or the rows of the matrix\n * are orthogonal (zero inner products).

```

Normalization means that each vector or each row of the matrix has an L2 norm that equals 1.

```

@doc {heading:'Operations', subheading:'Linear Algebra', namespace:'linalg'}
Tensor1D[]|Tensor2D): Tensor1D[]|Tensor2D {
 let inputIsTensor2D: boolean;
 if (Array.isArray(xs)) {
 inputIsTensor2D = false;
 assert(
 xs != null && xs.length > 0,
 () => 'Gram-Schmidt
process: input must not be null, undefined, or ' +
 'empty');
 const dim = xs[0].shape[0];
 for (let i = 1;
i < xs.length; ++i) {
 assert(
 xs[i].shape[0] === dim,
 () => 'Gram-Schmidt: Non-unique
lengths found in the input vectors: ' +
 `(${xs as Tensor1D[]}[i].shape[0]) vs. ${dim}`);
 }
 } else {
 inputIsTensor2D = true;
 xs = split(xs, xs.shape[0], 0).map(x => squeeze(x, [0]));
 }
 assert(
 xs.length
<= xs[0].shape[0],
 () => `Gram-Schmidt: Number of vectors (${
 xs as Tensor1D[]}).length`)
exceeds ` +
 `number of dimensions (${xs as Tensor1D[]}[0].shape[0]).`;
 const ys: Tensor1D[] = [];
 const xs1d = xs;
 for (let i = 0; i < xs.length; ++i) {
 ys.push(ENGINE.tidy(() => {
 let x = xs1d[i];
 if (i > 0) {
 for (let j = 0; j < i; ++j) {
 const proj = mul(sum(mul(ys[j], x)), ys[j]);
 x = sub(x, proj);
 }
 }
 return div(x, norm(x, 'euclidean'));
 }));
 }
 if (inputIsTensor2D) {
 return stack(ys, 0) as Tensor2D;
 } else {
 return ys;
 }
}
export const gramSchmidt =
op({gramSchmidt_});
"/**
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License.
 */

```

```

=====
*/
import {ENGINE} from '../engine';
import {dispose} from '../globals';
import {Tensor, Tensor2D} from '../tensor';
import {assert} from '../util';
import {clone} from './clone';
import {concat} from './concat';
import {div} from './div';
import {eye} from './eye';
import {greater} from './greater';
import {matMul} from './mat_mul';
import {mul} from './mul';
import {neg} from './neg';
import {norm} from './norm';
import {op} from './operation';
import {reshape} from './reshape';
import {slice} from './slice';
import {stack} from './stack';
import {sub} from './sub';
import {tensor2d} from './tensor2d';
import {transpose} from './transpose';
import {unstack} from './unstack';
import {where} from './where';
/**
 * Compute QR decomposition of m-by-n matrix using
Householder transformation.
 * Implementation based on
 * [http://www.cs.cornell.edu/~bindel/class/cs6210-f09/lec18.pdf]
 * [http://www.cs.cornell.edu/~bindel/class/cs6210-f09/lec18.pdf]
 * ```js
 * const a = tf.tensor2d([[1, 2], [3, 4]]);
 * let [q, r] = tf.linalg.qr(a);
 * console.log('Q');
 * q.print();
 * console.log('R');
 * r.print();
 * console.log('Orthogonalized');
 * q.dot(q.transpose()).print() // should be nearly
the identity matrix.
 * console.log('Reconstructed');
 * q.dot(r).print(); // should be nearly [[1, 2], [3, 4]]
 *
 * @param x The `tf.Tensor` to be QR-decomposed. Must have rank >= 2. Suppose
 * it has the shape `[..., M, N]`.
 * @param fullMatrices An optional boolean parameter. Defaults to `false`.
 * If `true`, compute full-sized
`Q`. If `false` (the default),
 * compute only the leading N columns of `Q` and `R`.
 * @returns An `Array` of
two `tf.Tensor`s: `[Q, R]`. `Q` is a unitary matrix,
 * i.e., its columns all have unit norm and are mutually
orthogonal.
 * If `M >= N`,
 * If `fullMatrices` is `false` (default),
 * - `Q` has a shape of `[..., M, N]`,
 * - `R` has a shape of `[..., N, N]`.
 * If `fullMatrices` is `true` (default),
 * - `Q` has a shape of `[..., M, M]`,
 * - `R` has a shape of
`[..., M, N]`.
 * If `M < N`,
 * - `Q` has a shape of `[..., M, M]`,
 * - `R` has a shape of `[..., M, N]`.
 * @throws If the rank of `x` is less than 2.
 */
@doc {heading:'Operations', subheading:'Linear Algebra',
namespace:'linalg'}
function qr_(x: Tensor, fullMatrices = false): [Tensor, Tensor] {
 assert(
 x.rank >= 2,
 () => `qr() requires input tensor to have a rank >= 2, but got rank ${
 x.rank}`);
 if (x.rank === 2) {
 return qr2d(x as Tensor2D, fullMatrices);
 } else {
 // Rank > 2. // TODO(cais): Below

```

```

we split the input into individual 2D tensors,\n // perform QR decomposition on them and then stack the results
back\n // together. We should explore whether this can be parallelized.\n const outerDimsProd =
x.shape.slice(0, x.shape.length - 2)\n
 .reduce((value, prev) => value * prev);\n const x2ds = unstack(\n reshape(\n x,\n
[\n outerDimsProd, x.shape[x.shape.length - 2],\n x.shape[x.shape.length - 1]\n]),\n 0);\n
const q2ds: Tensor2D[] = [];\n const r2ds: Tensor2D[] = [];\n x2ds.forEach(x2d => {\n const [q2d, r2d] =
qr2d(x2d as Tensor2D, fullMatrices);\n q2ds.push(q2d);\n r2ds.push(r2d);\n });\n const q =
reshape(stack(q2ds, 0), x.shape);\n const r = reshape(stack(r2ds, 0), x.shape);\n return [q, r];\n })\n\nfunction
qr2d(x: Tensor2D, fullMatrices = false): [Tensor2D, Tensor2D] {\n return ENGINE.tidy(() => {\n assert(\n
x.shape.length === 2,\n () => `qr2d() requires a 2D Tensor, but got a ${\n x.shape.length}D
Tensor.`);\n const m = x.shape[0];\n const n = x.shape[1];\n let q = eye(m); // Orthogonal transform so
far.\n let r = clone(x); //
Transformed matrix so far.\n const one2D = tensor2d([[1], [1, 1]]);\n let w: Tensor2D = clone(one2D);\n\n
const iters = m >= n ? n : m;\n for (let j = 0; j < iters; ++j) {\n // This tidy within the for-loop ensures we clean
up temporary\n // tensors as soon as they are no longer needed.\n const rTemp = r;\n const wTemp = w;\n
const qTemp = q;\n [w, r, q] = ENGINE.tidy(): [Tensor2D, Tensor2D, Tensor2D] => {\n // Find H = I - tau
* w * w', to put zeros below R(j, j).\n const rjEnd1 = slice(r, [j, j], [m - j, 1]);\n const normX =
norm(rjEnd1);\n const rjj = slice(r, [j, j], [1, 1]);\n // The sign() function returns 0 on 0, which causes
division by zero.\n const s = where(greater(rjj, 0), tensor2d([-1]), tensor2d([1]));\n const u1 = sub(rjj,
mul(s, normX));\n const wPre = div(rjEnd1, u1);\n if (wPre.shape[0] === 1) {\n w = clone(one2D);\n
} else {\n
w = concat(\n [\n one2D,\n slice(wPre, [1, 0], [wPre.shape[0] - 1, wPre.shape[1]]) as\n
Tensor2D\n],\n 0);\n }\n const tau = neg(div(matMul(s, u1), normX)) as
Tensor2D;\n // -- R := HR, Q := QH.\n const rjEndAll = slice(r, [j, 0], [m - j, n]);\n const tauTimesW:
Tensor2D = mul(tau, w);\n const wT: Tensor2D = transpose(w);\n if (j === 0) {\n r = sub(rjEndAll,
matMul(tauTimesW, matMul(wT, rjEndAll))); \n } else {\n const rTimesTau: Tensor2D =\n
sub(rjEndAll, matMul(tauTimesW, matMul(wT, rjEndAll))); \n r = concat([slice(r, [0, 0], [j, n]), rTimesTau],
0);\n }\n const tauTimesWT: Tensor2D = transpose(tauTimesW);\n const qAllJEnd = slice(q, [0, j],
[m, q.shape[1] - j]);\n if (j === 0) {\n q = sub(qAllJEnd, matMul(matMul(qAllJEnd, w), tauTimesWT));\n
} else {\n
const qTimesTau: Tensor2D =\n sub(qAllJEnd, matMul(matMul(qAllJEnd, w), tauTimesWT));\n
q = concat([slice(q, [0, 0], [m, j]), qTimesTau], 1);\n }\n return [w, r, q];\n });\n dispose([rTemp,
wTemp, qTemp]);\n }\n\n if (!fullMatrices && m > n) {\n q = slice(q, [0, 0], [m, n]);\n r = slice(r, [0, 0],
[n, n]);\n }\n\n return [q, r];\n }) as [Tensor2D, Tensor2D];\n }\n\nexport const qr = op({qr_});\n\n/*\n *
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2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
=====\n
\n\nexport enum Reduction {\n NONE,\n MEAN,\n SUM,\n SUM_BY_NONZERO_WEIGHTS\n}\n\n/\n *
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2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
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law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *

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=====
*/\nimport {Tensor} from '../tensor';\nimport {convertToTensor} from '../tensor_util_env';\nimport
{TensorLike} from '../types';\n\nimport {cast} from './cast';\nimport {div} from './div';\nimport {Reduction} from
../loss_ops_utils';\nimport {mean} from './mean';\nimport {mul} from './mul';\nimport {notEqual} from
../not_equal';\nimport {ones} from './ones';\nimport {op} from './operation';\nimport {scalar} from
../scalar';\nimport {sum} from './sum';\n\n/**\n * Computes the weighted loss between two tensors.\n * \n *
@param losses Tensor of shape `[batch_size, d1, ... dN]`.\n * @param weights Tensor whose rank is either 0, or the
same rank as\n * `losses`, and must be broadcastable to `losses` (i.e., all\n * dimensions must be either `1`, or the
same as the corresponding\n * `losses` dimension).\n * \n * @doc {heading: 'Training', subheading: 'Losses',
namespace: 'losses'}\n */\nfunction computeWeightedLoss_<T extends Tensor, O extends Tensor>(\n losses:
T|TensorLike, weights?: Tensor|TensorLike,\n reduction = Reduction.SUM_BY_NONZERO_WEIGHTS): O {\n
const $losses = convertToTensor(losses, 'losses', 'computeWeightedLoss');\n let $weights: Tensor = null;\n if
(weights != null) {\n $weights = convertToTensor(weights, 'weights', 'computeWeightedLoss');\n }\n\n const
weightedLoss = ($weights == null) ? $losses : mul($losses, $weights);\n\n if (reduction === Reduction.NONE) {\n
return weightedLoss as O;\n }\n if (reduction === Reduction.SUM) {\n return sum(weightedLoss);\n }\n if
(reduction === Reduction.MEAN) {\n if ($weights == null) {\n return mean(weightedLoss);\n } else {\n
const broadcastFactor = $losses.size / $weights.size;\n const result = div(sum(weightedLoss), sum($weights));\n
return broadcastFactor > 1 ? div(result, scalar(broadcastFactor)) :\n result as O;\n }\n }\n\n if
(reduction === Reduction.SUM_BY_NONZERO_WEIGHTS) {\n if ($weights == null)\n {\n return div(sum(weightedLoss), scalar($losses.size));\n } else {\n const broadcastedWeights =
mul($weights, ones($losses.shape));\n const numNonZeros =\n cast(sum(notEqual(broadcastedWeights,
scalar(0))), 'float32');\n return div(sum(weightedLoss), numNonZeros);\n }\n }\n\n throw Error(`Unknown
reduction: ${reduction}`);\n }\n\nexport const computeWeightedLoss = op({computeWeightedLoss_});\n\n"/**\n *
@license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific\n * language governing permissions and\n * limitations under the License.\n */
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=====
*/\n\nimport {Tensor} from '../tensor';\nimport {convertToTensor} from '../tensor_util_env';\nimport
{TensorLike} from '../types';\nimport {assertShapesMatch} from '../util';\nimport {abs} from './abs';\nimport
{Reduction} from ../loss_ops_utils';\nimport {op} from './operation';\nimport {sub} from './sub';\n\nimport
{computeWeightedLoss} from './compute_weighted_loss';\n\n/**\n * Computes the absolute difference loss
between two tensors.\n * \n * @param labels The ground truth output tensor, same dimensions as\n *
'predictions'.\n * @param predictions The predicted outputs.\n * @param weights Tensor whose rank is either 0, or
the same rank as\n * `labels`, and must be broadcastable to `labels` (i.e., all dimensions\n * must be either `1`, or
the same as the corresponding\n * `losses` dimension).\n * \n * @param\n * reduction Type of reduction to apply to loss. Should be of type\n * `Reduction`\n * \n * @doc {heading:
'Training', subheading: 'Losses', namespace: 'losses'}\n */\nfunction absoluteDifference_<T extends Tensor, O
extends Tensor>(\n labels: T|TensorLike, predictions: T|TensorLike,\n weights?: Tensor|TensorLike,\n
reduction = Reduction.SUM_BY_NONZERO_WEIGHTS): O {\n const $labels = convertToTensor(labels, 'labels',
'absoluteDifference');\n const $predictions =\n convertToTensor(predictions, 'predictions',
'absoluteDifference');\n let $weights: Tensor = null;\n if (weights != null) {\n $weights =
convertToTensor(weights, 'weights', 'absoluteDifference');\n }\n\n assertShapesMatch(\n $labels.shape,
$predictions.shape, 'Error in absoluteDifference: '); \n\n const losses = abs(sub($labels, $predictions));\n return
computeWeightedLoss(losses, $weights, reduction);\n }\n\nexport const absoluteDifference =

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op({absoluteDifference\_});\n", "/\*\n \* @license\n \* Copyright  
2020 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the \"License\");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \* http://www.apache.org/licenses/LICENSE-2.0\n \* Unless required by applicable law or agreed to in writing,  
software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES  
OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language  
governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\nimport {Tensor} from '../tensor';\nimport {convertToTensor} from '../tensor_util_env';\nimport\n{TensorLike} from '../types';\nimport {assertShapesMatch} from '../util';\nimport {Reduction} from\n../loss_ops_utils';\nimport {mul} from '../mul';\nimport {op} from '../operation';\nimport {scalar}\nfrom '../scalar';\nimport {sub} from '../sub';\nimport {sum} from '../sum';\nimport {computeWeightedLoss} from\n../compute_weighted_loss';\n\n/**\n * Computes the cosine distance loss between two tensors.\n * @param\n labels The ground truth output tensor, same dimensions as\n * `predictions`.\n * @param predictions The predicted\n outputs.\n * @param axis The dimension along which the cosine distance is computed.\n * @param weights Tensor\n whose rank is either 0, or the same rank as\n * `labels`, and must be broadcastable to `labels` (i.e., all dimensions\n * must be either `1`, or the same as the corresponding `losses`\n * dimension).\n * @param reduction Type of\n reduction to apply to loss. Should be of type\n * `Reduction`\n * @doc {heading: 'Training', subheading:\n 'Losses', namespace: 'losses'}\n\nfunction cosineDistance_<T extends Tensor, O extends Tensor>(\n labels:\n T|TensorLike, predictions: T|TensorLike, axis: number,\n weights?: Tensor|TensorLike,\n reduction = Reduction.SUM_BY_NONZERO_WEIGHTS): O {\n const $labels = convertToTensor(labels,\n 'labels', 'cosineDistance');\n const $predictions =\n convertToTensor(predictions, 'predictions',\n 'cosineDistance');\n let $weights: Tensor = null;\n if (weights != null) {\n $weights = convertToTensor(weights,\n 'weights', 'cosineDistance');\n }\n assertShapesMatch(\n $labels.shape, $predictions.shape, 'Error in\n cosineDistance:');\n const one = scalar(1);\n const losses = sub(one, sum(mul($labels, $predictions), axis,\n true));\n return computeWeightedLoss(losses, $weights, reduction);\n}\n\nexport const cosineDistance =
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op({cosineDistance\_});\n", "/\*\n \* @license\n \* Copyright 2020 Google LLC. All Rights Reserved.\n \* Licensed  
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BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the  
License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\nimport {Tensor} from '../tensor';\nimport {convertToTensor} from '../tensor_util_env';\nimport\n{TensorLike} from '../types';\nimport {assertShapesMatch} from '../util';\nimport {Reduction} from\n../loss_ops_utils';\nimport {mul} from '../mul';\nimport {op} from '../operation';\nimport {relu} from\n../relu';\nimport {scalar} from '../scalar';\nimport {sub} from '../sub';\nimport {computeWeightedLoss} from\n../compute_weighted_loss';\n\n/**\n * Computes the Hinge loss between two tensors.\n * @param labels The\n ground truth output tensor, same dimensions as\n * `predictions`.\n * @param predictions The predicted\n outputs.\n * @param weights Tensor whose rank is either 0, or the same rank\n as\n * `labels`, and must be broadcastable to `labels` (i.e., all dimensions\n * must be either `1`, or the same as\n the corresponding `losses`\n * dimension).\n * @param reduction Type of\n reduction to apply to loss. Should be of\n type\n * `Reduction`\n * @doc {heading: 'Training', subheading: 'Losses', namespace: 'losses'}\n\nfunction hingeLoss_<T extends Tensor, O extends Tensor>(\n labels: T|TensorLike, predictions: T|TensorLike,\n weights?: Tensor|TensorLike,\n reduction = Reduction.SUM_BY_NONZERO_WEIGHTS): O {\n let $labels =\n convertToTensor(labels, 'labels', 'hingeLoss');\n const $predictions = convertToTensor(predictions, 'predictions',\n 'hingeLoss');\n let $weights: Tensor = null;\n if (weights != null) {\n $weights = convertToTensor(weights,
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'weights', 'hingeLoss');\n }\n assertShapesMatch($labels.shape, $predictions.shape, 'Error
in hingeLoss: ');
const one = scalar(1); // Convert binary labels to (-1, 1)
$labels = sub(mul(scalar(2),
$labels), one);
const losses = relu(sub(one, mul($labels, $predictions)));
return computeWeightedLoss(losses,
$weights, reduction);
\nexport const hingeLoss = op({hingeLoss_});\n", "/*\n * @license\n * Copyright 2020
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
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=====\n
*\n\nimport {Tensor} from '././tensor';\nimport {convertToTensor} from '././tensor_util_env';\nimport
{TensorLike} from '././types';\nimport {assertShapesMatch} from '././util';\nimport {abs} from './abs';\nimport
{add} from './add';\nimport {Reduction} from './loss_ops_utils';\nimport {minimum} from './minimum';\nimport
{mul} from './mul';\nimport {op} from './operation';\nimport {scalar} from './scalar';\nimport {square} from
 './square';\nimport {sub} from './sub';\n\nimport {computeWeightedLoss} from
 './compute_weighted_loss';\n\n/**\n * Computes the huber loss between two tensors.\n * @param labels The
ground truth output tensor, same dimensions as\n * `predictions`.\n * @param predictions The predicted outputs.\n
* @param weights Tensor whose rank is either 0, or the same rank as\n * `labels`, and must be broadcastable to
`labels` (i.e., all dimensions\n * must be either `1`, or the same as the corresponding `losses`\n * dimension).\n
* @param delta Point where huber loss changes from quadratic to linear.\n * @param reduction Type of reduction
to apply to loss. Should be of type\n * `Reduction`.\n * @doc {heading: 'Training', subheading: 'Losses',
namespace: 'losses'}\n *\nfunction huberLoss<T extends Tensor, O extends Tensor>(\n labels: T|TensorLike,
predictions: T|TensorLike,\n weights?: Tensor|TensorLike, delta = 1.0,\n reduction =
Reduction.SUM_BY_NONZERO_WEIGHTS): O {\n const $labels = convertToTensor(labels, 'labels',
'huberLoss');\n const $predictions = convertToTensor(predictions, 'predictions', 'huberLoss');\n let $weights:
Tensor = null;\n if (weights != null) {\n $weights = convertToTensor(weights, 'weights', 'huberLoss');\n }\n assertShapesMatch($labels.shape, $predictions.shape, 'Error in huberLoss: ');
const deltaScalar =
scalar(delta);\n const error = abs(sub($predictions, $labels));\n const quadratic = minimum(error, deltaScalar);\n
const linear = sub(error,
quadratic);\n\n const losses =\n add(mul(scalar(0.5), square(quadratic)), mul(deltaScalar, linear));\n return
computeWeightedLoss(losses, $weights, reduction);\n}\n\nexport const huberLoss = op({huberLoss_});\n", "/*\n *
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2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a
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law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n
* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
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=====\n
*\n\nimport {Tensor} from '././tensor';\nimport {convertToTensor}
from '././tensor_util_env';\nimport {TensorLike} from '././types';\nimport {assertShapesMatch} from
 '././util';\nimport {add} from './add';\nimport {log} from './log';\nimport {Reduction} from
 './loss_ops_utils';\nimport {mul} from './mul';\nimport {neg} from './neg';\nimport {op} from
 './operation';\nimport {scalar} from './scalar';\nimport {sub} from './sub';\n\nimport {computeWeightedLoss} from
 './compute_weighted_loss';\n\n/**\n * Computes the log loss between two tensors.\n * @param labels The
ground truth output tensor, same dimensions as\n * `predictions`.\n * @param predictions The predicted outputs.\n
* @param weights Tensor whose rank is either 0, or the same rank as\n * `labels`, and must be broadcastable to
`labels` (i.e., all dimensions\n * must be either `1`, or the same as the corresponding `losses`\n * dimension).\n
*\nfunction logLoss<T extends Tensor, O extends Tensor>(\n labels: T|TensorLike,
predictions: T|TensorLike,\n weights?: Tensor|TensorLike, delta = 1.0,\n reduction =
Reduction.SUM_BY_NONZERO_WEIGHTS): O {\n const $labels = convertToTensor(labels, 'labels', 'logLoss');\n const
$predictions = convertToTensor(predictions, 'predictions', 'logLoss');\n let $weights: Tensor = null;\n if
(weights != null) {\n $weights = convertToTensor(weights, 'weights', 'logLoss');\n }\n assertShapesMatch($labels.shape, $predictions.shape, 'Error in logLoss: ');
const deltaScalar =
scalar(delta);\n const error = abs(sub($predictions, $labels));\n const quadratic = minimum(error, deltaScalar);\n
const linear = sub(error,
quadratic);\n\n const losses =\n add(mul(scalar(0.5), square(quadratic)), mul(deltaScalar, linear));\n return
computeWeightedLoss(losses, $weights, reduction);\n}\n\nexport const logLoss = op({logLoss_});\n", "/*\n *
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copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n
* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
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@param epsilon A small increment to avoid taking log of zero\n * @param reduction Type of reduction to apply to
loss. Should be of type\n * `Reduction`\n *\n * @doc {heading: 'Training', subheading: 'Losses', namespace:
'losses'}\n *\nfunction logLoss_<T extends Tensor, O extends Tensor>(\n labels: T|TensorLike, predictions:
T|TensorLike,\n weights?: Tensor|TensorLike, epsilon = 1e-7,\n reduction =
Reduction.SUM_BY_NONZERO_WEIGHTS): O {\n const $labels = convertToTensor(labels, 'labels', 'logLoss');\n
const $predictions = convertToTensor(predictions, 'predictions', 'logLoss');\n let $weights: Tensor = null;\n if
(weights != null) {\n $weights = convertToTensor(weights, 'weights', 'logLoss');\n }\n assertShapesMatch($labels.shape, $predictions.shape, 'Error in logLoss: ');\n const one = scalar(1);\n const
epsilonScalar = scalar(epsilon);\n const l1 = neg(mul($labels, log(add($predictions, epsilonScalar))));\n const l2
=\n mul(sub(one, $labels), log(add(sub(one, $predictions), epsilonScalar)));\n const losses = sub(l1, l2);\n return
computeWeightedLoss(losses,
 $weights, reduction);\n}\n\nexport const logLoss = op({logLoss_});\n", "/*\n * @license\n * Copyright 2020 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

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=====\n
*\n\nimport {Tensor} from '../tensor';\nimport {convertToTensor} from '../tensor_util_env';\nimport
{TensorLike} from '../types';\nimport {assertShapesMatch} from '../util';\nimport {Reduction} from
'./loss_ops_utils';\nimport {op} from './operation';\nimport {squaredDifference} from
'./squared_difference';\nimport {computeWeightedLoss} from './compute_weighted_loss';\n\n/**\n * Computes
the mean squared error between two tensors.\n *\n * @param labels The ground truth output tensor, same
dimensions as\n * `predictions`.\n * @param predictions The predicted outputs.\n * @param weights Tensor whose
rank is either 0, or the same rank as\n * `labels`, and must be broadcastable to `labels` (i.e., all dimensions\n
* must be either `1`, or the same as the corresponding `losses`\n * dimension).\n * @param reduction Type of
reduction to apply to loss. Should be of type\n * `Reduction`\n *\n * @doc {heading: 'Training', subheading:
'Losses', namespace: 'losses'}\n *\nfunction meanSquaredError_<T extends Tensor, O extends Tensor>(\n labels:
T|TensorLike, predictions: T|TensorLike,\n weights?: Tensor|TensorLike,\n reduction =
Reduction.SUM_BY_NONZERO_WEIGHTS): O
{\n const $labels = convertToTensor(labels, 'labels', 'meanSquaredError');\n const $predictions =\n
convertToTensor(predictions, 'predictions', 'meanSquaredError');\n let $weights: Tensor = null;\n if (weights !=
null) {\n $weights = convertToTensor(weights, 'weights', 'meanSquaredError');\n }\n assertShapesMatch(\n
$labels.shape, $predictions.shape, 'Error in meanSquaredError: ');\n const losses = squaredDifference($labels,
$predictions);\n return computeWeightedLoss(losses, $weights, reduction);\n}\n\nexport const meanSquaredError =
op({meanSquaredError_});\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n *
Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License
is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *

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=====\n
*\n\nimport {Tensor} from '../tensor';\nimport {convertToTensor} from '../tensor_util_env';\nimport
{TensorLike} from '../types';\nimport {assertShapesMatch} from '../util';\nimport {abs} from './abs';\nimport
{add} from './add';\nimport {exp} from './exp';\nimport {log1p} from './log1p';\nimport {Reduction} from

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./loss_ops_utils';\nimport {mul} from './mul';\nimport {neg} from './neg';\nimport {op} from
./operation';\nimport {relu} from './relu';\nimport {scalar} from './scalar';\nimport {sub} from './sub';\n\nimport
{computeWeightedLoss} from './compute_weighted_loss';\n\nfunction sigmoidCrossEntropyWithLogits_<T
extends Tensor, O extends Tensor>(\n
 labels: T|TensorLike, logits: T|TensorLike): O {\n const $labels =\n convertToTensor(labels, 'labels',
'sigmoidCrossEntropyWithLogits');\n const $logits =\n convertToTensor(logits, 'logits',
'sigmoidCrossEntropyWithLogits');\n assertShapesMatch(\n $labels.shape, $logits.shape, 'Error in
sigmoidCrossEntropyWithLogits: ');}\n\n/**\n * Implementation Details:\n * For brevity, let `x = logits`, `z
= labels`. The logistic loss is\n * $z * -\log(\text{sigmoid}(x)) + (1 - z) * -\log(1 - \text{sigmoid}(x))$ \n * $= z * -\log(1 / (1 + \exp(-x))) + (1 - z) * -\log(\exp(-x) / (1 + \exp(-x)))$ \n * $= z * \log(1 + \exp(-x)) + (1 - z) * (x + \log(1 + \exp(-x)))$ \n * $= (1 - z) * x + \log(1 + \exp(-x))$ \n * $= x - x * z + \log(1 + \exp(-x))$ \n * For $x < 0$, to avoid overflow in $\exp(-x)$, we reformulate the above\n * $x - x * z + \log(1 + \exp(-x))$ \n * $= \log(\exp(x)) - x * z + \log(1 + \exp(-x))$ \n * $= -x * z + \log(1 + \exp(x))$ \n * Hence, to ensure stability and avoid overflow, the implementation uses\n * this equivalent formulation:\n * $\max(x, 0) - x * z + \log(1 + \exp(-\text{abs}(x)))$ \n *\n const maxOutput =
relu($logits);\n const outputXTarget = mul($logits, $labels);\n const sigmoidOutput =
log1p(exp(neg(abs($logits))));\n return add(sub(maxOutput, outputXTarget), sigmoidOutput);\n}\n\n/**\n * Computes the sigmoid cross entropy loss between two tensors.\n * If labelSmoothing is nonzero, smooth the
labels towards 1/2:\n * $\text{newMulticlassLabels} = \text{multiclassLabels} * (1 - \text{labelSmoothing}) + 0.5 * \text{labelSmoothing}$ \n * @param multiClassLabels The ground truth output tensor of shape\n * [batch_size, num_classes], same dimensions as 'predictions'.\n * @param logits The predicted outputs.\n * @param weights Tensor whose rank is either 0, or the same rank as\n * `labels`, and must be broadcastable to `labels` (i.e., all
dimensions\n * must be either `1`, or the same as the corresponding `losses` dimension).\n * @param labelSmoothing If
greater than 0, then smooth the labels.\n * @param reduction Type of reduction to apply to loss. Should be of type\n * `Reduction`\n *\n @doc { heading: 'Training', subheading: 'Losses', namespace: 'losses' }\n\nfunction
sigmoidCrossEntropy_<T extends Tensor, O extends Tensor>(\n multiClassLabels: T|TensorLike, logits:
T|TensorLike,\n weights?: Tensor|TensorLike, labelSmoothing = 0,\n reduction =
Reduction.SUM_BY_NONZERO_WEIGHTS): O {\n let $multiClassLabels = convertToTensor(\n multiClassLabels, 'multiClassLabels', 'sigmoidCrossEntropy');\n const $logits = convertToTensor(logits, 'logits',
'sigmoidCrossEntropy');\n let $weights: Tensor = null;\n if (weights != null) {\n $weights =
convertToTensor(weights, 'weights', 'sigmoidCrossEntropy');\n }\n assertShapesMatch(\n $multiClassLabels.shape, $logits.shape, 'Error in sigmoidCrossEntropy:
');\n\n if (labelSmoothing > 0) {\n const labelSmoothingScalar = scalar(labelSmoothing);\n const one =
scalar(1);\n const half = scalar(0.5);\n\n $multiClassLabels =\n add(mul($multiClassLabels, sub(one, labelSmoothingScalar)),\n mul(half, labelSmoothingScalar));\n }\n const losses =
sigmoidCrossEntropyWithLogits_($multiClassLabels, $logits);\n\n return computeWeightedLoss(losses, $weights,
reduction);\n}\n\nexport const sigmoidCrossEntropy = op({sigmoidCrossEntropy_});\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
"License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS
OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions
and\n * limitations under the License.\n *\n =====\n\n *\nimport {customGrad} from './../gradients';\nimport {Tensor} from './../tensor';\nimport {GradSaveFunc} from
'./../tensor_types';\nimport {convertToTensor} from './../tensor_util_env';\nimport {TensorLike} from

```

```

'././types';\nimport {assertShapesMatch} from '././util';\nimport {add} from './add';\nimport
{expandShapeToKeepDim} from './axis_util';\nimport {cast} from './cast';\nimport {div} from './div';\nimport
{exp} from './exp';\nimport {logSumExp} from './log_sum_exp';\nimport {Reduction} from
'./loss_ops_utils';\nimport {mul} from './mul';\nimport {neg} from './neg';\nimport {op} from
'./operation';\nimport {reshape} from './reshape';\nimport {scalar} from './scalar';\nimport {sub} from
'./sub';\nimport {sum} from './sum';\n\nimport
{computeWeightedLoss} from './compute_weighted_loss';\n\n/**\n * Computes softmax cross entropy between
logits and labels.\n * \n * Measures the probability error in discrete classification tasks in which\n * the classes are
mutually exclusive (each entry is in exactly one class).\n * For example, each CIFAR-10 image is labeled with one
and only one label: an\n * image can be a dog or a truck, but not both.\n * \n * NOTE: While the classes are
mutually exclusive, their probabilities need\n * not be. All that is required is that each row of labels is a valid\n *
probability distribution. If they are not, the computation of the gradient\n * will be incorrect.\n * \n * WARNING:
This op expects unscaled logits, since it performs a softmax on\n * logits internally for efficiency. Do not call this op
with the output of\n * softmax, as it will produce incorrect results.\n * \n * logits and labels must have the same
shape, e.g. [batch_size, num_classes]\n * and the same dtype.\n * \n * @param
labels The labels array.\n * \n * @param logits The logits array.\n * \n * @param dim The dimension softmax would be
performed on. Defaults to -1\n * which indicates the last dimension.\n * \n * \n * function
softmaxCrossEntropyWithLogits_<T extends Tensor, O extends Tensor>(\n * labels: T, logits: T, dim = -1): O {\n *
if (dim === -1) {\n * dim = logits.rank - 1;\n * }\n * \n * if (dim !== logits.rank - 1) {\n * throw Error(\n * `Softmax
cross entropy along a non-last dimension is not yet\n * supported. Labels / logits was rank ${logits.rank}\n *
` +\n * `and dim was ${dim}`);\n * }\n * \n * // Use a custom gradient for numerical stability.\n * \n * const customOp =\n * customGrad((labels: Tensor, logits: Tensor, save: GradSaveFunc) => {\n * // Reference:\n * // 1.
http://cs231n.github.io/linear-classify/#softmax\n * // 2. https://blog.feedly.com/tricks-of-the-trade-logsumexp/\n *
const keepDims = true;\n * \n * const lse = logSumExp(logits, [dim], keepDims);\n *
const logResult = sub(cast(logits, 'float32'), lse);\n * \n * save([labels, logResult]);\n * \n * const costVector =
neg(mul(logResult, labels));\n * \n * const value: O = sum(costVector, [dim]);\n * \n * const gradFunc = (dy: O,
saved: Tensor[]) => {\n * \n * const [labels, logResult] = saved;\n * \n * const dyShape =
expandShapeToKeepDim(dy.shape, [dim]);\n * \n * return [\n * \n * mul(reshape(dy, dyShape),\n *
sub(cast(labels, 'float32'), exp(logResult))),\n * \n * mul(reshape(dy, dyShape),\n * \n * sub(exp(logResult),
cast(labels, 'float32'))),\n * \n *];\n * \n * \n * return {value, gradFunc};\n * \n * });\n * \n * \n * return customOp(labels,
logits);\n * \n * \n * \n * Computes the softmax cross entropy loss between two tensors.\n * \n * If labelSmoothing is
nonzero, smooth the labels towards 1/2:\n * \n * newOnehotLabels = onehotLabels * (1 - labelSmoothing)\n *
+ labelSmoothing / numClasses\n * \n * \n * @param onehotLabels One
hot encoded labels\n * [batch_size, num_classes], same dimensions as 'predictions'.\n * \n * @param logits The
predicted outputs.\n * \n * @param weights Tensor whose rank is either 0, or 1, and must be\n * broadcastable to `loss`
of shape [batch_size]\n * \n * @param labelSmoothing If greater than 0, then smooth the labels.\n * \n * @param reduction
Type of reduction to apply to loss. Should be of type\n * `Reduction`\n * \n * @doc { heading: 'Training',
subheading: 'Losses', namespace: 'losses' }\n * \n * \n * function softmaxCrossEntropy_<T extends Tensor, O extends
Tensor>(\n * onehotLabels: T|TensorLike, logits: T|TensorLike,\n * weights?: Tensor|TensorLike, labelSmoothing
= 0,\n * reduction = Reduction.SUM_BY_NONZERO_WEIGHTS): O {\n * \n * let $onehotLabels =\n *
convertToTensor(onehotLabels, 'onehotLabels', 'softmaxCrossEntropy');\n * \n * const $logits = convertToTensor(logits,
'logits', 'softmaxCrossEntropy');\n * \n * let $weights: Tensor = null;\n * \n * if (weights != null) {\n * $weights =
convertToTensor(weights,
'weights', 'softmaxCrossEntropy');\n * \n * \n * assertShapesMatch(\n * $onehotLabels.shape, $logits.shape, 'Error in
softmaxCrossEntropy:');\n * \n * if (labelSmoothing > 0) {\n * const labelSmoothingScalar = scalar(labelSmoothing);\n *
const one = scalar(1);\n * const numClasses = scalar($onehotLabels.shape[1]);\n * \n * $onehotLabels =\n *
add(mul($onehotLabels, sub(one, labelSmoothingScalar)),\n * div(labelSmoothingScalar, numClasses));\n *
}\n * \n * const losses = softmaxCrossEntropyWithLogits_($onehotLabels, $logits);\n * \n * return

```

```

computeWeightedLoss(losses, $weights, reduction);\n}\n\nexport const softmaxCrossEntropy =
op({softmaxCrossEntropy_});\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n *
Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless
required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an
\"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n *
* See the License for the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\n// Modularized ops.\nexport {abs} from './abs';\nexport {acos} from './acos';\nexport {acosh} from
'/acosh';\nexport {add} from './add';\nexport {addN} from './add_n';\nexport {all} from './all';\nexport {any} from
'/any';\nexport {argMax} from './arg_max';\nexport {argMin} from './arg_min';\nexport {asin} from './asin';\nexport
{asinh} from './asinh';\nexport {atan} from './atan';\nexport {atan2} from './atan2';\nexport {atanh} from
'/atanh';\nexport {avgPool} from './avg_pool';\nexport {avgPool3d} from './avg_pool_3d';\nexport
{basicLSTMCell} from './basic_lstm_cell';\nexport {batchToSpaceND}
from './batch_to_space_nd';\nexport {batchNorm} from './batchnorm';\nexport {batchNorm2d} from
'/batchnorm2d';\nexport {batchNorm3d} from './batchnorm3d';\nexport {batchNorm4d} from
'/batchnorm4d';\nexport {bincount} from './bincount';\nexport {broadcastTo} from './broadcast_to';\nexport {buffer}
from './buffer';\nexport {cast} from './cast';\nexport {ceil} from './ceil';\nexport {clipByValue} from
'/clip_by_value';\nexport {clone} from './clone';\nexport {complex} from './complex';\nexport {concat} from
'/concat';\nexport {concat1d} from './concat_1d';\nexport {concat2d} from './concat_2d';\nexport {concat3d} from
'/concat_3d';\nexport {concat4d} from './concat_4d';\nexport {conv1d} from './conv1d';\nexport {conv2d} from
'/conv2d';\nexport {conv2dTranspose} from './conv2d_transpose';\nexport {conv3d} from './conv3d';\nexport
{conv3dTranspose} from './conv3d_transpose';\nexport {cos} from './cos';\nexport {cosh} from './cosh';\nexport
{cumsum} from './cumsum';\nexport
{denseBincount} from './dense_bincount';\nexport {depthToSpace} from './depth_to_space';\nexport
{depthwiseConv2d} from './depthwise_conv2d';\nexport {diag} from './diag';\nexport {dilation2d} from
'/dilation2d';\nexport {div} from './div';\nexport {divNoNan} from './div_no_nan';\nexport {dot} from
'/dot';\nexport {elu} from './elu';\nexport {equal} from './equal';\nexport {erf} from './erf';\nexport {exp} from
'/exp';\nexport {expandDims} from './expand_dims';\nexport {expm1} from './expm1';\nexport {eye} from
'/eye';\nexport {fill} from './fill';\nexport {floor} from './floor';\nexport {floorDiv} from './floorDiv';\nexport
{gather} from './gather';\nexport {greater} from './greater';\nexport {greaterEqual} from './greater_equal';\nexport
{imag} from './imag';\nexport {isFinite} from './is_finite';\nexport {isInf} from './is_inf';\nexport {isNaN} from
'/is_nan';\nexport {leakyRelu} from './leaky_relu';\nexport {less} from './less';\nexport {lessEqual} from
'/less_equal';\nexport
{linspace} from './linspace';\nexport {localResponseNormalization} from './local_response_normalization';\nexport
{log} from './log';\nexport {log1p} from './log1p';\nexport {logSigmoid} from './log_sigmoid';\nexport
{logSoftmax} from './log_softmax';\nexport {logSumExp} from './log_sum_exp';\nexport {logicalAnd} from
'/logical_and';\nexport {logicalNot} from './logical_not';\nexport {logicalOr} from './logical_or';\nexport
{logicalXor} from './logical_xor';\nexport {matMul} from './mat_mul';\nexport {max} from './max';\nexport
{maxPool} from './max_pool';\nexport {maxPool3d} from './max_pool_3d';\nexport {maxPoolWithArgmax} from
'/max_pool_with_argmax';\nexport {maximum} from './maximum';\nexport {mean} from './mean';\nexport {min}
from './min';\nexport {minimum} from './minimum';\nexport {mirrorPad} from './mirror_pad';\nexport {mod} from
'/mod';\nexport {moments} from './moments';\nexport {mul} from './mul';\nexport {LSTMCellFunc,
multiRNNCell} from './multi_rnn_cell';\nexport
{multinomial} from './multinomial';\nexport {neg} from './neg';\nexport {notEqual} from './not_equal';\nexport
{oneHot} from './one_hot';\nexport {ones} from './ones';\nexport {onesLike} from './ones_like';\nexport
{outerProduct} from './outer_product';\nexport {pad} from './pad';\nexport {pad1d} from './pad1d';\nexport {pad2d}

```

```

from './pad2d';\nextport {pad3d} from './pad3d';\nextport {pad4d} from './pad4d';\nextport {pool} from
 './pool';\nextport {pow} from './pow';\nextport {prelu} from './prelu';\nextport {print} from './print';\nextport {prod}
 from './prod';\nextport {rand} from './rand';\nextport {randomGamma} from './random_gamma';\nextport
 {randomNormal} from './random_normal';\nextport {randomUniform} from './random_uniform';\nextport {range}
 from './range';\nextport {real} from './real';\nextport {reciprocal} from './reciprocal';\nextport {relu} from
 './relu';\nextport {relu6} from './relu6';\nextport {reshape} from './reshape';\nextport {reverse} from './reverse';\nextport
 {reverse1d} from './reverse_1d';\nextport
 {reverse2d} from './reverse_2d';\nextport {reverse3d} from './reverse_3d';\nextport {reverse4d} from
 './reverse_4d';\nextport {round} from './round';\nextport {rsqrt} from './rsqrt';\nextport {scalar} from './scalar';\nextport
 {selu} from './selu';\nextport {separableConv2d} from './separable_conv2d';\nextport {setdiff1dAsync} from
 './setdiff1d_async';\nextport {sigmoid} from './sigmoid';\nextport {sign} from './sign';\nextport {sin} from
 './sin';\nextport {sinh} from './sinh';\nextport {slice} from './slice';\nextport {slice1d} from './slice1d';\nextport
 {slice2d} from './slice2d';\nextport {slice3d} from './slice3d';\nextport {slice4d} from './slice4d';\nextport {softmax}
 from './softmax';\nextport {softplus} from './softplus';\nextport {spaceToBatchND} from
 './space_to_batch_nd';\nextport {fft} from './spectral/fft';\nextport {ifft} from './spectral/ifft';\nextport {irfft} from
 './spectral/irfft';\nextport {rfft} from './spectral/rfft';\nextport {split} from './split';\nextport {sqrt} from
 './sqrt';\nextport {square} from './square';\nextport {squaredDifference} from './squared_difference';\nextport
 {squeeze} from './squeeze';\nextport {stack} from './stack';\nextport {step} from './step';\nextport {stridedSlice} from
 './strided_slice';\nextport {sub} from './sub';\nextport {sum} from './sum';\nextport {tan} from './tan';\nextport {tanh}
 from './tanh';\nextport {tensor} from './tensor';\nextport {tensor1d} from './tensor1d';\nextport {tensor2d} from
 './tensor2d';\nextport {tensor3d} from './tensor3d';\nextport {tensor4d} from './tensor4d';\nextport {tensor5d} from
 './tensor5d';\nextport {tensor6d} from './tensor6d';\nextport {tile} from './tile';\nextport {topk} from './topk';\nextport
 {truncatedNormal} from './truncated_normal';\nextport {unique} from './unique';\nextport {unsortedSegmentSum}
 from './unsorted_segment_sum';\nextport {unstack} from './unstack';\nextport {variable} from './variable';\nextport
 {where} from './where';\nextport {whereAsync} from './where_async';\nextport {zeros} from
 './zeros';\nextport {zerosLike} from './zeros_like';\nextport * from './boolean_mask';\nextport * from
 './transpose';\nextport * from './norm';\nextport * from './moving_average';\nextport * from './scatter_nd';\nextport *
 from './sparse_to_dense';\nextport * from './gather_nd';\nextport * from './dropout';\nextport * from
 './signal_ops_util';\nextport * from './in_top_k';\nextport {op, OP_SCOPE_SUFFIX} from './operation';\n\nimport
 {rfft} from './spectral/rfft';\nimport {fft} from './spectral/fft';\nimport {ifft} from './spectral/ifft';\nimport {irfft} from
 './spectral/irfft';\nconst spectral = {\n fft,\n ifft,\n rfft,\n irfft\n};\nimport * as fused from './fused_ops';\nimport
 {hammingWindow} from './signal/hamming_window';\nimport {hannWindow} from
 './signal/hann_window';\nimport {frame} from './signal/frame';\nimport {stft} from './signal/stft';\nconst signal = {\n
 hammingWindow,\n hannWindow,\n frame,\n stft,\n};\n\n// Image Ops namespace\nimport {cropAndResize}
 from './image/crop_and_resize';\nimport
 {flipLeftRight} from './image/flip_left_right';\nimport {rotateWithOffset} from
 './image/rotate_with_offset';\nimport {nonMaxSuppression} from './image/non_max_suppression';\nimport
 {nonMaxSuppressionAsync} from './image/non_max_suppression_async';\nimport
 {nonMaxSuppressionWithScore} from './image/non_max_suppression_with_score';\nimport
 {nonMaxSuppressionWithScoreAsync} from './image/non_max_suppression_with_score_async';\nimport
 {nonMaxSuppressionPadded} from './image/non_max_suppression_padded';\nimport
 {nonMaxSuppressionPaddedAsync} from './image/non_max_suppression_padded_async';\nimport {resizeBilinear}
 from './image/resize_bilinear';\nimport {resizeNearestNeighbor} from './image/resize_nearest_neighbor';\nconst
 image = {\n flipLeftRight,\n resizeNearestNeighbor,\n resizeBilinear,\n rotateWithOffset,\n cropAndResize,\n
 nonMaxSuppression,\n nonMaxSuppressionAsync,\n nonMaxSuppressionWithScore,\n
 nonMaxSuppressionWithScoreAsync,\n nonMaxSuppressionPadded,\n
 nonMaxSuppressionPaddedAsync\n};\n\n// linalg namespace\nimport {bandPart} from
 './linalg/band_part';\nimport {gramSchmidt} from './linalg/gram_schmidt';\nimport {qr} from './linalg/qr';\nconst

```

```

linalg = {\n bandPart,\n gramSchmidt,\n qr\n};\n\n// losses namespace;\nimport {absoluteDifference} from
'/losses/absolute_difference';\nimport {computeWeightedLoss} from './losses/compute_weighted_loss';\nimport
{cosineDistance} from './losses/cosine_distance';\nimport {hingeLoss} from './losses/hinge_loss';\nimport
{huberLoss} from './losses/huber_loss';\nimport {logLoss} from './losses/log_loss';\nimport {meanSquaredError}
from './losses/mean_squared_error';\nimport {sigmoidCrossEntropy} from './losses/sigmoid_cross_entropy';\nimport
{softmaxCrossEntropy} from './losses/softmax_cross_entropy';\nconst losses = {\n absoluteDifference,\n
computeWeightedLoss,\n cosineDistance,\n hingeLoss,\n huberLoss,\n logLoss,\n meanSquaredError,\n
sigmoidCrossEntropy,\n softmaxCrossEntropy\n};\n\n//

```

Second level exports.\nexport {image, linalg, losses, spectral, fused, signal};\n"/\*\*\n \* @license\n \* Copyright
2018 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the "License");\n \*
you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \*
<http://www.apache.org/licenses/LICENSE-2.0>\n \* Unless required by applicable law or agreed to in writing,
software\n \* distributed under the License is distributed on an "AS IS" BASIS,\n \* WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language
governing permissions and\n \* limitations under the License.\n \*

```

=====
*\n\nimport {dispose} from './globals';\nimport {variableGrads} from './gradients';\nimport {scalar} from
'./ops/ops';\nimport {Serializable} from './serialization';\nimport
{Scalar, Variable} from './tensor';\nimport {NamedTensor, NamedTensorMap} from './tensor_types';\n\n/**\n * A
variable that belongs to an optimizer.\n * The `originalName` field is required for keeping track of the
canonical\n * name of the variable, which is usually the name of the model weight that\n * the variable is related to
plus a suffix, e.g., `dense1/kernel/momentum`.\n * The name of the `Variable` object itself cannot be used directly
due to\n * possible deduplication: Every `Variable` must have a unique name but more\n * than one optimizer
objects of the same type may be created for the same model\n * or the same `Variable`.\n */\n\nexport interface
OptimizerVariable {\n originalName: string;\n variable: Variable;\n}\n\n/** @doc {heading: 'Training',
subheading: 'Classes', namespace: 'train'} */\n\nexport abstract class Optimizer extends Serializable {\n protected
iterations_: number;\n\n /**\n * Executes `f()` and minimizes the scalar output of `f()` by computing\n
 * gradients of y with respect to the list of trainable variables provided by\n * `varList`. If no list is provided, it
defaults to all trainable variables.\n * @param f The function to execute and whose output to minimize.\n *
@param returnCost Whether to return the scalar cost value produced by\n * executing `f()`.\n * @param varList
An optional list of variables to update. If specified, only\n * the trainable variables in varList will be updated by
minimize. Defaults to\n * all trainable variables.\n */\n\n @doc {heading: 'Training', subheading: 'Optimizers'}\n
*\n minimize(f: () => Scalar, returnCost = false, varList?: Variable[]): Scalar\n |null {\n const {value, grads} =
this.computeGradients(f, varList);\n\n if (varList != null) {\n const gradArray: NamedTensor[] =\n
varList.map(v => ({name: v.name, tensor: grads[v.name]}));\n this.applyGradients(gradArray);\n } else {\n
this.applyGradients(grads);\n }\n\n // Dispose gradients.\n dispose(grads);\n\n if (returnCost) {\n return value;\n } else {\n
value.dispose();\n return null;\n }\n }\n\n /**\n * The number of iterations that this optimizer instance has
been invoked for.\n */\n get iterations(): number {\n if (this.iterations_ == null) {\n this.iterations_ = 0;\n }\n
return this.iterations_;\n }\n\n protected incrementIterations() {\n this.iterations_ = this.iterations + 1;\n }\n\n /**\n * Executes f() and computes the gradient of the scalar output of f() with\n
 * respect to the list of trainable variables provided by `varList`. If no\n * list is provided, it defaults to all trainable variables.\n * @param f The function to execute and whose output to use for computing\n
 * gradients with respect to variables.\n * @param varList An optional list of variables to compute gradients with\n
 * respect to. If specified, only the trainable variables in varList will have\n
 * gradients computed with respect to. Defaults to all trainable variables.\n */\n\n @doc {heading: 'Training',
subheading: 'Optimizers'}\n *\n computeGradients(f: () => Scalar, varList?: Variable[]):\n {value: Scalar,
grads: NamedTensorMap} {\n return variableGrads(f, varList);\n }\n\n /**\n * Updates variables by using the

```



```

add(mul(accumulatedUpdate, this.rho),\n mul(square(updates), 1 - this.rho));\n\naccumulatedGrad.assign(newAccumulatedGrad);\naccumulatedUpdate.assign(newAccumulatedUpdate);\n\nconst newValue = add(mul(updates, -this.learningRate), value);\nvalue.assign(newValue);\n});\n});\n\nthis.incrementIterations();\n}\n\ndispose(): void {\n if (this.accumulatedUpdates != null) {\n dispose(this.accumulatedGrads.map(v => v.variable));\n dispose(this.accumulatedUpdates.map(v\n => v.variable));\n }\n}\n\nasync getWeights(): Promise<NamedTensor[]> {\n // Order matters for Python\n compatibility.\n const variables: OptimizerVariable[] =\n [...this.accumulatedGrads,\n ...this.accumulatedUpdates];\n return [await this.saveIterations()].concat(\n variables.map(v => ({name:\n v.originalName, tensor: v.variable}));\n);\n}\n\nasync setWeights(weightValues: NamedTensor[]): Promise<void>\n{\n weightValues = await this.extractIterations(weightValues);\n const variableCount = weightValues.length /\n 2;\n const trainable = false;\n this.accumulatedGrads =\n weightValues.slice(0, variableCount).map(v =>\n ({\n originalName: v.name,\n variable:\n v.tensor.variable(\n trainable)\n }));\n this.accumulatedUpdates =\n weightValues.slice(variableCount, variableCount * 2)\n .map(v => ({\n originalName:\n v.name,\n variable: v.tensor.variable(trainable)\n }));\n}\n\ngetConfig(): ConfigDict {\n return {\n 'learningRate': this.learningRate,\n 'rho': this.rho,\n 'epsilon': this.epsilon\n };}\n\n/**\n @nocollapse */\n static fromConfig<T extends Serializable>(\n cls: SerializableConstructor<T>, config:\n ConfigDict): T {\n return new cls(config['learningRate'], config['rho'], config['epsilon']);\n }\n}\n\nregisterClass(AdadeltaOptimizer);\n",\n /**\n * Copyright 2018 Google LLC. All Rights\n Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file\n except in compliance with the License.\n * You may obtain a copy of the License at\n *
\n http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n governing permissions and\n * limitations under the License.\n */\n =====\n\n */\n\nimport {ENGINE} from './engine';\nimport {dispose, tidy} from './globals';\nimport {add} from\n './ops/add';\nimport {div} from './ops/div';\nimport {fill} from './ops/fill';\nimport {mul} from './ops/mul';\nimport\n {sqrt} from './ops/sqrt';\nimport {square} from './ops/square';\nimport {ConfigDict, registerClass, Serializable,\n SerializableConstructor} from './serialization';\nimport {NamedTensor, NamedVariableMap} from\n './tensor_types';\nimport {Optimizer, OptimizerVariable} from './optimizer';\n\n/** @doclink Optimizer\n */\n\nexport class AdagradOptimizer extends Optimizer {\n /** @nocollapse */\n static className = 'Adagrad';\n // Note: Name matters for Python compatibility.\n private accumulatedGrads: OptimizerVariable[] = [];\n\n constructor(\n protected learningRate: number, private initialAccumulatorValue = 0.1) {\n super();\n }\n\n applyGradients(variableGradients: NamedVariableMap|NamedTensor[]) {\n const variableNames =\n Array.isArray(variableGradients) ?\n variableGradients.map(item => item.name) :\n Object.keys(variableGradients);\n\n variableNames.forEach((name, i) => {\n const value =\n ENGINE.registeredVariables[name];\n if (this.accumulatedGrads[i] == null) {\n const trainable = false;\n this.accumulatedGrads[i] = {\n originalName: `${name}/accumulator`,\n variable: tidy(\n () =>\n fill(value.shape, this.initialAccumulatorValue)\n .variable(trainable))\n };}\n\n const\n gradient = Array.isArray(variableGradients) ?\n variableGradients[i].tensor :\n variableGradients[name];\n\n if (gradient == null) {\n return;\n }\n\n const accumulatedGrad =\n this.accumulatedGrads[i].variable;\n tidy(() => {\n const newAccumulatedGrad = add(accumulatedGrad,\n square(gradient));\n accumulatedGrad.assign(newAccumulatedGrad);\n const newValue = add(\n mul(div(gradient,\n sqrt(add(newAccumulatedGrad, ENGINE.backend.epsilon()))),\n -\n this.learningRate),\n value);\n value.assign(newValue);\n });\n this.incrementIterations();\n });\n }\n}

```



```

}\n\n dispose(): void {\n if (this.accumulatedGrads != null) {\n dispose(this.accumulatedGrads.map(v =>
v.variable));\n }\n}\n\n async getWeights(): Promise<NamedTensor[]> {\n // Order matters for Python
compatibility.\n return [await this.saveIterations()].concat(this.accumulatedGrads.map(\n v => ({name:
v.originalName, tensor: v.variable}));\n}\n\n async setWeights(weightValues:
NamedTensor[]): Promise<void> {\n weightValues = await this.extractIterations(weightValues);\n const
trainable = false;\n this.accumulatedGrads = weightValues.map(\n v => ({originalName: v.name, variable:
v.tensor.variable(trainable)}));\n}\n\n getConfig(): ConfigDict {\n return {\n 'learningRate':
this.learningRate,\n 'initialAccumulatorValue': this.initialAccumulatorValue,\n };\n}\n\n /** @nocollapse
*/\n static fromConfig<T extends Serializable>(\n cls: SerializableConstructor<T>, config: ConfigDict): T {\n
return new cls(config['learningRate'], config['initialAccumulatorValue']);\n}\n}\n\nregisterClass(AdagradOptimizer);\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless
required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an
"AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n *
* See the License for the specific language governing permissions and\n * limitations under the License.\n *
=====
*/\n\nimport {ENGINE} from './engine';\nimport {dispose, tidy} from './globals';\nimport {add} from
 './ops/add';\nimport {div} from './ops/div';\nimport {mul} from './ops/mul';\nimport {pow} from
 './ops/pow';\nimport {scalar} from './ops/scalar';\nimport {sqrt} from './ops/sqrt';\nimport {square} from
 './ops/square';\nimport {sub} from './ops/sub';\nimport {zerosLike} from './ops/zeros_like';\nimport {ConfigDict,
registerClass, Serializable, SerializableConstructor} from './serialization';\nimport {Variable} from
 './tensor';\nimport {NamedTensor, NamedVariableMap} from './tensor_types';\n\nimport
 {Optimizer, OptimizerVariable} from './optimizer';\n\nexport class AdamOptimizer extends Optimizer {\n /**
 @nocollapse */\n static className = 'Adam'; // Note: Name matters for Python compatibility.\n private accBeta1:
Variable;\n private accBeta2: Variable;\n\n private accumulatedFirstMoment: OptimizerVariable[] = [];\n private
accumulatedSecondMoment: OptimizerVariable[] = [];\n\n constructor(\n protected learningRate: number,
protected beta1: number,\n protected beta2: number, protected epsilon: number = null) {\n super();\n tidy(()
=> {\n // accB* will be updated by batch.\n this.accBeta1 = scalar(beta1).variable();\n this.accBeta2 =
scalar(beta2).variable();\n });\n\n if (epsilon == null) {\n this.epsilon = ENGINE.backend.epsilon();\n }\n }\n\n applyGradients(variableGradients: NamedVariableMap|NamedTensor[]) {\n const varNames =
Array.isArray(variableGradients) ?\n variableGradients.map(v => v.name)\n :\n Object.keys(variableGradients);\n tidy(() => {\n const oneMinusAccBeta1 = sub(1, this.accBeta1);\n
const oneMinusAccBeta2 = sub(1, this.accBeta2);\n\n varNames.forEach((name, i) => {\n const value =
ENGINE.registeredVariables[name];\n const trainable = false;\n if (this.accumulatedFirstMoment[i] ==
null) {\n this.accumulatedFirstMoment[i] = {\n originalName: `${name}/m`,\n variable: tidy(()
=> zerosLike(value).variable(trainable))\n };\n }\n if (this.accumulatedSecondMoment[i] ==
null) {\n this.accumulatedSecondMoment[i] = {\n originalName: `${name}/v`,\n variable: tidy(() =>
zerosLike(value).variable(trainable))\n };\n }\n\n const gradient = Array.isArray(variableGradients)
?\n variableGradients[i].tensor :\n variableGradients[name];\n if (gradient == null) {\n
return;\n }\n\n const firstMoment = this.accumulatedFirstMoment[i].variable;\n const secondMoment =
this.accumulatedSecondMoment[i].variable;\n\n const newFirstMoment =\n add(mul(firstMoment,
this.beta1), mul(gradient, 1 - this.beta1));\n const newSecondMoment =\n add(mul(secondMoment,
this.beta2),\n mul(square(gradient), 1 - this.beta2));\n const biasCorrectedFirstMoment =
div(newFirstMoment, oneMinusAccBeta1);\n const biasCorrectedSecondMoment =\n div(newSecondMoment,
oneMinusAccBeta2);\n firstMoment.assign(newFirstMoment);\n

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secondMoment.assign(newSecondMoment);\n const newValue =\n
add(mul(div(biasCorrectedFirstMoment,\n add(sqrt(biasCorrectedSecondMoment), this.epsilon)),\n
 -this.learningRate),\n value);\n value.assign(newValue);\n });\n\n
this.accBeta1.assign(mul(this.accBeta1, this.beta1));\n
 this.accBeta2.assign(mul(this.accBeta2, this.beta2));\n });\n this.incrementIterations();\n }\n\n dispose(): void\n {\n this.accBeta1.dispose();\n this.accBeta2.dispose();\n\n if (this.accumulatedFirstMoment != null) {\n
dispose(this.accumulatedFirstMoment.map(v => v.variable));\n }\n if (this.accumulatedSecondMoment != null)\n
{\n dispose(this.accumulatedSecondMoment.map(v => v.variable));\n }\n }\n\n async getWeights():\n Promise<NamedTensor[]> {\n // Order matters for Python compatibility.\n const variables: OptimizerVariable[]\n =\n [...this.accumulatedFirstMoment, ...this.accumulatedSecondMoment];\n return [await\n
this.saveIterations()].concat(\n variables.map(v => ({name: v.originalName, tensor: v.variable}));\n)\n\n async setWeights(weightValues: NamedTensor[]): Promise<void> {\n weightValues = await\n
this.extractIterations(weightValues);\n tidy(() => {\n this.accBeta1.assign(pow(this.beta1, this.iterations_ +\n
1));\n
 this.accBeta2.assign(pow(this.beta2, this.iterations_ + 1));\n });\n\n const variableCount =\n
weightValues.length / 2;\n const trainable = false;\n this.accumulatedFirstMoment =\n weightValues.slice(0,\n
variableCount).map(v => ({\n originalName: v.name,\n
 variable: v.tensor.variable(\n trainable)\n }));\n
 this.accumulatedSecondMoment =\n weightValues.slice(variableCount, variableCount * 2)\n .map(v =>\n
({\n originalName: v.name,\n variable: v.tensor.variable(trainable)\n }));\n }\n\n getConfig(): ConfigDict {\n return {\n 'learningRate': this.learningRate,\n 'beta1': this.beta1,\n 'beta2':\n
this.beta2,\n 'epsilon': this.epsilon,\n };}\n\n /** @nocollapse */\n
 static fromConfig<T extends Serializable>(\n cls: SerializableConstructor<T>, config: ConfigDict): T {\n
return new cls(\n config['learningRate'], config['beta1'], config['beta2'],\n config['epsilon']);\n
 }\n\n registerClass(AdamaxOptimizer);\n ", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n
 * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in\n
 compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n
 software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n
 governing permissions and\n * limitations under the License.\n *\n =====\n
 *\n\n import\n
 {ENGINE} from '../engine';\n import {dispose, tidy} from '../globals';\n import {abs} from '../ops/abs';\n import\n
 {add} from '../ops/add';\n import {div} from '../ops/div';\n import {maximum} from '../ops/maximum';\n import {mul}\n
 from '../ops/mul';\n import {scalar} from '../ops/scalar';\n import {sub} from '../ops/sub';\n import {zerosLike} from\n
 '../ops/zeros_like';\n import {ConfigDict, registerClass, Serializable, SerializableConstructor} from\n
 '../serialization';\n import {Variable} from '../tensor';\n import {NamedTensor, NamedVariableMap} from\n
 '../tensor_types';\n\n import {Optimizer, OptimizerVariable} from './optimizer';\n\n export class AdamaxOptimizer\n
 extends Optimizer {\n /** @nocollapse */\n static className = 'Adamax';\n // Note: Name matters for Python\n
 compatibility.\n private accBeta1: Variable;\n private iteration: Variable;\n\n private accumulatedFirstMoment:\n
 OptimizerVariable[] = [];\n private accumulatedWeightedInfNorm: OptimizerVariable[] = [];\n\n constructor(\n
 protected\n
 learningRate: number, protected beta1: number,\n protected beta2: number, protected epsilon: number = null,\n
 protected decay = 0.0) {\n super();\n\n tidy(() => {\n this.iteration = scalar(0).variable();\n this.accBeta1 =\n
 scalar(beta1).variable();\n });\n\n if (epsilon == null) {\n this.epsilon = ENGINE.backend.epsilon();\n }\n
 }\n\n applyGradients(variableGradients: NamedVariableMap|NamedTensor[]) {\n const variableNames =\n
 Array.isArray(variableGradients) ?\n variableGradients.map(item => item.name) :\n

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Object.keys(variableGradients);\n\n tidy() => {\n const oneMinusAccBeta1 = sub(1, this.accBeta1);\n const lr =\n div(-this.learningRate, add(mul(this.iteration, this.decay), 1));\n\n variableNames.forEach((name, i)\n => {\n const value = ENGINE.registeredVariables[name];\n const trainable = false;\n if\n (this.accumulatedFirstMoment[i] == null) {\n this.accumulatedFirstMoment[i]\n = {\n originalName: `${name}/m`,\n variable: zerosLike(value).variable(trainable)\n };\n }\n if (this.accumulatedWeightedInfNorm[i] == null) {\n this.accumulatedWeightedInfNorm[i] = {\n originalName: `${name}/v`,\n variable: zerosLike(value).variable(trainable)\n };\n }\n\n const\n gradient = Array.isArray(variableGradients) ?\n variableGradients[i].tensor :\n variableGradients[name];\n if (gradient == null) {\n return;\n }\n\n const firstMoment =\n this.accumulatedFirstMoment[i].variable;\n const weightedInfNorm =\n this.accumulatedWeightedInfNorm[i].variable;\n\n const newFirstMoment =\n add(mul(firstMoment,\n this.beta1), mul(gradient, 1 - this.beta1));\n\n const ut0 = mul(weightedInfNorm, this.beta2);\n const ut1 =\n abs(gradient);\n const newWeightedInfNorm = maximum(ut0, ut1);\n\n firstMoment.assign(newFirstMoment);\n weightedInfNorm.assign(newWeightedInfNorm);\n\n const\n newValue =\n add(mul(div(lr, oneMinusAccBeta1),\n div(newFirstMoment,\n add(newWeightedInfNorm, this.epsilon))),\n value);\n\n value.assign(newValue);\n });\n\n this.iteration.assign(add(this.iteration, 1));\n this.accBeta1.assign(mul(this.accBeta1, this.beta1));\n });\n\n this.incrementIterations();\n }\n\n dispose(): void {\n this.accBeta1.dispose();\n this.iteration.dispose();\n\n if\n (this.accumulatedFirstMoment != null) {\n dispose(this.accumulatedFirstMoment.map(v => v.variable));\n }\n if\n (this.accumulatedWeightedInfNorm != null) {\n dispose(this.accumulatedWeightedInfNorm.map(v =>\n v.variable));\n }\n }\n\n async getWeights(): Promise<NamedTensor[]> {\n throw new Error('getWeights() is\n not implemented for Adamax yet.);\n }\n\n async setWeights(weightValues: NamedTensor[]):\n Promise<void> {\n throw new Error('setWeights() is not implemented for Adamax yet.);\n }\n\n getConfig():\n ConfigDict {\n return {\n 'learningRate': this.learningRate,\n 'beta1': this.beta1,\n 'beta2': this.beta2,\n 'epsilon': this.epsilon,\n 'decay': this.decay\n };\n }\n\n /** @nocollapse */\n static fromConfig<T extends\n Serializable>(\n cls: SerializableConstructor<T>, config: ConfigDict): T {\n return new cls(\n config['learningRate'], config['beta1'], config['beta2'],\n config['epsilon'], config['decay']);\n }\n\n registerClass(AdamaxOptimizer);\n "/*\n * @license\n * Copyright 2018 Google LLC. All Rights\n Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file\n except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n governing permissions and\n * limitations under the License.\n *\n *=====\n\n */\n\n import {ENGINE} from '../engine';\n import {keep, tidy} from '../globals';\n import {add} from\n '../ops/add';\n import {mul} from\n '../ops/mul';\n import {scalar} from\n '../ops/scalar';\n import {ConfigDict,\n registerClass,\n Serializable,\n SerializableConstructor}\n from '../serialization';\n import {Scalar} from\n '../tensor';\n import {NamedTensor,\n NamedTensorMap}\n from '../tensor_types';\n import {Optimizer} from\n '../optimizer';\n\n /**\n * @doclink Optimizer */\n export class SGDOptimizer extends Optimizer {\n /** @nocollapse */\n static className\n = 'SGD';\n // Note: Name matters for Python compatibility.\n protected c: Scalar;\n\n constructor(protected\n learningRate: number)\n {\n super();\n this.setLearningRate(learningRate);\n }\n\n applyGradients(variableGradients: NamedTensorMap|NamedTensor[]) {\n const varNames =\n Array.isArray(variableGradients) ?\n variableGradients.map(v => v.name) :\n Object.keys(variableGradients);\n varNames.forEach((name, i) => {\n const gradient =\n Array.isArray(variableGradients) ?\n variableGradients[i].tensor :\n variableGradients[name];\n if\n (gradient == null) {\n return;\n }\n const value = ENGINE.registeredVariables[name];\n tidy(() => {\n const newValue =\n add(mul(this.c, gradient), value);\n value.assign(newValue);\n });\n });\n }\n }\n
```

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this.incrementIterations();\n } \n\n /**\n * Sets the learning rate of the optimizer.\n */\n
setLearningRate(learningRate: number) {\n this.learningRate = learningRate;\n if (this.c != null) {\n
this.c.dispose();\n } \n this.c = keep(scalar(-learningRate));\n
} \n\n dispose() {\n this.c.dispose();\n } \n\n async getWeights(): Promise<NamedTensor[]> {\n return [await
this.saveIterations()];\n } \n\n async setWeights(weightValues: NamedTensor[]): Promise<void> {\n
weightValues = await this.extractIterations(weightValues);\n if (weightValues.length !== 0) {\n throw new
Error('SGD optimizer does not have settable weights.);\n } \n\n } \n\n getConfig(): ConfigDict {\n return
{'learningRate': this.learningRate};\n } \n\n /** @nocollapse */\n static fromConfig<T extends Serializable>(\n
cls: SerializableConstructor<T>, config: ConfigDict): T {\n return new cls(config['learningRate']);\n
} \n\n registerClass(SGDOptimizer);\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n
* Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n
*\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is
distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n */\n
=====\n
*/\n\nimport {ENGINE} from '../engine';\nimport {dispose, tidy} from '../globals';\nimport {add} from
 '../ops/add';\nimport {mul} from '../ops/mul';\nimport {scalar} from '../ops/scalar';\nimport {zerosLike} from
 '../ops/zeros_like';\nimport {ConfigDict, registerClass, Serializable, SerializableConstructor} from
 '../serialization';\nimport {Scalar, Tensor} from '../tensor';\nimport {NamedTensor, NamedVariableMap} from
 '../tensor_types';\nimport {OptimizerVariable} from '../optimizer';\nimport {SGDOptimizer} from
 '../sgd_optimizer';\n\n/** @doclink Optimizer */\n\nexport
class MomentumOptimizer extends SGDOptimizer {\n /** @nocollapse */\n static className = 'Momentum'; //
Name matters for Python compatibility.\n private m: Scalar;\n private accumulations: OptimizerVariable[] = [];\n\n
constructor(\n protected learningRate: number, private momentum: number,\n private useNesterov = false) {\n
super(learningRate);\n this.m = scalar(this.momentum);\n } \n\n applyGradients(variableGradients:
NamedVariableMap|NamedTensor[]) {\n const variableNames = Array.isArray(variableGradients) ?\n
variableGradients.map(item => item.name) :\n Object.keys(variableGradients);\n\n
variableNames.forEach((name, i) => {\n const value = ENGINE.registeredVariables[name];\n if
(this.accumulations[i] == null) {\n const trainable = false;\n this.accumulations[i] = {\n originalName:
`${name}/momentum`,\n variable: tidy(() => zerosLike(value).variable(trainable))\n }; \n } \n\n
const accumulation = this.accumulations[i].variable;\n const gradient = Array.isArray(variableGradients) ?\n
variableGradients[i].tensor :\n variableGradients[name];\n if (gradient == null) {\n return;\n } \n\n
tidy(() => {\n let newValue: Tensor;\n const newAccumulation = add(mul(this.m, accumulation),
gradient);\n if (this.useNesterov) {\n newValue = add(\n mul(this.c, add(gradient,
mul(newAccumulation, this.m))), value);\n } else {\n newValue = add(mul(this.c, newAccumulation),
value);\n } \n accumulation.assign(newAccumulation);\n value.assign(newValue);\n }); \n });\n\n
this.incrementIterations();\n } \n\n dispose(): void {\n this.m.dispose();\n if (this.accumulations != null) {\n
dispose(this.accumulations.map(v => v.variable));\n } \n } \n\n /**\n * Sets the momentum of the optimizer.\n
*\n * @param momentum\n */\n setMomentum(momentum:
number) {\n this.momentum = momentum;\n } \n\n async getWeights(): Promise<NamedTensor[]> {\n // Order
matters for Python compatibility.\n return [await this.saveIterations()].concat(this.accumulations.map(\n v =>
({name: v.originalName, tensor: v.variable}));\n } \n\n async setWeights(weightValues: NamedTensor[]):
Promise<void> {\n weightValues = await this.extractIterations(weightValues);\n const trainable = false;\n
this.accumulations = weightValues.map(\n v => ({originalName: v.name, variable:
v.tensor.variable(trainable)}));\n } \n\n getConfig(): ConfigDict {\n return {\n 'learningRate':

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this.learningRate,\n 'momentum': this.momentum,\n 'useNesterov': this.useNesterov\n });\n}\n\n/**
@nocollapse */\n static fromConfig<T extends Serializable>(\n cls: SerializableConstructor<T>, config:
ConfigDict): T {\n return new cls(\n config['learningRate'], config['momentum'], config['useNesterov']);\n
}\n}\n\nregisterClass(MomentumOptimizer);\n", "/**\n
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2.0 (the \"License\");\n* you may not use this file except in compliance with the License.\n* You may obtain a
copy of the License at\n* http://www.apache.org/licenses/LICENSE-2.0\n* Unless required by applicable
law or agreed to in writing, software\n* distributed under the License is distributed on an \"AS IS\" BASIS,\n*
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n* See the License for
the specific language governing permissions and\n* limitations under the License.\n*
=====*\n
*\n\nimport {ENGINE} from '../engine';\nimport {dispose, tidy} from '../globals';\nimport {add} from
 '../ops/add';\nimport {div} from '../ops/div';\nimport {mul} from '../ops/mul';\nimport {sqrt} from
 '../ops/sqrt';\nimport {square} from
 '../ops/square';\nimport {sub} from '../ops/sub';\nimport {zerosLike} from '../ops/zeros_like';\nimport {ConfigDict,
registerClass, Serializable, SerializableConstructor} from '../serialization';\nimport {NamedTensor,
NamedTensorMap} from '../tensor_types';\nimport {Optimizer, OptimizerVariable} from './optimizer';\n\n/**
@doclink Optimizer */\nexport class RMSPropOptimizer extends Optimizer {\n /** @nocollapse */\n static
className = 'RMSProp'; // Note: Name matters for Python compatibility.\n private centered: boolean;\n private
accumulatedMeanSquares: OptimizerVariable[] = [];\n private accumulatedMoments: OptimizerVariable[] = [];\n private
accumulatedMeanGrads: OptimizerVariable[] = [];\n constructor(\n protected learningRate: number,
protected decay = 0.9,\n protected momentum = 0.0, protected epsilon: number = null,\n centered = false) {\n
super();\n\n this.centered = centered;\n\n if (epsilon == null) {\n this.epsilon = ENGINE.backend.epsilon();\n
 }\n if (learningRate == null) {\n throw new Error(`learningRate for RMSPropOptimizer must be
defined.`);\n }\n }\n\n applyGradients(variableGradients: NamedTensorMap|NamedTensor[]) {\n const
variableNames = Array.isArray(variableGradients) ?\n variableGradients.map(item => item.name) : \n
Object.keys(variableGradients);\n\n variableNames.forEach((name, i) => {\n const value =
ENGINE.registeredVariables[name];\n const trainable = false;\n if (this.accumulatedMeanSquares[i] == null)
{\n this.accumulatedMeanSquares[i] = {\n originalName: `${name}/rms`,\n variable: tidy(() =>
zerosLike(value).variable(trainable))\n }; \n }\n if (this.accumulatedMoments[i] == null) {\n
 this.accumulatedMoments[i] = {\n originalName: `${name}/momentum`,\n variable: tidy(() =>
zerosLike(value).variable(trainable))\n }; \n }\n if (this.accumulatedMeanGrads[i] == null &&
this.centered) {\n this.accumulatedMeanGrads[i] = {\n originalName: `${name}/mg`,\n variable:
tidy(() => zerosLike(value).variable(trainable))\n }; \n }\n const gradient =
Array.isArray(variableGradients) ?\n variableGradients[i].tensor : \n variableGradients[name];\n if
(gradient == null) {\n return;\n }\n const accumulatedMeanSquare =
this.accumulatedMeanSquares[i].variable;\n const accumulatedMoments =
this.accumulatedMoments[i].variable;\n tidy(() => {\n const newAccumulatedMeanSquare = \n
add(mul(accumulatedMeanSquare, this.decay),\n mul(square(gradient), 1 - this.decay));\n if
(this.centered) {\n const accumulatedMeanGrad = this.accumulatedMeanGrads[i].variable;\n // Centered
gradient\n const newAccumulatedMeanGrad = \n
add(mul(accumulatedMeanGrad, this.decay),\n mul(gradient, 1 - this.decay));\n }\n
 const gradContribution = \n
 div(mul(gradient, this.learningRate),\n sqrt(\n
sub(newAccumulatedMeanSquare,\n add(square(newAccumulatedMeanGrad), this.epsilon))));\n const
newAccumulatedMoments = \n
 add(mul(accumulatedMoments, this.momentum),\n gradContribution);\n accumulatedMeanSquare.assign(newAccumulatedMeanSquare);\n
 accumulatedMeanGrad.assign(newAccumulatedMeanGrad);\n accumulatedMoments.assign(newAccumulatedMoments);\n const newValue = sub(value,

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newAccumulatedMoments);\n value.assign(newValue);\n } else {\n // Plain gradient\n const
newAccumulatedMeanSquare =\n add(mul(accumulatedMeanSquare, this.decay),\n mul(square(gradient), 1 - this.decay));\n\n const newAccumulatedMoments =\n add(mul(accumulatedMoments, this.momentum),\n div(mul(gradient,
this.learningRate),\n sqrt(add(newAccumulatedMeanSquare, this.epsilon)));\n\n accumulatedMeanSquare.assign(newAccumulatedMeanSquare);\n
accumulatedMoments.assign(newAccumulatedMoments);\n\n const newValue = sub(value,
newAccumulatedMoments);\n value.assign(newValue);\n }\n });\n});\n
this.incrementIterations();\n }\n\n dispose(): void {\n if (this.accumulatedMeanSquares != null) {\n
dispose(this.accumulatedMeanSquares.map(v => v.variable));\n }\n if (this.accumulatedMeanGrads != null &&
this.centered) {\n dispose(this.accumulatedMeanGrads.map(v => v.variable));\n }\n if
(this.accumulatedMoments != null) {\n dispose(this.accumulatedMoments.map(v => v.variable));\n }\n }\n\n
async getWeights(): Promise<NamedTensor[]> {\n // Order matters for Python compatibility.\n const variables:
OptimizerVariable[] =\n [...this.accumulatedMeanSquares, ...this.accumulatedMoments];\n
 if (this.centered) {\n variables.push(...this.accumulatedMeanGrads);\n }\n return [await
this.saveIterations()].concat(\n variables.map(v => ({name: v.originalName, tensor: v.variable}));\n });\n\n
async setWeights(weightValues: NamedTensor[]): Promise<void> {\n weightValues = await
this.extractIterations(weightValues);\n const variableCount =\n this.centered ? weightValues.length / 3 :
weightValues.length / 2;\n const trainable = false;\n this.accumulatedMeanSquares =\n
weightValues.slice(0, variableCount).map(v => ({\n\n originalName: v.name,\n
 variable: v.tensor.variable(\n\n trainable)\n
 }));\n this.accumulatedMoments =\n weightValues.slice(variableCount, variableCount * 2)\n
.map(v => ({\n\n originalName: v.name,\n
 variable: v.tensor.variable(trainable)\n
 }));\n if
(this.centered) {\n this.accumulatedMeanGrads =\n weightValues.slice(variableCount * 2, variableCount *
3)\n .map(v => ({\n\n originalName: v.name,\n
 variable:
v.tensor.variable(trainable)\n
 }));\n }\n }\n\n getConfig(): ConfigDict {\n return {\n
'learningRate': this.learningRate,\n 'decay': this.decay,\n 'momentum': this.momentum,\n 'epsilon':
this.epsilon,\n 'centered': this.centered\n };}\n\n /** @nocollapse */\n static fromConfig<T extends
Serializable>(\n cls: SerializableConstructor<T>, config: ConfigDict): T {\n return new cls(\n
config['learningRate'], config['decay'], config['momentum'],\n config['epsilon'], config['centered']);\n
}\n}\n\nregisterClass(RMSPropOptimizer);\n", "/*\n * @license\n * Copyright 2018 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *\n
=====
*\n\nimport {AdadeltaOptimizer} from './adadelta_optimizer';\nimport {AdagradOptimizer} from
 './adagrad_optimizer';\nimport {AdamOptimizer} from './adam_optimizer';\nimport {AdamaxOptimizer} from
 './adamax_optimizer';\nimport {MomentumOptimizer} from './momentum_optimizer';\nimport
 {RMSPropOptimizer} from './rmsprop_optimizer';\nimport
 {SGDOptimizer} from './sgd_optimizer';\n\nexport class OptimizerConstructors {\n /**\n * Constructs a
`tf.SGDOptimizer` that uses stochastic gradient descent.\n *\n * ``js\n * // Fit a quadratic function by learning
the coefficients a, b, c.\n * const xs = tf.tensor1d([0, 1, 2, 3]);\n * const ys = tf.tensor1d([1.1, 5.9, 16.8, 33.9]);\n
*\n * const a = tf.scalar(Math.random()).variable();\n * const b = tf.scalar(Math.random()).variable();\n * const c
= tf.scalar(Math.random()).variable();\n *\n * // y = a * x^2 + b * x + c.\n * const f = x =>

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a.mul(x.square()).add(b.mul(x)).add(c);\n * const loss = (pred, label) => pred.sub(label).square().mean();\n *\n * const learningRate = 0.01;\n * const optimizer = tf.train.sgd(learningRate);\n *\n * // Train the model.\n * for\n * (let i = 0; i < 10; i++) {\n * optimizer.minimize(() => loss(f(xs), ys));\n * }\n *\n * // Make predictions.\n * console.log(\n * `a: ${a.dataSync()}\n * b: ${b.dataSync()}, c: ${c.dataSync()}`);\n * const preds = f(xs).dataSync();\n * preds.forEach((pred, i) => {\n * console.log(`x: ${i}, pred: ${pred}`);\n * });\n *```\n *\n * @param learningRate The learning rate to use\n * for the SGD algorithm.\n *\n * @doc {heading: 'Training', subheading: 'Optimizers', namespace: 'train'}\n *\n * ^/\n * static sgd(learningRate: number): SGDOptimizer {\n * return new SGDOptimizer(learningRate);\n * }\n *\n * /**\n * Constructs a `tf.MomentumOptimizer` that uses momentum gradient\n * descent.\n *\n * See\n * [http://proceedings.mlr.press/v28/sutskever13.pdf](\n * http://proceedings.mlr.press/v28/sutskever13.pdf)\n *\n * @param learningRate The learning rate to use for the Momentum gradient\n * descent algorithm.\n * @param momentum The momentum to use for the momentum gradient\n * algorithm.\n *\n * @doc {heading:\n * 'Training', subheading: 'Optimizers', namespace: 'train'}\n *\n * ^/\n * static momentum(learningRate:\n * number, momentum: number, useNesterov = false):\n * MomentumOptimizer {\n * return new\n * MomentumOptimizer(learningRate, momentum, useNesterov);\n * }\n *\n * /**\n * Constructs a\n * `tf.RMSPropOptimizer` that uses RMSProp gradient\n * descent. This implementation uses plain momentum and\n * is not centered\n * version of RMSProp.\n *\n * See\n * [http://www.cs.toronto.edu/~tijmen/csc321/slides/lecture_slides_lec6.pdf](\n * http://www.cs.toronto.edu/~tijmen/csc321/slides/lecture_slides_lec6.pdf)\n *\n * @param learningRate The\n * learning rate to use for the RMSProp gradient\n * descent algorithm.\n * @param decay The discounting factor\n * for the history/coming gradient.\n * @param momentum The momentum to use for the RMSProp gradient\n * descent\n * algorithm.\n * @param epsilon Small value to avoid zero denominator.\n * @param centered If true,\n * gradients are normalized by the estimated\n * variance of the gradient.\n *\n * @doc {heading: 'Training',\n * subheading:\n * 'Optimizers', namespace: 'train'}\n *\n * ^/\n * static rmsprop(\n * learningRate: number, decay = .9, momentum = 0.0,\n * epsilon: number = null,\n * centered = false): RMSPropOptimizer {\n * return new RMSPropOptimizer(\n * learningRate, decay, momentum, epsilon, centered);\n * }\n *\n * /**\n * Constructs a `tf.AdamOptimizer` that uses the\n * Adam algorithm.\n * See https://arxiv.org/abs/1412.6980\n *\n * @param\n * learningRate The learning rate to use for the Adam gradient\n * descent algorithm.\n * @param beta1 The\n * exponential decay rate for the 1st moment estimates.\n * @param beta2 The exponential decay rate for the 2nd\n * moment estimates.\n * @param epsilon A small constant for numerical stability.\n *\n * @doc {heading:\n * 'Training', subheading: 'Optimizers', namespace: 'train'}\n *\n * ^/\n * static adam(\n * learningRate = 0.001, beta1 = 0.9,\n * beta2 = 0.999,\n * epsilon: number = null): AdamOptimizer {\n * return new AdamOptimizer(learningRate,\n * beta1, beta2, epsilon);\n * }\n *\n * /**\n * Constructs a `tf.AdadeltaOptimizer` that uses the Adadelta algorithm.\n * See https://arxiv.org/abs/1212.5701\n *\n * @param learningRate The learning\n * rate to use for the Adadelta gradient\n * descent algorithm.\n * @param rho The learning rate decay over each\n * update.\n * @param epsilon A constant epsilon used to better condition the grad\n * update.\n *\n * @doc\n * {heading: 'Training', subheading: 'Optimizers', namespace: 'train'}\n *\n * ^/\n * static adadelta(learningRate = .001, rho =\n * .95, epsilon: number = null):\n * AdadeltaOptimizer {\n * return new AdadeltaOptimizer(learningRate, rho,\n * epsilon);\n * }\n *\n * /**\n * Constructs a `tf.AdamaxOptimizer` that uses the Adamax algorithm.\n * See\n * https://arxiv.org/abs/1412.6980\n *\n * @param learningRate The learning rate\n * to use for the Adamax gradient\n * descent algorithm.\n *\n * @param beta1 The exponential decay rate for the 1st moment estimates.\n * @param beta2 The exponential decay\n * rate for the 2nd moment estimates.\n * @param epsilon A small constant for numerical stability.\n *\n * @param\n * decay The learning rate decay over each update.\n *\n * @doc {heading: 'Training', subheading: 'Optimizers',\n * namespace: 'train'}\n *\n * ^/\n * static adamax(\n * learningRate = 0.002, beta1 = 0.9, beta2 = 0.999, epsilon: number =\n * null,\n * decay = 0.0): AdamaxOptimizer {\n * return new AdamaxOptimizer(learningRate, beta1, beta2, epsilon,\n * decay);\n * }\n *\n * /**\n * Constructs a `tf.AdagradOptimizer` that uses the Adagrad algorithm.\n * See\n *

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[http://www.jmlr.org/papers/volume12/duchi11a/duchi11a.pdf](\n *
http://www.jmlr.org/papers/volume12/duchi11a/duchi11a.pdf)\n * or\n * [http://ruder.io/optimizing-gradient-
descent/index.html#adagrad](\n * http://ruder.io/optimizing-gradient-descent/index.html#adagrad)\n * \n *
@param learningRate The learning
rate to use for the Adagrad gradient\n * descent algorithm.\n * @param initialAccumulatorValue Starting value
for the accumulators, must be\n * positive.\n * \n * @doc {heading: 'Training', subheading: 'Optimizers',
namespace: 'train'}\n * \n static adagrad(learningRate: number, initialAccumulatorValue = 0.1):\n
AdagradOptimizer {\n return new AdagradOptimizer(learningRate, initialAccumulatorValue);\n }\n}\n", "/*\n *
@license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific
language governing permissions and\n * limitations under the License.\n *
===== \n
*\n\n// So typings can propagate.\nimport { AdadelatOptimizer } from './optimizers/adadelat_optimizer';\nimport
{ AdagradOptimizer } from './optimizers/adagrad_optimizer';\nimport { AdamOptimizer } from
 './optimizers/adam_optimizer';\nimport { AdamaxOptimizer } from './optimizers/adamax_optimizer';\nimport
{ MomentumOptimizer } from './optimizers/momentum_optimizer';\nimport { OptimizerConstructors } from
 './optimizers/optimizer_constructors';\nimport { RMSPropOptimizer } from
 './optimizers/rmsprop_optimizer';\nimport { SGDOptimizer } from './optimizers/sgd_optimizer';\n\n// tslint:disable-
next-line:no-unused-expression\n[MomentumOptimizer, SGDOptimizer, AdadelatOptimizer, AdagradOptimizer,\nRMSPropOptimizer, AdamaxOptimizer, AdamOptimizer];\n\nexport const train = {\n sgd:
OptimizerConstructors.sgd,\n momentum: OptimizerConstructors.momentum,\n
adadelat: OptimizerConstructors.adadelat,\n adagrad: OptimizerConstructors.adagrad,\n rmsprop:
OptimizerConstructors.rmsprop,\n adamax: OptimizerConstructors.adamax,\n adam:
OptimizerConstructors.adam\n};\n", "/*\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n *
Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
===== \n
*\n\nconst delayCallback: Function = (() => {\n if (typeof requestAnimationFrame
 !== 'undefined') {\n return requestAnimationFrame;\n } else if (typeof setImmediate !== 'undefined') {\n return
setImmediate;\n }\n return (f: Function) => f(); // no delays\n})();\n\n/**\n * Returns a promise that resolve when
a requestAnimationFrame has completed.\n * \n * On Node.js this uses setImmediate instead of
requestAnimationFrame.\n * \n * This is simply a sugar method so that users can do the following:\n * `await
tf.nextFrame();`\n * \n * @doc {heading: 'Performance', subheading: 'Timing'}\n *\nfunction nextFrame():
Promise<void> {\n return new Promise<void>(resolve => delayCallback(() => resolve()));\n }\n\nexport
{ nextFrame};\n", "/*\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n *
Unless required
by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\"
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the

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*\n\nimport * as util from './util';\n\nexport function assertParamsConsistent(shapes: number[][], axis: number) {\n const rank = shapes[0].length;\n shapes.forEach((shape, i) => {\n util.assert(\n shape.length === rank,\n () =>\n `Error in concat${rank}D: rank of tensors[${i}] must be the same ` +\n `as the rank of the rest\n (${rank})`);\n util.assert(\n axis >= 0 && axis < rank,\n () => `Error in concat${rank}D: axis must be\n between 0 and ${rank - 1}.`);\n const firstShape = shapes[0];\n shapes.forEach((shape, i) => {\n for\n (let r = 0; r < rank; r++) {\n util.assert(\n (r === axis) || (shape[r] === firstShape[r]),\n () => `Error in\n concat${rank}D: Shape of tensors[${i}] (${shape}) ` +\n `does not match the shape of the rest\n (${firstShape}) ` +\n `along the non-concatenated axis ${i}.`);\n }\n });\n });\n}\n\nexport function\n computeOutShape(shapes: number[][], axis: number): number[] {\n const outputShape = shapes[0].slice();\n for\n (let i = 1; i < shapes.length; i++) {\n outputShape[axis] += shapes[i][axis];\n }\n return outputShape;\n}\n\n"/**\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a\n copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable\n law or agreed to in writing, software\n * distributed under the License is distributed\n on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n License.\n */
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*\n\n/**\n * Inputs of size above this threshold will be parallelized by calling multiple\n * shader programs.\n */\n\nimport {nearestDivisor} from './util';\n\nexport const PARALLELIZE_THRESHOLD = 30;\n\nexport interface\n ReduceInfo {\n windowSize: number;\n batchSize: number;\n inSize: number;\n outSize: number;\n }\n\nexport\n function computeOptimalWindowSize(inSize: number): number {\n if (inSize <= PARALLELIZE_THRESHOLD)\n return inSize;\n return nearestDivisor(inSize, Math.floor(Math.sqrt(inSize)));\n }\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n "License");\n * you may not use this file\n except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n governing permissions and\n * limitations under the License.\n */
```

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*\n\n// Returns the image center in pixels.\nexport function getImageCenter(\n center: number[number, number],\n imageHeight: number,\n imageWidth: number): [number, number] {\n const centerX =\n imageWidth *\n (typeof center === 'number' ? center : center[0]);\n const centerY =\n imageHeight *\n (typeof center ===\n 'number' ? center : center[1]);\n return [centerX, centerY];\n}\n\n"/**\n * @license\n * Copyright 2018 Google\n LLC. All\n Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this\n file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n governing permissions and\n * limitations under the License.\n */
```

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=====
*\n\n/**\n * Gets the new shape of the input Tensor after it's been reshaped\n * to:\n * [blockShape[0], ..., blockShape[M-1], batch / prod(blockShape),\n * inputShape[1], ..., inputShape[N-1]]\n * See step 1:\n * https://www.tensorflow.org/api_docs/python/tf/batch_to_space_nd\n */\n\nexport function getReshaped(\n
```

inputShape:

```
number[], blockShape: number[], prod: number,\n batchToSpace = true): number[] {\n let reshaped: number[] = [];\n if (batchToSpace) {\n reshaped = reshaped.concat(blockShape.slice(0));\n reshaped.push(inputShape[0] / prod);\n reshaped = reshaped.concat(inputShape.slice(1));\n } else {\n reshaped = reshaped.concat(inputShape[0]);\n const spatialLength = blockShape.length;\n for (let i = 0; i < spatialLength; ++i) {\n reshaped =\n reshaped.concat([inputShape[i + 1] / blockShape[i], blockShape[i]]);\n }\n reshaped = reshaped.concat(inputShape.slice(spatialLength + 1));\n }\n return reshaped;\n}\n\n/**\n * Gets the permutation that will transpose the dimensions of the\n * reshaped tensor to shape:\n * [batch / prod(block_shape),inputShape[1], blockShape[0], ..., \n * inputShape[M], blockShape[M-1],inputShape[M+1], ..., \n * inputShape[N-1]]\n * see step 2: https://www.tensorflow.org/api_docs/python/tf/batch_to_space_nd\n * ^\nexport function getPermuted(\n
```

```
 reshapedRank: number, blockShapeRank: number,\n batchToSpace = true): number[] {\n const permuted = [];\n if (batchToSpace) {\n permuted.push(blockShapeRank);\n for (let i = blockShapeRank + 1; i < reshapedRank; ++i) {\n if (i <= 2 * blockShapeRank) {\n permuted.push(i);\n permuted.push(i - (blockShapeRank + 1));\n } else {\n permuted.push(i);\n }\n } else {\n const permutedBeforeBatch = [];\n const permutedAfterBatch = [];\n for (let i = 1; i < reshapedRank; ++i) {\n if (i >= blockShapeRank * 2 + 1 || i % 2 === 1) {\n permutedAfterBatch.push(i);\n } else {\n permutedBeforeBatch.push(i);\n }\n }\n permuted.push(...permutedBeforeBatch);\n permuted.push(0);\n permuted.push(...permutedAfterBatch);\n }\n return permuted;\n}\n\n/**\n * Gets the shape of the reshaped and permuted input Tensor before any cropping\n * is applied. The new shape will be:\n * [batch / prod(blockShape),inputShape[1]
```

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 * blockShape[0], ..., \n * inputShape[M] * blockShape[M-1],inputShape[M+1], ..., \n * inputShape[N-1]]\n * See step 3: https://www.tensorflow.org/api_docs/python/tf/batch_to_space_nd\n * ^\nexport function
```

```
getReshapedPermuted(\n inputShape: number[], blockShape: number[], prod: number,\n batchToSpace = true): number[] {\n const reshapedPermuted = [];\n if (batchToSpace) {\n reshapedPermuted.push(inputShape[0] / prod);\n } else {\n reshapedPermuted.push(inputShape[0] * prod);\n }\n for (let i = 1; i < inputShape.length; ++i) {\n if (i <= blockShape.length) {\n if (batchToSpace) {\n reshapedPermuted.push(blockShape[i - 1] * inputShape[i]);\n } else {\n reshapedPermuted.push(inputShape[i] / blockShape[i - 1]);\n }\n } else {\n reshapedPermuted.push(inputShape[i]);\n }\n }\n return reshapedPermuted;\n}\n\n/**\n * Converts the crops argument into the beginning coordinates of a slice\n * operation.\n
```

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^\nexport function getSliceBeginCoords(\n crops: number[][], blockShape: number): number[] {\n const sliceBeginCoords = [0];\n for (let i = 0; i < blockShape; ++i) {\n sliceBeginCoords.push(crops[i][0]);\n }\n return sliceBeginCoords;\n}\n\n/**\n * Converts the crops argument into the size of a slice operation. When\n * combined with getSliceBeginCoords this function allows the reshaped and\n * permuted Tensor to be cropped to its final output shape of:\n * [inputShape[1] * blockShape[0] - crops[0,0] - crops[0,1], ..., \n * inputShape[M] * blockShape[M-1] - crops[M-1,0] -\n * crops[M-1,1],inputShape[M+1], ..., \n * inputShape[N-1]]\n * See step 4: https://www.tensorflow.org/api_docs/python/tf/batch_to_space_nd\n * ^\nexport function getSliceSize(\n
```

```
 uncroppedShape: number[], crops: number[][], blockShape: number): number[] {\n const sliceSize = uncroppedShape.slice(0, 1);\n for (let i = 0; i < blockShape; ++i) {\n sliceSize.push(uncroppedShape[i + 1] - crops[i][0]
```

```
 - crops[i][1]);\n }\n return sliceSize;\n}\n\n/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n
```

```
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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```

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*\n\nexport const SELU_SCALEALPHA = 1.7580993408473768599402175208123;\nexport const SELU_SCALE
= 1.0507009873554804934193349852946;\n","/**\n * @license\n * Copyright 2018 Google LLC. All Rights
Reserved.\n * Licensed under the
 Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====
*\n\nexport const ERF_P = 0.3275911;\nexport const ERF_A1 = 0.254829592;\nexport const ERF_A2 = -
0.284496736;\nexport const ERF_A3 = 1.421413741;\nexport const ERF_A4 = -1.453152027;\nexport const
ERF_A5 = 1.061405429;\n","/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the "License");\n * you may
 not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {env} from './environment';\nexport function warn(...msg: Array<{}>): void {\n if
(!env().getBool('IS_TEST')) {\n console.warn(...msg);\n }}\n\nexport function log(...msg: Array<{}>): void {\n
if (!env().getBool('IS_TEST')) {\n console.log(...msg);\n }}\n","/**\n * @license\n * Copyright 2018 Google
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {TypedArray} from './types';\n/**\n * Merges real and imaginary Float32Arrays into a single complex
Float32Array.\n * The memory layout is interleaved as follows:\n * real: [r0, r1, r2]\n * imag: [i0, i1, i2]\n *
complex: [r0, i0, r1, i1, r2, i2]\n * This is the inverse of splitRealAndImagArrays.\n * @param real The real
values of the complex tensor values.\n * @param imag The imag values of the
 complex tensor values.\n * @returns A complex tensor as a Float32Array with merged values.\n */\nexport function
mergeRealAndImagArrays(\n real: Float32Array, imag: Float32Array): Float32Array {\n if (real.length !==
imag.length) {\n throw new Error(`Cannot merge real and imag arrays of different lengths. real: ` +\n
`${real.length}, imag: ${imag.length}.`);\n }\n const result = new Float32Array(real.length * 2);\n for (let i = 0; i
< result.length; i += 2) {\n result[i] = real[i / 2];\n result[i + 1] = imag[i / 2];\n }\n return result;\n}\n\n/**\n *
Splits a complex Float32Array into real and imag parts.\n * The memory layout is interleaved as follows:\n *
 complex: [r0, i0, r1, i1, r2, i2]\n * real: [r0, r1, r2]\n * imag: [i0, i1, i2]\n * This is the inverse of
mergeRealAndImagArrays.\n * @param complex The complex tensor values.\n * @returns An object with real
and imag Float32Array components of the complex\n * tensor.\n */\nexport
 function splitRealAndImagArrays(complex: Float32Array):\n {real: Float32Array, imag: Float32Array} {\n
const real = new Float32Array(complex.length / 2);\n const imag = new Float32Array(complex.length / 2);\n for
(let i = 0; i < complex.length; i += 2) {\n real[i / 2] = complex[i];\n imag[i / 2] = complex[i + 1];\n }\n
return {real, imag};\n}\n\n/**\n * Extracts even indexed complex values in the given array.\n * @param complex The
complex tensor values\n */\nexport function complexWithEvenIndex(complex: Float32Array):\n {real:

```

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Float32Array, imag: Float32Array) {\n const len = Math.ceil(complex.length / 4);\n const real = new\n Float32Array(len);\n const imag = new Float32Array(len);\n for (let i = 0; i < complex.length; i += 4) {\n real[Math.floor(i / 4)] = complex[i];\n imag[Math.floor(i / 4)] = complex[i + 1];\n }\n return {real,\n imag};\n}\n\n/**\n * Extracts odd indexed complex values in the given array.\n * @param complex The complex\n tensor values\n */\nexport\n function complexWithOddIndex(complex: Float32Array):\n {real: Float32Array, imag: Float32Array} {\n const\n len = Math.floor(complex.length / 4);\n const real = new Float32Array(len);\n const imag = new\n Float32Array(len);\n for (let i = 2; i < complex.length; i += 4) {\n real[Math.floor(i / 4)] = complex[i];\n imag[Math.floor(i / 4)] = complex[i + 1];\n }\n return {real, imag};\n}\n\n/**\n * Get the map representing a\n complex value in the given array.\n * @param complex The complex tensor values.\n * @param index An index of\n the target complex value.\n */\nexport function getComplexWithIndex(\n complex: Float32Array, index: number):\n {real: number, imag: number} {\n const real = complex[index * 2];\n const imag = complex[index * 2 + 1];\n return {real, imag};\n}\n\n/**\n * Insert a given complex value into the TypedArray.\n * @param data The array in\n which the complex value is inserted.\n * @param c The complex value to be inserted.\n * @param index An index\n of\n the target complex value.\n */\nexport function assignToTypedArray(\n data: TypedArray, real: number, imag:\n number, index: number) {\n data[index * 2] = real;\n data[index * 2 + 1] = imag;\n}\n\n/**\n * Make the list of\n exponent terms used by FFT.\n */\nexport function exponents(\n n: number, inverse: boolean): {real:\n Float32Array, imag: Float32Array} {\n const real = new Float32Array(n / 2);\n const imag = new Float32Array(n / 2);\n for (let i = 0; i < Math.ceil(n / 2); i++) {\n const x = (inverse ? 2 : -2) * Math.PI * (i / n);\n real[i] =\n Math.cos(x);\n imag[i] = Math.sin(x);\n }\n return {real, imag};\n}\n\n/**\n * Make the exponent term used by\n FFT.\n */\nexport function exponent(\n k: number, n: number, inverse: boolean): {real: number, imag: number}\n {\n const x = (inverse ? 2 : -2) * Math.PI * (k / n);\n const real = Math.cos(x);\n const imag = Math.sin(x);\n return {real, imag};\n}\n\n", /**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in\n compliance with the License.\n * You may obtain a copy of the License at\n * \n http://www.apache.org/licenses/LICENSE-2.0\n * \n Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n governing permissions and\n * limitations under the License.\n */\n\n=====\n\n*/\nimport {TensorInfo} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport {assert} from\n './util';\n\n/**\n * Prepare the split size array. When the input is a number, the axis is evenly\n * divided among the\n split size. When the input contains the negative value, the\n * rest of the axis is allocated toward that.\n */\nexport\n function prepareSplitSize(\n x: Tensor|TensorInfo, numOrSizeSplits: number[]|number,\n axis = 0): number[]\n {\n let splitSizes = [];\n if (typeof (numOrSizeSplits) === 'number') {\n assert(\n x.shape[axis] %\n numOrSizeSplits === 0,\n () => 'Number of splits must evenly divide the axis.);\n splitSizes =\n new\n Array(numOrSizeSplits).fill(x.shape[axis] / numOrSizeSplits);\n } else {\n const numOfNegs =\n numOrSizeSplits.reduce((count, value) => {\n if (value === -1) {\n count += 1;\n }\n return count;\n }, 0);\n assert(\n numOfNegs <= 1,\n () => 'There should be only one negative value in split array.);\n const negIndex = numOrSizeSplits.indexOf(-1);\n // Allow the number of split array to be -1, which indicates the\n rest\n // of dimension is allocated to that split.\n if (negIndex !== -1) {\n const total =\n numOrSizeSplits.reduce((a, b) => b > 0 ? a + b : a);\n numOrSizeSplits[negIndex]\n = x.shape[axis] - total;\n }\n assert(\n x.shape[axis] === numOrSizeSplits.reduce((a, b) => a + b),\n ()\n => 'The sum of sizes must match the size of the axis dimension.);\n splitSizes = numOrSizeSplits;\n }\n return\n splitSizes;\n}\n\n", /**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the\n Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the\n License.\n * You may obtain a copy of the License at\n * \n http://www.apache.org/licenses/LICENSE-2.0\n * \n */

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limitations under the License.

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*\n\nimport {TensorInfo}
from './kernel_registry';\nimport {nearestDivisor} from './util';\n\nimport {PARALLELIZE_THRESHOLD} from
 './reduce_util';\n\nexport interface SegOpInfo {\n windowSize: number;\n batchSize: number;\n inSize: number;\n numSegments: number;\n}\n\nexport function segOpComputeOptimalWindowSize(\n inSize: number,
 numSegments: number): number {\n let done = false;\n let res;\n\n if (inSize <= PARALLELIZE_THRESHOLD)
 {\n res = inSize;\n done = true;\n } else {\n res = nearestDivisor(inSize, Math.floor(Math.sqrt(inSize)));\n
 }\n\n while (!done) {\n if (res > numSegments || res === inSize) {\n done = true;\n } else {\n res =
 nearestDivisor(inSize, res + 1);\n }\n }\n return res;\n}\n\nexport function computeOutShape(\n aShape:
 number[], axis: number, numSegments: number): number[] {\n const outShape = [];\n const rank =
 aShape.length;\n for (let dim = 0; dim < rank; dim++) {\n if (dim !== axis) {\n outShape.push(aShape[dim]);\n
 }\n } else {\n outShape.push(numSegments);\n }\n return outShape;\n}\n\nexport interface
 GatherOpShapeInfo {\n batchSize: number;\n sliceSize: number;\n outerSize: number;\n dimSize: number;\n
 outputShape: number[];\n}\n\nexport function collectGatherOpShapeInfo(\n x: TensorInfo, indices: TensorInfo,
 axis: number, batchDims: number): GatherOpShapeInfo {\n const indicesRank = indices.shape.length;\n const
 xRank = x.shape.length;\n if (batchDims !== 0) {\n if (batchDims < -indicesRank || batchDims > indicesRank)
 {\n throw new Error(`Expect batchDims in the range of [-${indicesRank}, ${indicesRank}], but got
 ${batchDims}`);\n }\n\n if (batchDims < 0) {\n batchDims += indicesRank;\n }\n\n if (batchDims >
 xRank) {\n throw new Error(`batchDims (${batchDims}) must be less than rank(x) (${xRank}).`);\n }\n\n if
 (axis < batchDims) {\n throw new Error(`batchDims (${batchDims}) must be less than or equal to axis
 (${axis}).`);\n }\n\n for (let i = 0; i < batchDims; ++i) {\n if (x.shape[i] !== indices.shape[i]) {\n
 throw new Error(`x.shape[${i}]: ${x.shape[i]} should be equal to indices.shape[${i}]:
 ${indices.shape[i]}`);\n }\n }\n\n const dimSize = x.shape[axis];\n\n const outputShape: number[] = [];\n
 let batchSize = 1;\n let outerSize = 1;\n let sliceSize = 1;\n\n for (let i = 0; i < batchDims; ++i) {\n
 outputShape.push(x.shape[i]);\n batchSize *= x.shape[i];\n }\n\n for (let i = batchDims; i < axis; i++) {\n
 outputShape.push(x.shape[i]);\n outerSize *= x.shape[i];\n }\n\n for (let i = batchDims; i < indicesRank; i++) {\n
 outputShape.push(indices.shape[i]);\n }\n\n for (let i = axis + 1; i < xRank; i++) {\n
 outputShape.push(x.shape[i]);\n sliceSize *= x.shape[i];\n }\n\n return {batchSize, sliceSize, outerSize, dimSize,
 outputShape};\n}\n\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed
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 distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
 express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
 the License.\n *
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*\n\nimport {decodeString, encodeString} from './util';\n\n// Utilities needed by backend consumers of tf-
core.\nexport * from './ops/axis_util';\nexport * from './ops/broadcast_util';\nexport * from
 './ops/concat_util';\nexport * from './ops/conv_util';\nexport * from './ops/fused_util';\nexport * from
 './ops/fused_types';\nexport * from './ops/reduce_util';\n\nimport
 * as slice_util from './ops/slice_util';\nexport {slice_util};\n\nexport {BackendValues, TypedArray, upcastType,
 PixelData} from './types';\nexport {MemoryInfo, TimingInfo} from './engine';\nexport * from
 './ops/rotate_util';\nexport * from './ops/array_ops_util';\nexport * from './ops/gather_nd_util';\nexport * from
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./ops/scatter_nd_util';\nexport * from './ops/selu_util';\nexport * from './ops/fused_util';\nexport * from
./ops/erf_util';\nexport * from './log';\nexport * from './backends/complex_util';\nexport * from
./ops/split_util';\n\nimport * as segment_util from './ops/segment_util';\nexport {segment_util};\n\nexport function
fromUint8ToArray(vals: Uint8Array[]) {\n try {\n // Decode the bytes into string.\n return vals.map(val
=> decodeString(val));\n } catch (err) {\n throw new Error(\n `Failed to decode encoded string bytes into utf-
8, error: ${err}`);\n }\n}\n\nexport function fromStringArrayToUint8(strings:
string[]) {\n return strings.map(s => encodeString(s));\n}\n\n"/**\n * @license\n * Copyright 2020 Google LLC.
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file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nexport {nonMaxSuppressionV3Impl, nonMaxSuppressionV4Impl, nonMaxSuppressionV5Impl} from
./non_max_suppression_impl';\nexport {whereImpl} from './where_impl';\n\n"/**\n * @license\n * Copyright 2020
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this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
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=====
*\n\n// base.ts is tfjs-core without auto registration of things like flags,\n// gradients, chained ops or the opHandler.
See base_side_effects.ts for parts\n// tfjs core that are required side effects.\n\n/**\n * @fileoverview\n * @suppress
{partialAlias} Optimization disabled due to passing the module\n * object into a function
below:\n * \n * import * as ops from './ops/ops';\n * setOpHandler(ops);\n * \n\n// Serialization.\n\nimport * as io
from './io/io';\nimport * as math from './math';\nimport * as browser from './ops/browser';\nimport * as gather_util
from './ops/gather_nd_util';\nimport * as scatter_util from './ops/scatter_nd_util';\nimport * as slice_util from
./ops/slice_util';\nimport * as serialization from './serialization';\nimport * as tensor_util from './tensor_util';\nimport
* as test_util from './test_util';\nimport * as util from './util';\nimport {version} from './version';\n\nexport
{InferenceModel, MetaGraph, MetaGraphInfo, ModelPredictConfig, ModelTensorInfo, SavedModelTensorInfo,
SignatureDef, SignatureDefEntry, SignatureDefInfo} from './model_types';\n\n// Optimizers.\n\nexport
{AdadeltaOptimizer} from './optimizers/adadelta_optimizer';\nexport {AdagradOptimizer} from
./optimizers/adagrad_optimizer';\nexport {AdamOptimizer} from './optimizers/adam_optimizer';\nexport
{AdamaxOptimizer}
from './optimizers/adamax_optimizer';\nexport {MomentumOptimizer} from
./optimizers/momentum_optimizer';\nexport {Optimizer} from './optimizers/optimizer';\nexport
{RMSPropOptimizer} from './optimizers/rmsprop_optimizer';\nexport {SGDOptimizer} from
./optimizers/sgd_optimizer';\nexport {Scalar, Tensor, Tensor1D, Tensor2D, Tensor3D, Tensor4D, Tensor5D,
TensorBuffer, Variable} from './tensor';\nexport {GradSaveFunc, NamedTensorMap, TensorContainer,
TensorContainerArray, TensorContainerObject} from './tensor_types';\nexport {BackendValues, DataType,
DataTypeMap, DataValues, NumericDataType, PixelData, Rank, RecursiveArray, ScalarLike, ShapeMap,
sumOutType, TensorLike, TypedArray, upcastType} from './types';\n\nexport * from './ops/ops';\nexport
{Reduction} from './ops/loss_ops_utils';\n\nexport * from './train';\nexport * from './globals';\nexport * from
./kernel_registry';\nexport {customGrad, grad, grads, valueAndGrad, valueAndGrads, variableGrads} from
./gradients';\n\nexport {TimingInfo,

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MemoryInfo, ForwardFunc} from './engine';\nexport {Environment, env, ENV} from './environment';\nexport
{Platform} from './platforms/platform';\n\nexport {version as version_core};\n\n// Top-level method
exports.\n\nexport {nextFrame} from './browser_util';\n\n// Second level exports.\n\nimport * as backend_util from
 './backends/backend_util';\n\nimport * as device_util from './device_util';\n\nexport {\n browser,\n io,\n math,\n
serialization,\n test_util,\n util,\n backend_util,\n tensor_util,\n slice_util,\n gather_util,\n scatter_util,\n
device_util\n};\n\nimport * as kernel_impls from './backends/kernel_impls';\n\nexport {kernel_impls};\n\n// Backend
specific.\n\nexport {KernelBackend, BackendTimingInfo, DataMover, DataStorage} from './backends/backend';\n\n//
Export all kernel names / info.\n\nexport * from './kernel_names';\n\n", "/*\n * @license\n * Copyright 2017 Google
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http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

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=====\n
*\n\n// Required side effectful code.\n\nimport './base_side_effects';\n\n// All exports from this package should be in
base.\n\nexport * from './base';\n\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n *
Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n *\n *
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the License.\n *

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=====\n
*\n\nconst contexts: {[key: string]: WebGLRenderingContext} = {};\n\nconst WEBGL_ATTRIBUTES:
WebGLContextAttributes = {\n alpha: false,\n antialias: false,\n premultipliedAlpha: false,\n
preserveDrawingBuffer: false,\n depth: false,\n stencil: false,\n failIfMajorPerformanceCaveat: true\n};\n\n\nexport
function clearWebGLContext(webGLVersion: number) {\n delete contexts[webGLVersion];\n}\n\n\nexport function
setWebGLContext(\n webGLVersion: number, gl: WebGLRenderingContext) {\n contexts[webGLVersion] =
gl;\n}\n\n\nexport function getWebGLContext(webGLVersion:
number): WebGLRenderingContext {\n if (!(webGLVersion in contexts)) {\n const newCtx =
getWebGLRenderingContext(webGLVersion);\n if (newCtx !== null) {\n contexts[webGLVersion] =
newCtx;\n } else {\n console.log('Could not get context for WebGL version', webGLVersion);\n return
null;\n }}\n }\n\n const gl = contexts[webGLVersion];\n if (gl.isContextLost()) {\n delete
contexts[webGLVersion];\n return getWebGLContext(webGLVersion);\n }\n\n gl.disable(gl.DEPTH_TEST);\n
gl.disable(gl.STENCIL_TEST);\n gl.disable(gl.BLEND);\n gl.disable(gl.DITHER);\n
gl.disable(gl.POLYGON_OFFSET_FILL);\n gl.disable(gl.SAMPLE_COVERAGE);\n
gl.enable(gl.SCISSOR_TEST);\n gl.enable(gl.CULL_FACE);\n gl.cullFace(gl.BACK);\n\n return
contexts[webGLVersion];\n}\n\n\nfunction createCanvas(webGLVersion: number) {\n if (typeof OffscreenCanvas
!== 'undefined' && webGLVersion === 2) {\n return new OffscreenCanvas(300, 150);\n } else if (typeof
document !==
'undefined') {\n return document.createElement('canvas');\n } else {\n throw new Error('Cannot create a canvas
in this context');\n }}\n}\n\n\nfunction getWebGLRenderingContext(webGLVersion: number):
WebGLRenderingContext {\n if (webGLVersion !== 1 && webGLVersion !== 2) {\n throw new Error('Cannot
get WebGL rendering context, WebGL is disabled.);\n }\n\n const canvas = createCanvas(webGLVersion);\n\n
canvas.addEventListener('webglcontextlost', (ev: Event) => {\n ev.preventDefault();\n delete
contexts[webGLVersion];\n }, false);\n\n if (webGLVersion === 1) {\n return (canvas.getContext('webgl',

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WEBGL_ATTRIBUTES) ||\n canvas.getContext('experimental-webgl', WEBGL_ATTRIBUTES)) as\n
WebGLRenderingContext;\n } \n return canvas.getContext('webgl2', WEBGL_ATTRIBUTES) as\n
WebGLRenderingContext;\n}\n"/**\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n *

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===== \n
*\n\nimport {backend_util, DataId, DataType, env, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nexport enum\n
PackingScheme {\n /**\n * All values in a single texel are densely packed without any constraints.\n *\n * This

is how the shader encodes a tensor with shape = [2, 3, 4]\n * (indices are [batch, row, col]).\n *\n * 000|001

010|011 020|021\n * -----\n * 002|003 012|013 022|023\n *\n * 100|101 110|111 120|121\n * -----\n * 102|103 112|113 122|123\n *\n *\n
DENSE,\n\n /**\n * Single texels contain only values from the same batch, and from adjacent\n * rows and

columns.\n *\n * This is how the shader encodes a tensor with shape = [2, 3, 5]\n * (indices are [batch, row,

col]).\n *\n * 000|001 002|003 004|xxx 020|021 022|023 024|xxx\n * -----\n * 010|011 012|013 014|xxx xxx|xxx xxx|xxx xxx|xxx\n *\n * 100|101 102|103 104|xxx

120|121 122|123 124|xxx\n * -----\n * 110|111 112|113 114|xxx

xxx|xxx xxx|xxx xxx|xxx\n *\n *\n SHARED_BATCH\n}\n\nexport enum TextureUsage {\n RENDER,\n
UPLOAD,\n PIXELS,\n DOWNLOAD\n}\n\nexport enum PhysicalTextureType {\n UNPACKED_FLOAT16,\n
UNPACKED_FLOAT32,\n PACKED_4X1_UNSIGNED_BYTE,\n PACKED_2X2_FLOAT32,\n
PACKED_2X2_FLOAT16\n}\n\nexport\n
interface TextureData {\n // Required.\n shape: number[];\n dtype: DataType;\n\n // Optional.\n values?:\n
backend_util.BackendValues;\n texture?: WebGLTexture;\n // For complex numbers, the real and imaginary parts

are stored as their own\n // individual tensorInfos, with a parent joining the two with the\n // complexTensors field.

When this is defined, texture will be null.\n complexTensorInfos?: {real: TensorInfo, imag: TensorInfo};\n /**

[rows, columns] shape of the texture. *\n texShape?: [number, number];\n usage?: TextureUsage;\n isPacked?:

boolean;\n\n refCount: number;\n\n // Available when the tensor has been sliced.\n slice?: {\n // Offset in the 'flat

index' space.\n flatOffset: number;\n // Used for counting how many sliced tensors point to the same texture.\n
origDataId: DataId;\n };\n}\n\nexport function getUnpackedMatrixTextureShapeWidthHeight(\n rows: number,

columns: number): [number, number] {\n return [columns,

rows];\n}\n\nexport function getUnpackedArraySizeFromMatrixSize(\n matrixSize: number, channelsPerTexture:

number): number {\n return matrixSize * channelsPerTexture;\n}\n\nexport function

getColorMatrixTextureShapeWidthHeight(\n rows: number, columns: number): [number, number] {\n return

[columns * 4, rows];\n}\n\n/**\n * Get shape for densely packed RGBA texture.\n *\n\nexport function

getDenseTexShape(shape: number[]): [number, number] {\n const size = util.sizeFromShape(shape);\n const

texelsNeeded = Math.ceil(size / 4);\n return util.sizeToSquarishShape(texelsNeeded);\n}\n\nexport function

getMatrixSizeFromUnpackedArraySize(\n unpackedSize: number, channelsPerTexture: number): number {\n if

(unpackedSize % channelsPerTexture !== 0) {\n throw new Error(\n `unpackedSize (${unpackedSize}) must

be a multiple of `\n ` ${channelsPerTexture}`);\n }\n return unpackedSize / channelsPerTexture;\n}\n\nexport

function decodeMatrixFromUnpackedColorRGBAArray(\n

unpackedArray: Float32Array, matrix: Float32Array, channels: number) {\n const requiredSize =

unpackedArray.length * channels / 4;\n if (matrix.length < requiredSize) {\n throw new Error(\n `matrix

length (${matrix.length}) must be >= ${requiredSize}`);\n }\n let dst = 0;\n for (let src = 0; src <

unpackedArray.length; src += 4) {\n for (let c = 0; c < channels; c++) {\n matrix[dst++] = unpackedArray[src +

c];\n }\n }\n}\n\nexport function getPackedMatrixTextureShapeWidthHeight(\n rows: number, columns:

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number): [number, number] {\n return [\n Math.max(1, Math.ceil(columns / 2)), Math.max(1, Math.ceil(rows /
2))\n];\n}\n\nexport function getPackedRGBAArraySizeFromMatrixShape(\n rows: number, columns: number):
number {\n const [w, h] = getPackedMatrixTextureShapeWidthHeight(rows, columns);\n return w * h *
4;\n}\n\nexport interface TextureConfig {\n internalFormatFloat: number;\n textureFormatFloat: number;\n
internalFormatPackedHalfFloat:
number;\n internalFormatHalfFloat: number;\n internalFormatPackedFloat: number;\n\n // The format to use
during a gl.readPixels call.\n downloadTextureFormat: number;\n // How many channels need to be unpacked after
a gl.readPixels call.\n downloadUnpackNumChannels: number;\n\n defaultNumChannels: number;\n
textureTypeHalfFloat: number;\n textureTypeFloat: number;\n}\n\nexport function getTextureConfig(\n //
tslint:disable-next-line:no-any\n gl: WebGLRenderingContext, textureHalfFloatExtension?: any): TextureConfig
{\n // tslint:disable-next-line:no-any\n const glany = gl as any;\n\n let internalFormatFloat: number;\n let
internalFormatHalfFloat: number;\n let internalFormatPackedHalfFloat: number;\n let internalFormatPackedFloat:
number;\n let textureFormatFloat: number;\n\n let downloadTextureFormat: number;\n let
downloadUnpackNumChannels: number;\n\n let defaultNumChannels: number;\n let textureTypeHalfFloat:
number;\n let textureTypeFloat: number;\n\n
if (env().getNumber('WEBGL_VERSION') === 2) {\n internalFormatFloat = glany.R32F;\n
internalFormatHalfFloat = glany.R16F;\n internalFormatPackedHalfFloat = glany.RGBA16F;\n
internalFormatPackedFloat = glany.RGBA32F;\n textureFormatFloat = glany.RED;\n
downloadUnpackNumChannels = 4;\n defaultNumChannels = 1;\n textureTypeHalfFloat =
glany.HALF_FLOAT;\n textureTypeFloat = glany.FLOAT;\n } else {\n internalFormatFloat = gl.RGBA;\n
internalFormatHalfFloat = gl.RGBA;\n internalFormatPackedHalfFloat = gl.RGBA;\n
internalFormatPackedFloat = glany.RGBA;\n textureFormatFloat = gl.RGBA;\n downloadUnpackNumChannels
= 4;\n defaultNumChannels = 4;\n textureTypeHalfFloat = textureHalfFloatExtension !== null ?\n
textureHalfFloatExtension.HALF_FLOAT_OES :\n null;\n textureTypeFloat = gl.FLOAT;\n }\n
downloadTextureFormat = gl.RGBA;\n\n return {\n internalFormatFloat,\n internalFormatHalfFloat,\n
internalFormatPackedHalfFloat,\n
internalFormatPackedFloat,\n textureFormatFloat,\n downloadTextureFormat,\n
downloadUnpackNumChannels,\n defaultNumChannels,\n textureTypeHalfFloat,\n textureTypeFloat\n
};\n}\n\n", /**\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n * Licensed under the Apache
License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You
may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required
by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS"
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {env, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport
{getWebGLContext} from './canvas_util';\n\nimport {getTextureConfig} from './tex_util';\n\nexport function
callAndCheck<T>(gl: WebGLRenderingContext, func: () => T): T {\n const returnValue = func();\n if
(env().getBool('DEBUG')) {\n checkWebGLError(gl);\n }\n return returnValue;\n}\n\nfunction
checkWebGLError(gl: WebGLRenderingContext) {\n const error = gl.getError();\n if (error !== gl.NO_ERROR)
{\n throw new Error('WebGL Error: ' + getWebGLErrorMessage(gl, error));\n }\n}\n\n//
https://en.wikipedia.org/wiki/Half-precision_floating-point_format\n\nconst MIN_FLOAT16 = 5.96e-8;\n\nconst
MAX_FLOAT16 = 65504;\n\nexport function canBeRepresented(num: number): boolean {\n if
(env().getBool('WEBGL_RENDER_FLOAT32_ENABLED') || num === 0 ||\n (MIN_FLOAT16 <
Math.abs(num) && Math.abs(num) < MAX_FLOAT16)) {\n return true;\n }\n return false;\n}\n\nexport
function getWebGLErrorMessage(\n gl: WebGLRenderingContext, status: number): string {\n switch (status) {\n
case gl.NO_ERROR:\n return 'NO_ERROR';\n case gl.INVALID_ENUM:\n return
'INVALID_ENUM';\n case gl.INVALID_VALUE:\n return 'INVALID_VALUE';\n case

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gl.INVALID_OPERATION:\n return 'INVALID_OPERATION';\n case
gl.INVALID_FRAMEBUFFER_OPERATION:\n return 'INVALID_FRAMEBUFFER_OPERATION';\n case
gl.OUT_OF_MEMORY:\n return 'OUT_OF_MEMORY';\n case gl.CONTEXT_LOST_WEBGL:\n return
'CONTEXT_LOST_WEBGL';\n default:\n return `Unknown error code ${status}`;\n }\n}\n\nexport function
getExtensionOrThrow(\n gl: WebGLRenderingContext, extensionName: string): {} {\n return
throwIfNull<{}>(\n gl, () => gl.getExtension(extensionName),\n 'Extension \'' + extensionName + '\'' not
supported on this browser.);\n }\n}\n\nexport function createVertexShader(\n gl: WebGLRenderingContext,
vertexShaderSource: string): WebGLShader {\n const vertexShader: WebGLShader =
throwIfNull<WebGLShader>(\n gl, () => gl.createShader(gl.VERTEX_SHADER),\n
 'Unable to create vertex WebGLShader.);\n callAndCheck(gl, () => gl.shaderSource(vertexShader,
vertexShaderSource));\n callAndCheck(gl, () => gl.compileShader(vertexShader));\n if
(gl.getShaderParameter(vertexShader, gl.COMPILE_STATUS) === false) {\n
 console.log(gl.getShaderInfoLog(vertexShader));\n throw new Error('Failed to compile vertex shader.);\n }\n
return vertexShader;\n }\n}\n\nexport function createFragmentShader(\n gl: WebGLRenderingContext,
fragmentShaderSource: string): WebGLShader {\n const fragmentShader: WebGLShader =
throwIfNull<WebGLShader>(\n gl, () => gl.createShader(gl.FRAGMENT_SHADER),\n
 'Unable to create
fragment WebGLShader.);\n callAndCheck(gl, () => gl.shaderSource(fragmentShader, fragmentShaderSource));\n
callAndCheck(gl, () => gl.compileShader(fragmentShader));\n if (gl.getShaderParameter(fragmentShader,
gl.COMPILE_STATUS) === false) {\n logShaderSourceAndInfoLog(\n fragmentShaderSource,
gl.getShaderInfoLog(fragmentShader));\n
 throw new Error('Failed to compile fragment shader.);\n }\n return fragmentShader;\n }\n}\n\nconst
lineNumberRegex = /ERROR: [0-9]+:([0-9]+)/g;\nfunction logShaderSourceAndInfoLog(\n shaderSource: string,
shaderInfoLog: string) {\n const lineNumberRegexResult = lineNumberRegex.exec(shaderInfoLog);\n if
(lineNumberRegexResult === null) {\n console.log(`Couldn't parse line number in error: ${shaderInfoLog}`);\n
 console.log(shaderSource);\n return;\n }\n const lineNumber = +lineNumberRegexResult[1];\n const
shaderLines = shaderSource.split('\n');\n const pad = shaderLines.length.toString().length + 2;\n const
linesWithLineNumbers = shaderLines.map(\n (line, lineNumber) =>\n util.rightPad((lineNumber +
1).toString(), pad) + line);\n let maxLineLength = 0;\n for (let i = 0; i < linesWithLineNumbers.length; i++) {\n
maxLineLength = Math.max(linesWithLineNumbers[i].length, maxLineLength);\n }\n const beforeErrorLines =
linesWithLineNumbers.slice(0,
lineNumber - 1);\n const errorLine = linesWithLineNumbers.slice(lineNumber - 1, lineNumber);\n const
afterErrorLines = linesWithLineNumbers.slice(lineNumber);\n console.log(beforeErrorLines.join('\n'));\n
console.log(shaderInfoLog.split('\n')[0]);\n console.log(\n `%c ${util.rightPad(errorLine[0],
maxLineLength)} `,\n 'border: 1px solid red; background-color: #e3d2d2; color: #a61717');\n
console.log(afterErrorLines.join('\n'));\n }\n}\n\nexport function createProgram(gl: WebGLRenderingContext):
WebGLProgram {\n return throwIfNull<WebGLProgram>(\n gl, () => gl.createProgram(), 'Unable to create
WebGLProgram.);\n }\n}\n\nexport function linkProgram(gl: WebGLRenderingContext, program: WebGLProgram)
{\n callAndCheck(gl, () => gl.linkProgram(program));\n if (gl.getProgramParameter(program, gl.LINK_STATUS)
=== false) {\n console.log(gl.getProgramInfoLog(program));\n throw new Error('Failed to link vertex and
fragment shaders.);\n }\n }\n}\n\nexport
function validateProgram(\n gl: WebGLRenderingContext, program: WebGLProgram) {\n callAndCheck(gl, ()
=> gl.validateProgram(program));\n if (gl.getProgramParameter(program, gl.VALIDATE_STATUS) === false) {\n
 console.log(gl.getProgramInfoLog(program));\n throw new Error('Shader program validation failed.);\n
}\n }\n}\n\nexport function createStaticVertexBuffer(\n gl: WebGLRenderingContext, data: Float32Array):
WebGLBuffer {\n const buffer: WebGLBuffer = throwIfNull<WebGLBuffer>(\n gl, () => gl.createBuffer(),
'Unable to create WebGLBuffer');\n callAndCheck(gl, () => gl.bindBuffer(gl.ARRAY_BUFFER, buffer));\n
callAndCheck(gl, () => gl.bufferData(gl.ARRAY_BUFFER, data, gl.STATIC_DRAW));\n return
buffer;\n }\n}\n\nexport function createStaticIndexBuffer(\n gl: WebGLRenderingContext, data: Uint16Array):

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WebGLBuffer {\n const buffer: WebGLBuffer = throwIfNull<WebGLBuffer>(\n gl, () => gl.createBuffer(),
'Unable to create WebGLBuffer');\n callAndCheck(gl, () => gl.bindBuffer(gl.ELEMENT_ARRAY_BUFFER,
 buffer));\n callAndCheck(\n gl, () => gl.bufferData(gl.ELEMENT_ARRAY_BUFFER, data,
gl.STATIC_DRAW));\n return buffer;\n}\n\n\nexport function getNumChannels(): number {\n if
(env().getNumber('WEBGL_VERSION') === 2) {\n return 1;\n }\n return 4;\n}\n\n\nexport function
createTexture(gl: WebGLRenderingContext): WebGLTexture {\n return throwIfNull<WebGLTexture>(\n gl, ()
=> gl.createTexture(), 'Unable to create WebGLTexture.);\n}\n\n\nexport function validateTextureSize(width:
number, height: number) {\n const maxTextureSize = env().getNumber('WEBGL_MAX_TEXTURE_SIZE');\n if
((width <= 0) || (height <= 0)) {\n const requested = `${width}x${height}`;\n throw new Error('Requested
texture size ' + requested + ' is invalid.);\n }\n if ((width > maxTextureSize) || (height > maxTextureSize)) {\n
const requested = `${width}x${height}`;\n const max = `${maxTextureSize}x${maxTextureSize}`;\n throw
new Error(\n 'Requested
texture size ' + requested + '\n ' greater than WebGL maximum on this browser / GPU ' + max + '.);\n
 }\n}\n\n\nexport function createFramebuffer(gl: WebGLRenderingContext): WebGLFramebuffer {\n return
throwIfNull<WebGLFramebuffer>(\n gl, () => gl.createFramebuffer(), 'Unable to create
WebGLFramebuffer.);\n}\n\n\nexport function bindVertexBufferToProgramAttribute(\n gl:
WebGLRenderingContext, program: WebGLProgram, attribute: string,\n buffer: WebGLBuffer,
arrayEntriesPerItem: number, itemStrideInBytes: number,\n itemOffsetInBytes: number): boolean {\n const loc =
gl.getAttribLocation(program, attribute);\n if (loc === -1) {\n // The GPU compiler decided to strip out this
attribute because it's unused,\n // thus no need to bind.\n return false;\n }\n callAndCheck(gl, () =>
gl.bindBuffer(gl.ARRAY_BUFFER, buffer));\n callAndCheck(\n gl,\n () => gl.vertexAttribPointer(\n
loc, arrayEntriesPerItem, gl.FLOAT, false, itemStrideInBytes,\n
 itemOffsetInBytes));\n callAndCheck(gl, () => gl.enableVertexAttribArray(loc));\n return true;\n}\n\n\nexport
function bindTextureUnit(\n gl: WebGLRenderingContext, texture: WebGLTexture, textureUnit: number) {\n
 validateTextureUnit(gl, textureUnit);\n callAndCheck(gl, () => gl.activeTexture(gl.TEXTURE0 + textureUnit));\n
 callAndCheck(gl, () => gl.bindTexture(gl.TEXTURE_2D, texture));\n}\n\n\nexport function unbindTextureUnit(\n
gl: WebGLRenderingContext, textureUnit: number) {\n validateTextureUnit(gl, textureUnit);\n callAndCheck(gl,
() => gl.activeTexture(gl.TEXTURE0 + textureUnit));\n callAndCheck(gl, () => gl.bindTexture(gl.TEXTURE_2D,
null));\n}\n\n\nexport function getProgramUniformLocationOrThrow(\n gl: WebGLRenderingContext, program:
WebGLProgram,\n uniformName: string): WebGLUniformLocation {\n return
throwIfNull<WebGLUniformLocation>(\n gl, () => gl.getUniformLocation(program, uniformName),\n '\n
uniform \'' + uniformName + '\' not present in
program.);\n}\n\n\nexport function getProgramUniformLocation(\n gl: WebGLRenderingContext, program:
WebGLProgram,\n uniformName: string): WebGLUniformLocation {\n return gl.getUniformLocation(program,
uniformName);\n}\n\n\nexport function bindTextureToProgramUniformSampler(\n gl: WebGLRenderingContext,
texture: WebGLTexture,\n uniformSamplerLocation: WebGLUniformLocation, textureUnit: number) {\n
 callAndCheck(gl, () => bindTextureUnit(gl, texture, textureUnit));\n callAndCheck(gl, () =>
gl.uniform1i(uniformSamplerLocation, textureUnit);\n}\n\n\nexport function bindCanvasToFramebuffer(gl:
WebGLRenderingContext) {\n callAndCheck(gl, () => gl.bindFramebuffer(gl.FRAMEBUFFER, null));\n
 callAndCheck(gl, () => gl.viewport(0, 0, gl.canvas.width, gl.canvas.height));\n callAndCheck(gl, () =>
gl.scissor(0, 0, gl.canvas.width, gl.canvas.height));\n}\n\n\nexport function bindColorTextureToFramebuffer(\n
gl:
WebGLRenderingContext, texture: WebGLTexture,\n framebuffer: WebGLFramebuffer)
{\n callAndCheck(gl, () => gl.bindFramebuffer(gl.FRAMEBUFFER, framebuffer));\n callAndCheck(\n gl,\n
() => gl.framebufferTexture2D(\n gl.FRAMEBUFFER, gl.COLOR_ATTACHMENT0, gl.TEXTURE_2D,
texture, 0));\n}\n\n\nexport function unbindColorTextureFromFramebuffer(\n gl: WebGLRenderingContext,
framebuffer: WebGLFramebuffer) {\n callAndCheck(gl, () => gl.bindFramebuffer(gl.FRAMEBUFFER,
framebuffer));\n callAndCheck(\n gl,\n () => gl.framebufferTexture2D(\n gl.FRAMEBUFFER,
gl.COLOR_ATTACHMENT0, gl.TEXTURE_2D, null, 0));\n}\n\n\nexport function validateFramebuffer(gl:

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WebGLRenderingContext) {\n const status = gl.checkFramebufferStatus(gl.FRAMEBUFFER);\n if (status !==\n gl.FRAMEBUFFER_COMPLETE) {\n throw new Error(\n 'Error binding framebuffer: ' +\n getFramebufferErrorMessage(gl, status));\n }\n}\n\nexport function getFramebufferErrorMessage(\n gl:\n WebGLRenderingContext, status: number): string {\n switch (status) {\n case\n gl.FRAMEBUFFER_INCOMPLETE_ATTACHMENT:\n return 'FRAMEBUFFER_INCOMPLETE_ATTACHMENT';\n case\n gl.FRAMEBUFFER_INCOMPLETE_MISSING_ATTACHMENT:\n return\n 'FRAMEBUFFER_INCOMPLETE_MISSING_ATTACHMENT';\n case\n gl.FRAMEBUFFER_INCOMPLETE_DIMENSIONS:\n return\n 'FRAMEBUFFER_INCOMPLETE_DIMENSIONS';\n case gl.FRAMEBUFFER_UNSUPPORTED:\n return\n 'FRAMEBUFFER_UNSUPPORTED';\n default:\n return `unknown error ${status}`;\n }\n}\n\nfunction\n throwIfNull<T>(\n gl: WebGLRenderingContext, returnOrNull: () => T | null,\n failureMessage: string): T {\n const tOrNull: T | null = callAndCheck(gl, () => returnOrNull());\n if (tOrNull === null) {\n throw new\n Error(failureMessage);\n }\n return tOrNull;\n}\n\nfunction validateTextureUnit(gl: WebGLRenderingContext,\n textureUnit: number) {\n const maxTextureUnit = gl.MAX_COMBINED_TEXTURE_IMAGE_UNITS - 1;\n const glTextureUnit = textureUnit + gl.TEXTURE0;\n if (glTextureUnit < gl.TEXTURE0 || glTextureUnit >\n maxTextureUnit) {\n const\n textureUnitRange = `[gl.TEXTURE0, gl.TEXTURE${maxTextureUnit}]`;\n throw new Error(`textureUnit must\n be in ${textureUnitRange}.`);\n }\n}\n\nexport function getBatchDim(shape: number[], dimsToSkip = 2): number\n {\n return util.sizeFromShape(shape.slice(0, shape.length - dimsToSkip));\n}\n\nexport function\n getRowsCols(shape: number[]): [number, number] {\n if (shape.length === 0) {\n throw Error('Cannot get rows\n and columns of an empty shape array.);\n }\n return [\n shape.length > 1 ? shape[shape.length - 2] : 1,\n shape[shape.length - 1]\n];\n}\n\nexport function getShapeAs3D(shape: number[]): [number, number, number] {\n let shapeAs3D: [number, number, number] = [1, 1, 1];\n const isScalar = shape.length === 0 || (shape.length === 1\n && shape[0] === 1);\n if (!isScalar) {\n shapeAs3D = [\n getBatchDim(shape), ...getRowsCols(shape)] as\n [number, number, number];\n }\n return shapeAs3D;\n}\n\nexport function getTextureShapeFromLogicalShape(\n logShape:\n number[], isPacked = false): [number, number] {\n let maxTexSize =\n env().getNumber('WEBGL_MAX_TEXTURE_SIZE');\n if (isPacked) {\n maxTexSize = maxTexSize * 2;\n }\n // This logic ensures we accurately count the number of packed texels needed\n // to accommodate the tensor. We\n can only pack values in the same texel if\n // they are from adjacent pairs of rows/cols within the same batch. So if\n a\n // tensor has 3 rows, we pretend it has 4 rows in order to account for the\n // fact that the texels containing the\n third row are half empty.\n logShape = logShape.map(\n (d, i) => i >= logShape.length - 2 ?\n util.nearestLargerEven(logShape[i]) :\n logShape[i]);\n // Packed texture height is at least 2 (the channel\n height of a single\n // texel).\n if (logShape.length === 1) {\n logShape = [2, logShape[0]];\n }\n // logical shape is 2, we don't squeeze, since we want to match physical.\n if (logShape.length !==\n 2) {\n const squeezeResult = util.squeezeShape(logShape);\n logShape = squeezeResult.newShape;\n }\n let\n size = util.sizeFromShape(logShape);\n if (logShape.length <= 1 && size <= maxTexSize) {\n return [1, size];\n }\n else if (\n logShape.length === 2 && logShape[0] <= maxTexSize &&\n logShape[1] <= maxTexSize) {\n return logShape as [number, number];\n }\n else if (\n logShape.length === 3 && logShape[0] * logShape[1] <=\n maxTexSize &&\n logShape[2] <= maxTexSize) {\n return [logShape[0] * logShape[1], logShape[2]];\n }\n else\n if (\n logShape.length === 3 && logShape[0] <= maxTexSize &&\n logShape[1] * logShape[2] <=\n maxTexSize) {\n return [logShape[0], logShape[1] * logShape[2]];\n }\n else if (\n logShape.length === 4 &&\n logShape[0] * logShape[1] * logShape[2] <= maxTexSize &&\n logShape[3] <= maxTexSize) {\n return\n [logShape[0] * logShape[1] * logShape[2], logShape[3]];\n }\n else if (\n logShape.length === 4\n && logShape[0] <= maxTexSize &&\n logShape[1] * logShape[2] * logShape[3] <= maxTexSize) {\n return\n [logShape[0], logShape[1] * logShape[2] * logShape[3]];\n }\n else {\n if (isPacked) {\n // For packed textures\n size equals the number of channels required to\n // accommodate the texture data. However in order to squarify

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such that\n // inner dimensions stay even, we rewrite size to equal the number of\n // texels. Then in the return
statement we rehydrate the squarified\n // dimensions to channel units.\n\n const batchDim =
getBatchDim(logShape);\n let rows = 2, cols = 2;\n if (logShape.length) {\n [rows, cols] =
getRowsCols(logShape);\n } \n size = batchDim * (rows / 2) * (cols / 2);\n return
util.sizeToSquarishShape(size).map(d => d * 2) as [number, number];\n } \n return
util.sizeToSquarishShape(size);\n } \n}\n\nfunction isEven(n: number): boolean {\n return n % 2 ===
0;\n}\n\n/**\n * This determines whether
reshaping a packed texture requires rearranging\n * the data within the texture, assuming 2x2 packing.\n */\n\nexport
function isReshapeFree(shape1: number[], shape2: number[]): boolean {\n shape1 = shape1.slice(-2);\n shape2 =
shape2.slice(-2);\n\n if (util.arraysEqual(shape1, shape2)) {\n return true;\n } \n\n if (!shape1.length ||
!shape2.length) { // One of the shapes is a scalar.\n return true;\n } \n\n if (shape1[0] === 0 || shape1[1] === 0 ||
shape2[0] === 0 ||\n shape2[1] === 0) {\n return true;\n } \n\n if (shape1.length !== shape2.length) { // One of
the shapes is a vector.\n const shape1Cols = shape1.slice(-1)[0];\n const shape2Cols = shape2.slice(-1)[0];\n if
(shape1Cols === shape2Cols) {\n return true;\n } \n\n if (isEven(shape1Cols) && isEven(shape2Cols) &&\n
(shape1[0] === 1 || shape2[0] === 1)) {\n return true;\n } \n } \n return shape1[1] === shape2[1] &&
isEven(shape1[0]) && isEven(shape2[0]);\n}\n\n// We cache
webgl params because the environment gets reset between\n// unit tests and we don't want to constantly query the
WebGLContext for\n// MAX_TEXTURE_SIZE.\n\nlet MAX_TEXTURE_SIZE: number;\n\nlet
MAX_TEXTURES_IN_SHADER: number;\n\nexport function getWebGLMaxTextureSize(webGLVersion:
number): number {\n if (MAX_TEXTURE_SIZE === null) {\n const gl = getWebGLContext(webGLVersion);\n
MAX_TEXTURE_SIZE = gl.getParameter(gl.MAX_TEXTURE_SIZE);\n } \n return
MAX_TEXTURE_SIZE;\n}\n\nexport function resetMaxTextureSize() {\n MAX_TEXTURE_SIZE =
null;\n}\n\nexport function resetMaxTexturesInShader() {\n MAX_TEXTURES_IN_SHADER = null;\n}\n\nexport
function getMaxTexturesInShader(webGLVersion: number): number {\n if (MAX_TEXTURES_IN_SHADER ===
null) {\n const gl = getWebGLContext(webGLVersion);\n MAX_TEXTURES_IN_SHADER =
gl.getParameter(gl.MAX_TEXTURE_IMAGE_UNITS);\n } \n // We cap at 16 to avoid spurious runtime \"memory
exhausted\" error.\n return Math.min(16, MAX_TEXTURES_IN_SHADER);\n}\n\nexport
function getWebGLDisjointQueryTimerVersion(webGLVersion: number):\n number {\n if (webGLVersion ===
0) {\n return 0;\n } \n\n let queryTimerVersion: number;\n const gl = getWebGLContext(webGLVersion);\n\n if
(hasExtension(gl, 'EXT_disjoint_timer_query_webgl2') &&\n webGLVersion === 2) {\n queryTimerVersion =
2;\n } else if (hasExtension(gl, 'EXT_disjoint_timer_query')) {\n queryTimerVersion = 1;\n } else {\n
queryTimerVersion = 0;\n } \n return queryTimerVersion;\n}\n\nexport function hasExtension(gl:
WebGLRenderingContext, extensionName: string) {\n const ext = gl.getExtension(extensionName);\n return ext !==
null;\n}\n\nexport function isWebGLVersionEnabled(webGLVersion: 1|2) {\n try {\n const gl =
getWebGLContext(webGLVersion);\n if (gl !== null) {\n return true;\n } \n } catch (e) {\n console.log('Error
when getting WebGL context: ', e);\n return false;\n } \n return false;\n}\n\nexport function
isCapableOfRenderingToFloatTexture(webGLVersion:
number):\n boolean {\n if (webGLVersion === 0) {\n return false;\n } \n\n const gl =
getWebGLContext(webGLVersion);\n\n if (webGLVersion === 1) {\n if (!hasExtension(gl, 'OES_texture_float'))
{\n return false;\n } \n } else {\n if (!hasExtension(gl, 'EXT_color_buffer_float')) {\n return false;\n } \n
} \n\n const isFrameBufferComplete = createFloatTextureAndBindToFramebuffer(gl);\n return
isFrameBufferComplete;\n}\n\n/**\n * Check if we can download values from a float/half-float texture.\n */\n *
Note that for performance reasons we use binding a texture to a framebuffer\n * as a proxy for ability to download
float values later using readPixels. The\n * texture params of this texture will not match those in readPixels
exactly\n * but if we are unable to bind some kind of float texture to the framebuffer\n * then we definitely will not
be able to read float values from it.\n */\n\nexport function isDownloadFloatTextureEnabled(webGLVersion:
number): boolean {\n if (webGLVersion === 0) {\n return false;\n } \n\n const gl =
getWebGLContext(webGLVersion);\n\n if (webGLVersion === 1) {\n if (!hasExtension(gl, 'OES_texture_float'))

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 {\n return false;\n } \n if (!hasExtension(gl, 'WEBGL_color_buffer_float')) {\n return false;\n } \n } else
 {\n if (hasExtension(gl, 'EXT_color_buffer_float')) {\n return createFloatTextureAndBindToFramebuffer(gl);\n
 }\n\n const COLOR_BUFFER_HALF_FLOAT = 'EXT_color_buffer_half_float';\n if (hasExtension(gl,
 COLOR_BUFFER_HALF_FLOAT)) {\n const textureHalfFloatExtension =\n
 gl.getExtension(COLOR_BUFFER_HALF_FLOAT);\n return
 createHalfFloatTextureAndBindToFramebuffer(\n gl, textureHalfFloatExtension);\n }\n\n return false;\n
 }\n\n const isFramebufferComplete = createFloatTextureAndBindToFramebuffer(gl);\n return
 isFramebufferComplete;\n}\n\nfunction createFloatTextureAndBindToFramebuffer(gl:
 WebGLRenderingContext):\n
 boolean {\n const texConfig = getTextureConfig(gl);\n const texture = gl.createTexture();\n
 gl.bindTexture(gl.TEXTURE_2D, texture);\n\n const width = 1;\n const height = 1;\n gl.texImage2D(\n
 gl.TEXTURE_2D, 0, texConfig.internalFormatFloat, width, height, 0,\n texConfig.textureFormatFloat,
 texConfig.textureTypeFloat, null);\n\n const framebuffer = gl.createFramebuffer();\n
 gl.bindFramebuffer(gl.FRAMEBUFFER, framebuffer);\n gl.framebufferTexture2D(\n gl.FRAMEBUFFER,
 gl.COLOR_ATTACHMENT0, gl.TEXTURE_2D, texture, 0);\n\n const isFramebufferComplete =\n
 gl.checkFramebufferStatus(gl.FRAMEBUFFER) === gl.FRAMEBUFFER_COMPLETE;\n\n gl.bindTexture(gl.TEXTURE_2D, null);\n
 gl.bindFramebuffer(gl.FRAMEBUFFER, null);\n\n gl.deleteTexture(texture);\n gl.deleteFramebuffer(frameBuffer);\n\n
 return isFramebufferComplete;\n}\n\nfunction
 createHalfFloatTextureAndBindToFramebuffer(\n // tslint:disable-next-line:no-any\n gl:
 WebGLRenderingContext, textureHalfFloatExtension:
 any): boolean {\n const texConfig = getTextureConfig(gl, textureHalfFloatExtension);\n const texture =
 gl.createTexture();\n gl.bindTexture(gl.TEXTURE_2D, texture);\n\n const width = 1;\n const height = 1;\n
 gl.texImage2D(\n gl.TEXTURE_2D, 0, texConfig.internalFormatHalfFloat, width, height, 0,\n
 texConfig.textureFormatFloat, texConfig.textureTypeHalfFloat, null);\n\n const framebuffer =
 gl.createFramebuffer();\n gl.bindFramebuffer(gl.FRAMEBUFFER, framebuffer);\n gl.framebufferTexture2D(\n
 gl.FRAMEBUFFER, gl.COLOR_ATTACHMENT0, gl.TEXTURE_2D, texture, 0);\n\n const
 isFramebufferComplete =\n gl.checkFramebufferStatus(gl.FRAMEBUFFER) ===
 gl.FRAMEBUFFER_COMPLETE;\n\n gl.bindTexture(gl.TEXTURE_2D, null);\n
 gl.bindFramebuffer(gl.FRAMEBUFFER, null);\n gl.deleteTexture(texture);\n
 gl.deleteFramebuffer(frameBuffer);\n\n return isFramebufferComplete;\n}\n\nexport function
 isWebGLFenceEnabled(webGLVersion: number) {\n if (webGLVersion !== 2) {\n return
 false;\n }\n const gl = getWebGLContext(webGLVersion);\n\n // tslint:disable-next-line:no-any\n const
 isEnabled = (gl as any).fenceSync !== null;\n return isEnabled;\n}\n\nexport function assertNotComplex(\n tensor:
 TensorInfo|TensorInfo[], opName: string): void {\n if (!Array.isArray(tensor)) {\n tensor = [tensor];\n }\n
 tensor.forEach(t => {\n if (t !== null) {\n util.assert(\n t.dtype !== 'complex64',\n () => `${opName}
 does not support complex64 tensors ` +\n 'in the WebGL backend.');\n }\n });\n}\n\n"/**\n * @license\n *
 Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
 "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
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 "\n * AS IS\n * BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n
 *\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
 =====\n\n * \n\nimport {device_util, env} from '@tensorflow/tfjs-core';\nimport {getMaxTexturesInShader,
 getWebGLDisjointQueryTimerVersion, getWebGLMaxTextureSize, isCapableOfRenderingToFloatTexture,
 isDownloadFloatTextureEnabled, isWebGLFenceEnabled, isWebGLVersionEnabled} from './webgl_util';\n\nconst
 ENV = env();\n\n/**\n * This file contains WebGL-specific flag registrations.\n * \n\n/**\n * True if WebGL is
 supported.\n * \n\nENV.registerFlag('HAS_WEBGL', () => ENV.getNumber('WEBGL_VERSION') > 0);\n\n/** 0:

```

```

No WebGL, 1: WebGL 1.0, 2: WebGL 2.0. *\nENV.registerFlag('WEBGL_VERSION', () => {\n if
(isWebGLVersionEnabled(2)) {\n return 2;\n } else if (isWebGLVersionEnabled(1)) {\n return 1;\n }\n return
0;\n});\n\n/** Whether to check for numerical representation problems.
*\nENV.registerFlag('WEBGL_CHECK_NUMERICAL_PROBLEMS', () => false);\n\nENV.registerFlag(\n
'WEBGL_BUFFER_SUPPORTED', () => ENV.get('WEBGL_VERSION') === 2);\n\n/** Whether the WebGL
backend will sometimes forward ops to the CPU. *\nENV.registerFlag('WEBGL_CPU_FORWARD', () =>
true);\n\n/** Whether the WebGL backend will always use f16 textures for rendering.
*\nENV.registerFlag('WEBGL_FORCE_F16_TEXTURES', () => false);\n\n/** Whether to turn all packing related
flags on. *\nENV.registerFlag('WEBGL_PACK', () => ENV.getBool('HAS_WEBGL'));\n\n/** Whether we will
pack the batchnormalization op. *\nENV.registerFlag('WEBGL_PACK_NORMALIZATION', () =>
ENV.getBool('WEBGL_PACK'));\n\n/** Whether we will pack the clip op.
*\nENV.registerFlag('WEBGL_PACK_CLIP', () => ENV.getBool('WEBGL_PACK'));\n\n/** Whether we will
pack the depthwise conv op. *\n// TODO:
https://github.com/tensorflow/tfjs/issues/1679\nENV.registerFlag('WEBGL_PACK_DEPTHWISECONV',
() => false);\n\n/** Whether we will pack binary ops. *\nENV.registerFlag(\n
'WEBGL_PACK_BINARY_OPERATIONS', () => ENV.getBool('WEBGL_PACK'));\n\n/** Whether we will pack
unary ops. *\nENV.registerFlag(\n 'WEBGL_PACK_UNARY_OPERATIONS', () =>
ENV.getBool('WEBGL_PACK'));\n\n/** Whether we will pack array ops. *\nENV.registerFlag(\n
'WEBGL_PACK_ARRAY_OPERATIONS', () => ENV.getBool('WEBGL_PACK'));\n\n/** Whether we will pack
image ops. *\nENV.registerFlag(\n 'WEBGL_PACK_IMAGE_OPERATIONS', () =>
ENV.getBool('WEBGL_PACK'));\n\n/** Whether we will pack reduce ops.
*\nENV.registerFlag('WEBGL_PACK_REDUCE', () => ENV.getBool('WEBGL_PACK'));\n\n/** Whether packed
WebGL kernels lazily unpack their outputs. *\nENV.registerFlag('WEBGL_LAZILY_UNPACK', () =>
ENV.getBool('WEBGL_PACK'));\n\n/** Whether we will use the im2col algorithm to speed up convolutions.
*\nENV.registerFlag('WEBGL_CONV_IM2COL', () => ENV.getBool('WEBGL_PACK'));\n\n/** The maximum
texture
dimension. *\nENV.registerFlag(\n 'WEBGL_MAX_TEXTURE_SIZE',\n () =>
getWebGLMaxTextureSize(ENV.getNumber('WEBGL_VERSION')));\n\n/** The maximum texture dimension.
*\nENV.registerFlag(\n 'WEBGL_MAX_TEXTURES_IN_SHADER',\n () =>
getMaxTexturesInShader(ENV.getNumber('WEBGL_VERSION')));\n\n/**\n * The disjoint_query_timer extension
version.\n * 0: disabled, 1: EXT_disjoint_timer_query, 2:\n * EXT_disjoint_timer_query_webgl2.\n * In Firefox
with WebGL 2.0,\n * EXT_disjoint_timer_query_webgl2 is not available, so we must use the\n * WebGL 1.0
extension.\n *\nENV.registerFlag('WEBGL_DISJOINT_QUERY_TIMER_EXTENSION_VERSION', () => {\n
const webGLVersion = ENV.getNumber('WEBGL_VERSION');\n\n if (webGLVersion === 0) {\n return 0;\n
}\n return getWebGLDisjointQueryTimerVersion(webGLVersion);\n});\n\n/**\n * Whether the timer object from
the disjoint_query_timer extension gives\n * timing information that is reliable.\n *\nENV.registerFlag(\n
'WEBGL_DISJOINT_QUERY_TIMER_EXTENSION_RELIABLE',\n
() => ENV.getNumber('WEBGL_DISJOINT_QUERY_TIMER_EXTENSION_VERSION') > 0 &&\n
!device_util.isMobile());\n\n/**\n * Whether the device is physically capable of rendering to float32 textures.\n
*\nENV.registerFlag(\n 'WEBGL_RENDER_FLOAT32_CAPABLE',\n () =>
isCapableOfRenderingToFloatTexture(ENV.getNumber('WEBGL_VERSION')));\n\n/**\n * Whether rendering to
float32 textures is enabled. If disabled, renders to\n * float16 textures.\n
*\nENV.registerFlag('WEBGL_RENDER_FLOAT32_ENABLED', () => {\n return
ENV.getBool('WEBGL_FORCE_F16_TEXTURES') ?\n false :\n
ENV.getBool('WEBGL_RENDER_FLOAT32_CAPABLE');\n});\n\n/**\n * Whether downloading float textures is
enabled (16 or 32 bit). If disabled,\n * uses IEEE 754 encoding of the float32 values to 4 uint8 when downloading.\n
*\nENV.registerFlag(\n 'WEBGL_DOWNLOAD_FLOAT_ENABLED',\n () =>
isDownloadFloatTextureEnabled(ENV.getNumber('WEBGL_VERSION')));\n\n/** Whether the fence API is

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available.

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*/nENV.registerFlag(\n 'WEBGL_FENCE_API_ENABLED',\n () =>
isWebGLFenceEnabled(ENV.getNumber('WEBGL_VERSION')));\n\n/**\n * Tensors with size <= than this will be
uploaded as uniforms, not textures.\n */nENV.registerFlag('WEBGL_SIZE_UPLOAD_UNIFORM', () => {\n //
Use uniform uploads only when 32bit floats are supported. In\n // 16bit\n // environments there are problems with
comparing a 16bit texture value\n // with a 32bit uniform value.\n const useUniforms =
ENV.getBool('WEBGL_RENDER_FLOAT32_ENABLED');\n return useUniforms ? 4 : 0;\n});\n\n/**\n * If the
total number of bytes allocated on the GPU is greater than this\n * number, we will aggressively delete textures
upon disposal with\n * gl.deleteMatrixTexture, rather than making them available for reuse.\n */n * Default value -1
indicates that we will never aggressively delete textures.\n */nENV.registerFlag(\n
'WEBGL_DELETE_TEXTURE_THRESHOLD',\n () => {\n return -1;\n },\n threshold => {\n if
(threshold
< 0 && threshold !== -1) {\n throw new Error(\n `WEBGL_DELETE_TEXTURE_THRESHOLD must
be -1 (indicating never ` +\n `delete) or at least 0, but got ${threshold}.`);\n }\n });\n },\n "/**\n *
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the specific language governing permissions and\n * limitations under the License.\n */\n\n
=====\n\n*/nimport {env} from '@tensorflow/tfjs-core';\n\nexport
type GLSL = {\n version: string,\n attribute: string,\n varyingVs: string,\n varyingFs: string,\n texture2D:
string,\n output: string,\n defineOutput: string,\n defineSpecialNaN: string,\n defineSpecialInf: string,\n
defineRound: string\n};\n\nexport function getGlsIDifferences(): GLSL {\n let version: string;\n let attribute:
string;\n let varyingVs: string;\n let varyingFs: string;\n let texture2D: string;\n let output: string;\n let
defineOutput: string;\n let defineSpecialNaN: string;\n let defineSpecialInf: string;\n let defineRound: string;\n
if (env().getNumber('WEBGL_VERSION') === 2) {\n version = '#version 300 es';\n attribute = 'in';\n varyingVs =
'out';\n varyingFs = 'in';\n texture2D = 'texture';\n output = 'outputColor';\n defineOutput = 'out
vec4 outputColor';\n // Use custom isnan definition to work across differences between\n // implementations
on various platforms. While this should happen in ANGLE\n // we still
see differences between android and windows (on chrome) when\n // using isnan directly.\n defineSpecialNaN
= `\n bool isnan_custom(float val) {\n return (val > 0.0 || val < 0.0) ? false : val !== 0.0;\n }\n bvec4
isnan_custom(bvec4 val) {\n return bvec4(isnan_custom(val.x),\n isnan_custom(val.y),
isnan_custom(val.z), isnan_custom(val.w));\n }\n #define isnan(value) isnan_custom(value)\n `;\n // In
webgl 2 we do not need to specify a custom isinf so there is no\n // need for a special INFINITY constant.\n
defineSpecialInf = `;\n defineRound = `\n #define round(value) newRound(value)\n int newRound(float
value) {\n return int(floor(value + 0.5));\n }\n ivec4 newRound(ivec4 value) {\n return
ivec4(floor(value + vec4(0.5)));\n }\n `;\n } else {\n version = ";\n attribute = 'attribute';\n varyingVs =
'varying';\n varyingFs = 'varying';\n texture2D = 'texture2D';\n
 output = 'gl_FragColor';\n defineOutput = ";\n // WebGL1 has no built in isnan so we define one here.\n
defineSpecialNaN = `\n #define isnan(value) isnan_custom(value)\n bool isnan_custom(float val) {\n
return (val > 0. || val < 1. || val == 0.) ? false : true;\n }\n bvec4 isnan_custom(bvec4 val) {\n return
bvec4(isnan(val.x), isnan(val.y), isnan(val.z), isnan(val.w));\n }\n `;\n defineSpecialInf = `\n uniform float
INFINITY;\n bool isinf(float val) {\n return abs(val) == INFINITY;\n }\n bvec4 isinf(bvec4 val) {\n
return equal(abs(val), vec4(INFINITY));\n }\n `;\n defineRound = `\n int round(float value) {\n
return int(floor(value + 0.5));\n }\n ivec4 round(ivec4 value) {\n return ivec4(floor(value +
vec4(0.5)));\n }\n `;\n }\n }\n return {\n version,\n attribute,\n varyingVs,\n varyingFs,\n texture2D,\n
}
```



```

output,\n defineOutput,\n
 defineSpecialNaN,\n defineSpecialInf,\n defineRound\n };}\n","/**\n * @license\n * Copyright 2018
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http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {util} from '@tensorflow/tfjs-core';\n\n/**\n * Produces GLSL code that derives logical coordinates
from a flat\n * index. The code performs integer division with each stride and decrements\n
* the index until the index equals the final dimension coordinate.\n */\nexport function
getLogicalCoordinatesFromFlatIndex(\n coords: string[], shape: number[], index = 'index'): string {\n const
strides = util.computeStrides(shape);\n return strides\n .map((stride, i) => {\n const line1 = `int ${coords[i]}
= ${index} / ${stride}`;\n const line2 = i === strides.length - 1 ?\n `int ${coords[i + 1]} = ${index} -
${coords[i]} * ${stride}` :\n `index -= ${coords[i]} * ${stride}`;\n return `${line1}; ${line2}`;\n })\n .join(");\n\n\nfunction buildVec(x: string[]): string {\n if (x.length === 1) {\n return `${x[0]}`;\n }\n return
`vec${x.length}(${x.join(',')})`;\n}\n\n/**\n * Produces GLSL code that computes the dot product of the input x and
y\n * vectors. Handles splitting inputs into increments of vec4s when necessary.\n */\nexport function dotify(x:
string[], y: string[]): string {\n if (x.length !== y.length)\n {\n throw new Error(\n `Vectors to be dotted must be of the same length -` +\n `got ${x.length} and
${y.length}`);\n }\n\n const slices: string[] = [];\n const nearestVec4 = Math.floor(x.length / 4);\n const
nearestVec4Remainder = x.length % 4;\n\n for (let i = 0; i < nearestVec4; i++) {\n const xSlice = x.slice(i * 4, i *
4 + 4);\n const ySlice = y.slice(i * 4, i * 4 + 4);\n slices.push(`${buildVec(xSlice)}, ${buildVec(ySlice)}`);\n }\n\n if (nearestVec4Remainder !== 0) {\n let xSlice = x.slice(nearestVec4 * 4);\n let ySlice =
y.slice(nearestVec4 * 4);\n if (xSlice.length === 1) {\n xSlice = xSlice.map(d => `float(${d})`);\n ySlice =
ySlice.map(d => `float(${d})`);\n }\n slices.push(`${buildVec(xSlice)}, ${buildVec(ySlice)}`);\n }\n\n return
slices.map((d, i) => `dot(${d})`).join('+');\n}\n\n/**\n * Produces GLSL that computes the flat index from 3D
coordinates.\n */\nexport function getFlatIndexFrom3D(shape: [number, number,
number]): string {\n const strides = util.computeStrides(shape).map(d => d.toString());\n\n return `\n int
getFlatIndex(ivec3 coords) {\n return coords.x * ${strides[0]} + coords.y * ${strides[1]} + coords.z;\n }\n`;\n}\n\nexport const ENCODE_FLOAT_SNIPPET = `\n const float FLOAT_MAX = 1.70141184e38;\n const
float FLOAT_MIN = 1.17549435e-38;\n\n lowp vec4 encode_float(highp float v) {\n if (isnan(v)) {\n return
vec4(255, 255, 255, 255);\n }\n\n highp float av = abs(v);\n\n if (av < FLOAT_MIN) {\n return vec4(0.0,
0.0, 0.0, 0.0);\n } else if (v > FLOAT_MAX) {\n return vec4(0.0, 0.0, 128.0, 127.0) / 255.0;\n } else if (v < -
FLOAT_MAX) {\n return vec4(0.0, 0.0, 128.0, 255.0) / 255.0;\n }\n\n highp vec4 c = vec4(0,0,0,0);\n\n highp float e = floor(log2(av));\n highp float m = exp2(fract(log2(av))) - 1.0;\n c[2] = floor(128.0 * m);\n m =
c[2] / 128.0;\n c[1] = floor(32768.0 * m);\n m -= c[1] / 32768.0;\n c[0] =
floor(8388608.0 * m);\n\n highp float ebias = e + 127.0;\n c[3] = floor(ebias / 2.0);\n ebias -= c[3] * 2.0;\n
c[2] += floor(ebias) * 128.0;\n c[3] += 128.0 * step(0.0, -v);\n\n return c / 255.0;\n }\n`;\n"}\n","/**\n *
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the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {getGlsIDifferences} from './gls_version';\n\nimport

```

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{GPGPUProgram} from './gpgpu_math';\nimport * as shader_util from './shader_compiler_util';\nimport
{getDenseTexShape, PackingScheme} from './tex_util';\n\nexport class DecodeMatrixProgram implements
GPGPUProgram {\n variableNames = ['A'];\n userCode: string;\n outputShape: [number, number, number];\n
packedInputs = false;\n packedOutput = true;\n outPackingScheme = PackingScheme.DENSE;\n\n
constructor(outputShape: [number, number, number]) {\n const texShape = getDenseTexShape(outputShape);\n
const glsl = getGlslDifferences();\n this.outputShape = outputShape;\n\n this.userCode = `\n
ivec3
outCoordsFromFlatIndex(int index) {\n ${\n shader_util.getLogLogicalCoordinatesFromFlatIndex(\n
[r', 'c', 'd'], outputShape))}\n return ivec3(r, c, d);\n }\n\n void main() {\n ivec2 resTexRC =
ivec2(resultUV.yx *\n vec2(${texShape[0]}, ${texShape[1]}));\n int index = 4 * (resTexRC.x *
${texShape[1]} +
resTexRC.y);\n\n vec4 result = vec4(0.);\n\n for (int i=0; i<4; i++) {\n int flatIndex = index + i;\n
ivec3 rc = outCoordsFromFlatIndex(flatIndex);\n result[i] = getA(rc.x, rc.y, rc.z);\n }\n\n
${glsl.output} = result;\n }\n `;\n }\n}\n\n",/**\n * @license\n * Copyright 2019 Google LLC. All Rights
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http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {getGlslDifferences} from './glsl_version';\nimport {GPGPUProgram} from './gpgpu_math';\nimport *
as shader_util from './shader_compiler_util';\nimport {getDenseTexShape, PackingScheme} from
'/tex_util';\n\nexport class DecodeMatrixPackedProgram implements GPGPUProgram {\n variableNames = ['A'];\n
userCode: string;\n packedInputs = true;\n packedOutput = true;\n outputShape: [number, number, number];\n
outPackingScheme = PackingScheme.DENSE;\n\n constructor(outputShape: [number, number, number]) {\n
const texShape = getDenseTexShape(outputShape);\n const glsl = getGlslDifferences();\n this.outputShape =
outputShape;\n\n this.userCode = `\n
ivec3 outCoordsFromFlatIndex(int index) {\n ${\n
shader_util.getLogLogicalCoordinatesFromFlatIndex(\n [r', 'c', 'd'], outputShape))}\n return ivec3(r, c, d);\n
}\n\n void main() {\n ivec2 resTexRC = ivec2(resultUV.yx *\n vec2(${texShape[0]},
${texShape[1]}));\n int index = 4 * (resTexRC.x * ${texShape[1]} + resTexRC.y);\n\n vec4 result =
vec4(0.);\n\n for (int i=0; i<4; i++) {\n int flatIndex = index + i;\n ivec3 rc =
outCoordsFromFlatIndex(flatIndex);\n result[i] = getChannel(getA(rc.x, rc.y, rc.z), vec2(rc.y, rc.z));\n
}\n\n ${glsl.output} = result;\n }\n `;\n }\n}\n\n",/**\n * @license\n * Copyright 2018 Google LLC. All
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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and\n * limitations under the License.\n *
=====\n
*/\n\nimport {getGlslDifferences} from './glsl_version';\nimport {GPGPUProgram} from './gpgpu_math';\nimport
{ENCODE_FLOAT_SNIPPET} from './shader_compiler_util';\nimport {TextureUsage} from './tex_util';\n\nexport
class EncodeFloatProgram implements GPGPUProgram {\n variableNames = ['A'];\n userCode: string;\n
outputShape: number[];\n outTexUsage = TextureUsage.DOWNLOAD;\n\n constructor(outputShape: number[])
{\n const glsl = getGlslDifferences();\n this.outputShape = outputShape;\n this.userCode = `\n
${ENCODE_FLOAT_SNIPPET}\n\n void main() {\n float x = getAAtOutCoords();\n ${glsl.output} =
encode_float(x);\n }\n `;\n }\n}\n\n",/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n

```

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```

=====
*\n\nimport {getGlsIDifferences} from './glsI_version';\nimport {GPGPUProgram} from './gpgpu_math';\nimport {ENCODE_FLOAT_SNIPPET} from './shader_compiler_util';\nimport {TextureUsage} from './tex_util';\n\nexport class EncodeFloatPackedProgram implements GPGPUProgram {\n variableNames = ['A'];\n userCode: string;\n outputShape: number[];\n packedInputs = true;\n packedOutput = false;\n outTexUsage = TextureUsage.DOWNLOAD;\n\n constructor(outputShape: [number, number, number]) {\n const glsl = getGlsIDifferences();\n this.outputShape = outputShape;\n this.userCode = `
 ${ENCODE_FLOAT_SNIPPET}\n\n void main() {\n ivec3 coords = getOutputCoords();\n float x = getChannel(getAAAtOutCoords(), vec2(coords.y, coords.z));\n ${glsl.output} = encode_float(x);\n }\n `;\n }\n}\n\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
=====

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*\n\nimport {getGlsIDifferences} from './glsI_version';\nimport {GPGPUProgram} from './gpgpu_math';\nimport * as shader_util from './shader_compiler_util';\n\nexport class EncodeMatrixProgram implements GPGPUProgram {\n variableNames = ['A'];\n userCode: string;\n outputShape: number[];\n\n constructor(\n outputShape: [number, number, number],\n texShape: [number, number],\n inputIsUnsignedByte = false) {\n const glsl = getGlsIDifferences();\n const [height, width] = texShape;\n this.outputShape = outputShape;\n\n let output = `result`;\n if (inputIsUnsignedByte) {\n output = `floor(result * 255. + 0.5)`;\n }\n\n this.userCode = `\n ${shader_util.getFlatIndexFrom3D(outputShape)}\n\n void main() {\n ivec3 coords = getOutputCoords();\n\n int flatIndex = getFlatIndex(coords);\n int offset = imod(flatIndex, 4);\n\n flatIndex = idiv(flatIndex, 4, 1);\n\n int r = flatIndex / ${width};\n int c = imod(flatIndex, ${width});\n vec2 uv = (vec2(c, r) + halfCR) / vec2(${width}, 0, ${height}, 0);\n vec4 values = ${glsl.texture2D}(A, uv);\n\n float result;\n\n if(offset == 0) {\n result = values[0];\n } else if(offset == 1) {\n result = values[1];\n } else if(offset == 2) {\n result = values[2];\n } else {\n result = values[3];\n }\n\n ${glsl.output} = vec4(${output}, 0., 0., 0.);`\n `;\n }\n}\n\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
=====

```

```

*\n\nimport {getGlsIDifferences} from './glsI_version';\nimport {GPGPUProgram} from './gpgpu_math';\nimport * as shader_util from './shader_compiler_util';\n\n/*This is how the shader encodes a tensor with shape = [2, 3,

```

```

5]\n(indices are [batch, row, col]).\n\n000|001 002|003 004|xxx 020|021 022|023 024|xxx\n-----

-----\n010|011 012|013 014|xxx xxx|xxx xxx|xxx xxx|xxx\n\n100|101 102|103 104|xxx
120|121 122|123 124|xxx\n-----

-----\n110|111 112|113 114|xxx xxx|xxx
xxx|xxx xxx|xxx\n\nSingle texels contain only values from the same batch, and from
adjacent rows\nand columns.\n *\n\nexport class EncodeMatrixPackedProgram implements GPGPUProgram {\n
variableNames = ['A'];\n userCode: string;\n outputShape: number[];\n packedInputs = false;\n packedOutput =
true;\n\n constructor(\n outputShape: [number, number, number], texShape: [number, number],\n
inputIsUnsignedByte = false) {\n const glsl = getGlslDifferences();\n const [height, width] = texShape;\n
this.outputShape = outputShape;\n\n let mainLoop = ";\n let output = 'result';\n if (inputIsUnsignedByte) {\n
output = 'floor(result * 255. + 0.5)';\n }\n\n for (let row = 0; row <= 1; row++) {\n for (let col = 0; col <= 1;
col++) {\n const channel = row * 2 + col;\n\n mainLoop += `\n localCoords = coords;\n
if(localCoords[2] + ${col} < ${outputShape[2]}) {\n localCoords[2] += ${col};\n if(localCoords[1] +
${row} < ${outputShape[1]}) {\n localCoords[1] += ${row};\n\n
 flatIndex = getFlatIndex(localCoords);\n offset = imod(flatIndex, 4);\n\n flatIndex =
idiv(flatIndex, 4, 1.);\n r = flatIndex / ${width};\n c = imod(flatIndex, ${width});\n uv =
(vec2(c, r) + halfCR) / vec2(${width}.0, ${height}.0);\n values = ${glsl.texture2D}(A, uv);\n\n
if(offset == 0) {\n result[${channel}] = values[0];\n } else if(offset == 1) {\n
result[${channel}] = values[1];\n } else if(offset == 2) {\n result[${channel}] = values[2];\n
} else {\n result[${channel}] = values[3];\n }\n }\n }\n `;\n }\n }\n\n
this.userCode = `\n ${shader_util.getFlatIndexFrom3D(outputShape)}\n\n void main() {\n ivec3 coords =
getOutputCoords();\n vec4 result = vec4(0.);\n int flatIndex, r, c, offset;\n
 ivec3 localCoords;\n vec2 uv;\n vec4 values;\n\n ${mainLoop}\n\n ${glsl.output} = ${output};\n
 }\n `;\n }\n }\n ",/**\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n * Licensed under
the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * \n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====
*\n\nimport {PixelData, TypedArray} from '@tensorflow/tfjs-core';\n\nimport {getGlslDifferences} from
'./glsl_version';\n\nimport
* as tex_util from './tex_util';\n\nimport {TextureConfig} from './tex_util';\n\nimport * as webgl_util from
'./webgl_util';\n\nexport function createVertexShader(gl: WebGLRenderingContext): WebGLShader {\n const glsl
= getGlslDifferences();\n const vertexShaderSource = `${glsl.version}\n precision highp float;\n
${glsl.attribute} vec3 clipSpacePos;\n ${glsl.attribute} vec2 uv;\n ${glsl.varyingVs} vec2 resultUV;\n\n
 void
main() {\n gl_Position = vec4(clipSpacePos, 1);\n resultUV = uv;\n `;\n return
webgl_util.createVertexShader(gl, vertexShaderSource);\n\n}\n\nexport function createVertexBuffer(gl:
WebGLRenderingContext): WebGLBuffer {\n // [x y z u v] * [upper-left, lower-left, upper-right, lower-right]\n
const vertexArray = new Float32Array(\n [-1, 1, 0, 0, 1, -1, -1, 0, 0, 0, 1, 1, 0, 1, 1, -1, 0, 1, 0]);\n
return
webgl_util.createStaticVertexBuffer(gl, vertexArray);\n\n}\n\nexport function createIndexBuffer(gl:
WebGLRenderingContext): WebGLBuffer
{\n // OpenGL (and WebGL) have "CCW == front" winding\n const triangleVertexIndices = new
Uint16Array([0, 1, 2, 2, 1, 3]);\n return webgl_util.createStaticIndexBuffer(gl,
triangleVertexIndices);\n\n}\n\nfunction createAndConfigureTexture(\n gl: WebGLRenderingContext, width:
number, height: number,\n internalFormat: number, textureFormat: number,\n textureType: number):
WebGLTexture {\n webgl_util.validateTextureSize(width, height);\n const texture =
webgl_util.createTexture(gl);\n\n const tex2d = gl.TEXTURE_2D;\n webgl_util.callAndCheck(gl, () =>

```

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gl.bindTexture(tex2d, texture));\n webgl_util.callAndCheck(\n gl, () => gl.texParameteri(tex2d,
gl.TEXTURE_WRAP_S, gl.CLAMP_TO_EDGE));\n webgl_util.callAndCheck(\n gl, () =>
gl.texParameteri(tex2d, gl.TEXTURE_WRAP_T, gl.CLAMP_TO_EDGE));\n webgl_util.callAndCheck(\n gl, ()
=> gl.texParameteri(tex2d, gl.TEXTURE_MIN_FILTER, gl.NEAREST));\n webgl_util.callAndCheck(\n gl, ()
=> gl.texParameteri(tex2d, gl.TEXTURE_MAG_FILTER,
gl.NEAREST));\n webgl_util.callAndCheck(\n gl,\n () => gl.texImage2D(\n tex2d, 0, internalFormat,
width, height, 0, textureFormat,\n textureType, null));\n webgl_util.callAndCheck(gl, () =>
gl.bindTexture(gl.TEXTURE_2D, null));\n return texture;\n}\n\nexport function
getInternalFormatForFloat32MatrixTexture(\n textureConfig: TextureConfig) {\n return
textureConfig.internalFormatFloat;\n}\n\nexport function createFloat32MatrixTexture(\n gl:
WebGLRenderingContext, rows: number, columns: number,\n textureConfig: TextureConfig): WebGLTexture {\n
const [width, height] =\n tex_util.getUnpackedMatrixTextureShapeWidthHeight(rows, columns);\n return
createAndConfigureTexture(\n gl, width, height,\n
getInternalFormatForFloat32MatrixTexture(textureConfig),\n textureConfig.textureFormatFloat,
gl.FLOAT);\n}\n\nexport function getInternalFormatForFloat16MatrixTexture(\n textureConfig: TextureConfig)
{\n return textureConfig.internalFormatHalfFloat;\n}\n\nexport
function createFloat16MatrixTexture(\n gl: WebGLRenderingContext, rows: number, columns: number,\n
textureConfig: TextureConfig): WebGLTexture {\n const [width, height] =\n
tex_util.getUnpackedMatrixTextureShapeWidthHeight(rows, columns);\n return createAndConfigureTexture(\n
gl, width, height,\n getInternalFormatForFloat16MatrixTexture(textureConfig),\n
textureConfig.textureFormatFloat, textureConfig.textureTypeHalfFloat);\n}\n\nexport function
getInternalFormatForUnsignedBytesMatrixTexture(\n textureConfig: TextureConfig) {\n return
textureConfig.downloadTextureFormat;\n}\n\nexport function createUnsignedBytesMatrixTexture(\n gl:
WebGLRenderingContext, rows: number, columns: number,\n textureConfig: TextureConfig): WebGLTexture {\n
const [width, height] =\n tex_util.getUnpackedMatrixTextureShapeWidthHeight(rows, columns);\n return
createAndConfigureTexture(\n gl, width, height,\n
getInternalFormatForUnsignedBytesMatrixTexture(textureConfig),
gl.RGBA,\n gl.UNSIGNED_BYTE);\n}\n\nexport function getInternalFormatForPackedMatrixTexture(\n
textureConfig: TextureConfig) {\n return textureConfig.internalFormatPackedFloat;\n}\n\nexport function
createPackedMatrixTexture(\n gl: WebGLRenderingContext, rows: number, columns: number,\n textureConfig:
TextureConfig): WebGLTexture {\n const [width, height] =\n
tex_util.getPackedMatrixTextureShapeWidthHeight(rows, columns);\n return createAndConfigureTexture(\n gl,
width, height, getInternalFormatForPackedMatrixTexture(textureConfig),\n gl.RGBA, gl.FLOAT);\n}\n\nexport
function getInternalFormatForFloat16PackedMatrixTexture(\n textureConfig: TextureConfig) {\n return
textureConfig.internalFormatPackedHalfFloat;\n}\n\nexport function createFloat16PackedMatrixTexture(\n gl:
WebGLRenderingContext, rows: number, columns: number,\n textureConfig: TextureConfig): WebGLTexture {\n
const [width,
height] =\n tex_util.getPackedMatrixTextureShapeWidthHeight(rows, columns);\n return
createAndConfigureTexture(\n gl, width, height,\n
getInternalFormatForFloat16PackedMatrixTexture(textureConfig), gl.RGBA,\n
textureConfig.textureTypeHalfFloat);\n}\n\nexport function bindVertexProgramAttributeStreams(\n gl:
WebGLRenderingContext, program: WebGLProgram,\n vertexBuffer: WebGLBuffer): boolean {\n const
posOffset = 0; // x is the first buffer element\n const uvOffset = 3 * 4; // uv comes after [x y z]\n
const stride = (3 * 4) + (2 * 4); // xyz + uv, each entry is 4-byte float.\n webgl_util.callAndCheck(\n gl, () =>
gl.bindBuffer(gl.ARRAY_BUFFER, vertexBuffer));\n const success =
webgl_util.bindVertexBufferToProgramAttribute(\n gl, program, 'clipSpacePos', vertexBuffer, 3, stride,
posOffset);\n return success &&\n webgl_util.bindVertexBufferToProgramAttribute(\n gl, program, 'uv',
vertexBuffer, 2, stride, uvOffset);\n}\n\nexport

```

```

function uploadDenseMatrixToTexture(\n gl: WebGLRenderingContext, texture: WebGLTexture, width:
number,\n height: number, data: TypedArray, textureConfig: TextureConfig) {\n webgl_util.callAndCheck(gl, ()
=> gl.bindTexture(gl.TEXTURE_2D, texture));\n\n let dataForUpload: TypedArray, texelDataType: number,
internalFormat: number;\n if (data instanceof Uint8Array) {\n dataForUpload = new Uint8Array(width * height *
4);\n texelDataType = gl.UNSIGNED_BYTE;\n internalFormat = gl.RGBA;\n } else {\n dataForUpload =
new Float32Array(width * height * 4);\n texelDataType = gl.FLOAT;\n internalFormat =
textureConfig.internalFormatPackedFloat;\n }\n\n dataForUpload.set(data);\n\n webgl_util.callAndCheck(\n
gl,\n () => gl.texImage2D(\n gl.TEXTURE_2D, 0, internalFormat, width, height, 0, gl.RGBA,\n texelDataType, dataForUpload));\n\n webgl_util.callAndCheck(gl, () => gl.bindTexture(gl.TEXTURE_2D,
null));\n}\n\nexport function
uploadPixelDataToTexture(\n gl: WebGLRenderingContext, texture: WebGLTexture,\n pixels:
PixelData|ImageData|HTMLImageElement|HTMLCanvasElement|\n HTMLVideoElement) {\n webgl_util.callAndCheck(gl, () => gl.bindTexture(gl.TEXTURE_2D, texture));\n if ((pixels as PixelData).data
instanceof Uint8Array) {\n webgl_util.callAndCheck(\n gl,\n () => gl.texImage2D(\n
gl.TEXTURE_2D, 0, gl.RGBA, pixels.width, pixels.height, 0, gl.RGBA,\n gl.UNSIGNED_BYTE, (pixels as
PixelData).data));\n } else {\n webgl_util.callAndCheck(\n gl,\n () => gl.texImage2D(\n
gl.TEXTURE_2D, 0, gl.RGBA, gl.RGBA, gl.UNSIGNED_BYTE,\n pixels as ImageData |
HTMLImageElement | HTMLCanvasElement |\n HTMLVideoElement));\n }\n\n webgl_util.callAndCheck(gl, () => gl.bindTexture(gl.TEXTURE_2D, null));\n}\n\nexport function
createBufferFromOutputTexture(\n gl2: WebGL2RenderingContext, rows: number, columns: number,\n textureConfig: TextureConfig): WebGLBuffer {\n // Create and bind the buffer.\n const buffer =
gl2.createBuffer();\n webgl_util.callAndCheck(\n gl2, () => gl2.bindBuffer(gl2.PIXEL_PACK_BUFFER,
buffer));\n\n // Initialize the buffer to the size of the texture in bytes.\n const bytesPerFloat = 4;\n const
valuesPerTexel = 4;\n const bufferSizeBytes = bytesPerFloat * valuesPerTexel * rows * columns;\n\n webgl_util.callAndCheck(\n gl2,\n () => gl2.bufferData(\n gl2.PIXEL_PACK_BUFFER,
bufferSizeBytes, gl2.STREAM_READ));\n\n // Enqueue a command on the GPU command queue to copy of
texture into the\n // buffer.\n webgl_util.callAndCheck(\n gl2, () => gl2.readPixels(0, 0, columns, rows,
gl2.RGBA, gl2.FLOAT, 0));\n\n webgl_util.callAndCheck(\n gl2, () =>
gl2.bindBuffer(gl2.PIXEL_PACK_BUFFER, null));\n\n return buffer;\n}\n\nexport function
downloadFloat32MatrixFromBuffer(\n gl: WebGLRenderingContext, buffer: WebGLBuffer,\n size: number):
Float32Array
{\n const gl2 = gl as WebGL2RenderingContext;\n\n const downloadTarget = new Float32Array(size);\n\n gl2.bindBuffer(gl2.PIXEL_PACK_BUFFER, buffer);\n gl2.getBufferSubData(gl2.PIXEL_PACK_BUFFER, 0,
downloadTarget);\n gl2.bindBuffer(gl2.PIXEL_PACK_BUFFER, null);\n\n return downloadTarget;\n}\n\nexport
function downloadByteEncodedFloatMatrixFromOutputTexture(\n gl: WebGLRenderingContext, rows: number,
columns: number,\n textureConfig: TextureConfig) {\n const [w, h] =\n tex_util.getUnpackedMatrixTextureShapeWidthHeight(rows, columns);\n\n const numChannels = 4;\n const
downloadTarget = new Uint8Array(\n tex_util.getUnpackedArraySizeFromMatrixSize(rows * columns,
numChannels));\n\n webgl_util.callAndCheck(\n gl,\n () => gl.readPixels(\n 0, 0, w, h,
textureConfig.downloadTextureFormat, gl.UNSIGNED_BYTE,\n downloadTarget));\n\n // By wrapping the
buffer in a Float32Array, we use native browser IEEE 754\n // decoding of the 4 bytes
that back each 32 bit float.\n return new Float32Array(downloadTarget.buffer);\n}\n\nexport function
downloadPackedMatrixFromBuffer(\n gl: WebGLRenderingContext, buffer: WebGLBuffer, batch: number, rows:
number,\n cols: number, physicalRows: number, physicalCols: number,\n textureConfig: TextureConfig):
Float32Array {\n const gl2 = gl as WebGL2RenderingContext;\n\n const downloadTarget =\n new
Float32Array(tex_util.getPackedRGBAArraySizeFromMatrixShape(\n physicalRows, physicalCols));\n\n gl2.bindBuffer(gl2.PIXEL_PACK_BUFFER, buffer);\n gl2.getBufferSubData(gl2.PIXEL_PACK_BUFFER, 0,
downloadTarget);\n gl2.bindBuffer(gl2.PIXEL_PACK_BUFFER, null);\n\n return downloadTarget;\n}\n\nexport

```

```
function downloadMatrixFromPackedOutputTexture(\n gl: WebGLRenderingContext, physicalRows: number,\n physicalCols: number): Float32Array {\n const packedRGBA = new Float32Array(physicalRows * physicalCols * 4);\n webgl_util.callAndCheck(\n gl,\n () => gl.readPixels(\n 0, 0, physicalCols, physicalRows, gl.RGBA, gl.FLOAT, packedRGBA));\n return\n packedRGBA;\n}\n", "/*\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n * Licensed under\n the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the\n License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n License.\n *
```

```
=====\n\n*\n\nimport {env, PixelData, TypedArray, util} from '@tensorflow/tfjs-core';\nimport {getWebGLContext, setWebGLContext} from './canvas_util';\nimport * as\n gpgpu_util from './gpgpu_util';\nimport * as tex_util from './tex_util';\nimport {TextureConfig} from\n './tex_util';\nimport {WebGL1DisjointQueryTimerExtension, WebGL2DisjointQueryTimerExtension} from\n './webgl_types';\nimport * as webgl_util from './webgl_util';\nexport interface FenceContext {\n query:\n WebGLQuery|WebGLSync;\n isFencePassed(): boolean;\n}\n\nexport class GPGPUContext {\n gl:\n WebGLRenderingContext;\n textureFloatExtension: {};\n textureHalfFloatExtension: {};\n colorBufferFloatExtension: {};\n colorBufferHalfFloatExtension: {};\n disjointQueryTimerExtension:\n WebGL2DisjointQueryTimerExtension|\n WebGL1DisjointQueryTimerExtension;\n vertexBuffer:\n WebGLBuffer;\n indexBuffer: WebGLBuffer;\n framebuffer: WebGLFramebuffer;\n outputTexture:\n WebGLTexture|null = null;\n program: WebGLProgram|null = null;\n private disposed = false;\n private disjoint:\n boolean;\n textureConfig: TextureConfig;\n\n constructor(gl?: WebGLRenderingContext) {\n const glVersion\n = env().getNumber('WEBGL_VERSION');\n if (gl != null) {\n this.gl = gl;\n setWebGLContext(glVersion,\n gl);\n } else {\n this.gl = getWebGLContext(glVersion);\n }\n // WebGL 2.0 enables texture floats without\n an extension.\n let COLOR_BUFFER_FLOAT = 'WEBGL_color_buffer_float';\n const\n COLOR_BUFFER_HALF_FLOAT = 'EXT_color_buffer_half_float';\n if\n (env().getNumber('WEBGL_VERSION') === 1) {\n const TEXTURE_FLOAT = 'OES_texture_float';\n const TEXTURE_HALF_FLOAT = 'OES_texture_half_float';\n this.textureFloatExtension =\n webgl_util.getExtensionOrThrow(this.gl, TEXTURE_FLOAT);\n if (webgl_util.hasExtension(this.gl,\n TEXTURE_HALF_FLOAT)) {\n this.textureHalfFloatExtension =\n webgl_util.getExtensionOrThrow(this.gl, TEXTURE_HALF_FLOAT);\n } else if\n (env().get('WEBGL_FORCE_F16_TEXTURES')) {\n throw new Error(\n 'GL context does not support\n half float textures, yet the '\n +\n 'environment\n flag WEBGL_FORCE_F16_TEXTURES is set to true.);\n }\n this.colorBufferFloatExtension =\n this.gl.getExtension(COLOR_BUFFER_FLOAT);\n if (webgl_util.hasExtension(this.gl,\n COLOR_BUFFER_HALF_FLOAT)) {\n this.colorBufferHalfFloatExtension =\n webgl_util.getExtensionOrThrow(this.gl, COLOR_BUFFER_HALF_FLOAT);\n } else if\n (env().get('WEBGL_FORCE_F16_TEXTURES')) {\n throw new Error(\n 'GL context does not support\n color renderable half floats, yet '\n +\n 'the environment flag WEBGL_FORCE_F16_TEXTURES is set to\n true.);\n }\n } else {\n COLOR_BUFFER_FLOAT = 'EXT_color_buffer_float';\n if\n (webgl_util.hasExtension(this.gl, COLOR_BUFFER_FLOAT)) {\n this.colorBufferFloatExtension =\n this.gl.getExtension(COLOR_BUFFER_FLOAT);\n } else if (webgl_util.hasExtension(this.gl,\n COLOR_BUFFER_HALF_FLOAT)) {\n this.colorBufferHalfFloatExtension =\n this.gl.getExtension(COLOR_BUFFER_HALF_FLOAT);\n }\n } else {\n throw new Error('GL context does not support color renderable floats');\n }\n }\n\n this.vertexBuffer = gpgpu_util.createVertexBuffer(this.gl);\n this.indexBuffer =
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gpgpu_util.createIndexBuffer(this.gl);\n this.framebuffer = webgl_util.createFramebuffer(this.gl);\n\n this.textureConfig =\n tex_util.getTextureConfig(this.gl, this.textureHalfFloatExtension);\n }\n\n private get\n debug(): boolean {\n return env().getBool('DEBUG');\n }\n\n public dispose() {\n if (this.disposed) {\n return;\n }\n if (this.program != null) {\n console.warn(\n 'Disposing a GPGPUContext that still has a\n bound WebGLProgram.' +\n ' This is probably a resource leak, delete the program with '\n 'GPGPUContext.deleteProgram before disposing.);\n }\n if (this.outputTexture != null) {\n console.warn(\n 'Disposing a GPGPUContext that still has a bound output matrix '\n 'texture. This is probably a resource leak, delete the output '\n 'matrix texture with\n GPGPUContext.deleteMatrixTexture before '\n 'disposing.);\n }\n const gl = this.gl;\n webgl_util.callAndCheck(gl, () => gl.finish());\n webgl_util.callAndCheck(gl, () =>\n gl.bindFramebuffer(gl.FRAMEBUFFER, null));\n webgl_util.callAndCheck(gl, () =>\n gl.deleteFramebuffer(this.framebuffer));\n webgl_util.callAndCheck(gl, () =>\n gl.bindBuffer(gl.ARRAY_BUFFER, null));\n webgl_util.callAndCheck(\n gl, () =>\n gl.bindBuffer(gl.ELEMENT_ARRAY_BUFFER, null));\n webgl_util.callAndCheck(gl, () =>\n gl.deleteBuffer(this.indexBuffer));\n this.disposed = true;\n }\n\n public createFloat32MatrixTexture(rows:\n number, columns: number):\n WebGLTexture {\n this.throwIfDisposed();\n return\n gpgpu_util.createFloat32MatrixTexture(\n this.gl, rows, columns, this.textureConfig);\n }\n\n public\n createFloat16MatrixTexture(rows: number, columns: number):\n WebGLTexture {\n this.throwIfDisposed();\n return gpgpu_util.createFloat16MatrixTexture(\n this.gl,\n rows, columns, this.textureConfig);\n }\n\n public createUnsignedBytesMatrixTexture(rows: number, columns:\n number):\n WebGLTexture {\n this.throwIfDisposed();\n return\n gpgpu_util.createUnsignedBytesMatrixTexture(\n this.gl, rows, columns, this.textureConfig);\n }\n\n public\n uploadPixelDataToTexture(\n texture: WebGLTexture,\n pixels:\n PixelData|ImageData|HTMLImageElement|HTMLCanvasElement) {\n this.throwIfDisposed();\n gpgpu_util.uploadPixelDataToTexture(this.gl, texture, pixels);\n }\n\n public uploadDenseMatrixToTexture(\n texture: WebGLTexture, width: number, height: number, data: TypedArray) {\n this.throwIfDisposed();\n gpgpu_util.uploadDenseMatrixToTexture(\n this.gl, texture, width, height, data, this.textureConfig);\n }\n\n public\n createFloat16PackedMatrixTexture(rows: number, columns: number):\n WebGLTexture {\n this.throwIfDisposed();\n return gpgpu_util.createFloat16PackedMatrixTexture(\n this.gl, rows, columns, this.textureConfig);\n }\n\n public createPackedMatrixTexture(rows: number, columns:\n number):\n WebGLTexture {\n this.throwIfDisposed();\n return gpgpu_util.createPackedMatrixTexture(\n this.gl, rows, columns, this.textureConfig);\n }\n\n public deleteMatrixTexture(texture: WebGLTexture) {\n this.throwIfDisposed();\n if (this.outputTexture === texture) {\n webgl_util.unbindColorTextureFromFramebuffer(this.gl, this.framebuffer);\n this.outputTexture = null;\n }\n webgl_util.callAndCheck(this.gl, () => this.gl.deleteTexture(texture));\n }\n\n public\n downloadByteEncodedFloatMatrixFromOutputTexture(\n texture: WebGLTexture, rows: number, columns:\n number): Float32Array {\n return this.downloadMatrixDriver(\n texture,\n () =>\n gpgpu_util.downloadByteEncodedFloatMatrixFromOutputTexture(\n this.gl, rows, columns, this.textureConfig));\n }\n\n public downloadPackedMatrixFromBuffer(\n buffer:\n WebGLBuffer, batch: number, rows: number, columns: number,\n physicalRows: number, physicalCols:\n number): Float32Array {\n return gpgpu_util.downloadPackedMatrixFromBuffer(\n this.gl, buffer, batch,\n rows, columns, physicalRows, physicalCols,\n this.textureConfig);\n }\n\n public\n downloadFloat32MatrixFromBuffer(buffer: WebGLBuffer, size: number):\n Float32Array {\n return\n gpgpu_util.downloadFloat32MatrixFromBuffer(this.gl, buffer, size);\n }\n\n public createBufferFromTexture(\n texture: WebGLTexture, rows: number, columns: number): WebGLBuffer {\n this.bindTextureToFrameBuffer(texture);\n const result = gpgpu_util.createBufferFromOutputTexture(\n this.gl as WebGL2RenderingContext, rows, columns, this.textureConfig);\n this.unbindTextureToFrameBuffer();\n return result;\n }\n\n public createAndWaitForFence():

```



```

Promise<void> {\n const fenceContext = this.createFence(this.gl);\n return this.pollFence(fenceContext);\n}\n\n private createFence(gl: WebGLRenderingContext): FenceContext {\n let query:
WebGLQuery|WebGLSync;\n let isFencePassed: () => boolean;\n\n if
(env().getBool('WEBGL_FENCE_API_ENABLED')) {\n const gl2 = gl as WebGL2RenderingContext;\n\n
const sync = gl2.fenceSync(gl2.SYNC_GPU_COMMANDS_COMPLETE, 0);\n gl.flush();\n\n
isFencePassed = () => {\n const status = gl2.clientWaitSync(sync, 0, 0);\n return status ===
gl2.ALREADY_SIGNALED ||\n status === gl2.CONDITION_SATISFIED;\n };\n\n query = sync;\n
} else if (\n env().getNumber('WEBGL_DISJOINT_QUERY_TIMER_EXTENSION_VERSION') > 0) {\n
query = this.beginQuery();\n this.endQuery();\n isFencePassed = () => this.isQueryAvailable(\n query,\n
env().getNumber('WEBGL_DISJOINT_QUERY_TIMER_EXTENSION_VERSION'));\n } else {\n
// If we have no way to fence, return true immediately. This will fire in\n // WebGL 1.0 when there is no
disjoint query timer. In this case, because\n // the fence passes immediately, we'll immediately ask for a
download of\n // the texture, which will cause the UI thread to hang.\n isFencePassed = () => true;\n }\n\n
return {query, isFencePassed};\n }\n\n public downloadMatrixFromPackedTexture(\n texture: WebGLTexture,
physicalRows: number,\n physicalCols: number): Float32Array {\n return this.downloadMatrixDriver(\n
texture,\n () => gpgpu_util.downloadMatrixFromPackedOutputTexture(\n this.gl, physicalRows,
physicalCols));\n }\n\n private vertexAttrsAreBound = false;\n\n public createProgram(fragmentShaderSource:
string): WebGLProgram {\n this.throwIfDisposed();\n const gl = this.gl;\n const fragmentShader:
WebGLShader =\n webgl_util.createFragmentShader(gl, fragmentShaderSource);\n const vertexShader:
WebGLShader = gpgpu_util.createVertexShader(gl);\n const program: WebGLProgram =
webgl_util.createProgram(gl);\n webgl_util.callAndCheck(gl, () => gl.attachShader(program, vertexShader));\n
webgl_util.callAndCheck(gl, () => gl.attachShader(program, fragmentShader));\n webgl_util.linkProgram(gl,
program);\n if (this.debug) {\n webgl_util.validateProgram(gl, program);\n }\n if
(!this.vertexAttrsAreBound) {\n this.setProgram(program);\n this.vertexAttrsAreBound =
gpgpu_util.bindVertexProgramAttributeStreams(\n gl, this.program, this.vertexBuffer);\n }\n return
program;\n }\n\n public deleteProgram(program: WebGLProgram) {\n this.throwIfDisposed();\n if (program
=== this.program) {\n this.program = null;\n }\n if (program != null) {\n webgl_util.callAndCheck(this.gl,
() => this.gl.deleteProgram(program));\n }\n }\n\n public setProgram(program: WebGLProgram|null) {\n
this.throwIfDisposed();\n this.program
= program;\n if ((this.program != null) && this.debug) {\n webgl_util.validateProgram(this.gl,
this.program);\n }\n webgl_util.callAndCheck(this.gl, () => this.gl.useProgram(program));\n }\n\n public
getUniformLocation(\n program: WebGLProgram, uniformName: string,\n shouldThrow = true):
WebGLUniformLocation {\n this.throwIfDisposed();\n if (shouldThrow) {\n return
webgl_util.getProgramUniformLocationOrThrow(\n this.gl, program, uniformName);\n } else {\n return
webgl_util.getProgramUniformLocation(\n this.gl, program, uniformName);\n }\n }\n\n public
getAttributeLocation(program: WebGLProgram, attribute: string):\n number {\n this.throwIfDisposed();\n
return webgl_util.callAndCheck(\n this.gl, () => this.gl.getAttribLocation(program, attribute));\n }\n\n public
getUniformLocationNoThrow(program: WebGLProgram, uniformName: string):\n WebGLUniformLocation {\n
this.throwIfDisposed();\n
return this.gl.getUniformLocation(program, uniformName);\n }\n\n public setInputMatrixTexture(\n
inputMatrixTexture: WebGLTexture, uniformLocation: WebGLUniformLocation,\n textureUnit: number) {\n
this.throwIfDisposed();\n this.throwIfNoProgram();\n webgl_util.bindTextureToProgramUniformSampler(\n
this.gl, inputMatrixTexture, uniformLocation, textureUnit);\n }\n\n public setOutputMatrixTexture(\n
outputMatrixTexture: WebGLTexture, rows: number, columns: number) {\n
this.setOutputMatrixTextureDriver(outputMatrixTexture, columns, rows);\n }\n\n public
setOutputPackedMatrixTexture(\n outputPackedMatrixTexture: WebGLTexture, rows: number, columns:
number) {\n this.throwIfDisposed();\n const [width, height] =\n tex_util.getPackedMatrixTextureShapeWidthHeight(rows, columns);\n
}

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this.setOutputMatrixTextureDriver(outputPackedMatrixTexture, width, height);\n }\n\n public
setOutputMatrixWriteRegion(\n startRow: number, numRows:
 number, startColumn: number,\n numColumns: number) {\n this.setOutputMatrixWriteRegionDriver(\n
startColumn, startRow, numColumns, numRows);\n }\n\n public setOutputPackedMatrixWriteRegion(\n
startRow: number, numRows: number, startColumn: number,\n numColumns: number) {\n throw new
Error('setOutputPackedMatrixWriteRegion not implemented.);\n }\n\n public debugValidate() {\n if
(this.program != null) {\n webgl_util.validateProgram(this.gl, this.program);\n }\n
webgl_util.validateFramebuffer(this.gl);\n }\n\n public executeProgram() {\n this.throwIfDisposed();\n
this.throwIfNoProgram();\n const gl = this.gl;\n if (this.debug) {\n this.debugValidate();\n }\n
webgl_util.callAndCheck(\n gl, () => gl.drawElements(gl.TRIANGLES, 6, gl.UNSIGNED_SHORT, 0);\n
)\n\n public blockUntilAllProgramsCompleted() {\n this.throwIfDisposed();\n webgl_util.callAndCheck(this.gl,
() => this.gl.finish());\n }\n\n private
getQueryTimerExtension(): WebGL1DisjointQueryTimerExtension | WebGL2DisjointQueryTimerExtension
{\n if (this.disjointQueryTimerExtension == null) {\n this.disjointQueryTimerExtension =\n
webgl_util.getExtensionOrThrow(\n this.gl,\n env().getNumber(\n
'WEBGL_DISJOINT_QUERY_TIMER_EXTENSION_VERSION') === 2 ?\n
'EXT_disjoint_timer_query_webgl2' :\n 'EXT_disjoint_timer_query') as\n
WebGL1DisjointQueryTimerExtension | WebGL2DisjointQueryTimerExtension;\n }\n return
this.disjointQueryTimerExtension;\n }\n\n private getQueryTimerExtensionWebGL2():
WebGL2DisjointQueryTimerExtension {\n return this.getQueryTimerExtension();\n }\n\n private
getQueryTimerExtensionWebGL1(): WebGL1DisjointQueryTimerExtension {\n return
this.getQueryTimerExtension() as WebGL1DisjointQueryTimerExtension;\n }\n\n beginQuery(): WebGLQuery
{\n if (env().getNumber('WEBGL_DISJOINT_QUERY_TIMER_EXTENSION_VERSION')
=== 2) {\n const gl2 = this.gl as WebGL2RenderingContext;\n const ext =
this.getQueryTimerExtensionWebGL2();\n\n const query = gl2.createQuery();\n
gl2.beginQuery(ext.TIME_ELAPSED_EXT, query);\n return query;\n }\n const ext =
this.getQueryTimerExtensionWebGL1();\n const query = ext.createQueryEXT() as WebGLQuery;\n
ext.beginQueryEXT(ext.TIME_ELAPSED_EXT, query);\n return query;\n }\n\n endQuery() {\n if
(env().getNumber('WEBGL_DISJOINT_QUERY_TIMER_EXTENSION_VERSION') === 2) {\n const gl2 =
this.gl as WebGL2RenderingContext;\n const ext = this.getQueryTimerExtensionWebGL2();\n
gl2.endQuery(ext.TIME_ELAPSED_EXT);\n return;\n }\n const ext =
this.getQueryTimerExtensionWebGL1();\n ext.endQueryEXT(ext.TIME_ELAPSED_EXT);\n }\n\n public async
waitForQueryAndGetTime(query: WebGLQuery): Promise<number> {\n await util.repeatedTry(\n () =>
this.disposed || // while testing
 contexts are created / disposed\n // in rapid succession, so without this check we\n
 // may poll for the query timer indefinitely\n this.isQueryAvailable(\n query,\n
env().getNumber(\n 'WEBGL_DISJOINT_QUERY_TIMER_EXTENSION_VERSION')));\n return
this.getQueryTime(\n query,\n
env().getNumber('WEBGL_DISJOINT_QUERY_TIMER_EXTENSION_VERSION'));\n }\n\n private
getQueryTime(query: WebGLQuery, queryTimerVersion: number): number {\n if (queryTimerVersion === 0) {\n
return null;\n }\n\n if (queryTimerVersion === 2) {\n const gl2 = this.gl as WebGL2RenderingContext;\n
const timeElapsedNanos = gl2.getQueryParameter(query, gl2.QUERY_RESULT);\n // Return milliseconds.\n
return timeElapsedNanos / 1000000;\n } else {\n const ext = this.getQueryTimerExtensionWebGL1();\n
const timeElapsedNanos =\n ext.getQueryObjectEXT(query,\n
ext.QUERY_RESULT_EXT);\n // Return milliseconds.\n return timeElapsedNanos / 1000000;\n }\n }\n\n private isQueryAvailable(query: WebGLQuery, queryTimerVersion: number): boolean {\n if
(queryTimerVersion === 0) {\n return true;\n }\n\n if (queryTimerVersion === 2) {\n const gl2 = this.gl
as WebGL2RenderingContext;\n const ext = this.getQueryTimerExtensionWebGL2();\n const available =\n

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 gl2.getQueryParameter(query, gl2.QUERY_RESULT_AVAILABLE);\n if (this.disjoint == null) {\n
this.disjoint = this.gl.getParameter(ext.GPU_DISJOINT_EXT);\n }\n return available && !this.disjoint;\n
} else {\n const ext = this.getQueryTimerExtensionWebGL1();\n const available =\n
ext.getQueryObjectEXT(query, ext.QUERY_RESULT_AVAILABLE_EXT);\n if (this.disjoint == null) {\n
this.disjoint = this.gl.getParameter(ext.GPU_DISJOINT_EXT);\n }\n return available && !this.disjoint;\n
}\n }\n pollFence(fenceContext: FenceContext) {\n return new Promise<void>(resolve => {\n
this.addItemToPoll(() => fenceContext.isFencePassed(), () => resolve());\n });\n }\n private itemsToPoll:\n
PollItem[] = [];\n pollItems(): void {\n // Find the last query that has finished.\n const index =\n
linearSearchLastTrue(this.itemsToPoll.map(x => x.isDoneFn));\n for (let i = 0; i <= index; ++i) {\n const\n
{resolveFn} = this.itemsToPoll[i];\n resolveFn();\n }\n this.itemsToPoll = this.itemsToPoll.slice(index +\n
1);\n }\n private addItemToPoll(isDoneFn: () => boolean, resolveFn: () => void) {\n
this.itemsToPoll.push({isDoneFn, resolveFn});\n if (this.itemsToPoll.length > 1) {\n // We already have a\n
running loop that polls.\n return;\n }\n // Start a new loop that polls.\n util.repeatedTry(() => {\n
this.pollItems();\n // End the loop if no more items to poll.\n return this.itemsToPoll.length ===\n
0;\n });\n }\n private bindTextureToFramebuffer(texture: WebGLTexture) {\n this.throwIfDisposed();\n
webgl_util.bindColorTextureToFramebuffer(\n this.gl, texture, this.framebuffer);\n if (this.debug) {\n
webgl_util.validateFramebuffer(this.gl);\n }\n }\n private unbindTextureToFramebuffer() {\n if\n
(this.outputTexture != null) {\n webgl_util.bindColorTextureToFramebuffer(\n this.gl, this.outputTexture,\n
this.framebuffer);\n if (this.debug) {\n webgl_util.validateFramebuffer(this.gl);\n }\n } else {\n
webgl_util.unbindColorTextureFromFramebuffer(this.gl, this.framebuffer);\n }\n }\n private\n
downloadMatrixDriver(\n texture: WebGLTexture,\n downloadAndDecode: () => Float32Array):\n
Float32Array {\n this.bindTextureToFramebuffer(texture);\n const result = downloadAndDecode();\n
this.unbindTextureToFramebuffer();\n return result;\n }\n private setOutputMatrixTextureDriver(\n
outputMatrixTextureMaybePacked:\n
WebGLTexture, width: number,\n height: number) {\n this.throwIfDisposed();\n const gl = this.gl;\n
webgl_util.bindColorTextureToFramebuffer(\n gl, outputMatrixTextureMaybePacked, this.framebuffer);\n if\n
(this.debug) {\n webgl_util.validateFramebuffer(gl);\n }\n this.outputTexture =\n
outputMatrixTextureMaybePacked;\n webgl_util.callAndCheck(gl, () => gl.viewport(0, 0, width, height));\n
webgl_util.callAndCheck(gl, () => gl.scissor(0, 0, width, height));\n }\n private\n
setOutputMatrixWriteRegionDriver(\n x: number, y: number, width: number, height: number) {\n
this.throwIfDisposed();\n webgl_util.callAndCheck(\n this.gl, () => this.gl.scissor(x, y, width, height));\n
}\n private throwIfDisposed() {\n if (this.disposed) {\n throw new Error('Attempted to use disposed\n
GPGPUContext.);\n }\n }\n private throwIfNoProgram() {\n if (this.program == null) {\n throw new\n
Error('No\n
GPU program is currently set.);\n }\n }\n }\n\n
type PollItem = {\n isDoneFn: () => boolean,\n resolveFn: () =>\n
void\n
};\n\n
/**\n * Finds the index of the last true element using linear search.\n * Note: We can't do binary search\n
because Chrome expects us to explicitly\n * test all fences before download.\n */\n
https://github.com/tensorflow/tfjs/issues/1145\n *\n
export function linearSearchLastTrue(arr: Array<() =>\n
boolean>): number {\n let i = 0;\n for (; i < arr.length; ++i) {\n const isDone = arr[i]();\n if (!isDone) {\n
break;\n }\n }\n return i - 1;\n }\n\n
"/**\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n
"License");\n * you may not use this file except in\n
compliance with the License.\n * You may obtain a copy of the License at\n *\n
http://www.apache.org/licenses/LICENSE-2.0\n *\n
* Unless required by applicable law or agreed to in writing,\n
software\n * distributed under the License\n
is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either\n
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under\n
the License.\n */\n
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*\n\nimport {backend_util, util} from '@tensorflow/tfjs-core';\nconst {getBroadcastDims} = backend_util;\nimport {getGslIDifferences, GLSL} from './glsl_version';\nimport * as shader_util from './shader_compiler_util';\n\nexport type ShapeInfo = {\n logicalShape: number[],\n texShape: [number, number],\n isUniform: boolean,\n isPacked: boolean,\n flatOffset: number\n};\n\nexport type InputInfo = {\n name: string,\n shapeInfo: ShapeInfo\n};\n\nexport function makeShader(\n inputsInfo: InputInfo[], outputShape: ShapeInfo, userCode: string,\n usesPackedTextures: boolean): string {\n const prefixSnippets: string[] = [];\n inputsInfo.forEach(x => {\n const size = util.sizeFromShape(x.shapeInfo.logicalShape);\n\n // Snippet when we decided to upload the values as uniform.\n if (x.shapeInfo.isUniform) {\n prefixSnippets.push(`uniform float ${x.name}${size > 1 ? `[${size}]` : ''};`);\n } else {\n prefixSnippets.push(`uniform sampler2D ${x.name};`);\n prefixSnippets.push(`uniform int offset${x.name};`);\n }\n });\n const inputPrefixSnippet = prefixSnippets.join("\\n");\n const inputSamplingSnippet =\n inputsInfo\n .map(x => getInputSamplingSnippet(x, outputShape, usesPackedTextures))\n .join("\\n");\n const outTexShape = outputShape.texShape;\n const glsl = getGslIDifferences();\n const floatTextureSampleSnippet = getFloatTextureSampleSnippet(glsl);\n let outputSamplingSnippet: string;\n let floatTextureSetOutputSnippet: string;\n let shaderPrefix = getShaderPrefix(glsl);\n\n if (outputShape.isPacked) {\n outputSamplingSnippet =\n getPackedOutputSamplingSnippet(outputShape.logicalShape,\n outTexShape);\n floatTextureSetOutputSnippet = getFloatTextureSetRGBASnippet(glsl);\n } else {\n outputSamplingSnippet =\n getOutputSamplingSnippet(outputShape.logicalShape, outTexShape);\n floatTextureSetOutputSnippet = getFloatTextureSetRSnippet(glsl);\n }\n\n if (usesPackedTextures) {\n shaderPrefix += SHADER_PACKED_PREFIX;\n }\n\n const source = [\n shaderPrefix,\n floatTextureSampleSnippet, floatTextureSetOutputSnippet,\n inputPrefixSnippet, outputSamplingSnippet,\n inputSamplingSnippet, userCode\n].join("\\n");\n return source;\n}\n\nfunction getSamplerFromInInfo(inInfo: InputInfo): string {\n const shape = inInfo.shapeInfo.logicalShape;\n switch (shape.length) {\n case 0:\n return getSamplerScalar(inInfo);\n case 1:\n return getSampler1D(inInfo);\n case 2:\n return getSampler2D(inInfo);\n case 3:\n return getSampler3D(inInfo);\n case 4:\n return getSampler4D(inInfo);\n case 5:\n return getSampler5D(inInfo);\n case 6:\n return getSampler6D(inInfo);\n default:\n throw new Error(`\n ${shape.length}-D input sampling` +\n ` is not yet supported`);\n }\n}\n\nfunction getPackedSamplerFromInInfo(inInfo: InputInfo): string {\n const shape = inInfo.shapeInfo.logicalShape;\n switch (shape.length) {\n case 0:\n return getPackedSamplerScalar(inInfo);\n case 1:\n return getPackedSampler1D(inInfo);\n case 2:\n return getPackedSampler2D(inInfo);\n case 3:\n return getPackedSampler3D(inInfo);\n default:\n return getPackedSamplerND(inInfo);\n }\n}\n\nfunction getInputSamplingSnippet(\n inInfo: InputInfo, outShapeInfo: ShapeInfo, usesPackedTextures = false): string {\n let res = "";\n if (usesPackedTextures) {\n res += getPackedSamplerFromInInfo(inInfo);\n } else {\n res += getSamplerFromInInfo(inInfo);\n }\n\n const inShape = inInfo.shapeInfo.logicalShape;\n const outShape = outShapeInfo.logicalShape;\n\n if (inShape.length <= outShape.length) {\n if (usesPackedTextures) {\n res +=\n getPackedSamplerAtOutputCoords(inInfo, outShapeInfo);\n } else {\n res +=\n getSamplerAtOutputCoords(inInfo, outShapeInfo);\n }\n }\n return res;\n}\n\nfunction getPackedOutputSamplingSnippet(\n outShape: number[], outTexShape: [number, number]): string {\n switch (outShape.length) {\n case 0:\n return getOutputScalarCoords();\n case 1:\n return getOutputPacked1DCoords(outShape as [number], outTexShape);\n case 2:\n return getOutputPacked2DCoords(outShape as [number, number], outTexShape);\n case 3:\n return getOutputPacked3DCoords(\n outShape as [number, number, number], outTexShape);\n default:\n return getOutputPackedNDCoords(outShape, outTexShape);\n }\n}\n\nfunction getOutputSamplingSnippet(\n outShape: number[], outTexShape: [number, number]): string {\n switch (outShape.length) {\n case 0:\n return getOutputScalarCoords();\n case 1:\n return getOutput1DCoords(outShape as [number], outTexShape);\n case 2:\n return getOutput2DCoords(outShape as [number, number], outTexShape);\n case 3:\n return

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getOutput3DCoords(\n outShape as [number, number, number], outTexShape);\n case 4:\n return
getOutput4DCoords(\n outShape as [number, number, number, number], outTexShape);\n case 5:\n return
getOutput5DCoords(\n outShape as [number, number, number, number, number], outTexShape);\n case 6:\n
return getOutput6DCoords(\n outShape as [number, number, number, number, number, number],\n
outTexShape);\n default:\n throw new Error(\n `${outShape.length}-D output sampling is not yet
supported`);\n })\n\nfunction getFloatTextureSampleSnippet(gls: GLSL): string {\n return \n float
sampleTexture(sampler2D textureSampler, vec2 uv) {\n return ${gls.texture2D}(textureSampler, uv).r;\n
}\n `;\n\nfunction getFloatTextureSetRSnippet(gls: GLSL): string {\n return \n void setOutput(float val)
{\n ${gls.output} = vec4(val, 0, 0, 0);\n }\n `;\n\nfunction getFloatTextureSetRGBASnippet(gls: GLSL):
string {\n return \n void setOutput(vec4 val) {\n ${gls.output} = val;\n }\n `;\n\nfunction
getShaderPrefix(gls: GLSL): string {\n const SHADER_PREFIX = `${gls.version}\n precision highp float;\n
precision highp int;\n precision highp sampler2D;\n ${gls.varyingFs} vec2 resultUV;\n
${gls.defineOutput}\n const vec2 halfCR = vec2(0.5, 0.5);\n\n struct ivec5\n {\n int x;\n int y;\n int
z;\n int w;\n int u;\n };\n\n struct ivec6\n {\n int x;\n int y;\n int z;\n int w;\n int u;\n
int v;\n };\n\n uniform float NAN;\n ${gls.defineSpecialNaN}\n ${gls.defineSpecialInf}\n
${gls.defineRound}\n\n int imod(int x, int y) {\n return
x - y * (x / y);\n }\n\n int idiv(int a, int b, float sign) {\n int res = a / b;\n int mod = imod(a, b);\n if
(sign < 0. && mod != 0) {\n res -= 1;\n }\n return res;\n }\n\n //Based on the work of Dave Hoskins\n
//https://www.shadertoy.com/view/4djSRW\n #define HASHSCALE1 443.8975\n float random(float seed){\n
vec2 p = resultUV * seed;\n vec3 p3 = fract(vec3(p.xy) * HASHSCALE1);\n p3 += dot(p3, p3.yzx +
19.19);\n return fract((p3.x + p3.y) * p3.z);\n }\n\n ${SAMPLE_1D_SNIIPPET}\n
${SAMPLE_2D_SNIIPPET}\n ${SAMPLE_3D_SNIIPPET}\n `;\n\n return SHADER_PREFIX;\n}\n\nconst
SAMPLE_1D_SNIIPPET = \nvec2 uvFromFlat(int texNumR, int texNumC, int index) {\n int texR = index /
texNumC;\n int texC = index - texR * texNumC;\n return (vec2(texC, texR) + halfCR) / vec2(texNumC,
texNumR);\n}\n\nvec2 packedUVfrom1D(int texNumR, int texNumC, int index) {\n int texelIndex = index / 2;\n int
texR = texelIndex / texNumC;\n
int texC = texelIndex - texR * texNumC;\n return (vec2(texC, texR) + halfCR) / vec2(texNumC,
texNumR);\n}\n\nconst SAMPLE_2D_SNIIPPET = \nvec2 packedUVfrom2D(int texelsInLogicalRow, int
texNumR,\n int texNumC, int row, int col) {\n int texelIndex = (row / 2) * texelsInLogicalRow + (col / 2);\n int
texR = texelIndex / texNumC;\n int texC = texelIndex - texR * texNumC;\n return (vec2(texC, texR) + halfCR) /
vec2(texNumC, texNumR);\n}\n\nconst SAMPLE_3D_SNIIPPET = \nvec2 packedUVfrom3D(int texNumR, int
texNumC,\n int texelsInBatch, int texelsInLogicalRow, int b,\n int row, int col) {\n int index = b * texelsInBatch
+ (row / 2) * texelsInLogicalRow + (col / 2);\n int texR = index / texNumC;\n int texC = index - texR *
texNumC;\n return (vec2(texC, texR) + halfCR) / vec2(texNumC, texNumR);\n}\n\nconst
SHADER_PACKED_PREFIX = \n float getChannel(vec4 frag, vec2 innerDims) {\n vec2 modCoord =
mod(innerDims, 2.);\n return modCoord.x == 0. ?\n (modCoord.y
== 0. ? frag.r : frag.g) :\n (modCoord.y == 0. ? frag.b : frag.a);\n }\n float getChannel(vec4 frag, int dim) {\n
float modCoord = mod(float(dim), 2.);\n return modCoord == 0. ? frag.r : frag.g;\n }\n `;\n\nfunction
getOutputScalarCoords() {\n return \n int getOutputCoords() {\n return 0;\n }\n `;\n\nfunction
getOutputPacked1DCoords(\n shape: [number], texShape: [number, number]): string {\n const packedTexShape
=\n [Math.ceil(texShape[0] / 2), Math.ceil(texShape[1] / 2)];\n if (packedTexShape[0] === 1) {\n return \n
int getOutputCoords() {\n return 2 * int(resultUV.x * ${packedTexShape[1]}.0);\n }\n `;\n }\n\n if
(packedTexShape[1] === 1) {\n return \n int getOutputCoords() {\n return 2 * int(resultUV.y *
${packedTexShape[0]}.0);\n }\n `;\n }\n\n return \n int getOutputCoords() {\n ivec2 resTexRC =
ivec2(resultUV.yx *\n vec2(${packedTexShape[0]}, ${packedTexShape[1]}));\n
return 2 * (resTexRC.x * ${packedTexShape[1]} + resTexRC.y);\n }\n `;\n}\n\nfunction
getOutput1DCoords(\n shape: [number], texShape: [number, number]): string {\n if (texShape[0] === 1) {\n
return \n int getOutputCoords() {\n return int(resultUV.x * ${texShape[1]}.0);\n }\n `;\n }\n if

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(texShape[1] === 1) {\n return \n int getOutputCoords() {\n return int(resultUV.y * ${texShape[0]}.0);\n }\n }\n return \n int getOutputCoords() {\n ivec2 resTexRC = ivec2(resultUV.yx *\n vec2(${texShape[0]}, ${texShape[1]}));\n return resTexRC.x * ${texShape[1]} + resTexRC.y;\n }\n }\n}\n\nfunction getOutputPacked3DCoords(\n shape: [number, number, number], texShape: [number, number]):\n string {\n const packedTexShape =\n [Math.ceil(texShape[0] / 2), Math.ceil(texShape[1] / 2)];\n const texelsInLogicalRow = Math.ceil(shape[2] / 2);\n const texelsInBatch = texelsInLogicalRow\n * Math.ceil(shape[1] / 2);\n return \n ivec3 getOutputCoords() {\n ivec2 resTexRC = ivec2(resultUV.yx *\n vec2(${packedTexShape[0]}, ${packedTexShape[1]}));\n int index = resTexRC.x *\n ${packedTexShape[1]} + resTexRC.y;\n int b = index / ${texelsInBatch};\n index -= b *\n ${texelsInBatch};\n int r = 2 * (index / ${texelsInLogicalRow});\n int c = imod(index,\n ${texelsInLogicalRow}) * 2;\n return ivec3(b, r, c);\n }\n }\n }\n}\n\nfunction getOutput3DCoords(\n shape: [number, number, number], texShape: [number, number]):\n string {\n const coordsFromIndexSnippet =\n shader_util.getLogicalCoordinatesFromFlatIndex(['r', 'c', 'd'], shape);\n return \n ivec3 getOutputCoords() {\n ivec2 resTexRC = ivec2(resultUV.yx *\n vec2(${texShape[0]}, ${texShape[1]}));\n int index = resTexRC.x * ${texShape[1]} + resTexRC.y;\n ${coordsFromIndexSnippet}\n return\n ivec3(r, c, d);\n }\n }\n }\n}\n\nfunction getOutputPackedNDCoords(\n shape: number[], texShape: [number,\n number]):\n string {\n const packedTexShape =\n [Math.ceil(texShape[0] / 2), Math.ceil(texShape[1] / 2)];\n const texelsInLogicalRow = Math.ceil(shape[shape.length - 1] / 2);\n const texelsInBatch =\n texelsInLogicalRow * Math.ceil(shape[shape.length - 2] / 2);\n let texelsInBatchN = texelsInBatch;\n let batches =\n ``;\n let coords = 'b, r, c';\n for (let b = 2; b < shape.length - 1; b++) {\n texelsInBatchN *= shape[shape.length -\n b - 1];\n batches = \n int b${b} = index / ${texelsInBatchN};\n index -= b${b} * ${texelsInBatchN};\n ` +\n batches;\n coords = `b${b}, ` + coords;\n }\n return \n ivec${shape.length} getOutputCoords() {\n ivec2 resTexRC = ivec2(resultUV.yx *\n vec2(${packedTexShape[0]},\n ${packedTexShape[1]}));\n int index = resTexRC.x * ${packedTexShape[1]} + resTexRC.y;\n ${batches}\n int b = index / ${texelsInBatch};\n index -= b * ${texelsInBatch};\n int r = 2 * (index /\n ${texelsInLogicalRow});\n int c = imod(index, ${texelsInLogicalRow}) * 2;\n return\n ivec${shape.length}(${coords});\n }\n }\n }\n}\n\nfunction getOutput4DCoords(\n shape: [number, number,\n number, number],\n texShape: [number, number]):\n string {\n const coordsFromIndexSnippet =\n shader_util.getLogicalCoordinatesFromFlatIndex(\n ['r', 'c', 'd', 'd2'], shape);\n return \n ivec4\n getOutputCoords() {\n ivec2 resTexRC = ivec2(resultUV.yx *\n vec2(${texShape[0]}, ${texShape[1]}));\n int index = resTexRC.x * ${texShape[1]} + resTexRC.y;\n ${coordsFromIndexSnippet}\n return ivec4(r, c,\n d, d2);\n }\n }\n }\n }\n}\n\nfunction getOutput5DCoords(\n shape: [number, number, number, number, number],\n texShape: [number, number]):\n string {\n const coordsFromIndexSnippet =\n shader_util.getLogicalCoordinatesFromFlatIndex(\n ['r', 'c', 'd', 'd2', 'd3'], shape);\n return \n ivec5 getOutputCoords() {\n ivec2 resTexRC =\n ivec2(resultUV.yx * vec2(${texShape[0]},\n ${texShape[1]}));\n int index = resTexRC.x *\n ${texShape[1]} + resTexRC.y;\n ${coordsFromIndexSnippet}\n ivec5 outShape = ivec5(r, c, d, d2, d3);\n return outShape;\n }\n }\n }\n}\n\nfunction getOutput6DCoords(\n shape: [number, number, number, number,\n number, number],\n texShape: [number, number]):\n string {\n const coordsFromIndexSnippet =\n shader_util.getLogicalCoordinatesFromFlatIndex(\n ['r', 'c', 'd', 'd2', 'd3', 'd4'], shape);\n return \n ivec6\n getOutputCoords() {\n ivec2 resTexRC = ivec2(resultUV.yx *\n vec2(${texShape[0]}, ${texShape[1]}));\n int index = resTexRC.x * ${texShape[1]} + resTexRC.y;\n ${coordsFromIndexSnippet}\n ivec6 result =\n ivec6(r, c, d, d2, d3, d4);\n return result;\n }\n }\n }\n }\n}\n\nfunction getOutputPacked2DCoords(\n shape: [number, number], texShape: [number, number]):\n string {\n const packedTexShape =\n [Math.ceil(texShape[0] / 2), Math.ceil(texShape[1] / 2)];\n if (util.arraysEqual(shape, texShape)) {\n return \n ivec2 getOutputCoords() {\n return 2 * ivec2(resultUV.yx * vec2(${packedTexShape[0]},\n ${packedTexShape[1]}));\n }\n }\n }\n // texels needed to accommodate a logical row\n const texelsInLogicalRow = Math.ceil(shape[1] / 2);\n /**\n * getOutputCoords\n * * resTexRC: The rows and

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columns of the texels. If you move over one
 * texel to the right in the packed texture, you are moving over one
column
 * (not two).
 * index: The texel index
 * return
ivec2 getOutputCoords() {
ivec2
resTexRC = ivec2(resultUV.yx
vec2({packedTexShape[0]}, {packedTexShape[1]}));
int index = resTexRC.x * {packedTexShape[1]} + resTexRC.y;
int r = 2 * (index
/ {texelsInLogicalRow});
int c = imod(index, {texelsInLogicalRow}) * 2;
return ivec2(r, c);
}

function getOutput2DCoords(shape: [number, number], texShape: [number, number]): string {
if
(util.arraysEqual(shape, texShape)) {
return
ivec2 getOutputCoords() {
return ivec2(resultUV.yx
vec2({texShape[0]}, {texShape[1]}));
}
}
if (shape[1] === 1) {
return
ivec2
getOutputCoords() {
ivec2 resTexRC = ivec2(resultUV.yx
vec2({texShape[0]},
{texShape[1]}));
int index = resTexRC.x * {texShape[1]} + resTexRC.y;
return ivec2(index, 0);
}
}
if (shape[0] === 1) {
return
ivec2 getOutputCoords() {
ivec2 resTexRC =
ivec2(resultUV.yx
vec2({texShape[0]}, {texShape[1]}));
int index = resTexRC.x *
{texShape[1]} + resTexRC.y;
return ivec2(0,
index);
}
}
return
ivec2 getOutputCoords() {
ivec2 resTexRC = ivec2(resultUV.yx
vec2({texShape[0]}, {texShape[1]}));
int index = resTexRC.x * {texShape[1]} +
resTexRC.y;
int r = index / {shape[1]};
int c = index - r * {shape[1]};
return ivec2(r, c);
}
}

function getFlatOffsetUniformName(texName: string): string {
return
`offset${texName}`;
}

function getPackedSamplerScalar(inputInfo: InputInfo): string {
const texName =
inputInfo.name;
const funcName = 'get' + texName.charAt(0).toUpperCase() + texName.slice(1);
const glsl =
getGlslDifferences();
return
vec4 {funcName}() {
return ${glsl.texture2D}({texName}, halfCR);
}
}

function getSamplerScalar(inputInfo: InputInfo): string {
const texName = inputInfo.name;
const
funcName = 'get' + texName.charAt(0).toUpperCase() + texName.slice(1);
if (inputInfo.shapeInfo.isUniform)
{
return
float {funcName}() {
return {texName};
}
}
const [texNumR, texNumC] =
inputInfo.shapeInfo.texShape;
if (texNumR === 1 && texNumC === 1) {
return
float {funcName}()
{
return sampleTexture({texName}, halfCR);
}
}
const [tNumR, tNumC] =
inputInfo.shapeInfo.texShape;
const offset = getFlatOffsetUniformName(texName);
return
float
{funcName}() {
vec2 uv = uvFromFlat({tNumR}, {tNumC}, {offset});
return
sampleTexture({texName}, uv);
}
}

function getPackedSampler1D(inputInfo: InputInfo): string {
const texName = inputInfo.name;
const funcName = 'get' + texName.charAt(0).toUpperCase() +
texName.slice(1);
const texShape = inputInfo.shapeInfo.texShape;
const packedTexShape =
[Math.ceil(texShape[0] / 2), Math.ceil(texShape[1] / 2)];
const glsl = getGlslDifferences();
return
vec4
{funcName}(int index) {
vec2 uv = packedUVfrom1D(
${packedTexShape[0]}, ${packedTexShape[1]}, index);
return ${glsl.texture2D}({texName}, uv);
}
}

function getSampler1D(inputInfo: InputInfo): string {
const texName = inputInfo.name;
const
funcName = 'get' + texName.charAt(0).toUpperCase() + texName.slice(1);
if (inputInfo.shapeInfo.isUniform)
{
// Uniform arrays will be less than 65505 (no risk of float16 overflow).
return
float {funcName}(int
index) {
return
${getUniformSampler(inputInfo)}
}
}
const texShape =
inputInfo.shapeInfo.texShape;
const tNumR = texShape[0];
const tNumC = texShape[1];
if (tNumC === 1
&& tNumR === 1) {
return
float {funcName}(int index) {
return sampleTexture({texName},
halfCR);
}
}
const offset = getFlatOffsetUniformName(texName);
if (tNumC === 1) {
return
float {funcName}(int index) {
vec2 uv = vec2(0.5, (float(index + {offset}) + 0.5) / {tNumR}.0);
return
sampleTexture({texName}, uv);
}
}
}
if (tNumR === 1) {
return
float
{funcName}(int index) {
vec2 uv = vec2((float(index + {offset}) + 0.5) / {tNumC}.0, 0.5);
return
sampleTexture({texName}, uv);
}
}
}
return
float {funcName}(int index) {
vec2 uv =
uvFromFlat({tNumR}, {tNumC}, index + {offset});
return sampleTexture({texName}, uv);
}
}

function getPackedSampler2D(inputInfo: InputInfo): string {
const shape =
inputInfo.shapeInfo.logicalShape;
const texName = inputInfo.name;
const funcName = 'get' +
texName.charAt(0).toUpperCase() + texName.slice(1);
const texShape = inputInfo.shapeInfo.texShape;
const

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texNumR = texShape[0];\n const texNumC = texShape[1];\n const glsl = getGlslDifferences();\n if (texShape !=
null && util.arraysEqual(shape, texShape)) {\n return \n vec4 ${funcName}(int row, int col) {\n vec2 uv
= (vec2(col,
row) + halfCR) / vec2(${texNumC}.0, ${texNumR}.0);\n return ${glsl.texture2D}(${texName}, uv);\n
}\n `;\n }\n\n const packedTexShape =\n [Math.ceil(texShape[0] / 2), Math.ceil(texShape[1] / 2)];\n const
valuesPerRow = Math.ceil(shape[1] / 2);\n\n return \n vec4 ${funcName}(int row, int col) {\n vec2 uv =
packedUVfrom2D(${valuesPerRow}, ${packedTexShape[0]}, ${\n packedTexShape[1]}, row, col);\n return
${glsl.texture2D}(${texName}, uv);\n }\n `;\n }\n\n function getSampler2D(inputInfo: InputInfo): string {\n const
shape = inputInfo.shapeInfo.logicalShape;\n const texName = inputInfo.name;\n const funcName = 'get' +
texName.charAt(0).toUpperCase() + texName.slice(1);\n const texShape = inputInfo.shapeInfo.texShape;\n\n if
(texShape != null && util.arraysEqual(shape, texShape)) {\n const texNumR = texShape[0];\n const texNumC =
texShape[1];\n return \n float ${funcName}(int row, int col) {\n vec2 uv = (vec2(col,
row) + halfCR) / vec2(${texNumC}.0, ${texNumR}.0);\n return sampleTexture(${texName}, uv);\n }\n `;\n
}\n\n const {newShape, keptDims} = util.squeezeShape(shape);\n const squeezedShape = newShape;\n if
(squeezedShape.length < shape.length) {\n const newInputInfo = squeezeInputInfo(inputInfo, squeezedShape);\n
const params = ['row', 'col'];\n return \n ${getSamplerFromInInfo(newInputInfo)}\n float ${funcName}(int
row, int col) {\n return ${funcName}(${getSqueezedParams(params, keptDims)});\n }\n `;\n }\n\n if
(inputInfo.shapeInfo.isUniform) {\n // Uniform arrays will be less than 65505 (no risk of float16 overflow).\n
return \n float ${funcName}(int row, int col) {\n int index = round(dot(vec2(row, col), vec2(${shape[1]},
1)));\n ${getUniformSampler(inputInfo)}\n }\n `;\n }\n\n const texNumR = texShape[0];\n const
texNumC = texShape[1];\n const offset = getFlatOffsetUniformName(texName);\n if (texNumC
=== 1) {\n // index is used directly as physical (no risk of float16 overflow).\n return \n float
${funcName}(int row, int col) {\n float index = dot(vec3(row, col, ${offset}), vec3(${shape[1]}, 1, 1));\n
vec2 uv = vec2(0.5, (index + 0.5) / ${texNumR}.0);\n return sampleTexture(${texName}, uv);\n }\n `;\n }\n
}\n\n if (texNumR === 1) {\n // index is used directly as physical (no risk of float16 overflow).\n return \n float
${funcName}(int row, int col) {\n float index = dot(vec3(row, col, ${offset}), vec3(${shape[1]}, 1, 1));\n
vec2 uv = vec2((index + 0.5) / ${texNumC}.0, 0.5);\n return sampleTexture(${texName}, uv);\n }\n `;\n }\n
}\n\n return \n float ${funcName}(int row, int col) {\n // Explicitly use integer operations as dot() only works on
floats.\n int index = row * ${shape[1]} + col + ${offset};\n vec2 uv = uvFromFlat(${texNumR}, ${texNumC},
index);\n return sampleTexture(${texName}, uv);\n }\n `;\n }\n\n\n function
getPackedSampler3D(inputInfo: InputInfo): string {\n const shape = inputInfo.shapeInfo.logicalShape;\n const
texName = inputInfo.name;\n const funcName = 'get' + texName.charAt(0).toUpperCase() + texName.slice(1);\n
const texShape = inputInfo.shapeInfo.texShape;\n const packedTexShape =\n [Math.ceil(texShape[0] / 2),
Math.ceil(texShape[1] / 2)];\n\n if (shape[0] === 1) {\n const squeezedShape = shape.slice(1);\n const keptDims
= [1, 2];\n const newInputInfo = squeezeInputInfo(inputInfo, squeezedShape);\n const params = ['b', 'row',
'col'];\n return \n ${getPackedSamplerFromInInfo(newInputInfo)}\n vec4 ${funcName}(int b, int row,
int col) {\n return ${funcName}(${getSqueezedParams(params, keptDims)});\n }\n `;\n }\n\n const
texNumR = packedTexShape[0];\n const texNumC = packedTexShape[1];\n\n const valuesPerRow =
Math.ceil(shape[2] / 2);\n const texelsInBatch = valuesPerRow * Math.ceil(shape[1] / 2);\n const glsl
= getGlslDifferences();\n\n return \n vec4 ${funcName}(int b, int row, int col) {\n vec2 uv =
packedUVfrom3D(\n ${texNumR}, ${texNumC}, ${texelsInBatch}, ${valuesPerRow}, b, row, col);\n
return ${glsl.texture2D}(${texName}, uv);\n }\n `;\n }\n\n\n function getSampler3D(inputInfo: InputInfo): string {\n
const shape = inputInfo.shapeInfo.logicalShape;\n const texName = inputInfo.name;\n const funcName = 'get' +
texName.charAt(0).toUpperCase() + texName.slice(1);\n const stride0 = shape[1] * shape[2];\n const stride1 =
shape[2];\n\n const {newShape, keptDims} = util.squeezeShape(shape);\n const squeezedShape = newShape;\n if
(squeezedShape.length < shape.length) {\n const newInputInfo = squeezeInputInfo(inputInfo, squeezedShape);\n
const params = ['row', 'col', 'depth'];\n return \n ${getSamplerFromInInfo(newInputInfo)}\n float
${funcName}(int row, int col, int depth) {\n return ${funcName}(${getSqueezedParams(params,

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keptDims));\n
 }\n `;\n }\n\n if (inputInfo.shapeInfo.isUniform) {\n // Uniform arrays will be less than 65505 (no risk of
float16 overflow).\n return \n float ${funcName}(int row, int col, int depth) {\n int index =
round(dot(vec3(row, col, depth),\n vec3(${stride0}, ${stride1}, 1));\n
${getUniformSampler(inputInfo)}\n }\n `;\n }\n\n const texShape = inputInfo.shapeInfo.texShape;\n const
texNumR = texShape[0];\n const texNumC = texShape[1];\n const flatOffset = inputInfo.shapeInfo.flatOffset;\n if
(texNumC === stride0 && flatOffset == null) {\n // texC is used directly as physical (no risk of float16
overflow).\n return \n float ${funcName}(int row, int col, int depth) {\n float texR = float(row);\n
float texC = dot(vec2(col, depth), vec2(${stride1}, 1));\n vec2 uv = (vec2(texC, texR) + halfCR) /\n
vec2(${texNumC}.0, ${texNumR}.0);\n return sampleTexture(${texName},
uv);\n }\n `;\n }\n\n if (texNumC === stride1 && flatOffset == null) {\n // texR is used directly as
physical (no risk of float16 overflow).\n return \n float ${funcName}(int row, int col, int depth) {\n float
texR = dot(vec2(row, col), vec2(${shape[1]}, 1));\n float texC = float(depth);\n vec2 uv = (vec2(texC, texR) +
halfCR) / vec2(${texNumC}.0, ${texNumR}.0);\n return sampleTexture(${texName}, uv);\n }\n `;\n }\n\n
const offset = getFlatOffsetUniformName(texName);\n return \n float ${funcName}(int row, int col, int depth)
{\n // Explicitly use integer operations as dot() only works on floats.\n int index = row * ${stride0} + col *
${stride1} + depth + ${offset};\n vec2 uv = uvFromFlat(${texNumR}, ${texNumC}, index);\n return
sampleTexture(${texName}, uv);\n }\n `;\n }\n\n\nfunction getPackedSamplerND(inputInfo: InputInfo): string {\n
const shape = inputInfo.shapeInfo.logicalShape;\n
const rank = shape.length;\n const texName = inputInfo.name;\n const funcName = 'get' +
texName.charAt(0).toUpperCase() + texName.slice(1);\n const texShape = inputInfo.shapeInfo.texShape;\n const
packedTexShape =\n [Math.ceil(texShape[0] / 2), Math.ceil(texShape[1] / 2)];\n const texNumR =
packedTexShape[0];\n const texNumC = packedTexShape[1];\n\n const valuesPerRow = Math.ceil(shape[rank - 1]
/ 2);\n let texelsInBatch = valuesPerRow * Math.ceil(shape[rank - 2] / 2);\n let params = `int b, int row, int col`;\n
let index = `b * ${texelsInBatch} + (row / 2) * ${valuesPerRow} + (col / 2)`;\n for (let b = 2; b < rank - 1; b++) {\n
params = `int b${b}, ` + params;\n texelsInBatch *= shape[rank - b - 1];\n index = `b${b} * ${texelsInBatch} +
` + index;\n }\n const glsl = getGlslDifferences();\n return \n vec4 ${funcName}(${params}) {\n int index =
${index};\n int texR = index / ${texNumC};\n int texC = index - texR * ${texNumC};\n
vec2 uv = (vec2(texC, texR) + halfCR) / vec2(${texNumC}, ${texNumR});\n return
${glsl.texture2D}(${texName}, uv);\n }\n `;\n }\n\n\nfunction getSampler4D(inputInfo: InputInfo): string {\n const
shape = inputInfo.shapeInfo.logicalShape;\n const texName = inputInfo.name;\n const funcName = 'get' +
texName.charAt(0).toUpperCase() + texName.slice(1);\n const stride2 = shape[3];\n const stride1 = shape[2] *
stride2;\n const stride0 = shape[1] * stride1;\n\n const {newShape, keptDims} = util.squeezeShape(shape);\n if
(newShape.length < shape.length) {\n const newInputInfo = squeezeInputInfo(inputInfo, newShape);\n const
params = ['row', 'col', 'depth', 'depth2'];\n return \n ${getSamplerFromInInfo(newInputInfo)}\n float
${funcName}(int row, int col, int depth, int depth2) {\n return ${funcName}(${getSqueezedParams(params,
keptDims)});\n }\n `;\n }\n\n\n if (inputInfo.shapeInfo.isUniform) {\n // Uniform arrays will be less than
65505 (no
risk of float16 overflow).\n return \n float ${funcName}(int row, int col, int depth, int depth2) {\n int
index = round(dot(vec4(row, col, depth, depth2),\n vec4(${stride0}, ${stride1}, ${stride2}, 1));\n
${getUniformSampler(inputInfo)}\n }\n `;\n }\n\n const flatOffset = inputInfo.shapeInfo.flatOffset;\n const
texShape = inputInfo.shapeInfo.texShape;\n const texNumR = texShape[0];\n const texNumC = texShape[1];\n\n
if (texNumC === stride0 && flatOffset == null) {\n // texC is used directly as physical (no risk of float16
overflow).\n return \n float ${funcName}(int row, int col, int depth, int depth2) {\n float texR =
float(row);\n float texC =\n dot(vec3(col, depth, depth2),\n vec3(${stride1}, ${stride2}, 1));\n
vec2 uv = (vec2(texC, texR) + halfCR) /\n vec2(${texNumC}.0, ${texNumR}.0);\n return
sampleTexture(${texName}, uv);\n }\n `;\n }\n

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};\n }\n if (texNumC === stride2 && flatOffset == null) {\n // texR is used directly as physical (no risk of
float16 overflow).\n return \n float ${funcName}(int row, int col, int depth, int depth2) {\n float texR =
dot(vec3(row, col, depth),\n vec3(${shape[1] * shape[2]}, ${shape[2]}, 1));\n float texC =
float(depth2);\n vec2 uv = (vec2(texC, texR) + halfCR) ^\n vec2(${texNumC}.0, ${texNumR}.0);\n
return sampleTexture(${texName}, uv);\n }\n `;\n }\n\n const offset =
getFlatOffsetUniformName(texName);\n return \n float ${funcName}(int row, int col, int depth, int depth2) {\n
// Explicitly use integer operations as dot() only works on floats.\n int index = row * ${stride0} + col *
${stride1} +\n depth * ${stride2} + depth2;\n vec2 uv = uvFromFlat(${texNumR}, ${texNumC}, index +
${offset});\n return sampleTexture(${texName}, uv);\n }\n `;\n }\n\nfunction getSampler5D(inputInfo:
InputInfo): string {\n const shape = inputInfo.shapeInfo.logicalShape;\n const texName = inputInfo.name;\n const
funcName = 'get' + texName.charAt(0).toUpperCase() + texName.slice(1);\n const stride3 = shape[4];\n const
stride2 = shape[3] * stride3;\n const stride1 = shape[2] * stride2;\n const stride0 = shape[1] * stride1;\n\n const
{newShape, keptDims} = util.squeezeShape(shape);\n if (newShape.length < shape.length) {\n const
newInputInfo = squeezeInputInfo(inputInfo, newShape);\n const params = ['row', 'col', 'depth', 'depth2', 'depth3'];\n
return \n ${getSamplerFromInInfo(newInputInfo)}\n float ${funcName}(int row, int col, int depth, int
depth2, int depth3) {\n return ${funcName}(${getSqueezedParams(params, keptDims)});\n }\n `;\n }\n\nif (inputInfo.shapeInfo.isUniform) {\n // Uniform arrays will be less than 65505 (no risk of float16 overflow).\n
return \n float ${funcName}(int row, int col, int depth,
int depth2, int depth3) {\n float index = dot(\n vec4(row, col, depth, depth2),\n vec4(${stride0},
${stride1}, ${stride2}, ${stride3})) +\n depth3;\n ${getUniformSampler(inputInfo)}\n }\n `;\n }\n\nconst flatOffset = inputInfo.shapeInfo.flatOffset;\n const texShape = inputInfo.shapeInfo.texShape;\n const
texNumR = texShape[0];\n const texNumC = texShape[1];\n\n if (texNumC === stride0 && flatOffset == null) {\n
// texC is used directly as physical (no risk of float16 overflow).\n return \n float ${funcName}(int row, int
col, int depth, int depth2, int depth3) {\n int texR = row;\n float texC = dot(vec4(col, depth, depth2,
depth3),\n vec4(${stride1}, ${stride2}, ${stride3}, 1));\n vec2 uv = (vec2(texC, texR) + halfCR)
^\n vec2(${texNumC}.0, ${texNumR}.0);\n return sampleTexture(${texName}, uv);\n }\n `;\n
}\n\n if (texNumC === stride3 &&
flatOffset == null) {\n // texR is used directly as physical (no risk of float16 overflow).\n return \n float
${funcName}(int row, int col, int depth, int depth2, int depth3) {\n float texR = dot(\n vec4(row, col,
depth, depth2),\n vec4(${shape[1] * shape[2] * shape[3]},\n ${shape[2] * shape[3]}, ${shape[3]},
1));\n int texC = depth3;\n vec2 uv = (vec2(texC, texR) + halfCR) ^\n vec2(${texNumC}.0,
${texNumR}.0);\n return sampleTexture(${texName}, uv);\n }\n `;\n }\n\n const offset =
getFlatOffsetUniformName(texName);\n return \n float ${funcName}(int row, int col, int depth, int depth2, int
depth3) {\n // Explicitly use integer operations as dot() only works on floats.\n int index = row * ${stride0} +
col * ${stride1} + depth * ${stride2} +\n depth2 * ${stride3} + depth3 + ${offset};\n vec2 uv =
uvFromFlat(${texNumR}, ${texNumC}, index);\n return sampleTexture(${texName},
uv);\n }\n `;\n }\n\nfunction getSampler6D(inputInfo: InputInfo): string {\n const shape =
inputInfo.shapeInfo.logicalShape;\n const texName = inputInfo.name;\n const funcName = 'get' +
texName.charAt(0).toUpperCase() + texName.slice(1);\n\n const {newShape, keptDims} =
util.squeezeShape(shape);\n if (newShape.length < shape.length) {\n const newInputInfo =
squeezeInputInfo(inputInfo, newShape);\n const params = ['row', 'col', 'depth', 'depth2', 'depth3', 'depth4'];\n
return \n ${getSamplerFromInInfo(newInputInfo)}\n float ${funcName}(int row, int col, int depth,\n
int depth2, int depth3, int depth4) {\n return ${funcName}(${getSqueezedParams(params, keptDims)});\n
}\n `;\n }\n\n const stride4 = shape[5];\n const stride3 = shape[4] * stride4;\n const stride2 = shape[3] *
stride3;\n const stride1 = shape[2] * stride2;\n const stride0 = shape[1] * stride1;\n\n if
(inputInfo.shapeInfo.isUniform) {\n //
Uniform arrays will be less than 65505 (no risk of float16 overflow).\n return \n float ${funcName}(int row,
int col, int depth,\n int depth2, int depth3, int depth4) {\n int index = round(dot(\n vec4(row,

```

```

col, depth, depth2),\n vec4(${stride0}, ${stride1}, ${stride2}, ${stride3})) +\n dot(\n
vec2(depth3, depth4),\n vec2(${stride4}, 1));\n ${getUniformSampler(inputInfo)}\n }\n `;\n\nconst flatOffset = inputInfo.shapeInfo.flatOffset;\n const texShape = inputInfo.shapeInfo.texShape;\n const
texNumR = texShape[0];\n const texNumC = texShape[1];\n if (texNumC === stride0 && flatOffset == null) {\n
// texC is used directly as physical (no risk of float16 overflow).\n return \n float ${funcName}(int row, int
col, int depth,\n int depth2, int depth3, int depth4) {\n int texR = row;\n float texC =
dot(vec4(col, depth, depth2, depth3),\n
 vec4(${stride1}, ${stride2}, ${stride3}, ${stride4})) +\n float(depth4);\n vec2 uv = (vec2(texC,
texR) + halfCR) /\n vec2(${texNumC}.0, ${texNumR}.0);\n return sampleTexture(${texName},
uv);\n }\n `;\n }\n if (texNumC === stride4 && flatOffset == null) {\n // texR is used directly as physical
(no risk of float16 overflow).\n return \n float ${funcName}(int row, int col, int depth,\n int
depth2, int depth3, int depth4) {\n float texR = dot(vec4(row, col, depth, depth2),\n vec4(${shape[1]} *
shape[2] * shape[3] * shape[4]),\n ${shape[2]} * shape[3] * shape[4]),\n ${shape[3]} * shape[4]),\n
 ${shape[4]})) + float(depth3);\n int texC = depth4;\n vec2 uv = (vec2(texC, texR) + halfCR) /\n
 vec2(${texNumC}.0, ${texNumR}.0);\n return sampleTexture(${texName}, uv);\n }\n `;\n }\n
const offset = getFlatOffsetUniformName(texName);\n
return \n float ${funcName}(int row, int col, int depth,\n int depth2, int depth3, int depth4) {\n //
Explicitly use integer operations as dot() only works on floats.\n int index = row * ${stride0} + col * ${stride1}
+ depth * ${stride2} +\n depth2 * ${stride3} + depth3 * ${stride4} + depth4 + ${offset};\n vec2 uv =
uvFromFlat(${texNumR}, ${texNumC}, index);\n return sampleTexture(${texName}, uv);\n }\n }\n
`;\n\nfunction getUniformSampler(inputInfo: InputInfo): string {\n const texName = inputInfo.name;\n const
inSize = util.sizeFromShape(inputInfo.shapeInfo.logicalShape);\n\n if (inSize < 2) {\n return \n return
${texName};\n }\n }\n return \n for (int i = 0; i < ${inSize}; i++) {\n if (i === index) {\n return
${texName}[i];\n }\n }\n }\n\nfunction getPackedSamplerAtOutputCoords(\n inputInfo: InputInfo,
outShapeInfo: ShapeInfo) {\n const texName = inputInfo.name;\n const
texFuncSnippet = texName.charAt(0).toUpperCase() + texName.slice(1);\n const funcName = 'get' +
texFuncSnippet + 'AtOutCoords';\n const inRank = inputInfo.shapeInfo.logicalShape.length;\n const outRank =
outShapeInfo.logicalShape.length;\n\n const broadcastDims = getBroadcastDims(\n
inputInfo.shapeInfo.logicalShape, outShapeInfo.logicalShape);\n\n const type = getCoordsDataType(outRank);\n
const rankDiff = outRank - inRank;\n let coordsSnippet: string;\n const fields = ['x', 'y', 'z', 'w', 'u', 'v'];\n\n if
(inRank === 0) {\n coordsSnippet = ";\n } else if (outRank < 2 && broadcastDims.length >= 1) {\n
coordsSnippet = 'coords = 0;'\n } else {\n coordsSnippet =\n broadcastDims.map(d => `coords.${fields[d +
rankDiff]} = 0;`)\n .join("\\n");\n }\n let unpackedCoordsSnippet = ";\n if (outRank < 2 && inRank > 0) {\n
unpackedCoordsSnippet = 'coords;'\n } else {\n unpackedCoordsSnippet = inputInfo.shapeInfo.logicalShape\n
 .map((s, i) => `coords.${fields[i + rankDiff]}`)\n .join(', ');\n }\n\n let output =
`return outputValue;`\n const inSize = util.sizeFromShape(inputInfo.shapeInfo.logicalShape);\n const
isInputScalar = inSize === 1;\n const outSize = util.sizeFromShape(outShapeInfo.logicalShape);\n const
isOutputScalar = outSize === 1;\n\n if (inRank === 1 && !isInputScalar && !isOutputScalar) {\n output = \n
return vec4(outputValue.xy, outputValue.xy);\n `;\n }\n else if (isInputScalar && !isOutputScalar) {\n if (outRank
=== 1) {\n output = \n return vec4(outputValue.x, outputValue.x, 0., 0.);`\n `;\n }\n else {\n output =
`\n return vec4(outputValue.x);\n `;\n }\n }\n else if (broadcastDims.length) {\n const rows = inRank - 2;\n
const cols = inRank - 1;\n if (broadcastDims.indexOf(rows) > -1 && broadcastDims.indexOf(cols) > -1) {\n
output = `return vec4(outputValue.x);`\n }\n }\n else if (broadcastDims.indexOf(rows) > -1) {\n output = `return vec4(outputValue.x, outputValue.y,`\n
 `outputValue.x, outputValue.y);`\n }\n else if (broadcastDims.indexOf(cols) > -1) {\n output = `return
vec4(outputValue.xx, outputValue.zz);`\n }\n }\n }\n return \n vec4 ${funcName}()\n {\n ${type} coords =
getOutputCoords();\n ${coordsSnippet}\n vec4 outputValue =

```



```

GPGPUContext, program: GPGPUProgram, inputs: TensorData[],\n output: TensorData): GPGPUBinary {\n
const userCode = program.userCode;\n const inputInfos: InputInfo[] = inputs.map((input, i) => {\n const
shapeInfo: ShapeInfo = {\n logicalShape: input.shape,\n texShape: input.isUniform ? null :
input.texData.texShape,\n isUniform: input.isUniform,\n isPacked: input.isUniform ? false :
input.texData.isPacked,\n flatOffset: null\n };\n if (input.texData
!= null && input.texData.slice != null &&\n input.texData.slice.flatOffset > 0) {\n shapeInfo.flatOffset =
input.texData.slice.flatOffset;\n }\n return {name: program.variableNames[i], shapeInfo};\n });\n const
inShapeInfos = inputInfos.map(x => x.shapeInfo);\n const outShapeInfo: ShapeInfo = {\n logicalShape:
output.shape,\n texShape: output.texData.texShape,\n isUniform: false,\n isPacked: output.texData.isPacked,\n
flatOffset: null\n };\n const source = shader_compiler.makeShader(\n inputInfos, outShapeInfo, userCode,
program.packedInputs);\n const webGLProgram = gpgpu.createProgram(source);\n // Add special uniforms
(NAN, INFINITY)\n let infLoc: WebGLUniformLocation = null;\n const nanLoc =
gpgpu.getUniformLocation(webGLProgram, 'NAN', false);\n if (env().getNumber('WEBGL_VERSION') === 1)
{\n infLoc = gpgpu.getUniformLocation(webGLProgram, 'INFINITY', false);\n }\n // Add user-defined
uniforms\n const uniformLocations:
{[name: string]: WebGLUniformLocation} = {};\n for (let i = 0; i < program.variableNames.length; i++) {\n
const varName = program.variableNames[i];\n const shouldThrow = false;\n uniformLocations[varName] =\n gpgpu.getUniformLocation(webGLProgram, varName, shouldThrow);\n uniformLocations[`offset${varName}`]
=\n gpgpu.getUniformLocation(webGLProgram, `offset${varName}`, shouldThrow);\n }\n return {\n
program,\n source,\n webGLProgram,\n uniformLocations,\n inShapeInfos,\n outShapeInfo,\n infLoc,\n
nanLoc,\n };\n}\n\nfunction validateBinaryAndProgram(\n shapeInfos: ShapeInfo[], inputs: TensorData[]) {\n if
(shapeInfos.length !== inputs.length) {\n throw Error(\n `Binary was compiled with ${shapeInfos.length}
inputs, but ` +\n `was executed with ${inputs.length} inputs`);\n }\n shapeInfos.forEach((s, i) => {\n const
shapeA = s.logicalShape;\n const input = inputs[i];\n const shapeB = input.shape;\n
 if (!util.arraysEqual(shapeA, shapeB)) {\n throw Error(\n `Binary was compiled with different shapes
than ` +\n `the current args. Shapes ${shapeA} and ${shapeB} must match`);\n }\n // The input is uploaded
as uniform.\n if (s.isUniform && input.isUniform) {\n return;\n }\n const texShapeA = s.texShape;\n
const texShapeB = input.isUniform ? null : input.texData.texShape;\n if (!util.arraysEqual(texShapeA,
texShapeB)) {\n throw Error(\n `Binary was compiled with different texture shapes than the ` +\n
 `current args. Shape ${texShapeA} and ${texShapeB} must match`);\n }\n });\n}\n\nexport function
runProgram<T extends Tensor, K extends Tensor>(\n gpgpu: GPGPUContext, binary: GPGPUBinary, inputs:
TensorData[],\n output: TensorData,\n customSetup?: (gpgpu: GPGPUContext, webGLProgram:
WebGLProgram) =>\n void): void {\n validateBinaryAndProgram(binary.inShapeInfos, inputs);\n validateBinaryAndProgram([binary.outShapeInfo],
[output]);\n const outTex = output.texData.texture;\n const outTexShape = output.texData.texShape;\n if
(output.texData.isPacked) {\n gpgpu.setOutputPackedMatrixTexture(outTex, outTexShape[0], outTexShape[1]);\n }
else {\n gpgpu.setOutputMatrixTexture(outTex, outTexShape[0], outTexShape[1]);\n }\n gpgpu.setProgram(binary.webGLProgram);\n // Set special uniforms (NAN, INFINITY)\n if
(env().getNumber('WEBGL_VERSION') === 1) {\n if (binary.infLoc !== null) {\n gpgpu.gl.uniform1f(binary.infLoc, Infinity);\n }\n if (binary.nanLoc !== null) {\n
gpgpu.gl.uniform1f(binary.nanLoc, NaN);\n }\n }\n // Set user-defined inputs\n inputs.forEach((input, i) => {\n
const varName = binary.program.variableNames[i];\n const varLoc = binary.uniformLocations[varName];\n const
varOffsetLoc = binary.uniformLocations[`offset${varName}`];\n if (varLoc == null) {\n // The
compiler inferred that this variable is not used
in this shader.\n return;\n }\n if (input.isUniform) {\n // Upload the values of the tensor as uniform.\n
if (util.sizeFromShape(input.shape) < 2) {\n gpgpu.gl.uniform1f(varLoc, input.uniformValues[0]);\n } else
{\n let vals = input.uniformValues;\n if (!(vals instanceof Float32Array)) {\n vals = new
Float32Array(vals);\n }\n gpgpu.gl.uniform1fv(varLoc, vals);\n }\n return;\n }\n }\n // If the input

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was sliced, upload the flat offset index.\n if (input.texData.slice != null && varOffsetLoc != null) {\n
 gpgpu.gl.uniform1i(varOffsetLoc, input.texData.slice.flatOffset);\n }\n\n
 gpgpu.setInputMatrixTexture(input.texData.texture, varLoc, i);\n });\n\n if (customSetup != null) {\n
 customSetup(gpgpu, binary.webGLProgram);\n }\n gpgpu.executeProgram();\n }\n\n export function
 makeShaderKey(\n program: GPGPUProgram, inputs: TensorData[], output: TensorData): string {\n let keyInputs
 =
 ";\n inputs.concat(output).forEach(x => {\n const hasOffset = x.texData != null && x.texData.slice != null &&\n
 x.texData.slice.flatOffset > 0;\n const texShape = x.isUniform ? 'uniform' : x.texData.texShape;\n keyInputs
 += `${x.shape}_${texShape}_${hasOffset}`;\n });\n const keyUserCode = program.userCode;\n let key =
 program.constructor.name;\n // Fast string concat. See https://jsperf.com/string-concatenation/14.\n key += '_' +
 keyInputs + '_' + keyUserCode;\n return key;\n }\n }"/**\n * @license\n * Copyright 2019 Google LLC. All Rights
 Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
 except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
 http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
 software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
 OR CONDITIONS OF
 ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n *
 limitations under the License.\n *
 =====\n
 *\n *\n import {TensorInfo, util} from '@tensorflow/tfjs-core';\n export function assertNotComplex(\n tensor:
 TensorInfo|TensorInfo[], opName: string): void {\n if (!Array.isArray(tensor)) {\n tensor = [tensor];\n }\n
 tensor.forEach(t => {\n if (t != null) {\n util.assert(\n t.dtype !== 'complex64',\n () => `${\n
 opName} does not support complex64 tensors in the CPU backend.`);\n }\n });\n }"/**\n * @license\n *
 Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
 License);\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
 License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required
 by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an AS IS
 BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
 License for the specific language governing permissions and\n * limitations under the License.\n *
 =====\n
 *\n *\n import {Abs, AbsInputs, KernelConfig, KernelFunc, TypedArray, util} from '@tensorflow/tfjs-
 core';\n import {MathBackendCPU} from './backend_cpu';\n import {assertNotComplex} from
 './cpu_util';\n export function simpleAbsImpl(vals: TypedArray): Float32Array {\n const resultValues = new
 Float32Array(vals.length);\n for (let i = 0; i < vals.length; ++i) {\n resultValues[i] = Math.abs(vals[i]);\n }\n
 return resultValues;\n }\n export const abs = (args: {inputs: AbsInputs, backend: MathBackendCPU}) => {\n const
 {x} = args.inputs;\n const cpuBackend = args.backend;\n \n assertNotComplex(x, 'abs');\n \n
 let resultValues = new Float32Array(util.sizeFromShape(x.shape));\n const values =
 cpuBackend.data.get(x.dataId).values as TypedArray;\n resultValues = simpleAbsImpl(values);\n \n return
 cpuBackend.makeOutput(resultValues, x.shape, 'float32');\n }\n export const absConfig: KernelConfig = {\n
 kernelName: Abs,\n backendName: 'cpu',\n kernelFunc: abs as {} as KernelFunc,\n };"/**\n * @license\n *
 Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
 "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
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 by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS"
 BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
 the specific language governing permissions and\n *
 limitations under the License.\n *
 =====\n

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*\n\nimport { backend_util, DataType, NumericDataType, TypedArray, util } from '@tensorflow/tfjs-
core';\n\nimport { SimpleBinaryKernelImpl, SimpleBinaryOperation } from './binary_types';\n\n/**\n * Template that
creates implementation for binary ops. Supports broadcast.\n */\n\nexport function createSimpleBinaryKernelImpl(op:
SimpleBinaryOperation):\n SimpleBinaryKernelImpl {\n return (aShape: number[], bShape: number[], aVals:
TypedArray,\n bVals: TypedArray, dtype: DataType): [TypedArray, number[]] => {\n const newShape =
backend_util.assertAndGetBroadcastShape(aShape, bShape);\n\n const resultRank = newShape.length;\n const
resultStrides = util.computeStrides(newShape);\n const resultSize = util.sizeFromShape(newShape);\n\n const
result =\n util.getTypedArrayFromDType(dtype as NumericDataType, resultSize);\n\n const aRank =
aShape.length;\n\n const bRank = bShape.length;\n\n const aStrides = util.computeStrides(aShape);\n const bStrides =
util.computeStrides(bShape);\n\n const aBroadcastDims = backend_util.getBroadcastDims(aShape, newShape);\n const
bBroadcastDims = backend_util.getBroadcastDims(bShape, newShape);\n\n if (aBroadcastDims.length +
bBroadcastDims.length === 0) {\n for (let i = 0; i < result.length; ++i) {\n result[i] = op(aVals[i %
aVals.length], bVals[i % bVals.length]);\n }\n } else {\n for (let i = 0; i < result.length; ++i) {\n const
loc = util.indexToLoc(i, resultRank, resultStrides);\n\n const aLoc = loc.slice(-aRank);\n\n aBroadcastDims.forEach(d => aLoc[d] = 0);\n const aIndex = util.locToIndex(aLoc, aRank, aStrides);\n\n const bLoc = loc.slice(-bRank);\n bBroadcastDims.forEach(d => bLoc[d] = 0);\n const bIndex =
util.locToIndex(bLoc, bRank, bStrides);\n\n result[i] = op(aVals[aIndex], bVals[bIndex]);\n }\n }\n\n return [result, newShape];\n };\n }\n}"/**\n * @license\n * Copyright 2020 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport { Complex, ComplexInputs, KernelConfig, KernelFunc, TensorInfo, TypedArray } from
'@tensorflow/tfjs-core';\n\nimport { MathBackendCPU } from '../backend_cpu';\n\nexport function complex(args:
{inputs: ComplexInputs,\n backend: MathBackendCPU}):\n TensorInfo {\n const {inputs, backend} = args;\n const {real, imag} =
inputs;\n\n const realVals = backend.data.get(real.dataId).values as TypedArray;\n const imagVals =
backend.data.get(imag.dataId).values as TypedArray;\n\n const complexInfo =
backend.makeTensorInfo(real.shape, 'complex64');\n\n const complex = backend.data.get(complexInfo.dataId);\n\n // The complex tensor owns the underlying real and imag tensorInfos, only the\n // complex tensor tracks refCount,
when complexData is disposed the\n // underlying tensorData will be disposed.\n complex.complexTensorInfos =
{\n real: backend.makeTensorInfo(real.shape, 'float32', realVals),\n imag: backend.makeTensorInfo(imag.shape,
'float32', imagVals)\n };\n\n return complexInfo;\n }\n\nexport const complexConfig: KernelConfig = {\n
kernelName: Complex,\n backendName: 'cpu',\n kernelFunc: complex as {} as KernelFunc\n};\n}"/**\n *
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Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport { DataType, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { MathBackendCPU } from
'../backend_cpu';\nimport { complex } from '../kernels/Complex';\n\n/**\n * Generates a tensorInfo with all zeros

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value.\n * @param backend cpu backend.\n * @param shape Shape for the zeros tensor.\n * @param dtype
Optional. If set, the
result has this dtype.\n *\nexport function zeros(\n backend: MathBackendCPU, shape: number[],\n dtype:
DataType = 'float32'): TensorInfo {\n if (dtype === 'complex64') {\n const real = zeros(backend, shape,
'float32');\n const imag = zeros(backend, shape, 'float32');\n return complex({inputs: {real, imag},
backend});\n }\n const values = util.makeZerosTypedArray(util.sizeFromShape(shape), dtype);\n return
backend.makeTensorInfo(shape, dtype, values);\n}\n"/**\n * @license\n * Copyright 2020 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *

```

```

=====\n
*/\n\nimport {Identity, IdentityInputs, KernelConfig, KernelFunc, TensorInfo} from '@tensorflow/tfjs-
core';\n\nimport {MathBackendCPU} from '../backend_cpu';\n\nexport function identity(\n args: {inputs:
IdentityInputs, backend: MathBackendCPU}): TensorInfo {\n const {inputs, backend} = args;\n const {x} =
inputs;\n backend.incRef(x.dataId);\n return {dataId: x.dataId, shape: x.shape, dtype: x.dtype};\n}\n\nexport
const identityConfig: KernelConfig = {\n kernelName: Identity,\n backendName: 'cpu',\n kernelFunc: identity as
{} as KernelFunc\n};\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain
a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by
applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS"
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *

```

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=====\n
*/\n\nimport {KernelConfig, KernelFunc, Real, RealInputs, TensorInfo} from '@tensorflow/tfjs-core';\n\nimport
{MathBackendCPU} from '../backend_cpu';\n\nexport function real(args: {inputs: RealInputs, backend:
MathBackendCPU}):\n TensorInfo {\n const {inputs, backend} = args;\n const {input} = inputs;\n const real =
backend.data.get(input.dataId).complexTensorInfos.real;\n const realVal = backend.data.get(real.dataId).values;\n\n
// When complex tensor is disposed, its underlying parts will
be disposed too.\n // Make new tensor out of the real value of the complex. This makes sure the\n // value is still
accessible even if complex tensor is disposed.\n return backend.makeTensorInfo(real.shape, real.dtype,
realVal);\n}\n\nexport const realConfig: KernelConfig = {\n kernelName: Real,\n backendName: 'cpu',\n kernelFunc: real as {} as KernelFunc\n};\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the
License.\n *

```

```

=====\n
*/\n\nimport {Cast, CastAttrs, CastInputs, KernelConfig, KernelFunc, TensorInfo, TypedArray, util} from
'@tensorflow/tfjs-core';\n\nimport {MathBackendCPU} from '../backend_cpu';\n\nimport
{createSimpleBinaryKernelImpl} from '../utils/binary_impl';\n\nimport {zeros} from '../utils/zeros_impl';\n\nimport

```



```

{complex} from './Complex';\nimport {identity} from './Identity';\nimport {real} from './Real';\n\nexport function
cast(\n args: {inputs: CastInputs, backend: MathBackendCPU, attrs: CastAttrs});\n TensorInfo {\n const
{inputs, backend, attrs} = args;\n const {x} = inputs;\n const {dtype} = attrs;\n\n // Casting to complex64.\n if
(dtype === 'complex64') {\n if (x.dtype === 'complex64') {\n return identity({inputs: {x}, backend});\n }\n\n const zerosTensorInfo = zeros(backend, x.shape, x.dtype);\n const floatX = cast({inputs: {x}, backend, attrs:
{dtype: 'float32'}});\n\n const result =\n complex({inputs: {real: floatX, imag: zerosTensorInfo}, backend});\n\n backend.disposeIntermediateTensorInfo(zerosTensorInfo);\n backend.disposeIntermediateTensorInfo(floatX);\n\n return result;\n }\n\n // Casting from complex64\n if (x.dtype === 'complex64') {\n const realPart =
real({inputs: {input: x}, backend});\n const result = cast({inputs: {x: realPart}, backend, attrs: {dtype}});\n\n backend.disposeIntermediateTensorInfo(realPart);\n\n return result;\n }\n\n if (!util.hasEncodingLoss(x.dtype,
dtype)) {\n // We don't change the underlying data, since we cast to higher\n // precision.\n const result =
identity({inputs: {x}, backend});\n return {dataId: result.dataId, shape: result.shape, dtype};\n }\n\n if (dtype
=== 'int32') {\n const values = backend.data.get(x.dataId).values as TypedArray;\n const resultValues =
Int32Array.from(values);\n return backend.makeTensorInfo(x.shape, 'int32', resultValues);\n }\n\n if (dtype === 'bool') {\n // This is essentially the result of notEqual(x, 0). We avoid using\n // kernel
notEqual to avoid circular dependency, i.e. binary_utils ->\n // cast -> notEqual -> binary_utils.\n const xVals =
backend.data.get(x.dataId).values as TypedArray;\n const zero = util.toTypedArray([0], x.dtype);\n\n const
[resultData, resultShape] = createSimpleBinaryKernelImpl(\n (a, b) => (a !== b) ? 1 : 0)(x.shape, [], xVals,
zero, 'bool');\n\n return backend.makeTensorInfo(resultShape, 'bool', resultData);\n }\n\n throw new Error(`Error
in Cast: failed to cast ${x.dtype} to ${dtype}`);\n\n\nexport const castConfig: KernelConfig = {\n kernelName:
Cast,\n backendName: 'cpu',\n kernelFunc: cast as {} as KernelFunc;\n};\n\n"/**\n * @license\n * Copyright 2020
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
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BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {backend_util, BinaryInputs, DataType, KernelFunc, TypedArray, util} from '@tensorflow/tfjs-
core';\n\nimport {MathBackendCPU} from './backend_cpu';\nimport {assertNotComplex} from
'./cpu_util';\nimport {cast} from './kernels/Cast';\nimport {complex} from './kernels/Complex';\n\nimport
{ComplexBinaryKernelImpl, ComplexBinaryOperation, SimpleBinaryKernelImpl} from './binary_types';\n\n/**\n *
Template that creates a `KernelFunc` for binary ops.\n * @param name Kernel name.\n * @param
binaryKernelImpl A `SimpleBinaryKernelImpl` for the kernel.\n * @param binaryKernelComplexImpl Optional. If
exists, represents a\n * `ComplexBinaryKernelImpl` for the kernel, will be used when input dtype\n * is
`complex64`.\n * @param dtype Optional. If set, the result has this dtype. Otherwise, the\n * result has the same
dtype as the first input. This is mainly used in\n * comparison kernels, such as Equal, Less, Greater, etc.\n
*/\n\nexport function binaryKernelFunc(\n name: string, simpleImpl: SimpleBinaryKernelImpl,\n complexImpl?:
ComplexBinaryKernelImpl, dtype?: DataType): KernelFunc {\n if (complexImpl == null) {\n return ({inputs,
backend}) => {\n const {a, b} = inputs as BinaryInputs;\n const cpuBackend = backend as
MathBackendCPU;\n\n assertNotComplex([a, b], name);\n const aVals =
cpuBackend.data.get(a.dataId).values as TypedArray;\n const bVals = cpuBackend.data.get(b.dataId).values as
TypedArray;\n\n const $dtype
= dtype || a.dtype;\n\n const [resultData, resultShape] =\n simpleImpl(a.shape, b.shape, aVals, bVals,
$dtype);\n\n return cpuBackend.makeTensorInfo(resultShape, $dtype, resultData);\n };\n }\n\n return ({inputs,
backend}) => {\n const {a, b} = inputs as BinaryInputs;\n const cpuBackend = backend as
MathBackendCPU;\n\n if (a.dtype === 'complex64' || b.dtype === 'complex64') {\n const $aComplex = cast(\n

```

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 {inputs: {x: a}, backend: cpuBackend, attrs: {dtype: 'complex64'}});
 const $aComplexVals =
 cpuBackend.data.get($aComplex.dataId);
 const aReal = $aComplexVals.complexTensorInfos.real;
 const aImag = $aComplexVals.complexTensorInfos.imag;
 const aRealVals =
 cpuBackend.data.get(aReal.dataId).values as Float32Array;
 const aImagVals =
 cpuBackend.data.get(aImag.dataId).values as Float32Array;
 const $bComplex = cast({inputs: {x: b},
 backend: cpuBackend, attrs: {dtype:
 'complex64'}});
 const $bComplexVals = cpuBackend.data.get($bComplex.dataId);
 const bReal =
 $bComplexVals.complexTensorInfos.real;
 const bImag = $bComplexVals.complexTensorInfos.imag;
 const bRealVals =
 cpuBackend.data.get(bReal.dataId).values as Float32Array;
 const bImagVals =
 cpuBackend.data.get(bImag.dataId).values as Float32Array;
 const [resultRealData, resultImagData,
 resultShape] = complexImpl(a.shape, b.shape, aRealVals, aImagVals, bRealVals, bImagVals);
 const resultReal =
 cpuBackend.makeTensorInfo(resultShape, 'float32', resultRealData);
 const resultImag =
 cpuBackend.makeTensorInfo(resultShape, 'float32', resultImagData);
 const result = complex({inputs: {real: resultReal, imag: resultImag}, backend: cpuBackend});
 cpuBackend.disposeIntermediateTensorInfo($aComplex);
 cpuBackend.disposeIntermediateTensorInfo($bComplex);
 cpuBackend.disposeIntermediateTensorInfo(resultReal);
 cpuBackend.disposeIntermediateTensorInfo(resultImag);
 return result;
 } else {
 const aVals =
 cpuBackend.data.get(a.dataId).values as TypedArray;
 const bVals = cpuBackend.data.get(b.dataId).values as
 TypedArray;
 const $dtype = dtype || a.dtype;
 const [resultData, resultShape] =
 simpleImpl(a.shape, b.shape, aVals, bVals, $dtype);
 return cpuBackend.makeTensorInfo(resultShape, $dtype,
 resultData);
 }
}
**/
Template that creates the complex type implementation for binary ops.
Supports broadcast.
export function createComplexBinaryKernelImpl(op: ComplexBinaryOperation):
ComplexBinaryKernelImpl {
 return (aShape: number[], bShape: number[], aRealVals: Float32Array,
 aImagVals: Float32Array, bRealVals: Float32Array,
 bImagVals: Float32Array): [TypedArray, TypedArray,
 number[]] => {
 const resultShape = backend_util.assertAndGetBroadcastShape(aShape,
 bShape);
 const resultSize = util.sizeFromShape(resultShape);
 const resultRank = resultShape.length;
 const resultStrides = util.computeStrides(resultShape);
 const resultRealVals =
 util.getTypedArrayFromDType('float32', resultSize);
 const resultImagVals =
 util.getTypedArrayFromDType('float32', resultSize);
 const aBroadcastDims =
 backend_util.getBroadcastDims(aShape, resultShape);
 const bBroadcastDims =
 backend_util.getBroadcastDims(bShape, resultShape);
 const aVals =
 backend_util.mergeRealAndImagArrays(aRealVals, aImagVals);
 const bVals =
 backend_util.mergeRealAndImagArrays(bRealVals, bImagVals);
 const aRank = aShape.length;
 const aStrides = util.computeStrides(aShape);
 const bRank = bShape.length;
 const bStrides =
 util.computeStrides(bShape);
 if (aBroadcastDims.length + bBroadcastDims.length === 0) {
 for (let i = 0;
 i < resultRealVals.length; i++) {
 const aIdx = i % aVals.length;
 const bIdx = i % bVals.length;
 const result =
 op(aVals[aIdx * 2], aVals[aIdx * 2 + 1], bVals[bIdx * 2],
 bVals[bIdx * 2 + 1]);
 resultRealVals[i] = result.real;
 resultImagVals[i] = result.imag;
 }
 } else {
 for (let i = 0; i < resultRealVals.length;
 i++) {
 const loc = util.indexToLoc(i, resultRank, resultStrides);
 const aLoc = loc.slice(-aRank);
 aBroadcastDims.forEach(d => aLoc[d] = 0);
 const aIndex = util.locToIndex(aLoc, aRank, aStrides);
 const bLoc = loc.slice(-bRank);
 bBroadcastDims.forEach(d => bLoc[d] = 0);
 const bIndex =
 util.locToIndex(bLoc, bRank, bStrides);
 const opResult =
 op(aVals[aIndex * 2], aVals[aIndex * 2 +
 1], bVals[bIndex * 2],
 bVals[bIndex * 2 + 1]);
 resultRealVals[i] = opResult.real;
 resultImagVals[i] = opResult.imag;
 }
 }
 }
}
return [resultRealVals, resultImagVals, resultShape];
}
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OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language  
governing permissions and\n \* limitations under the License.\n \*

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=====\n*\n\nimport {Add, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createSimpleBinaryKernelImpl} from\n './utils/binary_impl';\nimport {binaryKernelFunc, createComplexBinaryKernelImpl} from\n './utils/binary_utils';\n\nexport\n\nconst addImpl = createSimpleBinaryKernelImpl(((a, b) => a + b));\nexport const addComplexImpl =\ncreateComplexBinaryKernelImpl(((aReal, aImag, bReal, bImag) => {\n return {real: aReal + bReal, imag: aImag\n + bImag};\n }));\n\nexport const add = binaryKernelFunc(Add, addImpl, addComplexImpl);\n\nexport const\naddConfig: KernelConfig = {\n kernelName: Add,\n backendName: 'cpu',\n kernelFunc: add\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a\n copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n */\n\n=====\n
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=====\n*\n\nimport {buffer, DataType, Rank, TensorBuffer, TypedArray, util} from '@tensorflow/tfjs-core';\n\nexport\nfunction bincountImpl(\n xVals: TypedArray, weightsVals: TypedArray, weightsDtype: DataType,\n weightsShape: number[], size: number): TypedArray {\n const weightsSize = util.sizeFromShape(weightsShape);\n const outVals = util.makeZerosTypedArray(size, weightsDtype) as TypedArray;\n for (let i = 0; i < xVals.length;\n i++) {\n const value = xVals[i];\n if (value < 0) {\n throw new Error('Input x must be non-negative!');\n }\n if (value >= size) {\n continue;\n }\n if (weightsSize > 0) {\n outVals[value] +=\nweightsVals[i];\n } else {\n outVals[value] += 1;\n }\n }\n return outVals;\n}\n\nexport function\nbincountReduceImpl<R extends Rank>(\n xBuf: TensorBuffer<R>,\n weightsBuf: TensorBuffer<R>, size: number,\n binaryOutput = false): TensorBuffer<R> {\n const numRows =\nxBuf.shape[0];\n const numCols = xBuf.shape[1];\n const outBuf = buffer([numRows, size],\nweightsBuf.dtype);\n for (let i = 0; i < numRows; i++) {\n for (let j = 0; j < numCols; j++) {\n const value =\nxBuf.get(i, j);\n if (value < 0) {\n throw new Error('Input x must be non-negative!');\n }\n if (value\n>= size) {\n continue;\n }\n if (binaryOutput) {\n outBuf.set(1, i, value);\n } else {\n if\n(weightsBuf.size > 0) {\n outBuf.set(outBuf.get(i, value) + weightsBuf.get(i, j), i, value);\n } else {\n outBuf.set(outBuf.get(i, value) + 1, i, value);\n }\n }\n }\n }\n return outBuf as\nTensorBuffer<R>;\n}\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed\n under the Apache License, Version 2.0 (the \"License\");\n * you may\n not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n */\n\n=====\n
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=====\n*\n\nimport {NumericDataType, util} from '@tensorflow/tfjs-core';\nimport {SimpleUnaryImpl,\nSimpleUnaryOperation} from './unary_types';\n\n/**\n * Template that creates implementation for unary op.\n */\n\nexport function createSimpleUnaryImpl(op: SimpleUnaryOperation):\n SimpleUnaryImpl {\n return (values,\ndtype, attrs) => {\n const newValues =\nutil.getTypedArrayFromDType(dtype as NumericDataType,\nvalues.length);\n }\n}
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 for (let i = 0; i < values.length; ++i) {\n newValues[i] = op(values[i], attrs);\n }\n return newValues;\n };\n}\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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=====\n*\n\nimport {DataType, KernelFunc, TypedArray, UnaryInputs, util} from '@tensorflow/tfjs-core';\nimport {MathBackendCPU} from '../backend_cpu';\nimport {assertNotComplex} from '../cpu_util';\nimport {SimpleUnaryImpl, SimpleUnaryOperation} from '../unary_types';\n\n/**\n * Template that creates a `KernelFunc` for unary ops.\n * @param name Kernel name.\n * @param op A `SimpleUnaryOperation` for the kernel.\n * @param dtype Optional. If set, the result has this dtype. Otherwise, the\n * result has the same dtype as the input. This is mainly used in certain\n * kernels that return bool type, such as isFinite, isInf, etc.\n */\nexport function unaryKernelFunc(\n name: string, op: SimpleUnaryOperation, dtype?: DataType): KernelFunc {\n return ({inputs, attrs, backend}) => {\n const {x} = inputs as UnaryInputs;\n assertNotComplex(x, name);\n if (x.dtype === 'string' || dtype === 'string') {\n throw new Error('unaryKernelFunc does not support string input/output');\n }\n\n const cpuBackend = backend as MathBackendCPU;\n const values = cpuBackend.data.get(x.dataId).values as TypedArray;\n const xSize = util.sizeFromShape(x.shape);\n const $dtype = dtype || x.dtype;\n const newValues = util.getArrayFromDType($dtype, xSize);\n for (let i = 0; i < xSize; ++i) {\n newValues[i] = op(values[i], attrs);\n }\n return cpuBackend.makeTensorInfo(x.shape, $dtype, newValues);\n };\n}\n\n/**\n * Template that creates a `KernelFunc` for unary ops from the given\n * `SimpleUnaryImpl`.\n * @param name Kernel name.\n * @param unaryImpl A `SimpleUnaryImpl` that implements the op.\n * @param dtype Optional. If set, the result has this dtype. Otherwise, the\n * result has the same dtype as the input. This is mainly used in certain\n * kernels that return bool type, such as isFinite, isInf, etc.\n */\nexport function unaryKernelFuncFromImpl(\n name: string, unaryImpl: SimpleUnaryImpl, dtype?: DataType): KernelFunc {\n return ({inputs, attrs, backend}) => {\n const {x} = inputs as UnaryInputs;\n assertNotComplex(x, name);\n if (x.dtype === 'string' || dtype === 'string') {\n throw new Error('unaryKernelFunc does not support string input/output');\n }\n\n const cpuBackend = backend as MathBackendCPU;\n const values = cpuBackend.data.get(x.dataId).values as TypedArray;\n const $dtype = dtype || x.dtype;\n const newValues = unaryImpl(values, $dtype, attrs);\n return cpuBackend.makeTensorInfo(x.shape, $dtype, newValues);\n };\n}\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the License);\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an AS IS BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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=====\n*\n\nimport {Ceil, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createSimpleUnaryImpl} from '../utils/unary_impl';\nimport {unaryKernelFuncFromImpl} from '../utils/unary_utils';\n\nexport const ceilImpl = createSimpleUnaryImpl((xi) => Math.ceil(xi));\nexport const ceil = unaryKernelFuncFromImpl(Ceil, ceilImpl);\nexport const ceilConfig: KernelConfig = {\n kernelName: Ceil,\n backendName: 'cpu',\n kernelFunc: ceil,\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS
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=====\n*\n\nimport { backend_util, BackendValues, DataType, TypedArray, util } from '@tensorflow/tfjs-core';\n\nexport function concatImpl(\n inputs: Array<{ vals: BackendValues, shape: number[]}>, outShape: number[],\n dtype: DataType, simplyConcat: boolean): TypedArray|string[] {\n const outVals = util.getArrayFromDType(dtype,\n util.sizeFromShape(outShape));\n\n if (simplyConcat && dtype !== 'string') {\n // Use built-in TypedArray.set()\n method for speed.\n let offset = 0;\n inputs.forEach(input => {\n const size =\n util.sizeFromShape(input.shape);\n (outVals as TypedArray).set(input.vals as TypedArray, offset);\n offset\n += size;\n });\n } else {\n let colOffset = 0;\n inputs.forEach(input\n => {\n const decodedData = dtype === 'string' ?\n backend_util.fromUint8ToStringArray(input.vals as\n Uint8Array[]) :\n input.vals as TypedArray;\n let tIdx = 0;\n for (let row = 0; row < input.shape[0];\n ++row) {\n const resIdx = row * outShape[1] + colOffset;\n for (let col = 0; col < input.shape[1]; ++col) {\n outVals[resIdx + col] = decodedData[tIdx++];\n }\n colOffset += input.shape[1];\n }\n });\n\n return outVals;\n }\n}\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed\n * under the Apache License, Version 2.0 (the License);\n * you may not use this file except in compliance with the\n * License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n * on an AS IS BASIS,\n * WITHOUT WARRANTIES
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```
=====\n*\n\nimport { Exp, KernelConfig } from '@tensorflow/tfjs-core';\n\nimport { createSimpleUnaryImpl } from\n './utils/unary_impl';\nimport { unaryKernelFuncFromImpl } from './utils/unary_utils';\n\nexport const expImpl =\n createSimpleUnaryImpl((xi) => Math.exp(xi));\nexport const exp = unaryKernelFuncFromImpl(Exp,\n expImpl);\nexport const expConfig: KernelConfig = {\n kernelName: Exp,\n backendName: 'cpu',\n kernelFunc:\n exp,\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache\n * License, Version 2.0 (the License);\n * you may not use this file except in compliance with the License.\n * You\n * may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required\n * by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an AS IS\n * BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the\n * License for the specific language governing permissions and\n * limitations under the License.\n *
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```
=====\n*\n\nimport { Expm1, KernelConfig } from '@tensorflow/tfjs-core';\n\nimport { createSimpleUnaryImpl } from\n './utils/unary_impl';\nimport { unaryKernelFuncFromImpl } from './utils/unary_utils';\n\nexport const expm1Impl =\n createSimpleUnaryImpl((xi) => Math.expm1(xi));\nexport const expm1 = unaryKernelFuncFromImpl(Expm1,\n expm1Impl);\nexport const expm1Config: KernelConfig = {\n kernelName: Expm1,\n backendName: 'cpu',\n kernelFunc:\n expm1,\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed\n * under the Apache License, Version 2.0 (the License);\n * you may not use this\n * file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an AS IS BASIS,\n * WITHOUT WARRANTIES OR\n * CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing\n * permissions and\n * limitations under the License.\n *
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```
=====\n*\n\nimport { Floor, KernelConfig } from '@tensorflow/tfjs-core';\n\nimport { createSimpleUnaryImpl } from\n './utils/unary_impl';\nimport { unaryKernelFuncFromImpl } from './utils/unary_utils';\n\nexport const floorImpl =\n createSimpleUnaryImpl((xi) => Math.floor(xi));\nexport const floor = unaryKernelFuncFromImpl(Floor,
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floorImpl);\n\nexport const floorConfig: KernelConfig = {\n kernelName: Floor,\n backendName: 'cpu',\n kernelFunc: floor,\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an\n * \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
=====
\n
/\n\nimport {buffer, DataType, Rank, TensorBuffer} from '@tensorflow/tfjs-core';\n\nexport function gatherV2Impl<R extends Rank, D extends DataType>(\n xBuf: TensorBuffer<R, D>, indicesBuf: TensorBuffer<R, D>,\n flattenOutputShape: number[]): TensorBuffer<R, D> {\n const\n outBuf = buffer(flattenOutputShape, xBuf.dtype);\n for (let i = 0; i < outBuf.size; ++i) {\n const newLoc =\n outBuf.indexToLoc(i);\n const originalLoc: number[] = newLoc.slice();\n const batchIdx = originalLoc[0];\n const indicesIdx = originalLoc[2];\n const indicesIndex = indicesBuf.locToIndex([batchIdx, indicesIdx]);\n originalLoc[2] = indicesBuf.values[indicesIndex] as number;\n const originalIndex =\n xBuf.locToIndex(originalLoc);\n outBuf.values[i] = xBuf.values[originalIndex];\n }\n return outBuf as\n TensorBuffer<R, D>;\n}\n", "/\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed\n * under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the\n * License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless\n * required by applicable law or agreed to in writing, software\n * distributed\n * under the License is distributed\n * on\n * an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n * implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n * License.\n *
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\n
*/\n\nimport {Greater, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createSimpleBinaryKernelImpl}\n * from './utils/binary_impl';\n * import {binaryKernelFunc} from './utils/binary_utils';\n\nexport const greaterImpl =\n * createSimpleBinaryKernelImpl((a: number, b: number) => (a > b) ? 1 : 0);\n * export const greater =\n * binaryKernelFunc(Greater, greaterImpl, null /* complexImpl */, 'bool');\n * export const greaterConfig:\n * KernelConfig = {\n * kernelName: Greater,\n * backendName: 'cpu',\n * kernelFunc: greater\n * };}\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance\n * with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless\n * required by applicable law or agreed to in writing, software\n * distributed\n * under the License is\n * distributed on an\n * \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either\n * express or implied.\n * See the License for the specific language governing permissions and\n * limitations under\n * the License.\n *
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\n
*/\n\nimport {KernelConfig, Less} from '@tensorflow/tfjs-core';\n\nimport {createSimpleBinaryKernelImpl} from\n * './utils/binary_impl';\n * import {binaryKernelFunc} from './utils/binary_utils';\n\nexport const lessImpl =\n * createSimpleBinaryKernelImpl((a: number, b: number) => (a < b) ? 1 : 0);\n * export const less =\n * binaryKernelFunc(Less, lessImpl, null /* complexImpl */, 'bool');\n * export const lessConfig: KernelConfig = {\n * kernelName: Less,\n * backendName:\n * 'cpu',\n * kernelFunc: less\n * };}\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed\n * under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in\n * compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless\n * required by applicable law or agreed to in writing,

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=====\n*\n\nimport {TypedArray, util} from '@tensorflow/tfjs-core';\n\nexport function linspaceImpl(\n start: number,\n stop: number, num: number): TypedArray {\n const step = (stop - start) / (num - 1);\n\n const values =\n util.makeZerosTypedArray(num,\n 'float32');\n values[0] = start;\n for (let i = 1; i < values.length; i++) {\n values[i] = values[i - 1] + step;\n }\n\n return values;\n}\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under\n the Apache License, Version 2.0 (the License);\n * you may not use this file except in compliance with the\n License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n on an AS IS BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n License.\n *
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=====\n*\n\nimport {KernelConfig, Log} from '@tensorflow/tfjs-core';\n\nimport {createSimpleUnaryImpl} from\n '../utils/unary_impl';\n\nimport\n {unaryKernelFuncFromImpl} from '../utils/unary_utils';\n\nexport const logImpl = createSimpleUnaryImpl((xi) =>\n Math.log(xi));\n\nexport const log = unaryKernelFuncFromImpl(Log, logImpl);\n\nexport const logConfig:\n KernelConfig = {\n kernelName: Log,\n backendName: 'cpu',\n kernelFunc: log,\n };\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or\n agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n the specific language governing permissions and\n * limitations under the License.\n *
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=====\n*\n\nimport {DataType, NumericDataType, TypedArray, util} from '@tensorflow/tfjs-core';\n\nexport function\n maxImpl(\n aVals: TypedArray, reduceSize: number, outShape: number[],\n dtype: DataType): TypedArray {\n const vals = util.getTypedArrayFromDType(\n dtype as NumericDataType, util.sizeFromShape(outShape));\n\n for (let i = 0; i < vals.length; ++i) {\n const offset = i * reduceSize;\n let max = aVals[offset];\n for (let j = 0; j\n < reduceSize; ++j) {\n const value = aVals[offset + j];\n if (value > max) {\n max = value;\n }\n }\n vals[i] = max;\n }\n return vals;\n}\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in\n compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law\n or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n the specific language governing permissions and\n * limitations under the License.\n *
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=====\n*\n\nimport {KernelConfig, Maximum} from '@tensorflow/tfjs-core';\n\nimport {createSimpleBinaryKernelImpl}\n from '../utils/binary_impl';\n\nimport {binaryKernelFunc} from '../utils/binary_utils';\n\nexport const maximumImpl =\n createSimpleBinaryKernelImpl(\n ((aValue, bValue) => Math.max(aValue, bValue))); \n\nexport const maximum =\n binaryKernelFunc(Maximum, maximumImpl);\n\nexport const maximumConfig: KernelConfig = {\n kernelName:\n Maximum,\n backendName: 'cpu',\n kernelFunc: maximum\n};\n\n"/**\n * @license\n * Copyright 2020 Google\n LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n
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=====\n*\n\nimport { KernelConfig, Minimum } from '@tensorflow/tfjs-core';\nimport { createSimpleBinaryKernelImpl }\nfrom './utils/binary_impl';\nimport { binaryKernelFunc } from './utils/binary_utils';\n\nexport const minimumImpl =\ncreateSimpleBinaryKernelImpl(\n ((aValue, bValue) => Math.min(aValue, bValue)));\nexport const minimum =\nbinaryKernelFunc(Minimum, minimumImpl);\n\nexport const minimumConfig: KernelConfig\n= {\n kernelName: Minimum,\n backendName: 'cpu',\n kernelFunc: minimum\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n */
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=====\n*\n\nimport { KernelConfig, Multiply } from '@tensorflow/tfjs-core';\nimport { createSimpleBinaryKernelImpl }\nfrom './utils/binary_impl';\nimport { binaryKernelFunc, createComplexBinaryKernelImpl }\nfrom './utils/binary_utils';\n\nexport const multiplyImpl =\n createSimpleBinaryKernelImpl(((aValue, bValue) =>\naValue * bValue));\nexport const multiplyComplexImpl =\n createComplexBinaryKernelImpl(((aReal, aImag,\nbReal, bImag) => {\n return {\n real: aReal * bReal - aImag * bImag,\n imag: aReal * bImag + aImag *\nbReal\n };\n }));\n\nexport const multiply =\n binaryKernelFunc(Multiply, multiplyImpl,\nmultiplyComplexImpl);\n\nexport const multiplyConfig: KernelConfig = {\n kernelName: Multiply,\n backendName: 'cpu',\n kernelFunc: multiply\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights\n * Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file\n * except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the\n * License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY\n * KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
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=====\n*\n\nimport { DataType, KernelConfig, KernelFunc, Neg, TensorInfo, TypedArray, UnaryInputs, util } from\n '@tensorflow/tfjs-core';\nimport { MathBackendCPU } from './backend_cpu';\nimport { assertNotComplex } from\n './cpu_util';\nimport { multiplyImpl } from './Multiply';\n\nexport function negImpl(xVals: TypedArray, xShape:\n number[], xDtype: DataType):\n [TypedArray, number[]] {\n const minusOne =\n util.createScalarValue(-1 as\n { } as 'float32', xDtype) as TypedArray;\n return multiplyImpl([], xShape, minusOne, xVals, xDtype);\n}\n\nexport\nfunction neg(args: { inputs: UnaryInputs, backend: MathBackendCPU }):\n TensorInfo {\n const { inputs,\n backend } = args;\n const { x } =\n inputs;\n assertNotComplex(x, 'neg');\n const xVals = backend.data.get(x.dataId).values as TypedArray;\n const [res, newShape] = negImpl(xVals, x.shape, x.dtype);\n return backend.makeTensorInfo(newShape, x.dtype,\n res);\n}\n\nexport const negConfig: KernelConfig = {\n kernelName: Neg,\n backendName: 'cpu',\n kernelFunc:\n neg as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in\n * compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
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* =====\n
\n\nimport {KernelConfig, NotEqual} from '@tensorflow/tfjs-core';\n\nimport {createSimpleBinaryKernelImpl}\nfrom '../utils/binary_impl';\nimport {binaryKernelFunc} from '../utils/binary_utils';\n\nexport const notEqualImpl =\n createSimpleBinaryKernelImpl(((a, b) => (a !== b) ? 1 : 0));\n\nexport const notEqual =\n binaryKernelFunc(NotEqual, notEqualImpl, null / complexOp */, 'bool');\n\nexport const notEqualConfig:\n KernelConfig = {\n kernelName: NotEqual,\n backendName: 'cpu',\n kernelFunc: notEqual\n };

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*\n\nimport {DataType, NumericDataType, TypedArray} from '@tensorflow/tfjs-core';\n\nimport {util} from '@tensorflow/tfjs-core';\n\nexport function transposeImpl(\n xVals: TypedArray, xShape: number[], dtype:\n DataType, perm: number[],\n newShape: number[]): TypedArray {\n const xRank = xShape.length;\n const xSize = util.sizeFromShape(xShape);\n const xStrides = util.computeStrides(xShape);\n const newStrides = util.computeStrides(newShape);\n\n const result = util.getTypedArrayFromDType(\n dtype as NumericDataType, util.sizeFromShape(newShape));\n\n for (let i = 0; i < xSize; ++i) {\n const loc = util.indexToLoc(i, xRank, xStrides);\n\n // Permute location.\n const newLoc: number[] = new Array(loc.length);\n for (let i = 0; i < newLoc.length; i++) {\n newLoc[i] = loc[perm[i]];\n }\n\n const newIndex = util.locToIndex(newLoc, xRank, newStrides);\n result[newIndex] = xVals[i];\n }\n return result;\n}\n\n/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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*\n\nimport {KernelConfig, KernelFunc, TensorInfo, Transpose, TransposeAttrs, TransposeInputs, TypedArray}\nfrom '@tensorflow/tfjs-core';\n\nimport {MathBackendCPU} from '../backend_cpu';\n\nimport {assertNotComplex} from '../cpu_util';\n\nimport {transposeImpl} from './Transpose_impl';\n\nexport function transpose(args: {\n inputs: TransposeInputs,\n attrs: TransposeAttrs,\n backend: MathBackendCPU\n}): TensorInfo {\n const {inputs, attrs, backend} = args;\n const {x} = inputs;\n const {perm} = attrs;\n\n assertNotComplex(x, 'transpose');\n\n const xRank = x.shape.length;\n const newShape: number[] = new Array(xRank);\n for (let i = 0; i < newShape.length; i++) {\n newShape[i] = x.shape[perm[i]];\n }\n\n const values = backend.data.get(x.dataId).values as TypedArray;\n const result = transposeImpl(values, x.shape, x.dtype, perm, newShape);\n\n const dataId = backend.write(result, newShape, x.dtype);\n return {dataId, shape: newShape, dtype: x.dtype};\n}\n\nexport const transposeConfig: KernelConfig = {\n kernelName: Transpose,\n backendName: 'cpu',\n kernelFunc: transpose as {} as KernelFunc\n};

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=====\n*\n\nimport {backend_util, DataType, KernelConfig, KernelFunc, Prod, ProdAttrs, ProdInputs, TensorInfo, TypedArray, upcastType, util} from '@tensorflow/tfjs-core';\nimport {MathBackendCPU} from './backend_cpu';\nimport {assertNotComplex} from './cpu_util';\nimport {transpose} from './Transpose';\n\nexport function prodImpl(\n xShape: number[],\n xDtype: DataType, xVals: TypedArray,\n reductionAxes: number[]:\n {outVals: TypedArray, outShape: number[], outDtype: DataType} {\n const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(xShape, reductionAxes);\n const outDtype = upcastType(xDtype, 'int32');\n const outVals = util.makeZerosTypedArray(\n util.sizeFromShape(outShape), outDtype) as TypedArray;\n const reduceSize = util.sizeFromShape(reduceShape);\n for (let i = 0; i < outVals.length; ++i) {\n const offset = i * reduceSize;\n let prod = 1;\n for (let j = 0; j < reduceSize; ++j) {\n prod *= xVals[offset + j];\n }\n outVals[i] = prod;\n }\n return {outVals, outShape, outDtype};\n}\n\nexport function prod(\n args: {\n inputs: ProdInputs,\n backend: MathBackendCPU, attrs: ProdAttrs);\n TensorInfo {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {axis, keepDims} = attrs;\n assertNotComplex(x, 'prod');\n const xRank = x.shape.length;\n const axes = util.parseAxisParam(axis, x.shape);\n const permutation = backend_util.getAxesPermutation(axes, xRank);\n let reductionAxes = axes;\n let permutedX = x;\n const intermediateTensorInfos = [];\n if (permutation != null) {\n permutedX = transpose({inputs: {x}, backend, attrs: {perm: permutation}});\n intermediateTensorInfos.push(permutedX);\n reductionAxes = backend_util.getInnerMostAxes(reductionAxes.length, xRank);\n }\n const xVals = backend.data.get(permutedX.dataId).values as TypedArray;\n const {outVals, outShape, outDtype} =\n prodImpl(permutedX.shape, permutedX.dtype, xVals, reductionAxes);\n let resultShape = outShape;\n if (keepDims) {\n resultShape = backend_util.expandShapeToKeepDim(outShape, axes);\n }\n intermediateTensorInfos.forEach(\n t => backend.disposeIntermediateTensorInfo(t));\n return backend.makeTensorInfo(resultShape, outDtype, outVals);\n }\n}\n\nexport const prodConfig: KernelConfig = {\n kernelName: Prod,\n backendName: 'cpu',\n kernelFunc: prod as {} as KernelFunc;\n};\n\n/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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=====\n*\n\nimport {DataTypeMap, util} from '@tensorflow/tfjs-core';\n\nexport function rangeImpl(\n start: number, stop: number, step: number,\n dtype: 'float32'|'int32'): DataTypeMap['float32'|'int32'] {\n const sameStartStop = start === stop;\n const increasingRangeNegativeStep = start < stop && step < 0;\n const decreasingRangePositiveStep = stop < start && step > 1;\n if (sameStartStop || increasingRangeNegativeStep ||\n decreasingRangePositiveStep) {\n return util.makeZerosTypedArray(0, dtype);\n }\n const numElements = Math.abs(Math.ceil((stop - start) / step));\n const values = util.makeZerosTypedArray(numElements, dtype);\n if (stop < start && step === 1) {\n // Auto adjust the step's sign if it hasn't been set\n // (or was set to 1)\n step = -1;\n }\n values[0] = start;\n for (let i = 1; i < values.length; i++) {\n values[i] = values[i - 1] + step;\n }\n return values;\n}\n\n/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the License);\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
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=====\n*\n\nimport { KernelConfig, Rsqrt } from '@tensorflow/tfjs-core';\nimport { createSimpleUnaryImpl } from\n'./utils/unary_impl';\nimport { unaryKernelFuncFromImpl } from './utils/unary_utils';\nexport const rsqrtImpl =\ncreateSimpleUnaryImpl((xi) => 1 / Math.sqrt(xi));\nexport const rsqrt = unaryKernelFuncFromImpl(Rsqrt,\nrsqrtImpl);\n\nexport const rsqrtConfig: KernelConfig = {\n kernelName: Rsqrt,\n backendName: 'cpu',\n kernelFunc: rsqrt,\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed\n * under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the\n * License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n * on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n * implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n * License.\n */\n\n=====\n\n
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=====\n*\n\nimport { backend_util, BackendValues, buffer, DataType, KernelConfig, KernelFunc, Slice, slice_util,\nSliceAttrs, SliceInputs, TensorInfo,\nTypedArray, util } from '@tensorflow/tfjs-core';\nimport { MathBackendCPU } from './backend_cpu';\nimport\n{assertNotComplex } from './cpu_util';\nexport function sliceImpl(\n vals: BackendValues, begin: number[],\n size: number[], shape: number[],\n dtype: DataType): BackendValues {\n const isContinuous =\nslice_util.isSliceContinuous(shape, begin, size);\n const length = util.sizeFromShape(size);\n const xStrides =\nutil.computeStrides(shape);\n if (isContinuous) {\n const flatOffset = slice_util.computeFlatOffset(begin,\nxStrides);\n if (dtype === 'string') {\n return (vals as Uint8Array[]).slice(flatOffset, flatOffset + length);\n }\n return (vals as TypedArray).subarray(flatOffset, flatOffset + length);\n }\n const decodedData = dtype\n=== 'string' ?\n backend_util.fromUint8ToStringArray(vals as Uint8Array[]) :\n vals as TypedArray;\n const inBuf = buffer(shape, dtype, decodedData);\n const outBuf = buffer(size, dtype);\n for (let i =\n0; i < outBuf.size; ++i) {\n const outLoc = outBuf.indexToLoc(i);\n const inLoc = outLoc.map((idx: number, j)\n=> idx + begin[j]);\n outBuf.set(inBuf.get(...inLoc), ...outLoc);\n }\n if (dtype === 'string') {\n return\nbackend_util.fromStringArrayToUint8(outBuf.values as string[]);\n }\n return outBuf.values as\nTypedArray;\n}\n\nexport function slice(\n args: { inputs: SliceInputs, backend: MathBackendCPU, attrs:\nSliceAttrs }):\n TensorInfo {\n const { inputs, backend, attrs } = args;\n const { x } = inputs;\n const { begin, size } =\nattrs;\n assertNotComplex(x, 'slice');\n const [$begin, $size] = slice_util.parseSliceParams(x, begin, size);\n slice_util.assertParamsValid(x, $begin, $size);\n const vals = backend.data.get(x.dataId).values;\n const outVals\n= sliceImpl(vals, $begin, $size, x.shape, x.dtype);\n return backend.makeTensorInfo($size, x.dtype,\noutVals);\n}\n\nexport const sliceConfig: KernelConfig = {\n kernelName: Slice,\n backendName: 'cpu',\n kernelFunc: slice as { } as KernelFunc;\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights\n * Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file\n * except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n */\n\n=====\n\n
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=====\n*\n\nimport { KernelConfig, SquaredDifference } from '@tensorflow/tfjs-core';\nimport\n{createSimpleBinaryKernelImpl } from './utils/binary_impl';\nimport { binaryKernelFunc } from\n'./utils/binary_utils';\nexport const squaredDifferenceImpl
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= createSimpleBinaryKernelImpl(((a, b) => {\n const diff = a - b;\n return diff * diff;\n}));\nexport const
squaredDifference =\n binaryKernelFunc(SquaredDifference, squaredDifferenceImpl);\n\nexport const
squaredDifferenceConfig: KernelConfig = {\n kernelName: SquaredDifference,\n backendName: 'cpu',\n kernelFunc: squaredDifference\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in
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http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

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*/\n\nimport {buffer, Rank, TensorBuffer} from '@tensorflow/tfjs-core';\n\nexport function stridedSliceImpl<R
extends Rank>(\n outShape: number[], xBuf: TensorBuffer<R>, strides: number[],\n begin: number[]):\n TensorBuffer<R> {\n const outBuf = buffer(outShape, xBuf.dtype);\n for (let i = 0; i < outBuf.size; i++) {\n
const loc = outBuf.indexToLoc(i);\n const newLoc: number[] = new Array(loc.length);\n for (let j = 0; j <
newLoc.length; j++) {\n newLoc[j] = loc[j] * strides[j] + begin[j];\n }\n outBuf.set(xBuf.get(...newLoc),
...loc);\n }\n return outBuf as TensorBuffer<R>;\n}\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this
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express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *

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*/\n\nimport {KernelConfig, Sub} from '@tensorflow/tfjs-core';\n\nimport {createSimpleBinaryKernelImpl} from
'./utils/binary_impl';\nimport {binaryKernelFunc, createComplexBinaryKernelImpl} from
'./utils/binary_utils';\n\nexport const subImpl =\n createSimpleBinaryKernelImpl(((aValue, bValue) => aValue -
bValue));\nexport const subComplexImpl =\n createComplexBinaryKernelImpl(((aReal, aImag, bReal, bImag) =>
{\n return {real: aReal - bReal, imag: aImag - bImag};\n }));\nexport const sub = binaryKernelFunc(Sub,
subImpl, subComplexImpl);\n\nexport const subConfig:\n KernelConfig = {\n kernelName: Sub,\n backendName: 'cpu',\n kernelFunc: sub\n};\n\n"/**\n * @license\n *
Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *

```

```

=====\n
*/\n\nimport {buffer, DataType, Rank, TensorBuffer} from '@tensorflow/tfjs-core';\n\n/**\n * An implementation
of the tile kernel shared between webgl and cpu for string\n * tensors only.\n
*/\n\nexport function tileImpl<R extends Rank>(\n xBuf: TensorBuffer<R, DataType>,\n reps: number[]):\n TensorBuffer<R, DataType> {\n const newShape: number[] = new Array(xBuf.rank);\n for (let i = 0; i <
newShape.length; i++) {\n newShape[i] = xBuf.shape[i] * reps[i];\n }\n const result = buffer(newShape,
xBuf.dtype);\n for (let i = 0; i < result.values.length; ++i) {\n const newLoc = result.indexToLoc(i);\n const
originalLoc: number[] = new Array(xBuf.rank);\n for (let j = 0; j < originalLoc.length; j++) {\n originalLoc[j]
= newLoc[j] % xBuf.shape[j];\n }\n const originalIndex = xBuf.locToIndex(originalLoc);\n result.values[i]
= xBuf.values[originalIndex];\n }\n return result as TensorBuffer<R, DataType>;\n}\n\n"/**\n * @license\n *

```



```

data at [1, 0, 0] => \"4\"\\n // We got [1,4].\\n // Iteration 2: data at [0, 1, 0] => \"2\"\\n // Iteration 3: data at [1, 1, 0]
=> \"5\"\\n // We got [2,5].\\n // Iteration 4: data at [0, 2, 0] => \"3\"\\n // Iteration 5: data at [1, 2, 0] => \"6\"\\n // We
got [3,6].\\n const newShape = [1, shape[0], 1];\\n for (let i = 0; i < $axis; i++) {\\n newShape[0] *= shape[i];\\n }\\n
newShape[1] = shape[$axis];\\n for (let i = $axis + 1; i < shape.length; i++) {\\n newShape[2] *= shape[i];\\n }\\n\\n
// A map from unique elements (their string representations) to their values\\n // in \"indices\" (below).\\n const
uniqueElements: {[key: string]: number} = {};\\n // The indices of each unique element in the original tensor along
the given\\n // axis. It is 1D and has the same size as the given axis.\\n const indices = new
Int32Array(shape[$axis]);\\n // Create a buffer so we can easily extract value at a given location.\\n const
inputBuffer = new TensorBuffer(newShape, dtype, values as
 TypedArray);\\n // The indices along the given axis that have unique elements. This is a\\n // de-duped version of
\"indices\" above.\\n const uniqueIndices: number[] = [];\\n const is1DTensor = newShape[0] === 1 &&
newShape[2] === 1;\\n for (let i = 0; i < shape[$axis]; i++) {\\n // Extract values along the axis.\\n let element:
string;\\n if (is1DTensor) {\\n // Fast path for 1D tensor input.\\n element = values[i].toString();\\n } else {\\n
 const axisValues = [];\\n for (let m = 0; m < newShape[0]; m++) {\\n for (let n = 0; n < newShape[2]; n++)
{\\n axisValues.push(inputBuffer.get(m, i, n));\\n }\\n }\\n element = axisValues.join(',');\\n }\\n\\n
 Dedup and update various indices.\\n if (uniqueElements[element] !== undefined) {\\n indices[i] =
uniqueElements[element];\\n } else {\\n const uniqueIndex = Object.keys(uniqueElements).length;\\n
 uniqueElements[element] = uniqueIndex;\\n indices[i] = uniqueIndex;\\n
 uniqueIndices.push(i);\\n }\\n }\\n\\n // Now we know where each of the unique elements are located along the
axis\\n // (uniqueIndices). Extract them from input buffer and store them in the\\n // output buffer.\\n const
outputTmpShape = newShape.slice();\\n outputTmpShape[1] = Object.keys(uniqueElements).length;\\n const
outputBuffer = new TensorBuffer(outputTmpShape, dtype);\\n uniqueIndices.forEach((uniqueElementIndex, i) =>
{\\n for (let m = 0; m < newShape[0]; m++) {\\n for (let n = 0; n < newShape[2]; n++) {\\n
 outputBuffer.set(inputBuffer.get(m, uniqueElementIndex, n), m, i, n);\\n }\\n }\\n });\\n\\n // The output shape can
be calculated from the input shape with the size of\\n // the given axis replaced by the number of unique elements
along that axis.\\n const outputShape = shape.slice();\\n outputShape[$axis] = outputTmpShape[1];\\n\\n return {\\n
 outputValues: outputBuffer.values as BackendValues,\\n outputShape,\\n indices,\\n };\\n}\\n\", \"/*\\n
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2.0 (the \"License\");\\n * you may not use this file except in compliance with the License.\\n * You may obtain a
copy of the License at\\n * \\n * http://www.apache.org/licenses/LICENSE-2.0\\n * \\n * Unless required by applicable
law or agreed to in writing, software\\n * distributed under the License is distributed on an \"AS IS\" BASIS,\\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\\n * See the License for
the specific language governing permissions and\\n * limitations under the License.\\n *
=====\\n
*/\\n\\n// Shared functionality among backends.\\nexport {simpleAbsImpl} from './kernels/Abs';\\nexport {addImpl}
from './kernels/Add';\\nexport {bincountImpl, bincountReduceImpl} from './kernels/Bincount_impl';\\nexport
{ceilImpl} from './kernels/Ceil';\\nexport {concatImpl} from './kernels/Concat_impl';\\nexport
{expImpl} from './kernels/Exp';\\nexport {expm1Impl} from './kernels/Expm1';\\nexport {floorImpl} from
 './kernels/Floor';\\nexport {gatherV2Impl} from './kernels/GatherV2_impl';\\nexport {greaterImpl} from
 './kernels/Greater';\\nexport {lessImpl} from './kernels/Less';\\nexport {linSpaceImpl} from
 './kernels/LinSpace_impl';\\nexport {logImpl} from './kernels/Log';\\nexport {maxImpl} from
 './kernels/Max_impl';\\nexport {maximumImpl} from './kernels/Maximum';\\nexport {minimumImpl} from
 './kernels/Minimum';\\nexport {multiplyImpl} from './kernels/Multiply';\\nexport {negImpl} from
 './kernels/Neg';\\nexport {notEqualImpl} from './kernels/NotEqual';\\nexport {prodImpl} from
 './kernels/Prod';\\nexport {rangeImpl} from './kernels/Range_impl';\\nexport {rsqrtImpl} from
 './kernels/Rsqrt';\\nexport {sliceImpl} from './kernels/Slice';\\nexport {squaredDifferenceImpl} from
 './kernels/SquaredDifference';\\nexport {stridedSliceImpl} from './kernels/StridedSlice_impl';\\nexport {subImpl}
from './kernels/Sub';\\nexport

```

```
{tileImpl} from './kernels/Tile_impl';\nexport {topKImpl} from './kernels/TopK_impl';\nexport {transposeImpl}\nfrom './kernels/Transpose_impl';\nexport {uniqueImpl} from './kernels/Unique_impl';\nexport\n{ComplexBinaryKernelImpl, SimpleBinaryKernelImpl} from './utils/binary_types';\n", "\n/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n *\n
```

```
=====\n *\n// Import shared functionality from tfjs-backend-cpu without triggering\n// side effects.\n// tslint:disable-next-line: no-imports-from-dist\nimport * as shared from '@tensorflow/tfjs-backend-cpu/dist/shared';\n// tslint:disable-next-line: no-imports-from-dist\nimport {SimpleBinaryKernelImpl} from '@tensorflow/tfjs-backend-cpu/dist/shared';\n// tslint:disable-next-line: no-imports-from-dist\nimport {SimpleUnaryImpl} from '@tensorflow/tfjs-backend-cpu/dist/utils/unary_types';\n\nexport type SimpleBinaryKernelImplCPU = SimpleBinaryKernelImpl;\nexport type SimpleUnaryKernelImplCPU = SimpleUnaryImpl;\n\nconst {\n addImpl: addImplCPU,\n bincountImpl: bincountImplCPU,\n bincountReduceImpl: bincountReduceImplCPU,\n ceilImpl: ceilImplCPU,\n concatImpl: concatImplCPU,\n expImpl: expImplCPU,\n expm1Impl: expm1ImplCPU,\n floorImpl: floorImplCPU,\n gatherV2Impl: gatherV2ImplCPU,\n greaterImpl: greaterImplCPU,\n lessImpl: lessImplCPU,\n linSpaceImpl: linSpaceImplCPU,\n logImpl: logImplCPU,\n maxImpl: maxImplCPU,\n maximumImpl: maximumImplCPU,\n minimumImpl: minimumImplCPU,\n multiplyImpl: multiplyImplCPU,\n negImpl: negImplCPU,\n prodImpl: prodImplCPU,\n rangeImpl: rangeImplCPU,\n rsqrtImpl: rsqrtImplCPU,\n simpleAbsImpl: simpleAbsImplCPU,\n sliceImpl: sliceImplCPU,\n stridedSliceImpl: stridedSliceImplCPU,\n subImpl: subImplCPU,\n tileImpl: tileImplCPU,\n topKImpl: topKImplCPU,\n transposeImpl: transposeImplCPU,\n uniqueImpl: uniqueImplCPU,\n} = shared;\n\nexport {\n addImplCPU,\n bincountImplCPU,\n bincountReduceImplCPU,\n ceilImplCPU,\n concatImplCPU,\n expImplCPU,\n expm1ImplCPU,\n floorImplCPU,\n gatherV2ImplCPU,\n greaterImplCPU,\n lessImplCPU,\n linSpaceImplCPU,\n logImplCPU,\n maxImplCPU,\n maximumImplCPU,\n minimumImplCPU,\n multiplyImplCPU,\n negImplCPU,\n prodImplCPU,\n simpleAbsImplCPU,\n sliceImplCPU,\n stridedSliceImplCPU,\n subImplCPU,\n rangeImplCPU,\n rsqrtImplCPU,\n tileImplCPU,\n topKImplCPU,\n transposeImplCPU,\n uniqueImplCPU,\n};\n", "\n/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *\n
```

```
=====\n *\nexport function getVecChannels(name: string, rank: number): string[] {\n return ['x', 'y', 'z', 'w', 'u', 'v'].slice(0, rank).map(d => `${name}.${d}`);\n}\n\nexport function getChannels(name: string, rank: number): string[] {\n if (rank === 1) {\n return [name];\n }\n return getVecChannels(name, rank);\n}\n\nexport function getSourceCoords(rank: number, dims: string[]): string {\n if (rank === 1) {\n return 'rc';\n }\n let coords = '';\n for (let i = 0; i < rank; i++) {\n coords += dims[i];\n if (i < rank - 1) {\n coords += ',';\n }\n }\n return coords;\n}\n", "\n/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
```

implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\n\nimport {GPGPUProgram} from './gpgpu_math';\nimport {getChannels} from './packing_util';\nimport {getCoordsDataType} from './shader_compiler';\n\nexport class PackProgram implements GPGPUProgram {\n variableNames = ['A'];\n outputShape: number[];\n userCode: string;\n packedInputs = false;\n packedOutput = true;\n\n constructor(\n outputShape: number[]\n) {\n //\n // Only input / output 3D tensors.\n this.outputShape = outputShape;\n const rank = outputShape.length;\n\n if (rank === 0) {\n this.userCode =\n `\n void main() {\n setOutput(vec4(getA(), 0., 0., 0.));\n }\n `;\n } else {\n const channels =\n getChannels('rc', rank);\n const dtype = getCoordsDataType(rank);\n const outOfBoundsCondition =\n getOutOfBoundsCondition(rank,\n outputShape, channels);\n const setup = getSetup(\n rank, outputShape[outputShape.length - 1],\n outputShape[outputShape.length - 2], channels);\n const output = getOutput(outputShape, channels);\n\n this.userCode = `\n void main() {\n ${dtype} rc = getOutputCoords();\n if(${outOfBoundsCondition}) {\n setOutput(vec4(0));\n } else {\n ${setup}\n setOutput(vec4(${output}));\n }\n }\n `;\n }\n\n function getSourceCoordsArr(rank: number,\n dims: string[]): string[] {\n const coords = [];\n\n for (let row = 0; row <= 1; row++) {\n for (let col = 0; col <= 1;\n col++) {\n let coord = `${row === 0 ? 'r' : 'rp1'}`;\n for (let d = 2; d < rank; d++) {\n coord = `${dims[dims.length - 1 - d]}` + coord;\n }\n coords.push(coord);\n }\n }\n }\n\n return coords;\n }\n\n function getOutOfBoundsCondition(\n rank: number, shape: number[], dims: string[]): string {\n if (rank === 1) {\n return `rc > ${shape[0]}`;\n }\n\n let cond = `";\n for (let i = rank - 2; i < rank; i++) {\n cond += `${dims[i]} >= ${shape[i]}`;\n if (i < rank - 1) {\n cond += `|";\n }\n }\n return cond;\n }\n\n function getSetup(\n rank: number, cols: number, rows: number,\n dims: string[]): string {\n if (rank === 1) {\n return `";\n }\n\n const innerDims = dims.slice(-2);\n return `\n int r = ${innerDims[0]};\n int c = ${innerDims[1]};\n int rp1 = r + 1;\n int cp1 = c + 1;\n bool cEdge = cp1\n >= ${cols};\n bool rEdge = rp1 >= ${rows};\n `;\n }\n\n function getOutput(shape: number[], dims: string[]):\n string {\n const rank = shape.length;\n const sourceCoords = getSourceCoordsArr(rank, dims);\n if (rank === 1)\n {\n return `getA(rc),\n rc + 1 >= ${shape[0]} ? 0. : getA(rc + 1),\n 0, 0`;\n }\n return\n `getA(${sourceCoords[0]}),\n cEdge ? 0. : getA(${sourceCoords[1]}),\n rEdge ? 0. : getA(${sourceCoords[2]}),\n rEdge || cEdge ?\n 0. : getA(${sourceCoords[3]})`;\n }\n\n `**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in\n * compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS"\n * BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n *\n `;\n }\n\n =====\n*\n\nimport {GPGPUProgram} from './gpgpu_math';\nimport * as shader_util from\n './shader_compiler_util';\n\nexport class\n ReshapePackedProgram implements GPGPUProgram {\n variableNames = ['A'];\n packedInputs = true;\n packedOutput = true;\n outputShape: number[];\n userCode: string;\n\n constructor(outputShape: [number,\n number, number], inputShape: [number, number, number]\n) {\n this.outputShape = outputShape;\n\n let\n mainLoop = ``;\n for (let i = 0; i < 4; i++) {\n let thisRC = `thisRC = rc`;\n if (i % 2 === 1) {\n thisRC\n += `thisRC.z += 1`;\n }\n if (i > 1) {\n thisRC\n += `thisRC.y += 1`;\n }\n mainLoop += `\n ${thisRC}\n ${i > 0 ? `if(thisRC.y < rows && thisRC.z < cols){` : `}`}\n int flatIndex =\n getFlatIndex(thisRC);\n ivec3 inputRC = inputCoordsFromReshapedOutCoords(flatIndex);\n vec2`;\n }\n }\n\n =====
```



```

inputRCInnerDims = vec2(float(inputRC.y),float(inputRC.z));\n\n result[${i}] =\n
getChannel(getA(inputRC.x, inputRC.y, inputRC.z), inputRCInnerDims);\n ${i > 0 ? '}' : ''}\n
};\n }\n\n this.userCode = \n ${getReshapedInputCoords(inputShape)}\n
${shader_util.getFlatIndexFrom3D(outputShape)}\n\n void main() {\n ivec3 rc = getOutputCoords();\n
vec4 result = vec4(0.);\n\n ivec3 thisRC;\n int rows = ${outputShape[1]};\n int cols =
${outputShape[2]};\n\n ${mainLoop}\n\n setOutput(result);\n }\n\n }\n\n\nfunction
getReshapedInputCoords(shape: [number, number, number]): string {\n const coordsFromIndexSnippet =\n
shader_util.getLogicalCoordinatesFromFlatIndex(['r', 'c', 'd'], shape);\n\n return \n ivec3
inputCoordsFromReshapedOutCoords(int index) {\n ${coordsFromIndexSnippet}\n return ivec3(r, c, d);\n
}\n\n `;\n\n"/**\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
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agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {env} from '@tensorflow/tfjs-core';\n\nimport {GPGPUContext} from './gpgpu_context';\n\nimport
{getInternalFormatForFloat16MatrixTexture, getInternalFormatForFloat16PackedMatrixTexture,
getInternalFormatForFloat32MatrixTexture, getInternalFormatForPackedMatrixTexture,
getInternalFormatForUnsignedBytesMatrixTexture} from './gpgpu_util';\n\nimport
{getPackedMatrixTextureShapeWidthHeight, getUnpackedMatrixTextureShapeWidthHeight, PhysicalTextureType,
TextureConfig, TextureUsage} from './tex_util';\n\nexport class
TextureManager {\n private numUsedTextures = 0;\n private numFreeTextures = 0;\n private
_numBytesAllocated = 0;\n private _numBytesFree = 0; // How many bytes that have been allocated\n
// are available for reuse.\n private freeTextures: {[shape: string]: WebGLTexture[]} = {};\n private
logEnabled = false;\n private usedTextures: {[shape: string]: WebGLTexture[]} = {};\n\n constructor(private
gpgpu: GPGPUContext) {\n\n acquireTexture(\n shapeRC: [number, number], usage: TextureUsage,\n
isPacked: boolean): WebGLTexture {\n const physicalTexType = getPhysicalFromLogicalTextureType(usage,
isPacked);\n\n const shapeKey = getKeyFromTextureShape(shapeRC, physicalTexType, isPacked);\n if
(!shapeKey in this.freeTextures) {\n this.freeTextures[shapeKey] = [];\n }\n if
(!shapeKey in this.usedTextures) {\n this.usedTextures[shapeKey] = [];\n }\n\n const texBytes = computeBytes(\n
shapeRC, physicalTexType,
this.gpgpu.gl, this.gpgpu.textureConfig,\n isPacked);\n\n if (this.freeTextures[shapeKey].length > 0) {\n
this.numFreeTextures--;\n this.numUsedTextures++;\n this._numBytesFree -= texBytes;\n this.log();\n const newTexture = this.freeTextures[shapeKey].shift();\n this.usedTextures[shapeKey].push(newTexture);\n return newTexture;\n }\n\n let newTexture: WebGLTexture;\n if (physicalTexType ===
PhysicalTextureType.PACKED_2X2_FLOAT32) {\n newTexture =
this.gpgpu.createPackedMatrixTexture(shapeRC[0], shapeRC[1]);\n } else if (physicalTexType ===
PhysicalTextureType.PACKED_2X2_FLOAT16) {\n newTexture =\n this.gpgpu.createFloat16PackedMatrixTexture(shapeRC[0], shapeRC[1]);\n } else if (physicalTexType ===
PhysicalTextureType.UNPACKED_FLOAT32) {\n newTexture =\n this.gpgpu.createFloat32MatrixTexture(shapeRC[0], shapeRC[1]);\n } else if (physicalTexType ===
PhysicalTextureType.UNPACKED_FLOAT16) {\n newTexture =\n this.gpgpu.createFloat16MatrixTexture(shapeRC[0], shapeRC[1]);\n } else if (\n physicalTexType === PhysicalTextureType.PACKED_4X1_UNSIGNED_BYTE) {\n newTexture =\n this.gpgpu.createUnsignedBytesMatrixTexture(shapeRC[0], shapeRC[1]);\n }\n\n this.usedTextures[shapeKey].push(newTexture);\n\n this.numUsedTextures++;\n this._numBytesAllocated +=

```

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texBytes;\n this.log();\n\n return newTexture;\n }\n\n releaseTexture(\n texture: WebGLTexture, shape:
[number, number],\n logicalTexType: TextureUsage, isPacked: boolean): void {\n if (this.freeTextures == null)
{\n // Already disposed.\n return;\n }\n const physicalTexType =\n getPhysicalFromLogicalTextureType(logicalTexType, isPacked);\n const shapeKey =
getKeyFromTextureShape(shape, physicalTexType, isPacked);\n if (!(shapeKey in this.freeTextures)) {\n
this.freeTextures[shapeKey] = [];\n }\n\n const texBytes = computeBytes(\n
shape, physicalTexType, this.gpgpu.gl, this.gpgpu.textureConfig,\n isPacked);\n const
deleteTexThreshold = env().get('WEBGL_DELETE_TEXTURE_THRESHOLD');\n if (deleteTexThreshold !== -
1 &&\n this._numBytesAllocated > deleteTexThreshold) {\n this.gpgpu.deleteMatrixTexture(texture);\n
this._numBytesAllocated -= texBytes;\n } else {\n this.freeTextures[shapeKey].push(texture);\n
this.numFreeTextures++;\n this._numBytesFree += texBytes;\n }\n\n this.numUsedTextures--;\n\n const
texList = this.usedTextures[shapeKey];\n const texIndex = texList.indexOf(texture);\n if (texIndex < 0) {\n
throw new Error(\n 'Cannot release a texture that was never provided by this ' +\n 'texture manager');\n
}\n texList.splice(texIndex, 1);\n this.log();\n }\n\n private log() {\n if (!this.logEnabled) {\n return;\n
}\n\n const total = this.numFreeTextures + this.numUsedTextures;\n console.log(\n
'Free/Used', `${this.numFreeTextures} / ${this.numUsedTextures}`,\n `(${total})`);\n const freeRatio =
this._numBytesFree / this._numBytesAllocated;\n console.log(`Bytes allocated: ${this._numBytesAllocated}`);\n
console.log(`Bytes unused: ${this._numBytesFree} (${Math.round(100 * freeRatio)}%)`);\n }\n\n get
numBytesAllocated(): number {\n return this._numBytesAllocated;\n }\n\n get numBytesFree(): number {\n
return this._numBytesFree;\n }\n\n getNumUsedTextures(): number {\n return this.numUsedTextures;\n }\n\n
getNumFreeTextures(): number {\n return this.numFreeTextures;\n }\n\n dispose() {\n if (this.freeTextures ==
null) {\n // Already disposed.\n return;\n }\n for (const texShape in this.freeTextures) {\n
this.freeTextures[texShape].forEach(tex => {\n this.gpgpu.deleteMatrixTexture(tex);\n });\n }\n for
(const texShape in this.usedTextures) {\n this.usedTextures[texShape].forEach(tex
=> {\n this.gpgpu.deleteMatrixTexture(tex);\n });\n }\n this.freeTextures = null;\n this.usedTextures =
null;\n this.numUsedTextures = 0;\n this.numFreeTextures = 0;\n this._numBytesAllocated = 0;\n
this._numBytesFree = 0;\n }\n}\n\nfunction numBytesForInternalFormat(\n gl: WebGLRenderingContext,
internalFormat: number): number {\n // tslint:disable-next-line:no-any\n const glany = gl as any;\n if
(internalFormat === glany.R32F) {\n return 4;\n } else if (internalFormat === glany.R16F) {\n return 2;\n }
else if (internalFormat === glany.RGBA32F) {\n return 16;\n } else if (internalFormat === gl.RGBA) {\n
return 16;\n } else if (internalFormat === glany.RGBA16F) {\n return 8;\n }\n throw new Error(`Unknown
internal format ${internalFormat}`);\n }\n\nexport function computeBytes(\n shape: [number, number],
physicalTexType: PhysicalTextureType,\n gl: WebGLRenderingContext, textureConfig: TextureConfig,\n
isPacked:
boolean): number {\n // It is not possible to infer packed status from the texture type because\n // depending on the
textureConfig, different texture types may resolve to the\n // same internal format (e.g. in WebGL1, the internal
format for\n // UNPACKED_FLOAT16 textures is gl.RGBA). Therefore we pass in `isPacked`\n // explicitly.\n
const internalFormat =\n internalFormatForPhysicalTexType(physicalTexType, textureConfig);\n let
numElements: number;\n if (isPacked) {\n const [packedWidth, packedHeight] =\n
getPackedMatrixTextureShapeWidthHeight(shape[0], shape[1]);\n numElements = packedWidth *
packedHeight;\n\n } else {\n const [width, height] =\n
getUnpackedMatrixTextureShapeWidthHeight(shape[0], shape[1]);\n numElements = width * height;\n }\n\n
const bytesPerElement = numBytesForInternalFormat(gl, internalFormat);\n return numElements *
bytesPerElement;\n }\n\nfunction internalFormatForPhysicalTexType(\n physicalTexType:
PhysicalTextureType,\n
textureConfig: TextureConfig): number {\n switch (physicalTexType) {\n case
PhysicalTextureType.PACKED_2X2_FLOAT32:\n return
getInternalFormatForPackedMatrixTexture(textureConfig);\n case

```

```

PhysicalTextureType.PACKED_2X2_FLOAT16;\n return
getInternalFormatForFloat16PackedMatrixTexture(textureConfig);\n case
PhysicalTextureType.UNPACKED_FLOAT32;\n return
getInternalFormatForFloat32MatrixTexture(textureConfig);\n case
PhysicalTextureType.UNPACKED_FLOAT16;\n return
getInternalFormatForFloat16MatrixTexture(textureConfig);\n case
PhysicalTextureType.PACKED_4X1_UNSIGNED_BYTE;\n return
getInternalFormatForUnsignedBytesMatrixTexture(textureConfig);\n default;\n throw new Error(`Unknown
physical texture type ${physicalTexType}`);\n }\n}\n\nfunction getPhysicalTextureForRendering(isPacked:
boolean);\n PhysicalTextureType {\n if (env().getBool('WEBGL_RENDER_FLOAT32_ENABLED')) {\n if
(isPacked) {\n return PhysicalTextureType.PACKED_2X2_FLOAT32;\n
 }\n return PhysicalTextureType.UNPACKED_FLOAT32;\n }\n if (isPacked) {\n return
PhysicalTextureType.PACKED_2X2_FLOAT16;\n }\n return
PhysicalTextureType.UNPACKED_FLOAT16;\n }\n}\n\nfunction getPhysicalFromLogicalTextureType(\n
logicalTexType: TextureUsage, isPacked: boolean): PhysicalTextureType {\n if (logicalTexType ===
TextureUsage.UPLOAD) {\n return PhysicalTextureType.PACKED_2X2_FLOAT32;\n } else if (logicalTexType
=== TextureUsage.RENDER || logicalTexType === null) {\n return getPhysicalTextureForRendering(isPacked);\n
 } else if (\n logicalTexType === TextureUsage.DOWNLOAD ||\n logicalTexType ===
TextureUsage.PIXELS) {\n return PhysicalTextureType.PACKED_4X1_UNSIGNED_BYTE;\n }\n throw new
Error(`Unknown logical texture type ${logicalTexType}`);\n }\n}\n\nfunction getKeyFromTextureShape(\n
shapeRowsCol: [number, number], physicalTexType: PhysicalTextureType, \n isPacked: boolean): string {\n
return `${shapeRowsCol[0]}_${shapeRowsCol[1]}_${physicalTexType}_${isPacked}`;\n }\n },"/**\n
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {GPGPUProgram} from './gpgpu_math';\n\nexport class UnaryOpProgram implements
GPGPUProgram {\n variableNames = ['A'];\n userCode: string;\n outputShape: number[];\n\n constructor(aShape: number[], opSnippet:
string) {\n this.outputShape = aShape;\n this.userCode = `\n float unaryOperation(float x) {\n
${opSnippet}\n }\n\n void main() {\n float x = getAAtOutCoords();\n float y =
unaryOperation(x);\n\n setOutput(y);\n }\n `;\n }\n}\n\nexport const CHECK_NAN_SNIPPET = `if
(isnan(x)) return x;`; \n\nexport const LINEAR = `return x;`; \n\nexport const ABS = `return abs(x);`; \n\nexport
function STEP(alpha = 0.0) {\n return CHECK_NAN_SNIPPET + `\n return x > 0.0 ? 1.0 : float(${alpha});\n
`;\n}\n\nexport const ELU = `return (x >= 0.0) ? x : (exp(x) - 1.0);`; \n\nexport const RELU =
CHECK_NAN_SNIPPET + `\n return (x < 0.0) ? 0.0 : x;\n`; \n\nexport const RELU6 = CHECK_NAN_SNIPPET +
`\n return (x < 0.0) ? 0.0 : min(6.0, x);\n`; \n\nexport const CLONE = `return x;`; \n },"/**\n
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file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====

```

```

*\n\nimport {GPGPUProgram} from './gpgpu_math';\n\nexport const LINEAR = `return x;`\n\nexport const ELU
= `\n vec4 result;\n\n result.r = (x.r >= 0.0) ? x.r : (exp(x.r) - 1.0);\n result.g = (x.g >= 0.0) ? x.g : (exp(x.g) -
1.0);\n result.b = (x.b >= 0.0) ? x.b : (exp(x.b) - 1.0);\n result.a = (x.a >= 0.0) ? x.a : (exp(x.a) - 1.0);\n\n return
result;\n`;\n\nexport const RELU = `\n vec4 result = x * vec4(greaterThanEqual(x, vec4(0.0)));`\n
 bvec4 isNaN = isnan(x);\n\n result.r = isNaN.r ? x.r : result.r;\n result.g = isNaN.g ? x.g : result.g;\n result.b =
isNaN.b ? x.b : result.b;\n result.a = isNaN.a ? x.a : result.a;\n\n return result;\n`;\n\nexport const RELU6 = `\n
vec4 result = min(x, vec4(6.)) * vec4(greaterThanEqual(x, vec4(0.0)));`\n bvec4 isNaN = isnan(x);\n\n result.r =
isNaN.r ? x.r : result.r;\n result.g = isNaN.g ? x.g : result.g;\n result.b = isNaN.b ? x.b : result.b;\n result.a =
isNaN.a ? x.a : result.a;\n\n return result;\n`;\n\nexport class UnaryOpPackedProgram implements GPGPUProgram
{\n variableNames = ['A'];\n userCode: string;\n outputShape: number[];\n packedInputs = true;\n packedOutput
= true;\n\n constructor(aShape: number[], opSnippet: string) {\n this.outputShape = aShape;\n this.userCode =
`\n vec4 unaryOperation(vec4 x) {\n ${opSnippet}\n }\n\n void main() {\n vec4 x =
getAAAtOutCoords();\n vec4 y = unaryOperation(x);\n\n setOutput(y);\n }\n `;\n }\n}\n\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n *
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compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {GPGPUProgram} from './gpgpu_math';\nimport {getChannels, getSourceCoords} from
'/packing_util';\nimport {getCoordsDataType} from './shader_compiler';\n\nexport class UnpackProgram
implements GPGPUProgram {\n variableNames
= ['A'];\n packedInputs = true;\n packedOutput = false;\n outputShape: number[];\n userCode: string;\n\n constructor(outputShape: number[]) {\n this.outputShape = outputShape;\n const rank = outputShape.length;\n\n const channels = getChannels('rc', rank);\n const dtype = getCoordsDataType(rank);\n const sourceCoords =
getSourceCoords(rank, channels);\n const innerDims = channels.slice(-2);\n const coords = rank <= 1 ? 'rc' :
`vec2(${innerDims.join(',')}`;\n\n this.userCode = `\n void main() {\n ${dtype} rc = getOutputCoords();\n
 vec4 packedInput = getA(${sourceCoords});\n setOutput(getChannel(packedInput, ${coords}));\n }\n
 `;\n }\n}\n\n"/**\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n * Licensed under the
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http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is
distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *
=====
*\n\n// Import WebGL flags.\nimport './flags_webgl';\n\nimport * as tf from '@tensorflow/tfjs-core';\nimport
{backend_util, BackendValues, buffer, DataId, DataStorage, DataType, DataValues, engine, env, kernel_impls,
KernelBackend, MemoryInfo, NumericDataType, Rank, RecursiveArray, scalar, ShapeMap, Tensor, Tensor2D,
TensorBuffer, TensorInfo, tidy, TimingInfo, TypedArray, util} from '@tensorflow/tfjs-core';\nimport
{getWebGLContext} from './canvas_util';\nimport {DecodeMatrixProgram} from './decode_matrix_gpu';\nimport
{DecodeMatrixPackedProgram} from './decode_matrix_packed_gpu';\nimport
{EncodeFloatProgram} from './encode_float_gpu';\nimport {EncodeFloatPackedProgram} from
'/encode_float_packed_gpu';\nimport {EncodeMatrixProgram} from './encode_matrix_gpu';\nimport
{EncodeMatrixPackedProgram} from './encode_matrix_packed_gpu';\nimport {GPGPUContext} from
'/gpgpu_context';\nimport * as gpgpu_math from './gpgpu_math';\nimport {GPGPUBinary, GPGPUProgram,

```

```

TensorData} from './gpgpu_math';\nimport {simpleAbsImplCPU} from './kernel_utils/shared';\nimport
{PackProgram} from './pack_gpu';\nimport {ReshapePackedProgram} from './reshape_packed_gpu';\nimport * as
tex_util from './tex_util';\nimport {TextureData, TextureUsage} from './tex_util';\nimport {TextureManager} from
 './texture_manager';\nimport * as unary_op from './unaryop_gpu';\nimport {UnaryOpProgram} from
 './unaryop_gpu';\nimport {UnaryOpPackedProgram} from './unaryop_packed_gpu';\nimport {UnpackProgram} from
 './unpack_gpu';\nimport * as webgl_util from './webgl_util';\n\nconst whereImpl
= kernel_impls.whereImpl;\n\nexport const EPSILON_FLOAT32 = 1e-7;\nexport const EPSILON_FLOAT16 =
1e-4;\n\ninterface KernelInfo = {\n name: string;\n query: Promise<number>;\n};\n\nexport type TimerNode =
RecursiveArray<KernelInfo>|KernelInfo;\n\nexport interface CPUTimerQuery {\n startMs: number;\n endMs?:
number;\n}\n\nexport interface WebGLMemoryInfo extends MemoryInfo {\n numBytesInGPU: number;\n //
Tracks the total number of bytes allocated on the GPU, accounting for the\n // physical texture type.\n numBytesInGPUAllocated: number;\n // Tracks byte size of textures that were created and then made available
for\n // reuse (disposed).\n numBytesInGPUFree: number;\n unreliable: boolean;\n}\n\nexport interface
WebGLTimingInfo extends TimingInfo {\n uploadWaitMs: number;\n downloadWaitMs: number;\n}\n\nconst
binaryCaches: {[webGLVersion: string]: {[key: string]: GPGPUBinary}} = {};\n\nexport function
getBinaryCache(webGLVersion: number) {\n if (webGLVersion in binaryCaches)
{\n return binaryCaches[webGLVersion];\n }\n binaryCaches[webGLVersion] = {};\n return
binaryCaches[webGLVersion];\n}\n\n// Empirically determined constant used to determine size threshold for
handling\n// off execution to the CPU.\nconst CPU_HANDOFF_SIZE_THRESHOLD = 128;\n\n// Empirically
determined constant used to decide the number of MB on GPU\n// before we warn about high memory use. The MB
are this constant * screen area\n// * dpi / 1024 / 1024.\nconst BEFORE_PAGING_CONSTANT = 600;\n\nfunction
numMBBeforeWarning(): number {\n if (env().global.screen == null) {\n return 1024; // 1 GB.\n }\n return
(env().global.screen.height * env().global.screen.width * \n window.devicePixelRatio) * \n BEFORE_PAGING_CONSTANT / 1024 / 1024;\n}\n\nexport class MathBackendWebGL extends KernelBackend
{\n texData: DataStorage<TextureData>;\n gpgpu: GPGPUContext;\n\n private static nextDataId = 0;\n private
nextDataId(): number {\n return MathBackendWebGL.nextDataId++;\n }\n\n // Maps data ids that have a pending read operation, to list of subscribers.\n private pendingRead = new
WeakMap<DataId, Array<(arr: TypedArray) => void>>();\n // List of data ids that are scheduled for disposal, but
are waiting on a\n // pending read operation.\n private pendingDisposal = new WeakSet<DataId>();\n\n // Used to
count the number of 'shallow' sliced tensors that point to the\n // same data id.\n dataRefCount = new
WeakMap<DataId, number>();\n private numBytesInGPU = 0;\n private canvas:
HTMLCanvasElement|OffscreenCanvas;\n\n private programTimersStack: TimerNode[];\n private activeTimers:
TimerNode[];\n // Accumulated time spent (including blocking) in uploading data to webgl.\n private
uploadWaitMs = 0;\n // Accumulated time spent (including blocking in downloading data from webgl.\n private
downloadWaitMs = 0;\n private cpuBackend: KernelBackend;\n\n // Number of bits of precision of this backend.\n private floatPrecisionValue: 32|16;\n\n private
textureManager: TextureManager;\n private binaryCache: {[key: string]: GPGPUBinary};\n private
gpgpuCreatedLocally: boolean;\n private numMBBeforeWarning: number;\n private warnedAboutMemory =
false;\n private warnedAboutCPUBackend = false;\n\n constructor(gpgpu?: GPGPUContext) {\n super();\n if
(!env().getBool('HAS_WEBGL')) {\n throw new Error('WebGL is not supported on this device');\n }\n\n if
(gpgpu == null) {\n const gl = getWebGLContext(env().getNumber('WEBGL_VERSION'));\n this.binaryCache = getBinaryCache(env().getNumber('WEBGL_VERSION'));\n this.gpgpu = new
GPGPUContext(gl);\n this.canvas = gl.canvas;\n this.gpgpuCreatedLocally = true;\n } else {\n this.gpgpu
= gpgpu;\n this.binaryCache = {};\n this.gpgpuCreatedLocally = false;\n this.canvas = gpgpu.gl.canvas;\n }\n this.textureManager = new TextureManager(this.gpgpu);\n this.numMBBeforeWarning =
numMBBeforeWarning();\n\n this.texData = new DataStorage(this,
engine());\n }\n\n numDataIds() {\n return this.texData.numDataIds() + \n (this.cpuBackend ?
this.cpuBackend.numDataIds() : 0) - \n this.pendingDeletes;\n }\n\n write(values: BackendValues, shape:

```

```

number[], dtype: DataType): DataId {
 if (env().getBool('WEBGL_CHECK_NUMERICAL_PROBLEMS') ||
 env().getBool('DEBUG')) {
 this.checkNumericalProblems(values);
 }
 if (dtype === 'complex64' &&
 values != null) {
 throw new Error(
 `Cannot write to a complex64 dtype. ` +
 `Please use tf.complex(real, imag).`);
 }
 const dataId = {id: this.nextDataId()};
 this.texData.set(
 {shape, dtype, values, usage: TextureUsage.UPLOAD, refCount: 1});
 return dataId;
}

/** Return refCount of a `TensorData`. */
refCount(dataId: DataId): number {
 if (this.texData.has(dataId)) {
 const tensorData = this.texData.get(dataId);
 return tensorData.refCount;
 }
 return 0;
}

/** Increase refCount of a `TextureData`. */
incRef(dataId: DataId): void {
 const texData = this.texData.get(dataId);
 texData.refCount++;
}

/** Decrease refCount of a `TextureData`. */
decRef(dataId: DataId): void {
 if (this.texData.has(dataId)) {
 const texData = this.texData.get(dataId);
 texData.refCount--;
 }
}

move(
 dataId: DataId, values: BackendValues, shape: number[], dtype:
 DataType, refCount: number): void {
 if (env().getBool('DEBUG')) {
 this.checkNumericalProblems(values);
 }
 if (dtype === 'complex64') {
 throw new Error(
 `Cannot write to a complex64 dtype. ` +
 `Please use tf.complex(real, imag).`);
 }
 this.texData.set(
 {shape, dtype, values, usage: TextureUsage.UPLOAD, refCount});
}

disposeIntermediateTensorInfo(tensorInfo: TensorInfo): void {
 this.disposeData(tensorInfo.dataId);
}

readSync(dataId:
 DataId): BackendValues {
 const texData = this.texData.get(dataId);
 const {values, dtype, complexTensorInfos, slice, shape, isPacked} = texData;

 // The presence of `slice` indicates this tensor is a shallow slice of
 // a different tensor, and is using that original tensor's texture. Run
 // `clone` in order to copy that texture and read from it.
 if (slice != null) {
 let program;
 if (isPacked) {
 program = new UnaryOpPackedProgram(shape, unary_op.CLONE);
 } else {
 program = new UnaryOpProgram(shape, unary_op.CLONE);
 }
 const res = this.runWebGLProgram(program, [{dataId, shape, dtype}], dtype);
 const data = this.readSync(res.dataId);
 this.disposeIntermediateTensorInfo(res);
 return data;
 }
 if (values != null) {
 return this.convertAndCacheOnCPU(dataId);
 }
 if (dtype === 'string') {
 return values;
 }
 const shouldTimeProgram = this.activeTimers
 != null;
 let start: number;
 if (shouldTimeProgram) {
 start = util.now();
 }
 let result: Float32Array;
 if (dtype === 'complex64') {
 const realValues = this.readSync(complexTensorInfos.real.dataId) as Float32Array;
 const imagValues = this.readSync(complexTensorInfos.imag.dataId) as Float32Array;
 result = backend_util.mergeRealAndImagArrays(realValues, imagValues);
 } else {
 result = this.getValuesFromTexture(dataId);
 }
 if (shouldTimeProgram) {
 this.downloadWaitMs += util.now() - start;
 }
 return this.convertAndCacheOnCPU(dataId, result);
}

async read(dataId: DataId):
 Promise<BackendValues> {
 if (this.pendingRead.has(dataId)) {
 const subscribers = this.pendingRead.get(dataId);
 return new Promise<TypedArray>(resolve => subscribers.push(resolve));
 }
 const texData = this.texData.get(dataId);
 const {values, shape, slice, dtype, complexTensorInfos, isPacked} = texData;

 // The presence of `slice` indicates this tensor is a shallow slice of
 // a different tensor, and is using that original tensor's texture. Run
 // `clone` in order to copy that texture and read from it.
 if (slice != null) {
 let program;
 if (isPacked) {
 program = new UnaryOpPackedProgram(shape, unary_op.CLONE);
 } else {
 program = new UnaryOpProgram(shape, unary_op.CLONE);
 }
 const res = this.runWebGLProgram(program, [{dataId, shape, dtype}], dtype);
 const data = this.read(res.dataId);
 this.disposeIntermediateTensorInfo(res);
 return data;
 }
 if (values != null) {
 return this.convertAndCacheOnCPU(dataId);
 }
 if (!env().getBool('WEBGL_DOWNLOAD_FLOAT_ENABLED') &&
 env().getNumber('WEBGL_VERSION') === 2) {
 throw new Error(
 `tensor.data() with WEBGL_DOWNLOAD_FLOAT_ENABLED=false and ` +
 `WEBGL_VERSION=2 not yet supported.`);
 }
 let buffer = null;
 let tmpDownloadTarget: TensorInfo;
 if (dtype !== 'complex64' && env().get('WEBGL_BUFFER_SUPPORTED')) {
 // Possibly

```

```

copy the texture into a buffer before inserting a fence.\n tmpDownloadTarget = this.decode(dataId);\n const
tmpData = this.texData.get(tmpDownloadTarget.dataId);\n buffer = this.gpgpu.createBufferFromTexture(\n
 tmpData.texture, ...tex_util.getDenseTexShape(shape));\n }\n\n this.pendingRead.set(dataId, []);\n if (dtype
!=='complex64') {\n // Create a fence and wait for it to resolve.\n await
this.gpgpu.createAndWaitForFence();\n }\n\n // Download the values from the GPU.\n let vals:
Float32Array;\n if (dtype === 'complex64') {\n const ps = await Promise.all([\n
this.read(complexTensorInfos.real.dataId),\n this.read(complexTensorInfos.imag.dataId)\n]);\n const
realValues = ps[0];\n const
imagValues = ps[1];\n vals = backend_util.mergeRealAndImagArrays(\n realValues as Float32Array,
imagValues as Float32Array);\n } else if (buffer == null) {\n vals = this.getValuesFromTexture(dataId);\n }
else {\n const size = util.sizeFromShape(shape);\n vals =
this.gpgpu.downloadFloat32MatrixFromBuffer(buffer, size);\n }\n if (tmpDownloadTarget != null) {\n
this.disposeIntermediateTensorInfo(tmpDownloadTarget);\n }\n const dTypeVals =
this.convertAndCacheOnCPU(dataId, vals);\n\n const subscribers = this.pendingRead.get(dataId);\n
this.pendingRead.delete(dataId);\n\n // Notify all pending reads.\n subscribers.forEach(resolve =>
resolve(dTypeVals));\n if (this.pendingDisposal.has(dataId)) {\n this.pendingDisposal.delete(dataId);\n if
(this.disposeData(dataId)) {\n engine().removeDataId(dataId, this);\n }\n this.pendingDeletes--;\n }\n
return dTypeVals;\n }\n\n bufferSync<R extends Rank>(t:
TensorInfo): TensorBuffer<R> {\n const data = this.readSync(t.dataId);\n let decodedData = data as
DataValues;\n if (t.dtype === 'string') {\n try {\n // Decode the bytes into string.\n decodedData = (data
as Uint8Array[]).map(d => util.decodeString(d));\n } catch {\n throw new Error('Failed to decode encoded
string bytes into utf-8');\n }\n }\n return buffer(t.shape as ShapeMap[R], t.dtype, decodedData) as\n
TensorBuffer<R>;\n }\n\n private checkNumericalProblems(values: BackendValues): void {\n if (values == null)
{\n return;\n }\n for (let i = 0; i < values.length; i++) {\n const num = values[i] as number;\n if
(!webgl_util.canBeRepresented(num)) {\n if (env().getBool('WEBGL_RENDER_FLOAT32_CAPABLE')) {\n
throw Error(\n `The value ${num} cannot be represented with your ` +\n `current settings.
Consider enabling float32 rendering: ` +\n `tf.env().set('WEBGL_RENDER_FLOAT32_ENABLED',
true);`);\n }\n throw Error(`The value ${num} cannot be represented on this device.`);\n }\n }\n }\n\n
private getValuesFromTexture(dataId: DataId): Float32Array {\n const {shape, dtype, isPacked} =
this.texData.get(dataId);\n const size = util.sizeFromShape(shape);\n if
(env().getBool('WEBGL_DOWNLOAD_FLOAT_ENABLED')) {\n const tmpTarget = this.decode(dataId);\n
const tmpData = this.texData.get(tmpTarget.dataId);\n const vals = this.gpgpu\n
.downloadMatrixFromPackedTexture(\n tmpData.texture, ...tex_util.getDenseTexShape(shape))\n
.subarray(0, size);\n this.disposeIntermediateTensorInfo(tmpTarget);\n return vals;\n }\n\n
const shouldUsePackedProgram =\n env().getBool('WEBGL_PACK') && isPacked === true;\n const
outputShape =\n shouldUsePackedProgram ? webgl_util.getShapeAs3D(shape) : shape;\n
const program = shouldUsePackedProgram ?\n new EncodeFloatPackedProgram(outputShape as [number,
number, number]) :\n new EncodeFloatProgram(outputShape);\n const output = this.runWebGLProgram(\n
program, [{shape: outputShape, dtype, dataId}], 'float32');\n const tmpData = this.texData.get(output.dataId);\n
const vals =\n this.gpgpu\n .downloadByteEncodedFloatMatrixFromOutputTexture(\n
tmpData.texture, tmpData.texShape[0], tmpData.texShape[1])\n .subarray(0, size);\n
this.disposeIntermediateTensorInfo(output);\n return vals;\n }\n\n timerAvailable(): boolean {\n return
env().getNumber('WEBGL_DISJOINT_QUERY_TIMER_EXTENSION_RELIABLE') > 0;\n }\n\n async time(f:
() => void): Promise<WebGLTimingInfo> {\n const oldActiveTimers = this.activeTimers;\n const
newActiveTimers: TimerNode[] = [];\n\n let outerMostTime = false;\n if (this.programTimersStack == null) {\n
this.programTimersStack
= newActiveTimers;\n outerMostTime = true;\n } else {\n this.activeTimers.push(newActiveTimers);\n
}\n this.activeTimers = newActiveTimers;\n\n f();\n // needing to split these up because util.flatten only

```

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accepts certain types\n const flattenedActiveTimerQueries =\n util.flatten(this.activeTimers.map((d:\n KernelInfo) => d.query))\n .filter(d => d != null);\n const flattenedActiveTimerNames =\n util.flatten(this.activeTimers.map((d: KernelInfo) => d.name))\n .filter(d => d != null);\n this.activeTimers = oldActiveTimers;\n\n if (outerMostTime) {\n this.programTimersStack = null;\n }\n\n const res: WebGLTimingInfo = {\n uploadWaitMs: this.uploadWaitMs,\n downloadWaitMs:\n this.downloadWaitMs,\n kernelMs: null,\n wallMs: null // will be filled by the engine\n };\n if\n (env().getNumber('WEBGL_DISJOINT_QUERY_TIMER_EXTENSION_RELIABLE') > 0) {\n const kernelMs\n = await Promise.all(flattenedActiveTimerQueries);\n\n res['kernelMs'] = util.sum(kernelMs);\n res['getExtraProfileInfo'] = () =>\n kernelMs.map((d, i) =>\n ({name: flattenedActiveTimerNames[i], ms: d}))\n .map(d => `${d.name}: ${d.ms}`)\n .join(', ');\n } else {\n res['kernelMs'] = {\n error: 'WebGL query timers are not supported in this environment.'\n };\n }\n\n this.uploadWaitMs = 0;\n this.downloadWaitMs = 0;\n return res;\n}\nmemory():\nWebGLMemoryInfo {\n return {\n unreliable: false,\n numBytesInGPU: this.numBytesInGPU,\n numBytesInGPUAllocated: this.textureManager.numBytesAllocated,\n numBytesInGPUFree:\n this.textureManager.numBytesFree\n } as WebGLMemoryInfo;\n}\n\nprivate startTimer():\nWebGLQuery|CPUTimerQuery {\n if\n (env().getNumber('WEBGL_DISJOINT_QUERY_TIMER_EXTENSION_RELIABLE') > 0) {\n return\n this.gpgpu.beginQuery();\n }\n return {startMs: util.now(), endMs: null};\n}\n\nprivate endTimer(query: WebGLQuery|CPUTimerQuery): WebGLQuery|CPUTimerQuery {\n if\n (env().getNumber('WEBGL_DISJOINT_QUERY_TIMER_EXTENSION_RELIABLE') > 0) {\n this.gpgpu.endQuery();\n return query;\n }\n (query as CPUTimerQuery).endMs = util.now();\n return\n query;\n}\n\nprivate async getQueryTime(query: WebGLQuery|CPUTimerQuery): Promise<number> {\n if\n (env().getNumber('WEBGL_DISJOINT_QUERY_TIMER_EXTENSION_RELIABLE') > 0) {\n return\n this.gpgpu.waitForQueryAndGetTime(query as WebGLQuery);\n }\n const timerQuery = query as\n CPUTimerQuery;\n return timerQuery.endMs - timerQuery.startMs;\n}\n\nprivate pendingDeletes = 0;\n\n/**\n * Decrease the RefCount on the dataId and dispose the memory if the dataId\n * has 0 refCount. If there are\n pending read on the data, the disposal would\n * added to the pending delete queue. Return true if the dataId is\n removed\n * from backend or the backend does not contain the dataId, false if\n the\n * dataId is not removed. Memory may or may not be released even when dataId\n * is removed, which also\n depends on dataRefCount, see `releaseGPU`.\n * @param dataId\n * @oaram force Optional, remove the data\n regardless of refCount\n */\nprivate disposeData(dataId: DataId, force = false): boolean {\n if\n (this.pendingDisposal.has(dataId)) {\n return false;\n }\n // No-op if already disposed.\n if\n (!this.texData.has(dataId)) {\n return true;\n }\n // if force flag is set, change refCount to 0, this would\n ensure disposal\n // when added to the pendingDisposal queue. Memory may or may not be\n // released, which\n also depends on dataRefCount, see `releaseGPU`.\n if (force) {\n this.texData.get(dataId).refCount = 0;\n }\n else {\n this.texData.get(dataId).refCount--;\n }\n if (!force && this.texData.get(dataId).refCount > 0) {\n return false;\n }\n if (this.pendingRead.has(dataId)) {\n this.pendingDisposal.add(dataId);\n this.pendingDeletes++;\n return false;\n }\n this.releaseGPUData(dataId);\n const\n {complexTensorInfos} = this.texData.get(dataId);\n if (complexTensorInfos != null) {\n this.disposeData(complexTensorInfos.real.dataId, force);\n this.disposeData(complexTensorInfos.imag.dataId,\n force);\n }\n this.texData.delete(dataId);\n return true;\n}\n\nprivate releaseGPUData(dataId: DataId):\nvoid {\n const {texture, dtype, texShape, usage, isPacked, slice} =\n this.texData.get(dataId);\n const key =\n slice && slice.origDataId || dataId;\n const refCount = this.dataRefCount.get(key);\n if (refCount > 1) {\n this.dataRefCount.set(key, refCount - 1);\n } else {\n this.dataRefCount.delete(key);\n if (texture != null) {\n this.numBytesInGPU -= this.computeBytes(texShape, dtype);\n this.textureManager.releaseTexture(texture,\n texShape, usage, isPacked);\n }\n }\n const texData\n = this.texData.get(dataId);\n texData.texture = null;\n texData.texShape = null;\n texData.isPacked = false;\n texData.slice = null;\n}\n\nprivate getTexture(dataId: DataId): WebGLTexture {\n this.uploadToGPU(dataId);\n}

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return this.texData.get(dataId).texture;\n }\n\n /**\n * Returns internal information for the specific data bucket.
Used in unit\n * tests.\n */\n getDataInfo(dataId: DataId): TextureData {\n return this.texData.get(dataId);\n }\n\n private getCPUBackend(): KernelBackend|null {\n if (!env().getBool('WEBGL_CPU_FORWARD')) {\n return null;\n }\n\n if (this.cpuBackend == null) {\n this.cpuBackend = engine().findBackend('cpu');\n }\n\n return this.cpuBackend;\n }\n\n /*\n Tests whether all the inputs to an op are small and on the CPU. This
heuristic\n determines when it would be faster to execute a kernel on the CPU. WebGL\n kernels opt into running
this check and forwarding when appropriate.\n TODO(https://github.com/tensorflow/tfjs/issues/872):
Develop a more\n sustainable strategy for optimizing backend execution of ops.\n */\n shouldExecuteOnCPU(\n inputs: TensorInfo[],\n sizeThreshold = CPU_HANDOFF_SIZE_THRESHOLD): boolean {\n const
cpuBackend = this.getCPUBackend();\n if (!env().getBool('IS_TEST') && !this.warnedAboutCPUBackend &&\n cpuBackend == null) {\n console.warn(\n 'Your application contains ops that are small enough to be '
+\n 'executed on the CPU backend, however the CPU backend cannot ' +\n 'be found. Consider importing
the CPU backend ' +\n '(@tensorflow/tfjs-backend-cpu) for better performance.);\n\n
this.warnedAboutCPUBackend = true;\n }\n\n return cpuBackend != null &&\n inputs.every(\n input
=> this.texData.get(input.dataId).texture == null &&\n util.sizeFromShape(input.shape) <
sizeThreshold);\n }\n\n getGPGPUContext(): GPGPUContext {\n return this.gpgpu;\n
}\n\n where(condition: Tensor): Tensor2D {\n backend_util.warn(\n 'tf.where() in webgl locks the UI thread.
'+\n 'Call tf.whereAsync() instead');\n const condVals = condition.dataSync();\n return
whereImpl(condition.shape, condVals);\n }\n\n private packedUnaryOp(x: TensorInfo, op: string, dtype:
DataType) {\n const program = new UnaryOpPackedProgram(x.shape, op);\n const outInfo =
this.compileAndRun(program, [x], dtype);\n return engine().makeTensorFromDataId(\n outInfo.dataId,
outInfo.shape, outInfo.dtype);\n }\n\n // TODO(msoulanille) remove this once the backend has been modularized\n
// a copy is needed here to break a circular dependency.\n // Also remove the op from unary_op.\n abs<T extends
Tensor>(x: T): T {\n // TODO: handle cases when x is complex.\n if (this.shouldExecuteOnCPU([x]) &&
x.dtype !== 'complex64') {\n const outValues =\n simpleAbsImplCPU(this.texData.get(x.dataId).values as
TypedArray);\n return this.makeOutput(x.shape, x.dtype, outValues);\n }\n\n if
(env().getBool('WEBGL_PACK_UNARY_OPERATIONS')) {\n return this.packedUnaryOp(x, unary_op.ABS,
x.dtype) as T;\n }\n\n const program = new UnaryOpProgram(x.shape, unary_op.ABS);\n const outInfo =
this.compileAndRun(program, [x]);\n return engine().makeTensorFromDataId(\n outInfo.dataId,
outInfo.shape, outInfo.dtype) as T;\n }\n\n makeTensorInfo(\n shape: number[], dtype: DataType,\n values?:
BackendValues|string[]): TensorInfo {\n let dataId;\n if (dtype === 'string' && values != null && values.length
> 0 &&\n util.isString(values[0])) {\n const encodedValues =\n (values as {}) as string[]).map(d =>
util.encodeString(d));\n dataId = this.write(encodedValues, shape, dtype);\n } else {\n dataId =
this.write(values as TypedArray, shape, dtype);\n }\n\n this.texData.get(dataId).usage = null;\n return {dataId,
shape, dtype};\n }\n\n private makeOutput<T extends Tensor>(\n shape: number[], dtype: DataType, values?: BackendValues): T {\n
const {dataId} = this.makeTensorInfo(shape, dtype, values);\n return engine().makeTensorFromDataId(dataId,
shape, dtype, this) as T;\n }\n\n private unpackTensor(input: TensorInfo): TensorInfo {\n const program = new
UnpackProgram(input.shape);\n return this.runWebGLProgram(program, [input], input.dtype);\n }\n\n private
packTensor(input: TensorInfo): TensorInfo {\n const program = new PackProgram(input.shape);\n const
preventEagerUnpackingOutput = true;\n return this.runWebGLProgram(\n program, [input], input.dtype, null
/* customSetup */,\n preventEagerUnpackingOutput);\n }\n\n private packedReshape(input: TensorInfo,
afterShape: number[]): TensorInfo {\n const input3DShape = [\n webgl_util.getBatchDim(input.shape),\n
...webgl_util.getRowsCols(input.shape)\n] as [number, number, number];\n const input3D: TensorInfo
= {\n dtype: input.dtype,\n shape: input3DShape,\n dataId: input.dataId\n };\n const afterShapeAs3D =
[\n webgl_util.getBatchDim(afterShape), ...webgl_util.getRowsCols(afterShape)\n] as [number, number,
number];\n const program = new ReshapePackedProgram(afterShapeAs3D, input3DShape);\n const

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preventEagerUnpackingOfOutput = true;\n const output = this.runWebGLProgram(\n program, [input3D],
input.dtype, null /* customSetup */);\n preventEagerUnpackingOfOutput);\n return {dataId: output.dataId,
shape: afterShape, dtype: output.dtype};\n } \n\n private decode(dataId: DataId): TensorInfo {\n const texData =
this.texData.get(dataId);\n const {isPacked, shape, dtype} = texData;\n const shapeAs3D =\n webgl_util.getShapeAs3D(shape) as [number, number, number];\n let program;\n if (isPacked) {\n program =
new DecodeMatrixPackedProgram(shapeAs3D);\n } else {\n program = new
DecodeMatrixProgram(shapeAs3D);\n }\n const preventEagerUnpackingOfOutput = true;\n const out = this.runWebGLProgram(\n program,
[shape: shapeAs3D, dtype, dataId]), dtype,\n null /* customSetup */, preventEagerUnpackingOfOutput);\n return {dtype, shape, dataId: out.dataId};\n } \n\n runWebGLProgram(\n program: GPGPUProgram, inputs:
TensorInfo[], outputDtype: DataType,\n customSetup?: (gpgpu: GPGPUContext, webGLProgram:
WebGLProgram) => void,\n preventEagerUnpackingOfOutput = false): TensorInfo {\n const output =
this.makeTensorInfo(program.outputShape, outputDtype);\n const outData = this.texData.get(output.dataId);\n if
(program.packedOutput) {\n outData.isPacked = true;\n }\n if (program.outPackingScheme ===
tex_util.PackingScheme.DENSE) {\n const texelShape = tex_util.getDenseTexShape(program.outputShape);\n }\n // For a densely packed output, we explicitly set texShape\n // so it doesn't get assigned later according to our
typical packing\n // scheme wherein a single texel can only contain values from adjacent\n // rows/cols.\n outData.texShape
= texelShape.map(d => d * 2) as [number, number];\n }\n if (program.outTexUsage != null) {\n
outData.usage = program.outTexUsage;\n }\n if (util.sizeFromShape(output.shape) === 0) {\n // Short-circuit
the computation since the result is empty (has 0 in its\n // shape).\n outData.values =\n util.getTypedArrayFromDType(output.dtype as 'float32', 0);\n return output;\n }\n const dataToDispose:
TensorInfo[] = [];\n const inputsData: TensorData[] = inputs.map(input => {\n if (input.dtype === 'complex64')
{\n throw new Error(\n `GPGPUProgram does not support complex64 input. For complex64` +\n
 `dtypes, please separate the program into real and imaginary` +\n `parts.`);\n }\n });\n let texData =
this.texData.get(input.dataId);\n if (texData.texture ===
null) {\n if (!program.packedInputs &&\n util.sizeFromShape(input.shape) <= \n
env().getNumber('WEBGL_SIZE_UPLOAD_UNIFORM')) {\n // Upload small tensors that live on the CPU
as uniforms, not as\n // textures. Do this only when the environment supports 32bit floats\n // due to
problems when comparing 16bit floats with 32bit floats.\n //
TODO(https://github.com/tensorflow/tfjs/issues/821): Make it\n // possible for packed shaders to sample from
uniforms.\n return {\n shape: input.shape,\n texData: null,\n isUniform: true,\n
uniformValues: texData.values as TypedArray\n }; \n }\n }\n // This ensures that if a packed program's
inputs have not yet been\n // uploaded to the GPU, they get uploaded as packed right off the bat.\n if
(program.packedInputs) {\n texData.isPacked = true;\n texData.shape = input.shape;\n }\n } else if (!!texData.isPacked !== !!program.packedInputs) {\n input = texData.isPacked ?
this.unpackTensor(input) : \n this.packTensor(input);\n dataToDispose.push(input);\n }\n texData = this.texData.get(input.dataId);\n } else if (\n texData.isPacked &&\n
!webgl_util.isReshapeFree(texData.shape, input.shape)) {\n // This is a special case where a texture exists for a
tensor\n // but the shapes are incompatible (due to packing constraints) because\n // the tensor did not have
a chance to go through the packed reshape\n // shader. This only happens when we reshape the *same* tensor to
form\n // *distinct* inputs to an op, e.g. dotting a vector with itself. This\n // case will disappear once
packed uploading is the default.\n const savedInput = input;\n const targetShape = input.shape;\n \n
input.shape = texData.shape;\n input =
this.packedReshape(input as Tensor, targetShape);\n dataToDispose.push(input);\n texData =
this.texData.get(input.dataId);\n savedInput.shape = targetShape;\n }\n this.uploadToGPU(input.dataId);\n return {shape: input.shape, texData, isUniform: false};\n }\n\n
this.uploadToGPU(output.dataId);\n const outputData:\n TensorData = {shape: output.shape, texData:

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outData, isUniform: false});\n const key = gpgpu_math.makeShaderKey(program, inputsData, outputData);\n const binary = this.getAndSaveBinary(key, () => {\n return gpgpu_math.compileProgram(\n this.gpgpu,\n program, inputsData, outputData);\n });\n const shouldTimeProgram = this.activeTimers != null;\n let query: WebGLQuery|CPUTimerQuery;\n if (shouldTimeProgram) {\n query = this.startTimer();\n }\n gpgpu_math.runProgram(\n this.gpgpu, binary, inputsData, outputData, customSetup);\n dataToDispose.forEach(info => this.disposeIntermediateTensorInfo(info));\n\n if (shouldTimeProgram) {\n query = this.endTimer(query);\n this.activeTimers.push(\n {name: program.constructor.name, query: this.getQueryTime(query)});\n }\n if (!env().getBool('WEBGL_LAZILY_UNPACK') && outData.isPacked &&\n preventEagerUnpackingOfOutput === false) {\n const unpacked = this.unpackTensor(output);\n this.disposeIntermediateTensorInfo(output);\n return unpacked;\n }\n return output;\n}\n\ncompileAndRun(\n program: GPGPUProgram, inputs: TensorInfo[],\n outputDType?: DataType,\n customSetup?: (gpgpu: GPGPUContext, webGLProgram: WebGLProgram) => void,\n preventEagerUnpackingOfOutput = false): TensorInfo {\n outputDType =\n outputDType || inputs[0].dtype;\n const outInfo = this.runWebGLProgram(\n program, inputs, outputDType,\n customSetup,\n preventEagerUnpackingOfOutput);\n return outInfo;\n}\n\nprivate getAndSaveBinary(key: string, getBinary: () => GPGPUBinary):\n GPGPUBinary {\n if (!(key in this.binaryCache)) {\n this.binaryCache[key] =\n getBinary();\n }\n return this.binaryCache[key];\n}\n\nprivate getTextureManager(): TextureManager {\n return this.textureManager;\n}\n\nprivate disposed = false;\n dispose() {\n if (this.disposed) {\n return;\n }\n // Avoid disposing the compiled webgl programs during unit testing because\n // it slows down test execution.\n if (!env().getBool('IS_TEST')) {\n const allKeys = Object.keys(this.binaryCache);\n allKeys.forEach(key => {\n this.gpgpu.deleteProgram(this.binaryCache[key].webGLProgram);\n delete this.binaryCache[key];\n });\n }\n this.textureManager.dispose();\n if (this.canvas != null &&\n (typeof (HTMLCanvasElement) !== 'undefined' &&\n this.canvas instanceof HTMLCanvasElement)) {\n this.canvas.remove();\n } else {\n this.canvas = null;\n }\n if (this.gpgpuCreatedLocally)\n {\n this.gpgpu.program = null;\n this.gpgpu.dispose();\n }\n this.disposed = true;\n}\n\nfloatPrecision(): 16|32 {\n if (this.floatPrecisionValue == null) {\n this.floatPrecisionValue = tidy(() => {\n if (!env().get('WEBGL_RENDER_FLOAT32_ENABLED')) {\n // Momentarily switching DEBUG flag to\n false so we don't throw an\n // error trying to upload a small value.\n const debugFlag =\n env().getBool('DEBUG');\n env().set('DEBUG', false);\n const underflowCheckValue =\n this.abs(scalar(1e-8)).dataSync()[0];\n env().set('DEBUG', debugFlag);\n if (underflowCheckValue >\n 0) {\n return 32;\n }\n }\n return 16;\n });\n }\n return this.floatPrecisionValue;\n}\n\n/** Returns the smallest representable number. */\n epsilon(): number {\n return this.floatPrecision() === 32 ?\n EPSILON_FLOAT32 : EPSILON_FLOAT16;\n}\n\nuploadToGPU(dataId: DataId):\n void {\n const texData = this.texData.get(dataId);\n const {shape, dtype, values, texture, usage, isPacked} =\n texData;\n if (texture != null) {\n // Array is already on GPU. No-op.\n return;\n }\n const\n shouldTimeProgram = this.activeTimers != null;\n let start: number;\n if (shouldTimeProgram) {\n start =\n util.now();\n }\n let texShape = texData.texShape;\n if (texShape == null) {\n texShape =\n webgl_util.getTextureShapeFromLogicalShape(shape, isPacked);\n texData.texShape = texShape;\n }\n if (values != null) {\n const shapeAs3D = webgl_util.getShapeAs3D(shape);\n let program;\n let width =\n texShape[1], height = texShape[0];\n const isArray = values instanceof Uint8Array;\n if (isPacked) {\n [width, height] = tex_util.getPackedMatrixTextureShapeWidthHeight(\n texShape[0], texShape[1]);\n program = new EncodeMatrixPackedProgram(\n shapeAs3D, [height,\n width], isArray);\n } else {\n program =\n new EncodeMatrixProgram(shapeAs3D, [height,\n width], isArray);\n }\n const tempDenseInputHandle = this.makeTensorInfo([height, width], dtype);\n if (isArray) {\n this.texData.get(tempDenseInputHandle.dataId).usage =\n TextureUsage.PIXELS;\n } else {\n this.texData.get(tempDenseInputHandle.dataId).usage =\n TextureUsage.UPLOAD;\n }\n this.gpgpu.uploadDenseMatrixToTexture(\n this.getTexture(tempDenseInputHandle.dataId), width,\n
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height,\n values as TypedArray);\n\n // We want the output to remain packed regardless of the value of\n // WEBGL_PACK.\n const preventEagerUnpacking = true;\n const encodedOutputTarget =
this.runWebGLProgram(\n program, [tempDenseInputHandle], dtype, null, preventEagerUnpacking);\n\n //
Have the original texture assume the identity of the encoded output.\n const
 outputTexData = this.texData.get(encodedOutputTarget.dataId);\n texData.texture = outputTexData.texture;\n
texData.texShape = outputTexData.texShape;\n texData.isPacked = outputTexData.isPacked;\n texData.usage
= outputTexData.usage;\n\n this.disposeIntermediateTensorInfo(tempDenseInputHandle);\n
this.texData.delete(encodedOutputTarget.dataId);\n\n // Once uploaded, don't store the values on cpu.\n
texData.values = null;\n if (shouldTimeProgram) {\n this.uploadWaitMs += util.now() - start;\n }\n }
else {\n const newTexture = this.acquireTexture(texShape, usage, dtype, isPacked);\n texData.texture =
newTexture;\n } }\n\n private convertAndCacheOnCPU(dataId: DataId, float32Values?: Float32Array):\n
TypedArray {\n const texData = this.texData.get(dataId);\n const {dtype} = texData;\n\n this.releaseGPUData(dataId);\n\n if (float32Values != null) {\n texData.values =
float32ToTypedArray(float32Values,
 dtype as 'float32');\n }\n return texData.values as TypedArray;\n }\n\n private acquireTexture(\n texShape:
[number, number], texType: TextureUsage, dtype: DataType,\n isPacked: boolean): WebGLTexture {\n
this.numBytesInGPU += this.computeBytes(texShape, dtype);\n if (!this.warnedAboutMemory &&\n
this.numBytesInGPU > this.numMBBeforeWarning * 1024 * 1024) {\n const mb = (this.numBytesInGPU / 1024
/ 1024).toFixed(2);\n this.warnedAboutMemory = true;\n console.warn(\n `High memory usage in GPU:
${mb} MB, ` +\n `most likely due to a memory leak`);\n }\n return
this.textureManager.acquireTexture(texShape, texType, isPacked);\n }\n\n private computeBytes(shape: [number,
number], dtype: DataType) {\n return shape[0] * shape[1] * util.bytesPerElement(dtype);\n }\n}\n\nfunction
float32ToTypedArray<D extends NumericDataType>(\n a: Float32Array, dtype: D): tf.DataTypeMap[D] {\n if
(dtype === 'float32' ||
dtype === 'complex64') {\n return a as tf.DataTypeMap[D];\n } else if (dtype === 'int32' || dtype === 'bool') {\n
const result = (dtype === 'int32') ? new Int32Array(a.length) :\n new
Uint8Array(a.length);\n for (let i = 0; i < result.length; ++i) {\n result[i] = Math.round(a[i]);\n }\n return
result as tf.DataTypeMap[D];\n } else {\n throw new Error(`Unknown dtype ${dtype}`);\n }\n}\n\n"/**\n *
@license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License
for the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {env} from '@tensorflow/tfjs-core';\n\nimport * as gpgpu_util from './gpgpu_util';\nimport * as
webgl_util from './webgl_util';\n\nexport {MathBackendWebGL, WebGLMemoryInfo, WebGLTimingInfo} from
'./backend_webgl';\nexport {setWebGLContext} from './canvas_util';\nexport {GPGPUContext} from
'./gpgpu_context';\nexport {GPGPUProgram} from './gpgpu_math';\n\n// WebGL specific utils.\nexport {gpgpu_util,
webgl_util};\n\n/**\n * Enforce use of half precision textures if available on the platform.\n *\n * @doc {heading:
'Environment', namespace: 'webgl'}\n *\nexport function forceHalfFloat(): void {\n
env().set('WEBGL_FORCE_F16_TEXTURES', true);\n}\n\n"/**\n * @license\n * Copyright 2017 Google LLC.
All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use
this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

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*\n\nimport {backend_util} from '@tensorflow/tfjs-core';\n\nimport {GPGPUProgram} from
'./gpgpu_math';\n\nexport const CHECK_NAN_SNIPPET = `
if (isnan(a)) return a;\n if (isnan(b)) return
b;\n`;
\n\nexport const SQUARED_DIFFERENCE = 'return (a - b) * (a - b);';
\n\nexport class BinaryOpProgram
implements GPGPUProgram {\n variableNames = ['A', 'B'];\n outputShape: number[];\n userCode: string;\n\n constructor(op: string, aShape: number[],
 bShape: number[]) {\n this.outputShape = backend_util.assertAndGetBroadcastShape(aShape, bShape);\n\n this.userCode = `
float binaryOperation(float a, float b) {\n ${op}\n }\n\n void main() {\n float a
= getAAtOutCoords();\n float b = getBAAtOutCoords();\n setOutput(binaryOperation(a, b));\n }\n `;\n\n }\n}\n`, "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache
License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You
may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required
by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS"
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the
License.\n *

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*\n\nimport {backend_util, util} from '@tensorflow/tfjs-core';\n\nimport {GPGPUProgram} from
'./gpgpu_math';\n\nimport {getChannels} from './packing_util';\n\nimport {getCoordsDataType} from
'./shader_compiler';\n\nexport const CHECK_NAN_SNIPPET = `
result.r = isNaN.r > 0. ? NAN : result.r;\n
result.g = isNaN.g > 0. ? NAN : result.g;\n
result.b = isNaN.b > 0. ? NAN : result.b;\n
result.a = isNaN.a > 0. ?
NAN : result.a;\n`;
\n\nexport const ELU_DER = `
vec4 bGTEZero = vec4(greaterThanEqual(b, vec4(0.)));
\n\nreturn (bGTEZero * a) + ((vec4(1.0) - bGTEZero) * (a * (b + vec4(1.0))));\n`;
\n\nexport const NOT_EQUAL = `
return vec4(notEqual(a, b));\n`;
\n\nexport class BinaryOpPackedProgram implements GPGPUProgram {\n
 variableNames = ['A', 'B'];\n outputShape: number[];\n userCode: string;\n supportsBroadcasting = true;\n
 packedInputs = true;\n packedOutput = true;\n\n constructor(\n
 op: string, aShape: number[], bShape: number[],\n checkOutOfBounds = false) {\n this.outputShape =
backend_util.assertAndGetBroadcastShape(aShape, bShape);\n const rank = this.outputShape.length;\n let
checkOutOfBoundsString = ";\n if (checkOutOfBounds) {\n if (rank === 0 ||
util.sizeFromShape(this.outputShape) === 1) {\n checkOutOfBoundsString = `
result.y = 0.;\n
result.z = 0.;\n
result.w = 0.;\n
`;
 } else {\n const dtype = getCoordsDataType(rank);\n
checkOutOfBoundsString = `
${dtype} coords = getOutputCoords();\n
`;
 if (rank === 1) {\n
checkOutOfBoundsString += `
result.y = (coords + 1) >= ${this.outputShape[0]} ? 0. : result.y;\n
result.z = 0.;\n
result.w = 0.;\n
`;
 } else {\n const channels = getChannels('coords', rank);\n
checkOutOfBoundsString += `
bool nextRowOutOfBounds
=
${channels[rank - 2]} + 1 >= ${this.outputShape[rank - 2]};\n
bool nextColOutOfBounds =
${channels[rank - 1]} + 1 >= ${this.outputShape[rank - 1]};\n
result.y = nextColOutOfBounds ? 0. :
result.y;\n
result.z = nextRowOutOfBounds ? 0. : result.z;\n
result.w = nextColOutOfBounds ||
nextRowOutOfBounds ? 0. : result.w;\n
`;
 }\n }\n\n this.userCode = `
vec4
binaryOperation(vec4 a, vec4 b) {\n ${op}\n }\n\n void main() {\n vec4 a = getAAtOutCoords();\n
vec4 b = getBAAtOutCoords();\n\n vec4 result = binaryOperation(a, b);\n ${checkOutOfBoundsString}\n\n
setOutput(result);\n }\n `;\n\n }\n}\n`, "/*\n * @license\n * Copyright 2020 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain
a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by
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BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *

```

```

=====
*\n\nimport {env, KernelConfig, KernelFunc, LeakyRelu, LeakyReluAttrs, LeakyReluInputs, TensorInfo, util}
from '@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from '../backend_webgl';\nimport
{BinaryOpProgram} from '../binaryop_gpu';\nimport {BinaryOpPackedProgram} from
'../binaryop_packed_gpu';\n\nexport const LEAKYRELU = `return (a < 0.) ? b * a : a;`\n\nexport const
LEAKYRELU_PACKED = `\n vec4 aLessThanZero = vec4(lessThan(a, vec4(0.)));
\n return (aLessThanZero * (b
* a)) + ((vec4(1.0) - aLessThanZero)
* a);\n`;
\n\nexport function leakyRelu(args: {\n inputs: LeakyReluInputs,\n backend: MathBackendWebGL,\n attrs: LeakyReluAttrs\n}): TensorInfo {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const
{alpha} = attrs;\n\n const $alpha = backend.makeTensorInfo([\n [], 'float32',\n util.createScalarValue(alpha as
{ } as 'float32', 'float32'));\n\n const program = env().getBool('WEBGL_PACK_BINARY_OPERATIONS') ?\n new
BinaryOpPackedProgram(LEAKYRELU_PACKED, x.shape, $alpha.shape) :\n new
BinaryOpProgram(LEAKYRELU, x.shape, $alpha.shape);\n const result = backend.runWebGLProgram(program,
[x, $alpha], x.dtype);\n\n backend.disposeIntermediateTensorInfo($alpha);\n\n return result;\n}\n\nexport const
leakyReluConfig: KernelConfig = {\n kernelName: LeakyRelu,\n backendName: 'webgl',\n kernelFunc: leakyRelu
as { } as KernelFunc\n};\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License,
Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may
obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by
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BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {env, KernelConfig, KernelFunc, Prelu, PreluInputs, TensorInfo} from '@tensorflow/tfjs-
core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\nimport {BinaryOpProgram} from
'../binaryop_gpu';\nimport {BinaryOpPackedProgram} from '../binaryop_packed_gpu';\n\nexport const PRELU =
`return (a < 0.) ? b * a : a;`\n\nexport const PRELU_PACKED = `\n vec4 aLessThanZero = vec4(lessThan(a,
vec4(0.)));
\n return (aLessThanZero * (b * a)) + ((vec4(1.0) - aLessThanZero) * a);\n`;
\n\nexport function
prelu(args: {inputs: PreluInputs, backend: MathBackendWebGL}):\n TensorInfo {\n const {inputs, backend} =
args;\n const {x, alpha} = inputs;\n\n const program = env().getBool('WEBGL_PACK_BINARY_OPERATIONS')
?\n new BinaryOpPackedProgram(PRELU_PACKED, x.shape, alpha.shape) :\n new
BinaryOpProgram(PRELU, x.shape, alpha.shape);\n return backend.runWebGLProgram(program, [x, alpha],
x.dtype);\n}\n\nexport const preluConfig: KernelConfig = {\n kernelName: Prelu,\n backendName: 'webgl',\n
kernelFunc: prelu as { } as KernelFunc\n};\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required
by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS"
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {backend_util, BinaryInputs, DataType, env, KernelFunc, TypedArray, UnaryInputs, upcastType}
from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\nimport
{BinaryOpProgram} from '../binaryop_gpu';\nimport {BinaryOpPackedProgram} from
'../binaryop_packed_gpu';\nimport {complex} from '../kernels/Complex';\nimport {LEAKYRELU,
LEAKYRELU_PACKED} from '../kernels/LeakyRelu';\nimport {PRELU, PRELU_PACKED} from
'../kernels/Prelu';\nimport * as unary_op from '../unaryop_gpu';\nimport {UnaryOpProgram} from
'../unaryop_gpu';\nimport * as unary_packed_op from '../unaryop_packed_gpu';\nimport

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{UnaryOpPackedProgram} from './unaryop_packed_gpu';\n\nimport {SimpleBinaryKernelImplCPU,
SimpleUnaryKernelImplCPU} from './shared';\n\nexport const CHECK_NAN_SNIPPET_UNARY = `if (isnan(x))
return x;`;
\n\nexport const CHECK_NAN_SNIPPET_BINARY = `
\n if (isnan(a)) return a;\n if (isnan(b)) return
b;\n`;
\n\nexport const CHECK_NAN_SNIPPET_BINARY_PACKED = `
\n result.r = isNaN.r > 0. ? NAN :
result.r;\n result.g = isNaN.g > 0. ? NAN : result.g;\n result.b = isNaN.b > 0. ? NAN : result.b;\n result.a = isNaN.a
> 0. ? NAN : result.a;\n`;
\n\ntype UnaryKernelFuncConfig = {\n opSnippet: string,\n packedOpSnippet?: string,\n
cpuKernelImpl?: SimpleUnaryKernelImplCPU,\n dtype?: DataType\n};
\n\n/**\n * Template that creates a
`KernelFunc` for unary ops.\n * @param opSnippet Op snippet to create `UnaryOpProgram`.\n * @param
packedOpSnippet Op snippet to create `UnaryOpPackedProgram`.\n * @param dtype Optional. If set, the result has
this dtype. Otherwise, the\n *
result has the same dtype as the first input. This is mainly used in\n * comparison kernels, such as Equal, Less,
Greater, etc.\n */
\n\nexport function unaryKernelFunc(\n {opSnippet, packedOpSnippet, cpuKernelImpl, dtype}:
UnaryKernelFuncConfig):\n KernelFunc {\n return ({inputs, backend}) => {\n const {x} = inputs as
UnaryInputs;\n const webGLBackend = backend as MathBackendWebGL;\n\n const $dtype = dtype || x.dtype;\n
if (webGLBackend.shouldExecuteOnCPU([x]) && cpuKernelImpl != null) {\n const xData =
webGLBackend.texData.get(x.dataId);\n const outValues = cpuKernelImpl(xData.values as TypedArray,
$dtype);\n return webGLBackend.makeTensorInfo(x.shape, $dtype, outValues);\n }\n\n const
shouldUsePackedProgram =\n env().getBool('WEBGL_PACK_UNARY_OPERATIONS') &&
packedOpSnippet != null;\n let program: UnaryOpProgram|UnaryOpPackedProgram;\n if
(shouldUsePackedProgram) {\n program = new UnaryOpPackedProgram(x.shape, packedOpSnippet);\n
} else {\n program = new UnaryOpProgram(x.shape, opSnippet);\n }\n\n return
webGLBackend.runWebGLProgram(program, [x], $dtype);\n };
\n\n\ntype BinaryKernelFuncConfig = {\n opSnippet: string,\n packedOpSnippet?: string,\n
checkOutOfBounds?: boolean,\n supportsComplex?: boolean,\n
cpuKernelImpl?: SimpleBinaryKernelImplCPU,\n dtype?: DataType\n};
\n\n/**\n * Template that creates a
`KernelFunc` for binary ops.\n * @param opSnippet Op snippet to create `BinaryOpProgram`.\n * @param
packedOpSnippet Op snippet to create `BinaryOpPackedProgram`.\n * @param
checkOutOfBoundsForPackedProgram Whether to set checkOutOfBounds=true\n * when creating
BinaryOpPackedProgram.\n * @param dtype Optional. If set, the result has this dtype. Otherwise, the\n * result
has the same dtype as the first input. This is mainly used in\n * comparison kernels, such as Equal, Less, Greater,
etc.\n */
\n\nexport function binaryKernelFunc(\n {opSnippet, packedOpSnippet, checkOutOfBounds
= false,\n supportsComplex = false,\n cpuKernelImpl, dtype}: BinaryKernelFuncConfig): KernelFunc {\n
return ({inputs, backend}) => {\n const {a, b} = inputs as BinaryInputs;\n const webGLBackend = backend as
MathBackendWebGL;\n\n if (supportsComplex && a.dtype === 'complex64') {\n const aData =
webGLBackend.texData.get(a.dataId);\n const bData = webGLBackend.texData.get(b.dataId);\n\n const [real,
imag] = [\n [aData.complexTensorInfos.real, bData.complexTensorInfos.real],\n
[aData.complexTensorInfos.imag, bData.complexTensorInfos.imag]\n].map(complexParts => {\n const
[aPart, bPart] = complexParts;\n\n const aHandle = {\n dataId: aPart.dataId,\n dtype: aPart.dtype,\n
shape: a.shape\n };
\n const bHandle = {\n dataId: bPart.dataId,\n dtype: bPart.dtype,\n
shape: b.shape\n };
\n\n const program = new BinaryOpProgram(opSnippet, a.shape,
b.shape);\n return webGLBackend.runWebGLProgram(\n program, [aHandle, bHandle],
upcastType(aPart.dtype, bPart.dtype));\n });\n\n const complexOutput =\n complex({inputs: {real,
imag}, backend: webGLBackend});\n\n webGLBackend.disposeIntermediateTensorInfo(real);\n
webGLBackend.disposeIntermediateTensorInfo(imag);\n\n // TODO(annxingyuan): Implement CPU forwarding
for complex inputs.\n\n return complexOutput;\n }\n\n const $dtype = dtype || upcastType(a.dtype,
b.dtype);\n if (webGLBackend.shouldExecuteOnCPU([a, b]) && cpuKernelImpl != null) {\n const aData =
webGLBackend.texData.get(a.dataId);\n const bData = webGLBackend.texData.get(b.dataId);\n const
[outValues, outShape] = cpuKernelImpl(\n a.shape, b.shape, aData.values as TypedArray,\n bData.values
as TypedArray, $dtype);\n const out = webGLBackend.makeTensorInfo(outShape, $dtype);\n const outData

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= webglBackend.texData.get(out.dataId);\n
 outData.values = outValues;\n return out;\n };\n\n const shouldUsePackedProgram =\n
env().getBool('WEBGL_PACK_BINARY_OPERATIONS') &&\n packedOpSnippet != null;\n let program:\n
BinaryOpProgram|BinaryOpPackedProgram;\n if (shouldUsePackedProgram) {\n program = new\n
BinaryOpPackedProgram(\n packedOpSnippet, a.shape, b.shape, checkOutOfBounds);\n } else {\n
program = new BinaryOpProgram(opSnippet, a.shape, b.shape);\n };\n\n return\n
webglBackend.runWebGLProgram(program, [a, b], $dtype);\n };\n\n\nexport function\n
mapActivationToShaderProgram(\n activation: backend_util.Activation, packed = false): string {\n if (activation\n
=== 'linear') {\n if (packed) {\n return unary_packed_op.LINEAR;\n }\n return unary_op.LINEAR;\n }\n
else if (activation === 'relu') {\n if (packed) {\n return unary_packed_op.RELU;\n }\n return\n
unary_op.RELU;\n } else if (activation === 'elu') {\n if (packed)\n
{\n return unary_packed_op.ELU;\n }\n return unary_op.ELU;\n } else if (activation === 'relu6') {\n if\n
(packed) {\n return unary_packed_op.RELU6;\n }\n return unary_op.RELU6;\n } else if (activation ===\n
'prelu') {\n if (packed) {\n return PRELU_PACKED;\n }\n return PRELU;\n } else if (activation ===\n
'leakyrelu') {\n if (packed) {\n return LEAKYRELU_PACKED;\n }\n return LEAKYRELU;\n }\n\n throw\n
new Error('Activation ${\n activation} has not been implemented for the WebGL backend.);\n };\n\n\n"/**\n *\n
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BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the\n
License for the specific language governing permissions and\n * limitations under the License.\n *\n
=====\n\n\n*\n\nimport {GPGPUProgram} from './gpgpu_math';\n\nexport class MatMulPackedProgram implements\n
GPGPUProgram {\n variableNames = ['matrixA', 'matrixB'];\n packedInputs = true;\n packedOutput = true;\n\n outputShape: number[];\n userCode: string;\n\n constructor(\n aShape: [number, number, number], bShape:\n
[number, number, number],\n outputShape: [number, number, number], transposeA = false,\n transposeB =\n false, addBias = false, activation: string = null,\n hasPreluActivation = false, hasLeakyreluActivation = false) {\n\n this.outputShape = outputShape;\n const sharedDim = transposeA ? aShape[1] : aShape[2];\n const\n
sharedDimensionPacked = Math.ceil(sharedDim / 2);\n\n const aSample\n
= transposeA ? 'i * 2, rc.y' : 'rc.y, i * 2';\n const bSample = transposeB ? 'rc.z, i * 2' : 'i * 2, rc.z';\n const\n
aSwizzle = transposeA ? ['a.xxyy', 'a.zzww'] : ['a.xzzz', 'a.yyww'];\n const bSwizzle = transposeB ? ['b.xzzz',\n
'b.yyyw'] : ['b.xxyy', 'b.zzww'];\n\n let activationSnippet = "", applyActivationSnippet = "";\n if (activation) {\n\n if (hasPreluActivation) {\n activationSnippet = `vec4 activation(vec4 a) {\n vec4 b =\n
getPreluActivationWeightsAtOutCoords();\n ${activation}\n };`\n } else if (hasLeakyreluActivation)\n
{\n activationSnippet = `vec4 activation(vec4 a) {\n vec4 b = getLeakyreluAlphaAtOutCoords();\n\n ${activation}\n };\n } else {\n activationSnippet = `vec4 activation(vec4 x) {\n ${activation}\n\n };\n };\n\n applyActivationSnippet = `result = activation(result);`\n }\n\n const addBiasSnippet = addBias\n
? `result += getBiasAtOutCoords();`\n\n : `;\n\n if (addBias) {\n this.variableNames.push('bias');\n }\n\n if (hasPreluActivation) {\n\n this.variableNames.push('preluActivationWeights');\n }\n\n if (hasLeakyreluActivation) {\n\n this.variableNames.push('leakyreluAlpha');\n }\n\n let batchASnippet = 'rc.x';\n let batchBSnippet = 'rc.x';\n\n if (aShape[0] < bShape[0]) {\n batchASnippet = `int(min(float(rc.x), ${aShape[0]} - 1));`\n } else if\n
(bShape[0] < aShape[0]) {\n batchBSnippet = `int(min(float(rc.x), ${bShape[0]} - 1));`\n }\n\n this.userCode\n
= `\n ${activationSnippet}\n\n const float sharedDimension = ${sharedDimensionPacked}.0;\n\n vec4\n
dot2x2ARowBCol(ivec3 rc) {\n vec4 result = vec4(0);\n for (int i = 0; i < ${sharedDimensionPacked}; i++)\n
{\n int batchA = ${batchASnippet};\n int batchB = ${batchBSnippet};\n vec4 a =\n
getMatrixA(batchA, ${aSample});\n vec4 b = getMatrixB(batchB, ${bSample});\n\n

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// These swizzled products need to be separately added.\n // See:
https://github.com/tensorflow/tfjs/issues/1735\n result += (${aSwizzle[0]} * ${bSwizzle[0]});\n result
+= (${aSwizzle[1]} * ${bSwizzle[1]});\n }\n return result;\n }\n\n void main() {\n ivec3 rc =
getOutputCoords();\n ivec4 result = dot2x2ARowBCol(rc);\n\n ${addBiasSnippet}\n\n
${applyActivationSnippet}\n\n setOutput(result);\n }\n `;\n }\n}\n\n",/**\n * @license\n * Copyright 2018
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may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS
OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions
and\n * limitations under the License.\n *
=====
*\n\nimport {backend_util} from '@tensorflow/tfjs-core';\nimport {GPGPUProgram} from './gpgpu_math';\n\n//
(Ar + Ai)(Br + Bi) =\n// ArBr + ArBi + AiBr + AiBi = ArBr - AB + ArBi + AiBr\n// Yr = ArBr - AB\n// Yi = ArBi
+ AiBr\n\nexport const COMPLEX_MULTIPLY = {\n REAL: 'return areal * breal - aimag * bimag;',\n IMAG:
'return areal * bimag + aimag * breal;'\n};\n\nexport class BinaryOpComplexProgram implements GPGPUProgram
{\n variableNames = ['AReal', 'AImag', 'BReal', 'BImag'];\n userCode: string;\n outputShape: number[];\n\n
constructor(op: string, aShape: number[], bShape: number[]) {\n this.outputShape =
backend_util.assertAndGetBroadcastShape(aShape, bShape);\n\n this.userCode = `\n float
binaryOpComplex(\n float areal, float
aimag, float breal, float bimag) {\n ${op}\n }\n\n void main() {\n float areal =
getARealAtOutCoords();\n float aimag = getAImagAtOutCoords();\n float breal =
getBRealAtOutCoords();\n float bimag = getBImagAtOutCoords();\n setOutput(binaryOpComplex(areal,
aimag, breal, bimag));\n }\n `;\n }\n}\n\n",/**\n * @license\n * Copyright 2020 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n
*
=====
*\n\nimport {TensorInfo} from '@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from
'./backend_webgl';\nimport {ReshapePackedProgram} from './reshape_packed_gpu';\nimport {getBatchDim,
getRowsCols} from './webgl_util';\n\nexport function packedReshape(\n input: TensorInfo, afterShape:
number[],\n backend: MathBackendWebGL): TensorInfo {\n const input3DShape =\n[getBatchDim(input.shape),\n ...getRowsCols(input.shape)] as [number, number, number];\n const input3D:
TensorInfo = {\n dtype: input.dtype,\n shape: input3DShape,\n dataId: input.dataId\n }; \n const
afterShapeAs3D =\n[getBatchDim(afterShape),\n ...getRowsCols(afterShape)] as [number, number,
number];\n const program = new ReshapePackedProgram(afterShapeAs3D, input3DShape);\n const
preventEagerUnpackingOfOutput = true;\n const output = backend.runWebGLProgram(\n program, [input3D],
input.dtype,
null /* customSetup */,\n preventEagerUnpackingOfOutput);\n return {dataId: output.dataId, shape: afterShape,
dtype: output.dtype};\n }\n\n",/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
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on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or

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implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

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=====\n*\n\nimport { KernelConfig, KernelFunc, Reshape, ReshapeAttrs, ReshapeInputs, TensorInfo, util } from\n '@tensorflow/tfjs-core';\nimport\n { MathBackendWebGL } from '../backend_webgl';\nimport { packedReshape } from '../kernel_utils/reshape';\nimport\n { isReshapeFree } from '../webgl_util';\n\nexport function reshape(args: {\n inputs: ReshapeInputs,\n backend: MathBackendWebGL,\n attrs: ReshapeAttrs\n}): TensorInfo {\n const {inputs, backend, attrs} = args;\n const {x}\n = inputs;\n const {shape} = attrs;\n const webglBackend = backend;\n\n const xSize =\n util.sizeFromShape(x.shape);\n const $shape = util.inferFromImplicitShape(shape, xSize);\n const $xSize =\n util.sizeFromShape($shape);\n\n util.assert(\n xSize === $xSize,\n () => `The new shape (${ $shape }) has\n ${ $xSize } elements and the old ` +\n `shape (${ x.shape }) has ${ xSize } elements. The new shape and old ` +\n `shape must have the same number of elements.`);\n const xTexData =\n webglBackend.texData.get(x.dataId);\n if (xTexData.isPacked && !isReshapeFree(x.shape, $shape) &&\n !(xTexData.texture !== null && isReshapeFree(xTexData.shape,\n $shape))) {\n return packedReshape(x, $shape, webglBackend);\n }\n webglBackend.incref(x.dataId);\n return {dataId: x.dataId, shape: $shape, dtype: x.dtype};\n}\n\nexport const reshapeConfig: KernelConfig = {\n kernelName: Reshape,\n backendName: 'webgl',\n kernelFunc: reshape as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a\n copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable\n law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS"\n BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n*\n\nimport { backend_util, util } from '@tensorflow/tfjs-core';\nimport { GPGPUProgram } from\n './gpgpu_math';\n\nexport class MeanProgram implements GPGPUProgram {\n variableNames = ['x'];\n outputShape: number[];\n userCode: string;\n\n constructor(reduceInfo: backend_util.ReduceInfo, divisor?:\n number) {\n const {windowSize, batchSize, inSize, outSize} = reduceInfo;\n this.outputShape = [batchSize,\n outSize];\n const windowSizeNearestVec4 = Math.floor(windowSize / 4);\n const\n windowSizeVec4Remainder = windowSize % 4;\n\n let updateSnippet = `sumValue += dot(values, ones);`\n if\n (divisor !== null) {\n const denominator = 1 / divisor;\n updateSnippet = `sumValue += dot(values * ${\n util.isInt(denominator) ? denominator.toPrecision(2) :\n denominator}, ones);`\n }\n\n let\n checkOutOfBounds = `);\n if (inSize % windowSize > 0) {\n checkOutOfBounds\n = `\n if (inIdx < 0 || inIdx >= ${inSize}) {\n return 0.0;\n }`\n this.userCode = `\n const vec4 ones = vec4(1.0, 1.0, 1.0, 1.0);\n float getValue(int batch, int inIdx) {\n\n ${checkOutOfBounds}\n return getX(batch, inIdx);\n }\n\n void main() {\n ivec2 coords =\n getOutputCoords();\n int batch = coords[0];\n int outIdx = coords[1];\n int inOffset = outIdx *\n ${windowSize};\n\n float sumValue = 0.0;\n\n for (int i = 0; i < ${windowSizeNearestVec4}; i += 4) {\n\n int inIdx = inOffset + i;\n vec4 values = vec4(\n getValue(batch, inIdx),\n getValue(batch,\n inIdx + 1),\n getValue(batch, inIdx + 2),\n getValue(batch, inIdx + 3)\n);\n\n ${updateSnippet}\n }\n\n int inIdx = inOffset + ${windowSizeNearestVec4};\n if\n (${windowSizeVec4Remainder} === 1) {\n vec4 values =\n vec4(getValue(batch, inIdx), 0.0, 0.0, 0.0);\n ${updateSnippet}\n } else if\n (${windowSizeVec4Remainder} === 2) {\n vec4 values = vec4(\n getValue(batch, inIdx),\n getValue(batch, inIdx + 1),\n 0.0, 0.0);\n ${updateSnippet}\n } else if (${windowSizeVec4Remainder\n === 3}) {\n vec4 values = vec4(\n getValue(batch, inIdx),\n getValue(batch, inIdx + 1),\n getValue(batch, inIdx + 2),\n 0.0);\n ${updateSnippet}\n }\n\n setOutput(sumValue);\n }\n `;\n }\n}
```

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```
=====\\n
*\\n\\nimport {backend_util} from '@tensorflow/tfjs-core';\\nimport {GPGPUProgram} from
'./gpgpu_math';\\n\\nexport class ReduceProgram implements GPGPUProgram {\\n variableNames = ['x'];\\n
outputShape: number[];\\n userCode: string;\\n\\n constructor(\\n reduceInfo: backend_util.ReduceInfo,\\n
reduceType: 'all'|'any'|'max'|'min'|'sum'|'prod') {\\n const {windowSize, batchSize, inSize, outSize} = reduceInfo;\\n
this.outputShape = [batchSize, outSize];\\n\\n let initializationValue = '0.0';\\n let compareOp = ``;\\n\\n if
(reduceType === 'prod') {\\n initializationValue = '1.0';\\n } else if (reduceType === 'min') {\\n // WebGL on
Firefox Linux can't compile
1/0 so we do 1/eps.\\n initializationValue = '1.0 / 1e-20';\\n compareOp = `min`;\\n } else if (reduceType ===
'max') {\\n // WebGL on Firefox Linux can't compile 1/0 so we do 1/eps.\\n initializationValue = '-1.0 / 1e-
20';\\n compareOp = `max`;\\n }\\n\\n let returnValue = `${reduceType}(${reduceType})(${reduceType})^ +\\n
'minMaxValue[0], minMaxValue[1], minMaxValue[2], minMaxValue[3]`;\\n\\n if (reduceType === 'sum') {\\n
returnValue = `sumValue`;\\n } else if (reduceType === 'prod') {\\n returnValue = `prodValue`;\\n } else if
(reduceType === 'all') {\\n returnValue = `allValue`;\\n } else if (reduceType === 'any') {\\n returnValue =
`anyValue`;\\n }\\n\\n const windowSizeNearestVec4 = Math.floor(windowSize / 4) * 4;\\n const
windowSizeVec4Remainder = windowSize % 4;\\n\\n let updateSnippet = `\\n if (${reduceType} === 'sum') {\\n
sumValue += dot(values, ones);\\n } else if (${reduceType} === 'prod') {\\n
vec2 tmp = vec2(values[0], values[1]) * vec2(values[2], values[3]);\\n prodValue *= tmp[0] * tmp[1];\\n }
else {\\n minMaxValue = ${compareOp}(values, minMaxValue);\\n }\\n `;\\n\\n let vecType = `vec4`;\\n\\n
if (reduceType === 'all') {\\n initializationValue = '1.0';\\n updateSnippet = `\\n bool reducedAllValue =
all(values);\\n float floatedReducedAllValue = float(reducedAllValue);\\n allValue = float(allValue >= 1.0
&& floatedReducedAllValue >= 1.0);\\n `;\\n vecType = `bvec4`;\\n } else if (reduceType === 'any') {\\n
initializationValue = '0.0';\\n updateSnippet = `\\n bool reducedAnyValue = any(values);\\n float
floatedReducedAnyValue = float(reducedAnyValue);\\n anyValue = float(anyValue >= 1.0 ||
floatedReducedAnyValue >= 1.0);\\n `;\\n vecType = `bvec4`;\\n }\\n\\n let checkOutOfBounds = `\\n if
(inSize % windowSize > 0) {\\n checkOutOfBounds = `\\n if (inIdx < 0
|| inIdx >= ${inSize}) {\\n return initializationValue;\\n }\\n `;\\n }\\n this.userCode = `\\n const
float initializationValue = ${initializationValue};\\n const vec4 ones = vec4(1.0, 1.0, 1.0, 1.0);\\n\\n float
getValue(int batch, int inIdx) {\\n ${checkOutOfBounds}\\n return getX(batch, inIdx);\\n }\\n\\n void
main() {\\n ivec2 coords = getOutputCoords();\\n int batch = coords[0];\\n int outIdx = coords[1];\\n
int inOffset = outIdx * ${windowSize};\\n\\n vec4 minMaxValue = vec4(${initializationValue});\\n float
prodValue = 1.0;\\n float sumValue = 0.0;\\n float allValue = 1.0;\\n float anyValue = 0.0;\\n\\n for
(int i = 0; i < ${windowSizeNearestVec4}; i += 4) {\\n int inIdx = inOffset + i;\\n ${vecType} values =
${vecType}(\\n getValue(batch, inIdx),\\n getValue(batch, inIdx + 1),\\n getValue(batch, inIdx +
2),\\n getValue(batch,
inIdx + 3)\\n);\\n\\n ${updateSnippet}\\n }\\n\\n int inIdx = inOffset +
${windowSizeNearestVec4};\\n if (${windowSizeVec4Remainder} === 1) {\\n ${vecType} values =
${vecType}(\\n getValue(batch, inIdx),\\n initializationValue,\\n initializationValue,\\n
initializationValue\\n);\\n\\n ${updateSnippet}\\n } else if (${windowSizeVec4Remainder} === 2) {\\n
${vecType} values = ${vecType}(\\n getValue(batch, inIdx),\\n getValue(batch, inIdx + 1),\\n
initializationValue,\\n initializationValue\\n);\\n\\n ${updateSnippet}\\n } else if
```

```

({windowSizeVec4Remainder === 3}) {
 $vecType values = $vecType(
 getValue(batch, inIdx),
 getValue(batch, inIdx + 1),
 getValue(batch, inIdx + 2),
 initializationValue);
 $updateSnippet
}
setOutput($returnValue);
}
`;
}
}
"/**
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 */
=====
*/
import {backend_util, DataType, TensorInfo} from '@tensorflow/tfjs-core';
import {MathBackendWebGL} from '../backend_webgl';
import {MeanProgram} from '../mean_gpu';
import {ReduceProgram} from '../reduce_gpu';
ntype
ReduceTypes = 'all'|'any'|'max'|'min'|'sum'|'prod'|'mean';
// Returns an array of configuration objects that describe
each stage of the
// reduction.
function getReductionStages(inShape: number[]):
 Array<{inSize: number,
 windowSize: number, outSize: number}> {
 const stages = [];
 while (stages.length === 0 ||
 stages[stages.length - 1].outSize !== 1) {
 const outSize: number =
 stages.length ? stages[stages.length -
 1].outSize : inShape[1];
 const windowSize = backend_util.computeOptimalWindowSize(outSize);
 stages.push({
 inSize: outSize,
 windowSize,
 outSize: Math.ceil(outSize / windowSize)
 });
 }
}
export function reduce(
 x: TensorInfo, dtype: DataType, reductionType: ReduceTypes,
 backend: MathBackendWebGL): TensorInfo {
 const reductionStages = getReductionStages(x.shape);
 let result = x;
 for (let i = 0; i < reductionStages.length; i++) {
 const {inSize,
 windowSize, outSize} = reductionStages[i];
 let program: ReduceProgram|MeanProgram;
 let previousResult: TensorInfo;
 if (reductionType === 'mean') {
 program = i === 0 ?
 new MeanProgram(
 {windowSize, inSize, batchSize: x.shape[0], outSize}, inSize) :
 new MeanProgram(
 {windowSize, inSize, batchSize: x.shape[0], outSize});
 } else {
 program = new ReduceProgram(
 {windowSize, inSize, batchSize: x.shape[0], outSize}, reductionType);
 }
 previousResult = result;
 result = backend.runWebGLProgram(program, [result], dtype);
 if
 (previousResult.dataId !== x.dataId) {
 backend.disposeIntermediateTensorInfo(previousResult);
 }
 }
 return result;
}
"/**
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 * limitations under the License.
 */
=====
*/
import {GPGPUProgram} from '../gpgpu_math';
import {getCoordsDataType} from
'/shader_compiler';
export class TransposeProgram implements GPGPUProgram {
 variableNames = ['A'];
 outputShape: number[];
 userCode: string;
 rank: number;
 constructor(aShape: number[], newDim:
 number[]) {
 const outputShape: number[] = new Array(aShape.length);
 for (let i = 0; i < outputShape.length;
 i++) {
 outputShape[i] = aShape[newDim[i]];
 }
 this.outputShape = outputShape;
 this.rank =
 outputShape.length;
 const dtype = getCoordsDataType(this.rank);
 const switched =
 getSwitchedCoords(newDim);
 this.userCode = `
 void main() {
 ${dtype} resRC =
 getOutputCoords();
 setOutput(getA(${switched}));
 }
`;
}
function
getSwitchedCoords(newDim: number[]): string {
 const rank = newDim.length;
 if (rank > 6) {
 throw
 Error(`Transpose for rank ${rank} is not yet supported`);
 }
 const originalOrder =
 ['resRC.x', 'resRC.y',

```

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'resRC.z', 'resRC.w', 'resRC.u', 'resRC.v'];\n const switchedCoords = new Array(rank);\n for (let i = 0; i <
newDim.length; i++) {\n switchedCoords[newDim[i]] = originalOrder[i];\n }\n return
switchedCoords.join();\n}\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed
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http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {GPGPUProgram} from './gpgpu_math';\nimport {getVecChannels} from './packing_util';\nimport
{getCoordsDataType} from './shader_compiler';\n\nexport class TransposePackedProgram implements
GPGPUProgram {\n variableNames = ['A'];\n outputShape: number[];\n userCode: string;\n rank: number;\n packedInputs = true;\n packedOutput = true;\n\n constructor(aShape: number[], newDim: number[]) {\n const
outputShape: number[] = new Array(aShape.length);\n for (let i = 0; i < outputShape.length; i++) {\n
outputShape[i]
= aShape[newDim[i];\n }\n this.outputShape = outputShape;\n this.rank = outputShape.length;\n if
(this.rank > 6) {\n throw Error(\n `Packed transpose for rank ${this.rank} is not yet supported.`);\n }\n const dtype = getCoordsDataType(this.rank);\n const outputOrder = getVecChannels('rc', this.rank);\n const
switchedOrder = new Array(this.rank);\n for (let i = 0; i < newDim.length; i++) {\n switchedOrder[newDim[i]]
= outputOrder[i];\n }\n const innerDims = `vec2(${switchedOrder.slice(-2).join()})`; \n const nextColumn =\n `++${outputOrder[this.rank - 1]} < ${outputShape[this.rank - 1]}`;\n const getc =
`getChannel(getA(${switchedOrder.join()}), ${innerDims})`; \n\n this.userCode = `\n void main() {\n
${dtype} rc = getOutputCoords();\n vec4 result = vec4(0.);\n result[0] = ${getc};\n if(${nextColumn}) {\n
 result[1] = ${getc};\n }\n --${outputOrder[this.rank - 1]};\n if(++${outputOrder[this.rank
- 2]} < ${outputShape[this.rank - 2]}) {\n result[2] = ${getc};\n if(${nextColumn}) {\n result[3] =
${getc};\n }\n }\n setOutput(result);\n }\n `;\n }\n}\n", "/*\n * @license\n * Copyright 2020 Google
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use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {backend_util, sumOutType, TensorInfo,
util} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from './backend_webgl';\nimport {reduce}
from './kernel_utils/reduce';\nimport {reshape} from './Reshape';\nimport {transposeImpl} from
'./Transpose_impl';\n\nexport function sumImpl(\n x: TensorInfo, axis: number|number[], keepDims: boolean,\n backend: MathBackendWebGL): TensorInfo {\n const reductionIndices = axis;\n\n const xRank =
x.shape.length;\n\n const origAxes = util.parseAxisParam(reductionIndices, x.shape);\n let axes = origAxes;\n const permutedAxes = backend_util.getAxesPermutation(axes, xRank);\n const sumInputIsTransposed =
permutedAxes != null;\n\n let sumInput = x;\n if (sumInputIsTransposed) {\n sumInput = transposeImpl(x,
permutedAxes, backend);\n\n axes = backend_util.getInnerMostAxes(axes.length, xRank);\n }\n\n backend_util.assertAxesAreInnerMostDims('sum', axes, xRank);\n const [sumOutShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(sumInput.shape, axes);\n\n let outShape = sumOutShape;\n if (keepDims) {\n // rather than reshape at the end, set the target shape here.\n outShape = backend_util.expandShapeToKeepDim(sumOutShape, origAxes);\n }\n\n const inSize =
util.sizeFromShape(reduceShape);\n const xSize = util.sizeFromShape(x.shape);\n const batchSize = xSize /

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inSize;\n const reshapedInput = reshape(\n {inputs: {x: sumInput}, attrs: {shape: [batchSize, inSize]},
backend});\n\n const outType = sumOutType(x.dtype);\n\n const reduced = reduce(reshapedInput, outType, 'sum',
backend);\n const out =\n reshape({inputs: {x: reduced}, attrs: {shape: outShape}, backend});\n\n\n
backend.disposeIntermediateTensorInfo(reshapedInput);\n backend.disposeIntermediateTensorInfo(reduced);\n if
(sumInputIsTransposed) {\n backend.disposeIntermediateTensorInfo(sumInput);\n }\n\n return out;\n\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {KernelConfig, KernelFunc, Sum, SumAttrs, SumInputs} from '@tensorflow/tfjs-core';\n\nimport
{MathBackendWebGL} from './backend_webgl';\n\nimport {sumImpl} from './Sum_impl';\n\nexport function
sum(\n args: {inputs: SumInputs, attrs: SumAttrs, backend: MathBackendWebGL}) {\n const {inputs, backend,
attrs} = args;\n\n const {x} = inputs;\n const {axis, keepDims} = attrs;\n\n return sumImpl(x,
axis, keepDims, backend);\n}\n\nexport const sumConfig: KernelConfig = {\n kernelName: Sum,\n
backendName: 'webgl',\n kernelFunc: sum as {} as KernelFunc\n};\n\n", "/*\n * @license\n * Copyright 2020
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {backend_util, TensorInfo, upcastType, util} from '@tensorflow/tfjs-core';\n\nimport
{MathBackendWebGL}
from './backend_webgl';\n\nimport {mapActivationToShaderProgram} from
'./kernel_utils/kernel_funcs_utils';\n\nimport {MatMulPackedProgram} from './mulmat_packed_gpu';\n\nimport
{multiply} from './Multiply';\n\nimport {reshape} from './Reshape';\n\nimport {sum} from './Sum';\n\nimport {transpose}
from './Transpose';\n\n// Empirically determined minimal shared dimension in matmul before we forward\n// to
a.mul(b).sum() in order to take advantage of GPU parallelism. See\n// https://github.com/tensorflow/tfjs-
core/pull/1379 for benchmarks.\n\nexport const MATMUL_SHARED_DIM_THRESHOLD = 1000;\n\n\ninterface
BatchMatMulConfig {\n a: TensorInfo,\n b: TensorInfo,\n transposeA: boolean,\n transposeB: boolean,\n
backend: MathBackendWebGL,\n bias?: TensorInfo,\n preluActivationWeights?: TensorInfo,\n leakyreluAlpha?:
number,\n activation?: backend_util.Activation\n};\n\nexport function batchMatMulImpl({\n a,\n b,\n
transposeA,\n transposeB,\n backend,\n bias = null,\n preluActivationWeights
= null,\n leakyreluAlpha = 0,\n activation = null\n}: BatchMatMulConfig): TensorInfo {\n const aRank =
a.shape.length;\n const bRank = b.shape.length;\n\n const innerShapeA = transposeA ? a.shape[aRank - 2] :
a.shape[aRank - 1];\n const innerShapeB = transposeB ? b.shape[bRank - 1] : b.shape[bRank - 2];\n\n const
outerShapeA = transposeA ? a.shape[aRank - 1] : a.shape[aRank - 2];\n const outerShapeB = transposeB ?
b.shape[bRank - 2] : b.shape[bRank - 1];\n\n const outerDimsA = a.shape.slice(0, -2);\n const outerDimsB =
b.shape.slice(0, -2);\n\n const batchDimA = util.sizeFromShape(outerDimsA);\n const batchDimB =
util.sizeFromShape(outerDimsB);\n\n const batchDimsCompatible =\n batchDimA === batchDimB ||
batchDimA === 1 || batchDimB === 1;\n\n util.assert(\n aRank >= 2 && bRank >= 2 &&
batchDimsCompatible,\n () => `Error in matMul: the input batch dimensions must either be the ` +\n `same
or at least one input batch dimension must be 1. Got

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```

input ` +\n `batch dimensions of (${outerDimsA}) and (${outerDimsB}).`);\n\n const outShapeOuterDims
=\n batchDimA > batchDimB ? a.shape.slice(0, -2) : b.shape.slice(0, -2);\n const outShape =
outShapeOuterDims.concat([outerShapeA, outerShapeB]);\n\n util.assert(\n innerShapeA === innerShapeB,\n () => `Error in matMul: inner shapes (${innerShapeA}) and ` +\n `${innerShapeB}) of Tensors with shapes
${a.shape} and ` +\n `${b.shape} and transposeA=${transposeA}` +\n ` and transposeB=${transposeB}
must match.`);\n\n const a3dShape: [number, number, number] = transposeA ?\n [batchDimA, innerShapeA,
outerShapeA] :\n [batchDimA, outerShapeA, innerShapeA];\n const b3dShape: [number, number, number] =
transposeB ?\n [batchDimB, outerShapeB, innerShapeB] :\n [batchDimB, innerShapeB, outerShapeB];\n\n //
The rest of the implementation is designed to operate on rank-3 tensors\n const a3d = reshape({inputs: {x: a},
backend,
attrs: {shape: a3dShape}});\n const b3d = reshape({inputs: {x: b}, backend, attrs: {shape: b3dShape}});\n\n const
intermediates: TensorInfo[] = [a3d, b3d];\n\n const batchDim = Math.max(batchDimA, batchDimB);\n const
sharedDim = transposeA ? a3d.shape[1] : a3d.shape[2];\n\n const hasBias = bias != null;\n const
hasPreluActivationWeights = preluActivationWeights != null;\n const hasLeakyreluAlpha = activation ===
'leakyrelu';\n const fusedActivation = activation != null ?\n mapActivationToShaderProgram(activation, true) :\n null;\n const containsFusedOps = hasBias || hasPreluActivationWeights ||\n hasLeakyreluAlpha ||
fusedActivation != null;\n let out: TensorInfo;\n\n // Since the matrices are vectors, it is faster to call mul().sum()\n
// because sum() is O(sqrt(N)) due to divide-and-conquer.\n if ((outerShapeA === 1 || outerShapeB === 1) &&\n
sharedDim > MATMUL_SHARED_DIM_THRESHOLD && containsFusedOps === false) {\n let aVec = a3d;\n let bVec
= b3d;\n if (transposeA) {\n aVec = transpose({inputs: {x: a3d}, backend, attrs: {perm: [0, 2, 1]}});\n
intermediates.push(aVec);\n }\n if (transposeB) {\n bVec = transpose({inputs: {x: b3d}, backend, attrs:
{perm: [0, 2, 1]}});\n intermediates.push(bVec);\n }\n\n const shouldReshapeA = outerShapeB !== 1;\n const
shouldReshapeB = outerShapeB === 1;\n\n let aVec3d = aVec;\n if (shouldReshapeA) {\n aVec3d =
reshape({\n inputs: {x: aVec},\n backend,\n attrs: {shape: [batchDim, sharedDim, 1]}\n });\n\n
intermediates.push(aVec3d);\n }\n\n const axis = outerShapeB === 1 ? 2 : 1;\n let bVec3d = bVec;\n if
(shouldReshapeB) {\n bVec3d = reshape({\n inputs: {x: bVec},\n backend,\n attrs: {shape:
[batchDim, 1, sharedDim]}\n });\n\n intermediates.push(bVec3d);\n }\n\n const product =
multiply({inputs: {a: aVec3d, b: bVec3d}, backend});\n out = sum({inputs: {x:
product}, backend, attrs: {axis, keepDims: true}});\n intermediates.push(product);\n } else {\n const dtype =
upcastType(a.dtype, b.dtype);\n\n const program = new MatMulPackedProgram(\n a3dShape, b3dShape,
[batchDim, outerShapeA, outerShapeB], transposeA,\n transposeB, hasBias, fusedActivation,
hasPreluActivationWeights,\n hasLeakyreluAlpha);\n\n const inputs: TensorInfo[] = [a3d, b3d];\n if (bias !=
null) {\n inputs.push(bias);\n }\n if (hasPreluActivationWeights) {\n
inputs.push(preluActivationWeights);\n }\n if (hasLeakyreluAlpha) {\n const $leakyreluAlpha =
backend.makeTensorInfo(\n [], 'float32',\n util.createScalarValue(leakyreluAlpha as {} as 'float32',
'float32'));\n inputs.push($leakyreluAlpha);\n intermediates.push($leakyreluAlpha);\n }\n\n out =
backend.runWebGLProgram(program, inputs, dtype);\n }\n\n const outReshaped =\n reshape({inputs: {x: out},
backend, attrs: {shape:
outShape}});\n intermediates.push(out);\n for (const i of intermediates) {\n
backend.disposeIntermediateTensorInfo(i);\n }\n return outReshaped;\n}\n\n", "/**\n * @license\n * Copyright 2020
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the License);\n * you may
not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
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CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing
permissions and\n * limitations under the License.\n *
===== \n

```

```

*\n\nimport { _FusedMatMul, _FusedMatMulAttrs, _FusedMatMulInputs, KernelConfig, KernelFunc } from
'@tensorflow/tfjs-core';\n\nimport
{ MathBackendWebGL } from './backend_webgl';\n\nimport { batchMatMulImpl } from
'./BatchMatMul_impl';\n\nexport function _fusedMatMul(args: {\n inputs: _FusedMatMulInputs,\n attrs:
_FusedMatMulAttrs,\n backend: MathBackendWebGL\n}) {\n const {inputs, backend, attrs} = args;\n const {a, b,
bias, preluActivationWeights} = inputs;\n const {transposeA, transposeB, activation, leakyreluAlpha} = attrs;\n\n
return batchMatMulImpl({\n a,\n b,\n transposeA,\n transposeB,\n backend,\n bias,\n
preluActivationWeights,\n leakyreluAlpha,\n activation\n });\n}\n\nexport const _fusedMatMulConfig:
KernelConfig = {\n kernelName: _FusedMatMul,\n backendName: 'webgl',\n kernelFunc: _fusedMatMul as {} as
KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License
at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in
writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT
WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport { Acos, KernelConfig } from '@tensorflow/tfjs-core';\n\nimport { unaryKernelFunc } from
'./kernel_utils/kernel_funcs_utils';\n\nimport { CHECK_NAN_SNIPPET } from './unaryop_gpu';\n\nconst ACOS =
CHECK_NAN_SNIPPET +`\n if (abs(x) > 1.) {\n return NAN;\n }\n return acos(x);`; \n\nexport const acos =
unaryKernelFunc({ opSnippet: ACOS });\n\nexport const acosConfig: KernelConfig = {\n kernelName: Acos,\n
backendName: 'webgl',\n kernelFunc: acos,\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport { Acosh, KernelConfig } from '@tensorflow/tfjs-core';\n\nimport { unaryKernelFunc } from
'./kernel_utils/kernel_funcs_utils';\n\nimport { CHECK_NAN_SNIPPET } from './unaryop_gpu';\n\nconst ACOSH =
CHECK_NAN_SNIPPET +`\n if (x < 1.0) return NAN;\n return log(x + sqrt(x * x - 1.0));`; \n\nexport const acosh =
unaryKernelFunc({ opSnippet:
ACOSH });\n\nexport const acoshConfig: KernelConfig = {\n kernelName: Acosh,\n backendName: 'webgl',\n
kernelFunc: acosh,\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed
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on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====\n
*\n\nimport { GPGPUProgram } from './gpgpu_math';\n\nexport class AddNProgram implements GPGPUProgram
{\n variableNames: string[];\n outputShape:
number[] = [];\n userCode: string;\n\n constructor(outputShape: number[], shapes: number[][]) {\n
this.outputShape = outputShape;\n this.variableNames = shapes.map((_, i) => `T${i}`);\n\n const snippets:
string[] = [];\n // Get target elements from every input tensor.\n this.variableNames.forEach(variable => {\n
snippets.push(`float v${variable} = get${variable}AtOutCoords();`);\n });\n\n // Calculate the sum of all

```



```

elements.\n const operation = this.variableNames\n .map(variable => {\n return
`v${variable}`;\n })\n .join(' + ');\n\n this.userCode = `\n void main() {\n
${snippets.join("\n ")}\n\n float result = ${operation};\n setOutput(result);\n }\n `;\n
}\n}\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache
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WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {GPGPUProgram} from './gpgpu_math';\n\nexport class AddNPackedProgram implements
GPGPUProgram {\n variableNames: string[];\n outputShape: number[] = [];\n userCode: string;\n packedInputs =
true;\n packedOutput = true;\n\n constructor(outputShape: number[], shapes: number[][])\n {\n this.outputShape =
outputShape;\n this.variableNames = shapes.map((_, i) => `T${i}`);\n const snippets: string[]
= [];\n // Get target elements from every input tensor.\n this.variableNames.forEach(variable => {\n
snippets.push(`vec4 v${variable} = get${variable}AtOutCoords();`);\n });\n // Calculate the sum of all
elements.\n const operation = this.variableNames\n .map(variable => {\n return
`v${variable}`;\n })\n .join(' + ');\n\n this.userCode = `\n void main() {\n
${snippets.join("\n ")}\n\n vec4 result = ${operation};\n setOutput(result);\n }\n `;\n
}\n}\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache
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 * you may not use this file except in compliance with the License.\n * You
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software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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=====
*\n\nimport {AddN, AddNInputs, env, KernelConfig, KernelFunc, TensorInfo, upcastType} from
'@tensorflow/tfjs-core';\n\nimport {AddNProgram} from './addn_gpu';\nimport {AddNPackedProgram} from
'./addn_packed_gpu';\nimport {MathBackendWebGL} from './backend_webgl';\nimport {identity} from
'./Identity';\n\nexport function addN(args: {inputs: AddNInputs, backend: MathBackendWebGL}):\n TensorInfo
{\n const {inputs, backend} = args;\n const tensors = inputs;\n if (tensors.length === 1) {\n return
identity({inputs: {x: tensors[0]}, backend});\n }\n // Limit the number of uploaded textures for optimization.\n
(tensors.length > env().get('WEBGL_MAX_TEXTURES_IN_SHADER'))\n
 {\n const midIndex = Math.floor(tensors.length / 2);\n const leftSide = addN({inputs: tensors.slice(0,
midIndex), backend});\n const rightSide = addN({inputs: tensors.slice(midIndex), backend});\n return
addN({inputs: [leftSide, rightSide], backend});\n }\n const dtype =\n tensors.map(t => t.dtype).reduce((d1,
d2) => upcastType(d1, d2));\n const shapes = tensors.map(t => t.shape);\n // We can make sure shapes are identical
in op level.\n const usePackedOp = env().getBool('WEBGL_PACK');\n const program = usePackedOp ?\n new
AddNPackedProgram(tensors[0].shape, shapes) :\n new AddNProgram(tensors[0].shape, shapes);\n return
backend.runWebGLProgram(program, tensors, dtype);\n}\n\nexport const addNConfig: KernelConfig = {\n
kernelName: AddN,\n backendName: 'webgl',\n kernelFunc: addN as { } as KernelFunc\n};\n", "/*\n * @license\n
 * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License,
Version 2.0 (the "License");\n
 * you may not use this file except in compliance with the License.\n * You may
obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by
applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS"
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the

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=====
*
\nimport {All, AllAttrs, AllInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util} from
'@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from './backend_webgl';\nimport {reduce} from
 './kernel_utils/reduce';\nimport {reshape} from './Reshape';\nimport {transpose} from './Transpose';\nexport
function all(\n args: {inputs: AllInputs, backend: MathBackendWebGL,
 attrs: AllAttrs});\n TensorInfo {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {axis,
 keepDims} = attrs;\n\n const xRank = x.shape.length;\n\n const origAxes = util.parseAxisParam(axis, x.shape);\n let axes = origAxes;\n const permutedAxes = backend_util.getAxesPermutation(axes, xRank);\n let permutedX =
 x;\n if (permutedAxes != null) {\n permutedX = transpose({inputs: {x}, backend, attrs: {perm:
permutedAxes}});\n axes = backend_util.getInnerMostAxes(axes.length, xRank);\n }\n\n backend_util.assertAxesAreInnerMostDims('all', axes, xRank);\n const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(permutedX.shape, axes);\n const inSize =
 util.sizeFromShape(reduceShape);\n\n const a2D =\n reshape({inputs: {x: permutedX}, backend, attrs: {shape:
[-1, inSize]}});\n const reduced = reduce(a2D, a2D.dtype, 'all', backend);\n\n let res;\n if (keepDims) {\n const
newShape = backend_util.expandShapeToKeepDim(outShape,
 origAxes);\n res = reshape({inputs: {x: reduced}, backend, attrs: {shape: newShape}});\n } else {\n res =
 reshape({inputs: {x: reduced}, backend, attrs: {shape: outShape}});\n }\n\n backend.disposeIntermediateTensorInfo(a2D);\n backend.disposeIntermediateTensorInfo(reduced);\n\n if
(permutedAxes != null) {\n backend.disposeIntermediateTensorInfo(permutedX);\n }\n\n return res;\n }\n\nexport
const allConfig: KernelConfig = {\n kernelName: All,\n backendName: 'webgl',\n kernelFunc: all as {} as
KernelFunc\n};\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License
for the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====
*
\nimport {Any, AnyAttrs, AnyInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util} from
'@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from './backend_webgl';\nimport {reduce} from
 './kernel_utils/reduce';\nimport {reshape} from './Reshape';\nimport {transpose} from './Transpose';\nexport
function any(\n args: {inputs: AnyInputs, backend: MathBackendWebGL, attrs: AnyAttrs});\n TensorInfo {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {axis, keepDims} = attrs;\n\n const xRank =
 x.shape.length;\n\n const origAxes = util.parseAxisParam(axis, x.shape);\n let axes = origAxes;\n const
permutedAxes = backend_util.getAxesPermutation(axes, xRank);\n let permutedX = x;\n\n if (permutedAxes != null) {\n permutedX = transpose({inputs: {x}, backend, attrs: {perm: permutedAxes}});\n axes = backend_util.getInnerMostAxes(axes.length, xRank);\n }\n\n backend_util.assertAxesAreInnerMostDims('any', axes, xRank);\n const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(permutedX.shape, axes);\n const inSize =
 util.sizeFromShape(reduceShape);\n\n const a2D =\n reshape({inputs: {x: permutedX}, backend, attrs: {shape:
[-1, inSize]}});\n const reduced = reduce(a2D, a2D.dtype, 'any', backend);\n\n let res;\n if (keepDims) {\n const
newShape = backend_util.expandShapeToKeepDim(outShape, origAxes);\n res = reshape({inputs: {x: reduced},
 backend, attrs: {shape: newShape}});\n } else {\n res = reshape({inputs: {x: reduced}, backend, attrs: {shape:
outShape}});\n }\n\n backend.disposeIntermediateTensorInfo(a2D);\n\n backend.disposeIntermediateTensorInfo(reduced);\n\n if (permutedAxes != null) {\n backend.disposeIntermediateTensorInfo(permutedX);\n }\n }\n
```

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}\n\n return res;\n}\n\nexport const anyConfig: KernelConfig = {\n kernelName: Any,\n backendName:
'webgl',\n kernelFunc: any as { } as KernelFunc\n};\n", "/**\n * @license\n * Copyright 2017 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

```

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=====
*\n\nimport {backend_util} from '@tensorflow/tfjs-core';\nimport {GPGPUProgram} from
'./gpgpu_math';\n\nexport
class ArgMinMaxProgram implements GPGPUProgram {\n variableNames = ['A'];\n outputShape: number[];\n
userCode: string;\n\n constructor(\n reduceInfo: backend_util.ReduceInfo, op: 'max'|'min',\n firstPass:
boolean) {\n const {windowSize, batchSize, outSize} = reduceInfo;\n if (!firstPass) {\n
this.variableNames.push('bestIndicesA');\n }\n this.outputShape = [batchSize, outSize];\n const compOp = (op
=== 'max') ? '>' : '<';\n const indexSnippet = firstPass ?\n 'inOffset + i;' :\n 'round(getBestIndicesA(batch,
inOffset + i));'\n this.userCode = \n void main() {\n ivec2 coords = getOutputCoords();\n int batch
= coords[0];\n int outIdx = coords[1];\n int inOffset = outIdx * ${windowSize};\n\n int bestIndex =
inOffset;\n float bestValue = getA(batch, bestIndex);\n for (int i = 0; i < ${windowSize}; i++) {\n
int inIdx = ${indexSnippet};\n
float candidate = getA(batch, inIdx);\n if (candidate ${compOp} bestValue) {\n bestValue =
candidate;\n bestIndex = inIdx;\n }\n }\n setOutput(float(bestIndex));\n }\n }\n\n
}]\n", "/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache
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may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required
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BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *

```

```

=====
*\n\nimport {util} from '@tensorflow/tfjs-core';\n\nimport
{GPGPUProgram} from './gpgpu_math';\nimport {getChannels} from './packing_util';\nimport
{getCoordsDataType} from './shader_compiler';\n\nexport class ArgMinMaxPackedProgram implements
GPGPUProgram {\n variableNames = ['A'];\n outputShape: number[];\n userCode: string;\n packedInputs =
true;\n packedOutput = true;\n\n constructor(\n shape: number[], windowSize: number, op: 'max'|'min',\n
firstPass: boolean) {\n util.assert(\n shape.length > 2,\n () => `Packed arg${\n
op.charAt(0).toUpperCase() +\n op.slice(1)} supports only inputs with rank above 2.`);\n const inSize =
shape[shape.length - 1];\n const outSize = Math.ceil(inSize / windowSize);\n this.outputShape = shape.slice(0, -
1);\n if (outSize > 1) {\n this.outputShape.push(outSize);\n }\n if (!firstPass) {\n
this.variableNames.push('bestIndicesA');\n }\n const outShape = this.outputShape;\n const rank =
outShape.length;\n
const dtype = getCoordsDataType(rank);\n const coords = getChannels('coords', rank);\n\n let
sourceLocSetup;\n let sourceRank;\n if (outSize === 1) {\n sourceRank = rank + 1;\n const
sourceLocDType = getCoordsDataType(sourceRank);\n sourceLocSetup = \n ${sourceLocDType}\n
sourceLocR = ${sourceLocDType}(${coords.join()}), 0);\n ++${coords[rank - 1]};\n ${sourceLocDType}\n
sourceLocG = ${sourceLocDType}(${coords.join()}), 0);\n ++${coords[rank - 2]};\n ${sourceLocDType}\n
sourceLocA = ${sourceLocDType}(${coords.join()}), 0);\n --${coords[rank - 1]};\n ${sourceLocDType}\n
sourceLocB = ${sourceLocDType}(${coords.join()}), 0);\n --${coords[rank - 2]};\n } else {\n
sourceRank = rank;\n sourceLocSetup = \n ${dtype} sourceLocR = coords;\n ++${coords[rank - 1]};\n

```

```

 ${dtype} sourceLocG = coords;\n ++${coords[rank - 2]};\n ${dtype} sourceLocA = coords;\n --
 ${coords[rank
 - 1]};\n ${dtype} sourceLocB = coords;\n --${coords[rank - 2]};\n }\n const channels = ['x', 'y', 'z',
 'w', 'u', 'v'].slice(0, sourceRank);\n const inChannel = '.' + channels[sourceRank - 1]; // e.g. ".b" for rank 3.\n const intChannels = channels.map(x => 'int ' + x);\n const srcRCoords =\n getChannels('sourceLocR',
 sourceRank - 1).concat('inIdx.r');\n const srcGCoords =\n getChannels('sourceLocG', sourceRank -
 1).concat('inIdx.g');\n const srcBCoords =\n getChannels('sourceLocB', sourceRank - 1).concat('inIdx.b');\n const srcACoords =\n getChannels('sourceLocA', sourceRank - 1).concat('inIdx.a');\n\n const compOp = (op
 === 'max') ? 'greaterThan' : 'lessThan';\n const fetchCandidateIdx = firstPass ? " : "\n inIdx =
 round(vec4(getBestIndicesAChannel(${srcRCoords.join()}),\n
 getBestIndicesAChannel(${srcGCoords.join()}),\n
 getBestIndicesAChannel(${srcBCoords.join()}),\n
 getBestIndicesAChannel(${srcACoords.join()}));\n\n const fetchValue = `vec4(\n
 getAChannel(${srcRCoords.join()}),\n hasNextCol ? getAChannel(${srcGCoords.join()}): 0.,\n
 hasNextRow ? getAChannel(${srcBCoords.join()}): 0.,\n hasNextRow && hasNextCol ?
 getAChannel(${srcACoords.join()}): 0.`;\n\n const getBestIndicesAChannelSnippet = firstPass ? " : "\n float
 getBestIndicesAChannel(${intChannels.join()}) {\n return getChannel(getBestIndicesA(${channels.join()}),\n
 vec2(${channels.slice(-2).join()}));\n };\n\n this.userCode = `\n float
 getAChannel(${intChannels.join()}) {\n return getChannel(getA(${channels.join()}),\n
 vec2(${channels.slice(-2).join()}));\n }\n ${getBestIndicesAChannelSnippet}\n void main() {\n
 ${dtype} coords = getOutputCoords();\n
 bool hasNextCol = ${coords[rank - 1]} < ${outShape[rank - 1] - 1};\n bool hasNextRow = ${coords[rank -
 2]} < ${outShape[rank - 2] - 1};\n ${sourceLocSetup}\n ivec4 srcIdx = ivec4(sourceLocR${inChannel},
 sourceLocG${inChannel},\n sourceLocB${inChannel}, sourceLocA${inChannel}) * ${windowSize};\n
 ivec4 inIdx = srcIdx;\n vec4 bestIndex = vec4(inIdx);\n vec4 bestValue = ${fetchValue};\n\n for (int i
 = 0; i < ${windowSize}; i++) {\n inIdx = srcIdx;\n ${fetchCandidateIdx}\n vec4 candidate =
 ${fetchValue};\n bvec4 nan = isnan(candidate);\n bvec4 replace = bvec4(\n
 vec4(${compOp}(candidate, bestValue)) * (vec4(1.0) - vec4(nan)));\n\n bestValue = vec4(replace.x ?
 candidate.x : bestValue.x,\n replace.y ? candidate.y : bestValue.y,\n replace.z ?
 candidate.z : bestValue.z,\n replace.w ? candidate.w
 : bestValue.w);\n bestIndex = mix(bestIndex, vec4(inIdx), vec4(replace));\n srcIdx++;\n }\n
 setOutput(bestIndex);\n }\n `;\n }\n}\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights
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 except in compliance with the License.\n * You may obtain a copy of the License at\n *
 http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
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 OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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 =====\n
 *\n\nimport {backend_util, env, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport {ArgMinMaxProgram}
 from './argminmax_gpu';\nimport {ArgMinMaxPackedProgram} from './argminmax_packed_gpu';\nimport
 {MathBackendWebGL} from './backend_webgl';\nimport {reshape} from './kernels/Reshape';\n\nfunction
 argReduce(\n backend: MathBackendWebGL, x: TensorInfo, reduceType: 'max'|'min',\n bestIndicesA:
 TensorInfo = null): TensorInfo {\n let batchSize = x.shape[0];\n let inSize = x.shape[1];\n if (bestIndicesA != null)
 {\n batchSize = bestIndicesA.shape[0];\n inSize = bestIndicesA.shape[1];\n }\n const windowSize =
 backend_util.computeOptimalWindowSize(inSize);\n const reduceInfo =\n {windowSize, inSize, batchSize,
 outSize: Math.ceil(inSize / windowSize)};\n const program =\n new ArgMinMaxProgram(reduceInfo,
 reduceType, bestIndicesA == null);\n const inputs = [x];\n if (bestIndicesA != null) {\n

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inputs.push(bestIndicesA);
}
const output = backend.runWebGLProgram(program, inputs, 'int32');
// No need to run another GPGPU program.
if (output.shape[1] === 1) {
 return output;
}
const result = argReduce(backend, x, reduceType, output);
backend.disposeIntermediateTensorInfo(output);
return result;
}

function argReducePacked(backend: MathBackendWebGL, x: TensorInfo, reduceType: 'max'|'min', bestIndicesA: TensorInfo = null): TensorInfo {
 const inShape = bestIndicesA != null ? bestIndicesA.shape : x.shape;
 const inSize = inShape[inShape.length - 1];
 const windowSize = backend_util.computeOptimalWindowSize(inSize);
 const program = new ArgMinMaxPackedProgram(inShape, windowSize, reduceType, bestIndicesA == null);
 const inputs = bestIndicesA == null ? [x] : [x, bestIndicesA];
 const output = backend.runWebGLProgram(program, inputs, 'int32');
 if (output.shape.length === x.shape.length) {
 const result = argReducePacked(backend, x, reduceType, output);
 backend.disposeIntermediateTensorInfo(output);
 return result;
 }
 return output;
}

export function argMinMaxReduce(backend: MathBackendWebGL, x: TensorInfo, axis: number, reduceType: 'min'|'max'): TensorInfo {
 const axes = [axis];
 backend_util.assertAxesAreInnerMostDims('arg' + reduceType.charAt(0).toUpperCase() + reduceType.slice(1), axes, x.shape.length);
 if (!env().getBool('WEBGL_PACK_REDUCE') || x.shape.length <= 2) {
 const intermediateTensorInfos = [];
 const [outShape, reduceShape] = backend_util.computeOutAndReduceShapes(x.shape, axes);
 const inSize = util.sizeFromShape(reduceShape);
 const a2D = reshape({inputs: {x}, backend, attrs: {shape: [-1, inSize]}});
 intermediateTensorInfos.push(a2D);
 const reduced = argReduce(backend, a2D, reduceType);
 intermediateTensorInfos.push(reduced);
 const reshaped = reshape({inputs: {x: reduced}, backend, attrs: {shape: outShape}});
 intermediateTensorInfos.forEach(t => backend.disposeIntermediateTensorInfo(t));
 return reshaped;
 }
 return argReducePacked(backend, x, reduceType);
}
}

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 */
=====
*/
import { ArgMax, ArgMaxAttrs, ArgMaxInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util }
from '@tensorflow/tfjs-core';
import { MathBackendWebGL } from './backend_webgl';
import { argMinMaxReduce } from './kernel_utils/arg_min_max';
import { transpose } from './Transpose';
export function argMax(args: {
 inputs: ArgMaxInputs, backend: MathBackendWebGL, attrs: ArgMaxAttrs}): TensorInfo {
 const {inputs, backend, attrs} = args;
 const {x} = inputs;
 const {axis} = attrs;
 let axes = util.parseAxisParam(axis, x.shape);
 const permutedAxes = backend_util.getAxesPermutation(axes, x.shape.length);
 let $x = x;
 const intermediateTensorInfos = [];
 if (permutedAxes != null) {
 $x = transpose({inputs: {x}, backend, attrs: {perm: permutedAxes}});
 intermediateTensorInfos.push($x);
 axes = backend_util.getInnerMostAxes(axes.length, $x.shape.length);
 }
 backend_util.assertAxesAreInnerMostDims('argMax', [axes[0]], $x.shape.length);
 const out = argMinMaxReduce(backend, $x, axes[0], 'max');
 intermediateTensorInfos.forEach(t => backend.disposeIntermediateTensorInfo(t));
 return out;
}

export const argMaxConfig: KernelConfig = {
 kernelName: ArgMax,
 backendName: 'webgl',
 kernelFunc: argMax as { } as KernelFunc;
};
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```
=====\n\n*\n\nimport { ArgMin, ArgMinAttrs, ArgMinInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util }\nfrom '@tensorflow/tfjs-core';\n\nimport { MathBackendWebGL } from\n'./backend_webgl';\nimport { argMinMaxReduce } from './kernel_utils/arg_min_max';\nimport { transpose } from\n'./Transpose';\n\nexport function argMin(\n args:\n {inputs: ArgMinInputs, backend: MathBackendWebGL,\n attrs: ArgMinAttrs});\n TensorInfo {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {axis}\n = attrs;\n\n let axes = util.parseAxisParam(axis, x.shape);\n const permutedAxes =\n backend_util.getAxesPermutation(axes, x.shape.length);\n let $x = x;\n const intermediateTensorInfos = [];\n if\n (permutedAxes != null) {\n $x = transpose({inputs: {x}, backend, attrs: {perm: permutedAxes}});\n }\n intermediateTensorInfos.push($x);\n axes = backend_util.getInnerMostAxes(axes.length, $x.shape.length);\n }\n\n backend_util.assertAxesAreInnerMostDims('argMin', [axes[0]], $x.shape.length);\n\n const out =\n argMinMaxReduce(backend, $x, axes[0], 'min');\n\n intermediateTensorInfos.forEach(\n t =>\n backend.disposeIntermediateTensorInfo(t));\n\n return out;\n}\n\nexport const argMinConfig: KernelConfig = {\n kernelName: ArgMin,\n backendName:\n 'webgl',\n kernelFunc: argMin as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All\n Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this\n file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n http://www.apache.org/licenses/LICENSE-2.0\n * \n Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n governing permissions and\n * limitations under the License.\n */\n\n=====\n\n*\n\nimport { Asin, KernelConfig } from '@tensorflow/tfjs-core';\nimport { unaryKernelFunc } from\n'./kernel_utils/kernel_funcs_utils';\nimport\n{ CHECK_NAN_SNIPPET } from './unaryop_gpu';\n\nconst ASIN = CHECK_NAN_SNIPPET +`\n if (abs(x) >\n 1.) {\n return NAN;\n }\n return asin(x);\n`;\n\nexport const asin = unaryKernelFunc({opSnippet:\n ASIN});\n\nexport const asinConfig: KernelConfig = {\n kernelName: Asin,\n backendName: 'webgl',\n kernelFunc: asin,\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed\n under the Apache License, Version 2.0 (the "License");\n * you may not use this\n file except in compliance with the\n License.\n * You may obtain a copy of the License at\n * \n http://www.apache.org/licenses/LICENSE-2.0\n * \n Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n License.\n */\n\n=====\n\n*\n\nimport { Asinh, KernelConfig } from '@tensorflow/tfjs-core';\nimport { unaryKernelFunc } from\n'./kernel_utils/kernel_funcs_utils';\nimport { CHECK_NAN_SNIPPET } from './unaryop_gpu';\n\nconst ASINH =\n CHECK_NAN_SNIPPET +`return log(x + sqrt(x * x + 1.0));`\n\nexport const asinh =\n unaryKernelFunc({opSnippet: ASINH});\n\nexport const asinhConfig: KernelConfig = {\n kernelName: Asinh,\n backendName: 'webgl',\n kernelFunc: asinh,\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights\n Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this\n file\n except in compliance with the License.\n * You may obtain a copy of the License at\n * \n http://www.apache.org/licenses/LICENSE-2.0\n * \n Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS\n OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions\n and\n * limitations under the License.\n */\n\n=====\n\n
```

```
=====\n
*\n\nimport {Atan, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {unaryKernelFunc} from
'./kernel_utils/kernel_funcs_utils';\n\nimport {CHECK_NAN_SNIPPET} from './unaryop_gpu';\n\nconst ATAN =
CHECK_NAN_SNIPPET +`\n return atan(x);\n`;\n\nexport const atan = unaryKernelFunc({opSnippet:
ATAN});\n\nexport const atanConfig: KernelConfig = {\n kernelName: Atan,\n backendName: 'webgl',\n
kernelFunc: atan,\n};\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
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the specific language governing permissions and\n * limitations under the License.\n *
```

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=====\n
*\n\nimport {Atan2} from '@tensorflow/tfjs-core';\n\nimport {KernelConfig} from '@tensorflow/tfjs-
core';\n\nimport {binaryKernelFunc, CHECK_NAN_SNIPPET_BINARY,
CHECK_NAN_SNIPPET_BINARY_PACKED} from './kernel_utils/kernel_funcs_utils';\n\nconst ATAN2 =
CHECK_NAN_SNIPPET_BINARY +`\n return atan(a, b);\n`;\n\nconst ATAN2_PACKED =`\n vec4 result =
atan(a, b);\n vec4 isNaN = min(vec4(isnan(a)) + vec4(isnan(b)), vec4(1.0));\n ` +\n
CHECK_NAN_SNIPPET_BINARY_PACKED +`\n return result;\n`;\n\nexport const atan2 =\n
binaryKernelFunc({opSnippet: ATAN2, packedOpSnippet: ATAN2_PACKED});\n\nexport const atan2Config:
KernelConfig = {\n kernelName: Atan2,\n backendName: 'webgl',\n kernelFunc: atan2,\n};\n"/**\n *
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```

```
=====\n
*\n\nimport {Atanh, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {unaryKernelFunc} from
'./kernel_utils/kernel_funcs_utils';\n\nimport {CHECK_NAN_SNIPPET} from './unaryop_gpu';\n\nconst
ATANH = CHECK_NAN_SNIPPET +`\n if ((x < -1.0) || (x > 1.0)) return NaN;\n\nreturn (log(1.0 + x) - log(1.0 -
x)) / 2.0;\n`;\n\nexport const atanh = unaryKernelFunc({opSnippet: ATANH});\n\nexport const atanhConfig:
KernelConfig = {\n kernelName: Atanh,\n backendName: 'webgl',\n kernelFunc: atanh,\n};\n"/**\n *
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```

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=====\n
*\n\nimport {backend_util} from '@tensorflow/tfjs-core';\n\nimport {GPGPUProgram} from
'./gpgpu_math';\n\nexport class Pool2DProgram implements GPGPUProgram {\n variableNames = ['x'];\n
outputShape: number[];\n userCode: string;\n\n constructor(\n convInfo: backend_util.Conv2DInfo, poolType:
'max'|'avg',\n computePositions: boolean, flattenPositions = false,\n includeBatchInIndex = false) {\n if
(poolType === 'avg' && computePositions) {\n throw new Error('Cannot compute positions for average
pool.);\n }\n\n const filterWidth = convInfo.filterWidth;\n const strideHeight = convInfo.strideHeight;\n
const strideWidth = convInfo.strideWidth;\n const dilationHeight = convInfo.dilationHeight;\n const
dilationWidth = convInfo.dilationWidth;\n const effectiveFilterHeight = convInfo.effectiveFilterHeight;\n const
```

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effectiveFilterWidth = convInfo.effectiveFilterWidth;\n\n const padTop = convInfo.padInfo.top;\n
const padLeft = convInfo.padInfo.left;\n this.outputShape = convInfo.outShape;\n\n const isAvgPool =
poolType === 'avg';\n const batchFlattenPositionStr = `((batch * ${convInfo.inHeight} + xR) * ${\n
convInfo.inWidth} + xC) * ${convInfo.inChannels} + d`;\n const flattenPositionStr =\n `(xR *
${convInfo.inWidth} + xC) * ${convInfo.inChannels} + d`;\n\n let initializationValue = '0.0';\n if (isAvgPool)
{\n // WebGL on Firefox Linux can't compile 1/0 so we do 1/eps.\n initializationValue = '-1.0 / 1e-20';\n
}\n\n if (computePositions) {\n const compareOp = '>=';\n\n this.userCode = `\n const ivec2 strides =
ivec2(${strideHeight}, ${strideWidth});\n const ivec2 pads = ivec2(${padTop}, ${padLeft});\n\n void
main() {\n ivec4 coords = getOutputCoords();\n int batch = coords[0];\n int d = coords[3];\n\n ivec2 xRCCorner = coords.yz * strides - pads;\n int xRCorner
= xRCCorner.x;\n int xCCorner = xRCCorner.y;\n\n // max/min x(?, ?, d) to get y(yR, yC, d).\n // ?
= to be determined\n float minMaxValue = 0.0;\n float minMaxValueFound = 0.0;\n int
minMaxPosition = 0;\n float avgValue = 0.0;\n\n for (int wR = 0; wR < ${effectiveFilterHeight};\n
wR += ${dilationHeight}) {\n int xR = xRCorner + wR;\n\n if (xR < 0 || xR >=
${convInfo.inHeight}) {\n continue;\n }\n\n for (int wC = 0; wC < ${effectiveFilterWidth};\n
wC += ${dilationWidth}) {\n int xC = xCCorner + wC;\n\n if (xC < 0 || xC >=
${convInfo.inWidth}) {\n continue;\n }\n\n float value = getX(batch, xR, xC, d);\n\n
// If a min / max value has already been found, use it. If not,\n // use the current value.\n float
currMinMaxValue = mix(\n
value, minMaxValue, minMaxValueFound);\n\n if (value ${compareOp} currMinMaxValue) {\n
minMaxValue = value;\n minMaxValueFound = 1.0;\n minMaxPosition = ${\n
flattenPositions ? (includeBatchInIndex ? batchFlattenPositionStr :\n
flattenPositionStr) :\n `wR * ${effectiveFilterWidth} + wC`};\n }\n }\n }\n\n
setOutput(float(minMaxPosition));\n }\n `;\n return;\n }\n\n const compareOp = 'max';\n\n let
returnValue = `${poolType}(${poolType})(${poolType})^ +\n 'minMaxValue[0], minMaxValue[1],
minMaxValue[2]), minMaxValue[3]';\n if (poolType === 'avg') {\n returnValue = `avgValue / count`;\n
}\n\n const filterWidthNearestVec4 = Math.floor(filterWidth / 4) * 4;\n const filterWidthVec4Remainder =
filterWidth % 4;\n\n const updateSnippet = `\n
if (${isAvgPool}) {\n avgValue += dot(values, ones);\n } else {\n minMaxValue =
${compareOp}(values, minMaxValue);\n }\n `;\n\n this.userCode = `\n const ivec2 strides =
ivec2(${strideHeight}, ${strideWidth});\n const ivec2 pads = ivec2(${padTop}, ${padLeft});\n const float
initializationValue = ${initializationValue};\n const vec4 ones = vec4(1.0, 1.0, 1.0, 1.0);\n\n float count =
0.0;\n\n float getValue(int batch, int xR, int xC, int d) {\n if (xC < 0 || xC >= ${convInfo.inWidth}) {\n
return initializationValue;\n }\n count += 1.0;\n return getX(batch, xR, xC, d);\n }\n\n void
main() {\n ivec4 coords = getOutputCoords();\n int batch = coords[0];\n int d = coords[3];\n\n ivec2 xRCCorner = coords.yz * strides - pads;\n int xRCorner = xRCCorner.x;\n int xCCorner =
xRCCorner.y;\n\n // max/min x(?, ?, d) to get y(yR, yC, d).\n
// ? = to be determined\n vec4 minMaxValue = vec4(${initializationValue});\n float avgValue = 0.0;\n
count = 0.0;\n\n for (int wR = 0; wR < ${effectiveFilterHeight};\n wR += ${dilationHeight}) {\n
int xR = xRCorner + wR;\n\n if (xR < 0 || xR >= ${convInfo.inHeight}) {\n continue;\n }\n\n
for (int wC = 0; wC < ${filterWidthNearestVec4}; wC += 4) {\n int xC = xCCorner + wC *
${dilationWidth};\n\n vec4 values = vec4(\n getValue(batch, xR, xC, d),\n getValue(batch,
xR, xC + ${dilationWidth}, d),\n getValue(batch, xR, xC + 2 * ${dilationWidth}, d),\n
getValue(batch, xR, xC + 3 * ${dilationWidth}, d)\n);\n\n ${updateSnippet}\n }\n\n int xC
= xCCorner + ${filterWidthNearestVec4};\n\n if (${filterWidthVec4Remainder} === 1) {\n vec4 values
= vec4(\n
getValue(batch,
xR, xC, d),\n initializationValue,\n initializationValue,\n initializationValue\n);\n\n
${updateSnippet}\n } else if (${filterWidthVec4Remainder} === 2) {\n vec4 values = vec4(\n

```



```

 getValue(batch, xR, xC, d),\n getValue(batch, xR, xC + ${dilationWidth}, d),\n initializationValue,\n initializationValue\n);\n\n ${updateSnippet}\n } else if\n (${filterWidthVec4Remainder === 3}) {\n vec4 values = vec4(\n getValue(batch, xR, xC, d),\n getValue(batch, xR, xC + ${dilationWidth}, d),\n getValue(batch, xR, xC + 2 * ${dilationWidth}, d),\n initializationValue\n);\n\n ${updateSnippet}\n }\n}\n\nsetOutput(${returnValue});\n}\n`;\n}\n\n\nexport class Pool3DProgram implements GPGPUProgram {\n variableNames = ['x'];\n\n outputShape: number[];\n userCode: string;\n\n constructor(\n convInfo: backend_util.Conv3DInfo, poolType:\n 'max'|'avg',\n computePositions: boolean, flattenPositions = false,\n includeBatchInIndex = false) {\n if\n (poolType === 'avg' && computePositions) {\n throw new Error('Cannot compute positions for average\n pool.);\n }\n\n const filterWidth = convInfo.filterWidth;\n const strideDepth = convInfo.strideDepth;\n const\n strideHeight = convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n const dilationDepth =\n convInfo.dilationDepth;\n const dilationHeight = convInfo.dilationHeight;\n const dilationWidth =\n convInfo.dilationWidth;\n const effectiveFilterDepth = convInfo.effectiveFilterDepth;\n const\n effectiveFilterHeight = convInfo.effectiveFilterHeight;\n const effectiveFilterWidth =\n convInfo.effectiveFilterWidth;\n\n const padFront = convInfo.padInfo.front;\n const padTop =\n convInfo.padInfo.top;\n const padLeft\n = convInfo.padInfo.left;\n this.outputShape = convInfo.outShape;\n\n const isAvgPool = poolType ===\n 'avg';\n\n let initializationValue = '0.0';\n if (!isAvgPool) {\n // WebGL on Firefox Linux can't compile 1/0 so\n we do 1/eps.\n initializationValue = '-1.0 / 1e-20';\n }\n\n if (computePositions) {\n const compareOp =\n '>=';\n this.userCode = `\n const ivec3 strides =\n ivec3(${strideDepth}, ${strideHeight},\n ${strideWidth});\n const ivec3 pads = ivec3(${padFront}, ${padTop}, ${padLeft});\n void main() {\n ivec5 coords = getOutputCoords();\n int batch = coords.x;\n int ch = coords.u;\n ivec3 xCorner\n = ivec3(coords.y, coords.z, coords.w) * strides - pads;\n int xDCorner = xCorner.x;\n int xRCorner =\n xCorner.y;\n int xCCorner = xCorner.z;\n\n // max/min x(?, ?, ch) to get y(yD, yR, yC, ch).\n // ?\n = to be determined\n float\n minMaxValue = 0.0;\n float minMaxValueFound = 0.0;\n int minMaxPosition = 0;\n\n for (int wD\n = 0; wD < ${effectiveFilterDepth};\n wD += ${dilationDepth}) {\n int xD = xDCorner + wD;\n\n if (xD < 0 || xD >= ${convInfo.inDepth})\n continue;\n\n for (int wR = 0; wR <\n ${effectiveFilterHeight};\n wR += ${dilationHeight}) {\n int xR = xRCorner + wR;\n\n if\n (xR < 0 || xR >= ${convInfo.inHeight})\n continue;\n\n for (int wC = 0; wC <\n ${effectiveFilterWidth};\n wC += ${dilationWidth}) {\n int xC = xCCorner + wC;\n\n if (xC < 0 || xC >= ${convInfo.inWidth})\n continue;\n\n float value =\n getX(batch, xD, xR, xC, ch);\n\n // If a min / max value has already been found, use it. If not,\n // use the current value.\n float currMinMaxValue = mix(\n value, minMaxValue,\n minMaxValueFound);\n\n if (value ${compareOp} currMinMaxValue) {\n minMaxValue =\n value;\n minMaxValueFound = 1.0;\n minMaxPosition = ${\n flattenPositions ?\n (includeBatchInIndex ?\n `(((batch * ${convInfo.inDepth} + xD) * ${\n convInfo.inHeight} + xR) * ${convInfo.inWidth} + xC) * ${\n convInfo.inChannels} + ch`\n :\n `((xD * ${convInfo.inHeight} + xR) * ${\n convInfo.inWidth} + xC) * ${convInfo.inChannels} +\n ch`\n)\n :n\n `wD * ${effectiveFilterHeight} * ${effectiveFilterWidth} +\n wR *\n ${effectiveFilterWidth} + wC`);\n }\n }\n }\n }\n\n setOutput(float(minMaxPosition));\n }\n `;\n\n return;\n }\n\n const compareOp = 'max';\n let returnValue = `${poolType}(${poolType})(${poolType})(\n +\n 'minMaxValue[0], minMaxValue[1], minMaxValue[2], minMaxValue[3])';\n if (poolType === 'avg')\n {\n returnValue = `avgValue / count`;\n }\n\n const filterWidthNearestVec4 = Math.floor(filterWidth / 4) *\n 4;\n const filterWidthVec4Remainder = filterWidth % 4;\n\n const updateSnippet = `\n if (${isAvgPool}) {\n avgValue += dot(values, ones);\n } else {\n minMaxValue = ${compareOp}(values, minMaxValue);\n }\n `;\n }\n}

```

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}\n `;\n\n this.userCode = `
 const ivec3 strides =
 ivec3({strideDepth}, {strideHeight},
 {strideWidth});
 const ivec3 pads = ivec3({padFront}, {padTop}, {padLeft});
 const float
 initializationValue = {initializationValue};
 const vec4 ones = vec4(1.0, 1.0, 1.0, 1.0);
 float count = 0.0;
 float getValue(int batch, int xD, int xR, int xC, int ch) {
 if (xC < 0 || xC >= {convInfo.inWidth}) {
 return initializationValue;
 }
 count += 1.0;
 return
 getX(batch, xD, xR, xC, ch);
 }
 void main() {
 ivec5 coords = getOutputCoords();
 int batch = coords.x;
 int ch = coords.u;
 ivec3 xCorner = ivec3(coords.y, coords.z, coords.w) * strides - pads;
 int xDCorner = xCorner.x;
 int xRCorner = xCorner.y;
 int xCCorner = xCorner.z;
 // max/min
 x(?, ?, ?, d) to get y(yD, yR, yC, ch).
 // ? = to be determined
 vec4 minMaxValue =
 vec4({initializationValue});
 float avgValue = 0.0;
 count = 0.0;
 for (int wD = 0; wD <
 {effectiveFilterDepth};
 wD += {dilationDepth}) {
 int xD = xDCorner + wD;
 if (xD < 0
 || xD >= {convInfo.inDepth}) {
 continue;
 }
 for (int wR = 0; wR <
 {effectiveFilterHeight};
 wR += {dilationHeight})
 {
 int xR = xRCorner + wR;
 if (xR < 0 || xR >= {convInfo.inHeight}) {
 continue;
 }
 for (int wC = 0; wC < {filterWidthNearestVec4}; wC += 4) {
 int xC = xCCorner + wC *
 {dilationWidth};
 vec4 values = vec4(
 getValue(batch, xD, xR, xC, ch),
 getValue(batch, xD, xR, xC + {dilationWidth}, ch),
 getValue(batch, xD, xR, xC + 2 *
 {dilationWidth}, ch),
 getValue(batch, xD, xR, xC + 3 *
 {dilationWidth}, ch)
);
 {updateSnippet}
 int xC = xCCorner + {filterWidthNearestVec4};
 if
 ({filterWidthVec4Remainder === 1}) {
 vec4 values = vec4(
 getValue(batch, xD, xR, xC,
 ch),
 initializationValue,
 initializationValue,
 initializationValue
);
 {updateSnippet}
 }
 else if ({filterWidthVec4Remainder === 2}) {
 vec4 values = vec4(
 getValue(batch,
 xD, xR, xC, ch),
 getValue(batch, xD, xR, xC + {dilationWidth}, ch),
 initializationValue,
 initializationValue
);
 {updateSnippet}
 }
 else if ({filterWidthVec4Remainder
 === 3}) {
 vec4 values = vec4(
 getValue(batch, xD, xR, xC, ch),
 getValue(batch,
 xD, xR, xC + {dilationWidth}, ch),
 getValue(batch, xD, xR, xC + 2 *
 {dilationWidth}, ch),
 initializationValue
);
 {updateSnippet}
 }
 }
 }
 }
 setOutput({returnValue});
 }
}
`;\n\n };\n\n `;\n };\n\n", "/*\n * @license\n * Copyright 2020 Google LLC. All
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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=====
*\nimport {AvgPool, AvgPoolAttrs, AvgPoolInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util}
from '@tensorflow/tfjs-core';
\nimport {MathBackendWebGL} from '../backend_webgl';
\nimport
{Pool2DProgram} from '../pool_gpu';
\nimport {assertNotComplex} from '../webgl_util';
\nimport {identity} from
'/Identity';
\nexport function avgPool(args: {
 inputs: AvgPoolInputs,
 backend: MathBackendWebGL,
 attrs:
 AvgPoolAttrs
}): TensorInfo
{
 const {inputs, backend, attrs} = args;
 const {x} = inputs;
 assertNotComplex(x, 'avgPool');
 const
 {filterSize, strides, pad, dimRoundingMode} = attrs;
 const dilations = 1;
 util.assert(
 backend_util.eitherStridesOrDilationsAreOne(strides, dilations),
 () => 'Error in avgPool: Either strides or
 dilations must be 1.' +
 `Got strides ${strides} and dilations '${dilations}'`);
 const convInfo =
 backend_util.computePool2DInfo(
 x.shape as [number, number, number, number], filterSize,
 strides,
 dilations, pad, dimRoundingMode);
 if (convInfo.filterWidth === 1 && convInfo.filterHeight === 1 &&
 util.arraysEqual(convInfo.inShape, convInfo.outShape)) {
 return identity({inputs: {x}, backend});
 }
 const

```

```

avgPoolProgram = new Pool2DProgram(convInfo, 'avg', false);\n return
backend.runWebGLProgram(avgPoolProgram, [x], 'float32');\n}\n\nexport const avgPoolConfig: KernelConfig =
{\n kernelName: AvgPool,\n backendName:
'webgl',\n kernelFunc: avgPool as {} as KernelFunc\n};\n"/**\n * @license\n * Copyright 2020 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\nimport {AvgPool3D, AvgPool3DAttrs, AvgPool3DInputs, backend_util, KernelConfig, KernelFunc,
TensorInfo} from '@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from '../backend_webgl';\nimport
{Pool3DProgram}
from './pool_gpu';\n\nexport function avgPool3D(args: {\n inputs: AvgPool3DInputs,\n backend:
MathBackendWebGL,\n attrs: AvgPool3DAttrs\n}): TensorInfo {\n const {inputs, backend, attrs} = args;\n const
{x} = inputs;\n const {filterSize, strides, pad, dimRoundingMode, dataFormat} = attrs;\n const dilations: [number,
number, number] = [1, 1, 1];\n\n const convInfo = backend_util.computePool3DInfo(\n x.shape as [number,
number, number, number], filterSize, strides,\n dilations, pad, dimRoundingMode, dataFormat);\n const
avgPoolProgram = new Pool3DProgram(convInfo, 'avg', false);\n return
backend.runWebGLProgram(avgPoolProgram, [x], 'float32');\n}\n\nexport const avgPool3DConfig: KernelConfig =
{\n kernelName: AvgPool3D,\n backendName: 'webgl',\n kernelFunc: avgPool3D as {} as
KernelFunc\n};\n"/**\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {backend_util} from '@tensorflow/tfjs-core';\nimport {GPGPUProgram} from
'./gpgpu_math';\n\nexport class AvgPool2DBackpropProgram implements GPGPUProgram {\n variableNames =
['dy'];\n outputShape: number[];\n userCode: string;\n\n constructor(convInfo: backend_util.Conv2DInfo) {\n
this.outputShape = convInfo.inShape;\n const filterHeight = convInfo.filterHeight;\n const filterWidth =
convInfo.filterWidth;\n const
strideHeight = convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n const dilationHeight =
convInfo.dilationHeight;\n const dilationWidth = convInfo.dilationWidth;\n const effectiveFilterHeight =
convInfo.effectiveFilterHeight;\n const effectiveFilterWidth = convInfo.effectiveFilterWidth;\n\n const padTop
= effectiveFilterHeight - 1 - convInfo.padInfo.top;\n const padLeft = effectiveFilterWidth - 1 -
convInfo.padInfo.left;\n\n const avgMultiplier = 1 / (filterHeight * filterWidth);\n\n this.userCode = `\n const
ivec2 pads = ivec2(${padTop}, ${padLeft});\n const float avgMultiplier = float(${avgMultiplier});\n\n void
main() {\n ivec4 coords = getOutputCoords();\n int b = coords[0];\n int d = coords[3];\n\n ivec2
dyRCCorner = coords.yz - pads;\n int dyRCorner = dyRCCorner.x;\n int dyCCorner = dyRCCorner.y;\n\n
// Convolve dy(?, ?, d) with pos mask(:, :, d) to get dx(xR, xC, d).\n
// ? = to be determined. : = across all values in that axis.\n float dotProd = 0.0;\n for (int wR = 0; wR <
${effectiveFilterHeight};\n wR += ${dilationHeight}) {\n float dyR = float(dyRCorner + wR) /
${strideHeight}.0;\n if (dyR < 0.0 || dyR >= ${convInfo.outHeight}.0 || fract(dyR) > 0.0) {\n
continue;\n } \n int idyR = int(dyR);\n\n for (int wC = 0; wC < ${effectiveFilterWidth};\n

```

```

wC += ${dilationWidth}) {\n float dyC = float(dyCCorner + wC) / ${strideWidth}.0;\n if (dyC < 0.0
|| dyC >= ${convInfo.outWidth}.0 ||\n fract(dyC) > 0.0) {\n continue;\n }\n int idyC
= int(dyC);\n float dyValue = getDy(b, idyR, idyC, d);\n dotProd += dyValue * avgMultiplier;\n
 }\n }\n setOutput(dotProd);\n }\n `;\n }\n}\n\nexport class AvgPool3DBackpropProgram
implements GPGPUProgram
{\n variableNames = ['dy'];\n outputShape: number[];\n userCode: string;\n\n constructor(convInfo:
backend_util.Conv3DInfo) {\n this.outputShape = convInfo.inShape;\n const filterDepth =
convInfo.filterDepth;\n const filterHeight = convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n
const strideDepth = convInfo.strideDepth;\n const strideHeight = convInfo.strideHeight;\n const strideWidth =
convInfo.strideWidth;\n const dilationDepth = convInfo.dilationDepth;\n const dilationHeight =
convInfo.dilationHeight;\n const dilationWidth = convInfo.dilationWidth;\n const effectiveFilterDepth =
convInfo.effectiveFilterDepth;\n const effectiveFilterHeight = convInfo.effectiveFilterHeight;\n const
effectiveFilterWidth = convInfo.effectiveFilterWidth;\n const padFront = effectiveFilterDepth - 1 -
convInfo.padInfo.front;\n const padTop = effectiveFilterHeight - 1 - convInfo.padInfo.top;\n const padLeft =
effectiveFilterWidth
- 1 - convInfo.padInfo.left;\n const avgMultiplier = 1 / (filterDepth * filterHeight * filterWidth);\n \n
this.userCode = `\n const ivec3 pads = ivec3(${padFront}, ${padTop}, ${padLeft});\n const float
avgMultiplier = float(${avgMultiplier});\n void main() {\n ivec5 coords = getOutputCoords();\n int
batch = coords.x;\n int ch = coords.u;\n ivec3 dyCorner = ivec3(coords.y, coords.z, coords.w) - pads;\n
int dyDCorner = dyCorner.x;\n int dyRCorner = dyCorner.y;\n int dyCCorner = dyCorner.z;\n //
Convolve dy(?, ?, ?, d) with pos mask(:, :, :, ch) to get\n // dx(xD, xR, xC, ch).\n // ? = to be determined. : =
across all values in that axis.\n float dotProd = 0.0;\n for (int wD = 0; wD < ${effectiveFilterDepth};\n
 wD += ${dilationDepth}) {\n float dyD = float(dyDCorner + wD) / ${strideDepth}.0;\n if (dyD <
0.0 || dyD >= ${convInfo.outDepth}.0 || fract(dyD)
> 0.0) {\n continue;\n }\n int idyD = int(dyD);\n \n for (int wR = 0; wR <
${effectiveFilterHeight};\n wR += ${dilationHeight}) {\n float dyR = float(dyRCorner + wR) /
${strideHeight}.0;\n if (dyR < 0.0 || dyR >= ${convInfo.outHeight}.0 ||\n fract(dyR) > 0.0) {\n
continue;\n }\n int idyR = int(dyR);\n \n for (int wC = 0; wC < ${effectiveFilterWidth};\n
wC += ${dilationWidth}) {\n float dyC = float(dyCCorner + wC) / ${strideWidth}.0;\n if
(dyC < 0.0 || dyC >= ${convInfo.outWidth}.0 ||\n fract(dyC) > 0.0) {\n continue;\n }\n
int idyC = int(dyC);\n float dyValue = getDy(batch, idyD, idyR, idyC, ch);\n \n dotProd +=
dyValue * avgMultiplier;\n }\n }\n }\n setOutput(dotProd);\n }\n `;\n
 }\n }\n }\n `;\n\n }\n }\n\n @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache
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may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required
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BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
\n =====\n
 *^nimport {AvgPool3DGrad, AvgPool3DGradAttrs, AvgPool3DGradInputs, backend_util, KernelConfig,
KernelFunc, TensorInfo} from '@tensorflow/tfjs-core';\n ^nimport {AvgPool3DBackpropProgram} from
'./avg_pool_backprop_gpu';\n ^nimport {MathBackendWebGL} from './backend_webgl';\n ^nexport
function avgPool3DGrad(args: {\n inputs: AvgPool3DGradInputs,\n backend: MathBackendWebGL,\n attrs:
AvgPool3DGradAttrs\n }): TensorInfo {\n const {inputs, backend, attrs} = args;\n const {dy, input} = inputs;\n
const x = input;\n const {filterSize, strides, pad, dimRoundingMode} = attrs;\n const dilations: [number, number,
number] = [1, 1, 1];\n const convInfo = backend_util.computePool3DInfo(\n x.shape as [number, number,
number, number, number], filterSize, strides,\n dilations, pad, dimRoundingMode);\n const
avgPoolBackpropProgram = new AvgPool3DBackpropProgram(convInfo);\n return

```

```

backend.runWebGLProgram(avgPoolBackpropProgram, [dy], x.dtype);\n\n\nexport const avgPoolGrad3DConfig:
KernelConfig = {\n kernelName: AvgPool3DGrad,\n backendName: 'webgl',\n kernelFunc: avgPool3DGrad as {
as KernelFunc\n};\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under
the Apache License, Version 2.0 (the "License");\n
* you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n
*\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in
writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT
WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
=====\n
*/\nimport { AvgPoolGrad, AvgPoolGradAttrs, AvgPoolGradInputs, backend_util, KernelConfig, KernelFunc,
TensorInfo } from '@tensorflow/tfjs-core';\nimport { AvgPool2DBackpropProgram } from
'./avg_pool_backprop_gpu';\nimport { MathBackendWebGL } from './backend_webgl';\nimport
{assertNotComplex } from './webgl_util';\n\nexport function avgPoolGrad(args: {\n inputs: AvgPoolGradInputs,\n
backend: MathBackendWebGL,\n attrs:
AvgPoolGradAttrs\n}): TensorInfo {\n const {inputs, backend, attrs} = args;\n const {dy, input} = inputs;\n const
x = input;\n assertNotComplex([dy, input], 'avgPoolGrad');\n const {filterSize, strides, pad} = attrs;\n\n const
convInfo = backend_util.computePool2DInfo(\n x.shape as [number, number, number, number], filterSize,
strides,\n 1 /* dilations */, pad);\n const avgPoolBackpropProgram = new
AvgPool2DBackpropProgram(convInfo);\n return backend.runWebGLProgram(avgPoolBackpropProgram, [dy],
x.dtype);\n}\n\n\nexport const avgPoolGradConfig: KernelConfig = {\n kernelName: AvgPoolGrad,\n
backendName: 'webgl',\n kernelFunc: avgPoolGrad as { } as KernelFunc\n};\n"/**\n * @license\n * Copyright
2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n *
you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n
*\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is
distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *
=====\n
*/\n\nimport { BatchMatMul, BatchMatMulAttrs, BatchMatMulInputs, KernelConfig, KernelFunc } from
'@tensorflow/tfjs-core';\nimport { MathBackendWebGL } from './backend_webgl';\nimport { batchMatMulImpl }
from './BatchMatMul_impl';\n\nexport function batchMatMul(args: {\n inputs: BatchMatMulInputs,\n attrs:
BatchMatMulAttrs,\n backend: MathBackendWebGL\n}) {\n const {inputs, backend, attrs} = args;\n const {a, b}
= inputs;\n const {transposeA, transposeB} = attrs;\n\n return batchMatMulImpl({a, b, transposeA, transposeB,
backend});\n}\n\n\nexport const batchMatMulConfig: KernelConfig
= {\n kernelName: BatchMatMul,\n backendName: 'webgl',\n kernelFunc: batchMatMul as { } as
KernelFunc,\n};\n"/**\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====\n
*/\n\nimport { backend_util } from '@tensorflow/tfjs-core';\nimport { GPGPUProgram } from
'./gpgpu_math';\n\nexport class BatchNormProgram implements GPGPUProgram {\n

```

```

 variableNames: string[];\n outputShape: number[] = [];\n userCode: string;\n\n constructor(\n xShape:
number[], meanShape: number[], varianceShape: number[],\n offsetShape: number[]|null, scaleShape:
number[]|null,\n varianceEpsilon: number) {\n this.variableNames = ['x', 'mean', 'variance'];\n
backend_util.assertAndGetBroadcastShape(xShape, meanShape);\n
backend_util.assertAndGetBroadcastShape(xShape, varianceShape);\n\n let offsetSnippet = '0.0';\n if
(offsetShape != null) {\n backend_util.assertAndGetBroadcastShape(xShape, offsetShape);\n
this.variableNames.push('offset');\n offsetSnippet = 'getOffsetAtOutCoords()';\n }\n\n let scaleSnippet =
'1.0';\n if (scaleShape != null) {\n backend_util.assertAndGetBroadcastShape(xShape, scaleShape);\n
this.variableNames.push('scale');\n scaleSnippet = 'getScaleAtOutCoords()';\n }\n\n this.outputShape =
xShape;\n this.userCode = `\n void main() {\n float
x = getXAtOutCoords();\n float mean = getMeanAtOutCoords();\n float variance =
getVarianceAtOutCoords();\n float offset = ${offsetSnippet};\n float scale = ${scaleSnippet};\n float
inv = scale * inversesqrt(variance + float(${varianceEpsilon}));\n setOutput(dot(vec3(x, -mean, offset),
vec3(inv, inv, 1)));;\n }\n `;\n }\n}\n\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under
the License.\n *
=====\n
*/\n\nimport {backend_util} from '@tensorflow/tfjs-core';\nimport {GPGPUProgram} from
'./gpgpu_math';\n\nexport class BatchNormPackedProgram implements GPGPUProgram {\n variableNames:
string[];\n outputShape: number[];\n userCode: string;\n packedInputs = true;\n packedOutput = true;\n\n
constructor(\n xShape: number[], meanShape: number[], varianceShape: number[],\n offsetShape:
number[]|null, scaleShape: number[]|null,\n varianceEpsilon: number) {\n this.variableNames = ['x', 'mean',
'variance'];\n backend_util.assertAndGetBroadcastShape(xShape, meanShape);\n
backend_util.assertAndGetBroadcastShape(xShape, varianceShape);\n\n let offsetSnippet = 'vec4(0.0)';\n if
(offsetShape != null) {\n backend_util.assertAndGetBroadcastShape(xShape, offsetShape);\n
this.variableNames.push('offset');\n offsetSnippet = 'getOffsetAtOutCoords()';\n }\n\n let scaleSnippet =
'vec4(1.0)';\n if (scaleShape != null) {\n
backend_util.assertAndGetBroadcastShape(xShape, scaleShape);\n this.variableNames.push('scale');\n
scaleSnippet = 'getScaleAtOutCoords()';\n }\n\n this.outputShape = xShape;\n this.userCode = `\n void
main() {\n vec4 offset = ${offsetSnippet};\n vec4 scale = ${scaleSnippet};\n\n vec4 x =
getXAtOutCoords();\n vec4 mean = getMeanAtOutCoords();\n vec4 variance =
getVarianceAtOutCoords();\n\n vec4 inv = scale * inversesqrt(variance + vec4(${varianceEpsilon}));\n\n
setOutput((x - mean) * inv + offset);\n }\n `;\n }\n}\n\n", "/*\n * @license\n * Copyright 2020 Google LLC.
All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless
required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an
\"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n
* See the License for the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {env, FusedBatchNorm, FusedBatchNormAttrs, FusedBatchNormInputs, KernelConfig, KernelFunc,
TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from '../backend_webgl';\nimport
{BatchNormProgram} from '../batchnorm_gpu';\nimport {BatchNormPackedProgram} from

```



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```
=====
*/\n\nimport {GPGPUContext} from './gpgpu_context';\nimport {GPGPUProgram} from './gpgpu_math';\nimport {getChannels} from './packing_util';\nimport {getCoordsDataType} from './shader_compiler';\n\nexport class SlicePackedProgram implements GPGPUProgram {\n variableNames = ['source'];\n packedInputs = true;\n packedOutput = true;\n outputShape: number[];\n userCode: string;\n rank: number;\n\n // Caching uniform location for speed.\n startLoc: WebGLUniformLocation;\n\n constructor(destSize: number[]) {\n this.outputShape = destSize;\n this.rank = destSize.length;\n\n const dtype = getCoordsDataType(this.rank);\n const coords = getChannels('coords', this.rank);\n const sourceLoc = getChannels('sourceLoc', this.rank);\n\n const innerDims =\n this.rank === 1 ? 'sourceLoc' : `vec2(${sourceLoc.slice(-2).join()})`;\n const getChannel =\n `getChannel(getSource(${sourceLoc.join()}), ${innerDims})`;\n\n const upperRow =\n result.x = ${getChannel};\n if (++${coords[this.rank - 1]} < ${destSize[this.rank - 1]}) {\n ++${sourceLoc[this.rank - 1]};\n result.y = ${getChannel};\n --${sourceLoc[this.rank - 1]};\n }\n `;\n const lowerRow = this.rank === 1 ? `--${coords[this.rank - 1]}` :\n `--${coords[this.rank - 1]}`;\n if (++${coords[this.rank - 2]} < ${destSize[this.rank - 2]}) {\n ++${sourceLoc[this.rank - 2]};\n result.z = ${getChannel};\n if (++${coords[this.rank - 1]} < ${destSize[this.rank - 1]}) {\n ++${sourceLoc[this.rank - 1]};\n result.w = ${getChannel};\n }\n }\n `;\n\n const sourceLocSetup = this.rank <= 4 ?\n `sourceLoc = coords +\n ${dtype}(${destSize.map((_, i) => `start[${i}]`).join()})` :\n `destSize.map((_, i) => `${sourceLoc[i]} =\n ${coords[i]} + start[${i}]`);\n\n this.userCode =\n `uniform int start[${this.rank}];\n void main() {\n ${dtype} coords = getOutputCoords();\n ${dtype} sourceLoc;\n ${sourceLocSetup}\n vec4 result = vec4(0.);\n ${upperRow}\n ${lowerRow}\n setOutput(result);\n }\n `;\n }\n\n getCustomSetupFunc(start: number[]) {\n if (start.length !== this.rank) {\n throw Error(`The rank (${this.rank}) of the program must match the ` +\n `length of start (${start.length})`);\n }\n return (gpgpu: GPGPUContext, webGLProgram: WebGLProgram) => {\n if (this.startLoc == null) {\n this.startLoc = gpgpu.getUniformLocationNoThrow(webGLProgram, 'start');\n }\n if (this.startLoc == null) {\n // This means the compiler has optimized and realized it doesn't need\n // the uniform.\n return;\n }\n gpgpu.gl.uniform1iv(this.startLoc, start);\n };\n }\n\n "/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n=====
```

```
*/\n\nimport {backend_util, BatchToSpaceND, BatchToSpaceNDAttrs, BatchToSpaceNDInputs, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from './backend_webgl';\nimport {reshape} from './Reshape';\nimport {slice} from './Slice';\nimport {transpose} from './Transpose';\n\nexport const batchToSpaceND = (args: {\n inputs: BatchToSpaceNDInputs,\n backend: MathBackendWebGL,\n attrs: BatchToSpaceNDAttrs\n}): TensorInfo => {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {blockShape, crops} = attrs;\n\n util.assert(x.shape.length <= 4, () => 'batchToSpaceND for rank > 4 with a WebGL backend not implemented yet');\n const prod = blockShape.reduce((a, b) => a * b);\n const reshaped = backend_util.getReshaped(x.shape, blockShape, prod);\n const permuted = backend_util.getPermuted(reshaped.length, blockShape.length);\n const reshapedPermuted =\n backend_util.getReshapedPermuted(x.shape, blockShape, prod);\n const sliceBeginCoords =\n backend_util.getSliceBeginCoords(crops, blockShape.length);\n const sliceSize =\n backend_util.getSliceSize(reshapedPermuted, crops, blockShape.length);\n\n const toDispose = [];\n\n const reshapedIntermediate =\n reshape({inputs: {x}, backend, attrs: {shape: reshaped}});\n const
```



```

transposedIntermediate
= transpose(\n {inputs: {x: reshapedIntermediate}, backend, attrs: {perm: permuted}});\n const
reshapedIntermediate2 = reshape({\n inputs: {x: transposedIntermediate},\n backend,\n attrs: {shape:
reshapedPermuted}\n });\n const sliced = slice({\n inputs: {x: reshapedIntermediate2},\n backend,\n attrs:
{begin: sliceBeginCoords, size: sliceSize}\n });\n\n toDispose.push(reshapedIntermediate);\n
toDispose.push(transposedIntermediate);\n toDispose.push(reshapedIntermediate2);\n\n toDispose.forEach(t =>
backend.disposeIntermediateTensorInfo(t));\n\n return sliced;\n};\n\nexport const batchToSpaceNDConfig:
KernelConfig = {\n kernelName: BatchToSpaceND,\n backendName: 'webgl',\n kernelFunc: batchToSpaceND as
{} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may
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applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS"
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {Bincount, BincountAttrs, BincountInputs, KernelConfig, KernelFunc, TensorInfo, TypedArray} from
'@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\n\nimport {bincountImplCPU}
from '../kernel_utils/shared';\n\nexport function bincount(args: {\n inputs: BincountInputs,\n backend:
MathBackendWebGL,\n attrs: BincountAttrs\n}): TensorInfo {\n const {inputs, backend, attrs} = args;\n const {x,
weights} = inputs;\n const {size} = attrs;\n\n const xVals =
 backend.readSync(x.dataId) as TypedArray;\n const weightsVals = backend.readSync(weights.dataId) as
TypedArray;\n\n const outVals =\n bincountImplCPU(xVals, weightsVals, weights.dtype, weights.shape,
size);\n\n return backend.makeTensorInfo([size], weights.dtype, outVals);\n}\n\nexport const bincountConfig:
KernelConfig = {\n kernelName: Bincount,\n backendName: 'webgl',\n kernelFunc: bincount as {} as
KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
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on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific
 language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from
'../backend_webgl';\n\nimport {UnaryOpProgram} from '../unaryop_gpu';\n\nconst TO_INT = `return
float(int(x));`\n\nexport function int(input: TensorInfo, backend: MathBackendWebGL): TensorInfo {\n const
program = new UnaryOpProgram(input.shape, TO_INT);\n const output = backend.runWebGLProgram(program,
[input], 'int32');\n return {dataId: output.dataId, shape: output.shape, dtype: output.dtype};\n}\n", "/*\n *
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {GPGPUContext} from './gpgpu_context';\n\nimport {GPGPUProgram} from './gpgpu_math';\n\nexport
class ClipProgram implements GPGPUProgram {\n variableNames = ['A'];\n userCode: string;\n outputShape:

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number[];\n\n // Caching uniform locations for speed.\n minLoc: WebGLUniformLocation;\n maxLoc:
WebGLUniformLocation;\n\n constructor(aShape: number[]) {\n this.outputShape = aShape;\n this.userCode =
\n uniform float minVal;\n uniform float maxVal;\n\n void main() {\n float value =
getAAtOutCoords();\n if (isnan(value)) {\n setOutput(value);\n return;\n
 }\n\n setOutput(clamp(value, minVal, maxVal));\n }\n `;\n }\n\n getCustomSetupFunc(min: number,
max: number) {\n return (gpgpu: GPGPUContext, webGLProgram: WebGLProgram) => {\n if (this.minLoc
== null) {\n this.minLoc = gpgpu.getUniformLocationNoThrow(webGLProgram, 'minVal');\n this.maxLoc
= gpgpu.getUniformLocationNoThrow(webGLProgram, 'maxVal');\n }\n gpgpu.gl.uniform1f(this.minLoc,
min);\n gpgpu.gl.uniform1f(this.maxLoc, max);\n };;\n }\n}\n\n", "/*\n * @license\n * Copyright 2018 Google
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use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS
OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions
and\n * limitations under the License.\n *
=====
\n
*\n\nimport { GPGPUContext } from './gpgpu_context';\nimport { GPGPUProgram } from './gpgpu_math';\n\nexport
class ClipPackedProgram implements GPGPUProgram {\n variableNames = ['A'];\n packedInputs = true;\n
packedOutput = true;\n userCode: string;\n outputShape: number[];\n\n // Caching uniform locations for speed.\n
minLoc: WebGLUniformLocation;\n maxLoc: WebGLUniformLocation;\n\n constructor(aShape: number[]) {\n
this.outputShape = aShape;\n this.userCode = \n uniform float minVal;\n uniform float maxVal;\n\n
void
main() {\n vec4 value = getAAtOutCoords();\n\n if (any(isnan(value))) {\n setOutput(value);\n
return;\n }\n\n setOutput(clamp(value, vec4(minVal), vec4(maxVal)));\n
 }\n `;\n }\n\n getCustomSetupFunc(min: number, max: number) {\n return (gpgpu: GPGPUContext,
webGLProgram: WebGLProgram) => {\n if (this.minLoc == null) {\n this.minLoc =
gpgpu.getUniformLocationNoThrow(webGLProgram, 'minVal');\n this.maxLoc =
gpgpu.getUniformLocationNoThrow(webGLProgram, 'maxVal');\n }\n gpgpu.gl.uniform1f(this.minLoc,
min);\n gpgpu.gl.uniform1f(this.maxLoc, max);\n };;\n }\n}\n\n", "/*\n * @license\n * Copyright 2020 Google
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
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\n
*\n\nimport { ClipByValue, ClipByValueAttrs, ClipByValueInputs, env, KernelConfig, KernelFunc, TensorInfo }
from '@tensorflow/tfjs-core';\n\nimport { MathBackendWebGL } from './backend_webgl';\nimport { ClipProgram }
from './clip_gpu';\nimport { ClipPackedProgram } from './clip_packed_gpu';\n\nexport function clipByValue(args:
{\n inputs: ClipByValueInputs,\n backend: MathBackendWebGL,\n attrs: ClipByValueAttrs\n}): TensorInfo {\n
const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {clipValueMin, clipValueMax} = attrs;\n\n
let
program;\n if (env().getBool('WEBGL_PACK_CLIP')) {\n program = new ClipPackedProgram(x.shape);\n }
else {\n program = new ClipProgram(x.shape);\n }\n const customSetup =
program.getCustomSetupFunc(clipValueMin, clipValueMax);\n return backend.runWebGLProgram(program,
[x], x.dtype, customSetup);\n }\n\nexport const clipByValueConfig: KernelConfig = {\n kernelName:
ClipByValue,\n backendName: 'webgl',\n kernelFunc: clipByValue as {} as KernelFunc\n};\n\n", "/*\n * @license\n
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*\n\nimport {GPGPUProgram} from './gpgpu_math';\n\nexport class ComplexAbsProgram implements
 GPGPUProgram {\n variableNames = ['real', 'imag'];\n userCode: string;\n outputShape: number[];\n\n constructor(shape: number[]) {\n this.outputShape = shape;\n this.userCode = `\n void main() {\n float re
= abs(getRealAtOutCoords());\n float im = abs(getImagAtOutCoords());\n float mx = max(re, im);\n\n // sadly the length function in glsl is not underflow-safe\n // (at least not on Intel GPUs). So the safe solution
is\n // to ensure underflow-safety in all cases.\n setOutput(\n mx == 0.0 ? 0.0 : mx * length(vec2(1,
min(re, im)/mx))\n);\n }\n };\n}\n\n",/**\n * @license\n * Copyright 2020 Google LLC. All Rights
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
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*\n\nimport {ComplexAbs, ComplexAbsInputs, KernelConfig, KernelFunc, TensorInfo} from '@tensorflow/tfjs-
core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\nimport {ComplexAbsProgram} from
'../complex_abs_gpu';\n\n// Returns a TensorInfo with the complex shape and the dataId of the\n// underlying part.
We need to do this because a reshaped complex tensor is\n// not reflected in its parts.\nfunction
makeComplexComponentTensorInfo(\n complexTensor: TensorInfo, complexPart: TensorInfo): TensorInfo {\n
return {\n dataId: complexPart.dataId,\n dtype: complexPart.dtype,\n shape: complexTensor.shape\n
};\n}\n\nexport function complexAbs(\n args: {inputs: ComplexAbsInputs, backend: MathBackendWebGL}):
TensorInfo {\n const {inputs, backend} = args;\n const {x} = inputs;\n\n const xData =
backend.texData.get(x.dataId);\n\n const program = new ComplexAbsProgram(x.shape);\n const programInputs =
[\n makeComplexComponentTensorInfo(x, xData.complexTensorInfos.real),\n
makeComplexComponentTensorInfo(x, xData.complexTensorInfos.imag),\n];\n\n return
backend.runWebGLProgram(\n program, programInputs, programInputs[0].dtype);\n}\n\nexport const
complexAbsConfig: KernelConfig = {\n kernelName: ComplexAbs,\n backendName: 'webgl',\n kernelFunc:
complexAbs as { } as KernelFunc\n};\n\n",/**\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n
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under the License.\n *
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*\n\nimport {backend_util} from '@tensorflow/tfjs-core';\nimport {GPGPUProgram} from
'./gpgpu_math';\n\nexport class ConcatProgram implements GPGPUProgram {\n variableNames: string[];\n
outputShape: number[] = [];\n userCode: string;\n\n // Concat 2d tensors along axis=1. See comments in
MathBackendWebGL.concat().\n constructor(shapes: Array<number, number>[]) {\n this.outputShape =
backend_util.computeOutShape(shapes, 1 /* axis */);\n this.variableNames = shapes.map((_, i) => `T${i}`);\n
const offsets: number[] = new Array(shapes.length - 1);\n
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*\n\nimport {backend_util} from '@tensorflow/tfjs-core';\nimport {GPGPUProgram} from
'./gpgpu_math';\n\nexport class ConcatProgram implements GPGPUProgram {\n variableNames: string[];\n
outputShape: number[] = [];\n userCode: string;\n\n // Concat 2d tensors along axis=1. See comments in
MathBackendWebGL.concat().\n constructor(shapes: Array<number, number>[]) {\n this.outputShape =
backend_util.computeOutShape(shapes, 1 /* axis */);\n this.variableNames = shapes.map((_, i) => `T${i}`);\n
const offsets: number[] = new Array(shapes.length - 1);\n
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offsets[0] = shapes[0][1];\n for (let i = 1; i < offsets.length; i++) {\n offsets[i] = offsets[i - 1] + shapes[i][1];\n }\n\n const snippets = [\n if (yC < ${offsets[0]}) setOutput(getT0(yR, yC));\n];\n for (let i = 1; i < offsets.length;\n i++) {\n const shift = offsets[i - 1];\n snippets.push(\n `else if (yC < ${offsets[i]})` +\n `setOutput(getT${i}(yR, yC-${shift}));`\n);\n }\n\n const lastIndex = offsets.length;\n const lastShift =\n offsets[offsets.length - 1];\n snippets.push(`else setOutput(getT${lastIndex}(yR, yC-${lastShift}));`);\n\n this.userCode = \n void main() {\n ivec2 coords = getOutputCoords();\n int yR = coords.x;\n int yC\n = coords.y;\n\n ${snippets.join("\n ")}\n }\n `;\n}\n\n"/**\n * @license\n * Copyright 2019 Google\n LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not\n use this file except in compliance\n with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is\n distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either\n express or implied.\n * See the License for the specific language governing permissions and\n * limitations under\n the License.\n *
 =====\n *\n \nimport {backend_util} from 'tensorflow/tfjs-core';\nimport {GPGPUProgram} from\n './gpgpu_math';\nimport {getChannels} from './packing_util';\nimport {getCoordsDataType} from\n './shader_compiler';\n\nexport class ConcatPackedProgram implements GPGPUProgram {\n variableNames:\n string[];\n packedInputs = true;\n packedOutput = true;\n outputShape: number[] = [];\n userCode: string;\n\n constructor(shapes: number[][], axis: number) {\n this.outputShape =\n backend_util.computeOutShape(shapes, axis);\n const shape = this.outputShape;\n const rank = shape.length;\n const dtype = getCoordsDataType(rank);\n const coords = getChannels('coords', rank);\n const channels = ['x',\n 'y', 'z', 'w', 'u', 'v'].slice(0, rank);\n this.variableNames = shapes.map((_, i) => `T${i}`);\n\n const offsets:\n number[] = new Array(shapes.length - 1);\n offsets[0] = shapes[0][axis];\n for (let i = 1; i < offsets.length; i++)\n {\n offsets[i] = offsets[i - 1] + shapes[i][axis];\n }\n\n const channel = channels[axis];\n const lastChannels\n = channels.slice(-2);\n const allChannels = channels.join();\n\n let getValueSnippet = `if (${channel} <\n ${offsets[0]}) {\n return getChannel(\n getT0(${allChannels}), vec2(${lastChannels.join()}));\n }`;\n\n for (let i = 1; i < offsets.length; i++) {\n const shift = offsets[i - 1];\n // Note: the >= comparison below\n may seem unnecessary given the check\n\n // above but is needed to workaround branch execution issues on some\n // devices. It makes all the\n conditions exclusive without relying on\n // execution order.\n getValueSnippet += `\n if (${channel} <\n ${offsets[i]} && ${channel} >= ${offsets[i - 1]}) {\n return getChannel(\n getT${i}(${shiftedChannels(channels, channel, shift)}),\n vec2(${shiftedChannels(lastChannels, channel,\n shift)}));\n }`;\n }\n\n const lastIndex = offsets.length;\n const shift = offsets[offsets.length - 1];\n\n getValueSnippet += `\n return getChannel(\n getT${lastIndex}(${shiftedChannels(channels, channel,\n shift)}),\n vec2(${shiftedChannels(lastChannels, channel, shift)}));`;\n\n this.userCode = \n float\n getValue(${channels.map(x => 'int ' + x)}) {\n ${getValueSnippet}\n }\n\n void main() {\n ${dtype}\n coords = getOutputCoords();\n vec4 result = vec4(getValue(${coords}), 0.,\n 0., 0.); \n ${coords[rank - 1]} = ${coords[rank - 1]} + 1;\n if (${coords[rank - 1]} < ${shape[rank - 1]})\n {\n result.g = getValue(${coords});\n }\n ${coords[rank - 2]} = ${coords[rank - 2]} + 1;\n if\n (${coords[rank - 2]} < ${shape[rank - 2]}) {\n result.a = getValue(${coords});\n }\n ${coords[rank\n - 1]} = ${coords[rank - 1]} - 1;\n if (${coords[rank - 2]} < ${shape[rank - 2]} &&\n ${coords[rank - 1]}\n < ${shape[rank - 1]}) {\n result.b = getValue(${coords});\n }\n setOutput(result);\n }\n `;\n\n }\n\n}/**\n * Return an expression for coordinates into a vector where a given channel\n * will be offset by\n [shift].\n * @param channels the channels to consider\n * @param channel the channel we want shifted\n * @param shift the amount to subtract from the channel.\n * @returns a string of the form 'x, y-[shift], z' where\n any one channel can\n * have the shift

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applied.\n *\nfunction shiftedChannels(channels: string[], channel: string, shift: number) {\n const channelId =
channels.indexOf(channel);\n const res = channels.map((c, idx) => {\n if (idx === channelId) {\n return
`${c} - ${shift}`;\n } else {\n return c;\n }\n });\n return res.join();\n}\n"/**\n * @license\n * Copyright
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http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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*\n\nimport {Imag, ImagInputs, KernelConfig, KernelFunc, TensorInfo} from '@tensorflow/tfjs-core';\n\nimport
{MathBackendWebGL} from '../backend_webgl';\n\nimport {identity} from './Identity';\n\nexport function imag(args:
{inputs: ImagInputs, backend: MathBackendWebGL});\n TensorInfo {\n const {inputs, backend} = args;\n const
{input} = inputs;\n const inputData = backend.texData.get(input.dataId);\n\n return identity({inputs: {x:
inputData.complexTensorInfos.imag}, backend});\n }\n\nexport const imagConfig: KernelConfig = {\n
kernelName: Imag,\n backendName: 'webgl',\n kernelFunc: imag as {} as KernelFunc\n};\n"/**\n * @license\n *
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BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *

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*\n\nimport {backend_util, Concat, ConcatAttrs, ConcatInputs, KernelConfig, KernelFunc, TensorInfo, util} from
 '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\n\nimport {concatImpl} from
 './Concat_impl';\n\nimport {identity} from './Identity';\n\nexport function concat(\n args:\n {inputs:
ConcatInputs, attrs: ConcatAttrs, backend: MathBackendWebGL});\n TensorInfo {\n const {inputs, backend,
attrs} = args;\n const {axis} = attrs;\n\n const $axis = util.parseAxisParam(axis, inputs[0].shape)[0];\n const
outShape =\n backend_util.computeOutShape(inputs.map(t
=> t.shape), $axis);\n\n if (util.sizeFromShape(outShape) === 0) {\n return backend.makeTensorInfo(outShape,
inputs[0].dtype, []);\n }\n\n // Keep only non-empty tensors (ignore tensors with 0 in their shape).\n const $inputs
= inputs.filter(t => util.sizeFromShape(t.shape) > 0);\n if ($inputs.length === 1) {\n return identity({inputs: {x:
$inputs[0]}, backend});\n }\n\n const shapes = $inputs.map(t => t.shape);\n\n backend_util.assertParamsConsistent(shapes, $axis);\n\n return concatImpl($inputs, $axis, backend);\n }\n\nexport
const concatConfig: KernelConfig = {\n kernelName: Concat,\n backendName: 'webgl',\n kernelFunc: concat as
{} as KernelFunc\n};\n"/**\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n * Licensed
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"AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n *
See the License for the specific language governing permissions and\n * limitations under the License.\n *

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*\n\nimport {backend_util} from '@tensorflow/tfjs-core';\n\nimport {GPGPUProgram} from
 './gpgpu_math';\n\nexport class Conv2DProgram implements GPGPUProgram {\n variableNames = ['x', 'W'];\n outputShape: number[];\n userCode: string;\n\n constructor(\n convInfo: backend_util.Conv2DInfo, addBias =
false,\n activation: string = null, hasPreluActivationWeights = false,\n hasLeakyreluAlpha = false) {\n this.outputShape = convInfo.outShape;\n const padTop = convInfo.padInfo.top;\n const padLeft =

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convInfo.padInfo.left;\n const strideHeight = convInfo.strideHeight;\n
 const strideWidth = convInfo.strideWidth;\n const dilationHeight = convInfo.dilationHeight;\n const
dilationWidth = convInfo.dilationWidth;\n const filterHeight = convInfo.filterHeight;\n const filterWidth =
convInfo.filterWidth;\n\n const inputDepthNearestVec4 = Math.floor(convInfo.inChannels / 4) * 4;\n const
inputDepthVec4Remainder = convInfo.inChannels % 4;\n const isChannelsLast = convInfo.dataFormat ===
'channelsLast';\n\n const rowDim = isChannelsLast ? 1 : 2;\n const colDim = isChannelsLast ? 2 : 3;\n const
channelDim = isChannelsLast ? 3 : 1;\n\n let activationSnippet = ", applyActivationSnippet = ";\n if (activation)
{\n if (hasPreluActivationWeights) {\n activationSnippet = `float activation(float a) {\n float b =
getPreluActivationWeightsAtOutCoords();\n ${activation}\n }`; \n } else if (hasLeakyreluAlpha) {\n
activationSnippet = `float activation(float a) {\n float b = getLeakyreluAlphaAtOutCoords();\n
 ${activation}\n }`; \n } else {\n activationSnippet = `\n float activation(float x) {\n
${activation}\n }\n `;\n }\n\n applyActivationSnippet = `result = activation(result);`; \n }\n\n
const addBiasSnippet = addBias ? 'result += getBiasAtOutCoords():' : ";\n if (addBias) {\n
this.variableNames.push('bias');\n }\n\n if (hasPreluActivationWeights) {\n
this.variableNames.push('preluActivationWeights');\n }\n\n if (hasLeakyreluAlpha) {\n
this.variableNames.push('leakyreluAlpha');\n }\n\n this.userCode = `\n ${activationSnippet}\n\n const
ivec2 strides = ivec2(${strideHeight}, ${strideWidth});\n const ivec2 pads = ivec2(${padTop}, ${padLeft});\n\n
void main() {\n ivec4 coords = getOutputCoords();\n int batch = coords[0];\n int d2 =
coords[${channelDim}];\n\n ivec2 xRCCorner =\n ivec2(coords[${rowDim}],
coords[${colDim}]) * strides - pads;\n int xRCorner = xRCCorner.x;\n int xCCorner = xRCCorner.y;\n\n
// Convolve x(?, ?, d1) with w(:, :, d1, d2) to get y(yR, yC, d2).\n // ? = to be determined. : = across all values
in that axis.\n float dotProd = 0.0;\n for (int wR = 0; wR < ${filterHeight}; wR++) {\n int xR =
xRCorner + wR * ${dilationHeight};\n\n if (xR < 0 || xR >= ${convInfo.inHeight}) {\n continue;\n
}\n\n for (int wC = 0; wC < ${filterWidth}; wC++) {\n int xC = xCCorner + wC *
${dilationWidth};\n\n if (xC < 0 || xC >= ${convInfo.inWidth}) {\n continue;\n }\n\n
for (int d1 = 0; d1 < ${inputDepthNearestVec4}; d1 += 4) {\n vec4 wValues = vec4(\n getW(wR,
wC, d1, d2),\n getW(wR, wC, d1 + 1, d2),\n getW(wR, wC, d1 + 2, d2),\n getW(wR,
wC, d1 + 3, d2)\n);\n\n if (${isChannelsLast}) {\n vec4 xValues = vec4(\n getX(batch, xR, xC,
d1),\n getX(batch, xR, xC, d1 + 1),\n getX(batch, xR, xC, d1 + 2),\n getX(batch, xR,
xC, d1 + 3)\n);\n dotProd += dot(xValues, wValues);\n } else {\n vec4 xValues
= vec4(\n getX(batch, d1, xR, xC),\n getX(batch, d1 + 1, xR, xC),\n getX(batch, d1
+ 2, xR, xC),\n getX(batch, d1 + 3, xR, xC)\n);\n dotProd += dot(xValues,
wValues);\n }\n }\n\n if (${inputDepthVec4Remainder} === 1) {\n if
(${isChannelsLast}) {\n dotProd +=\n getX(batch, xR, xC, ${inputDepthNearestVec4}) * \n
 getW(wR, wC, ${inputDepthNearestVec4}, d2);\n } else {\n
 dotProd +=\n getX(batch, ${inputDepthNearestVec4}, xR, xC) * \n getW(wR, wC,
${inputDepthNearestVec4}, d2);\n }\n } else if (${inputDepthVec4Remainder} === 2) {\n
 vec2 wValues = vec2(\n getW(wR, wC, ${inputDepthNearestVec4}, d2),\n getW(wR, wC,
${inputDepthNearestVec4} + 1, d2)\n);\n\n if (${isChannelsLast}) {\n vec2 xValues =
vec2(\n getX(batch, xR, xC, ${inputDepthNearestVec4}),\n getX(batch, xR, xC,
${inputDepthNearestVec4} + 1)\n);\n dotProd += dot(xValues, wValues);\n } else {\n
 vec2 xValues = vec2(\n getX(batch, ${inputDepthNearestVec4}, xR, xC),\n getX(batch,
${inputDepthNearestVec4} + 1, xR, xC)\n);\n dotProd += dot(xValues, wValues);\n }\n
 }\n } else if
(${inputDepthVec4Remainder} === 3) {\n vec3 wValues = vec3(\n getW(wR, wC,
${inputDepthNearestVec4}, d2),\n getW(wR, wC, ${inputDepthNearestVec4} + 1, d2),\n getW(wR, wC,
${inputDepthNearestVec4} + 2, d2)\n);\n\n if (${isChannelsLast}) {\n

```



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```
=====\n*\n\nimport { backend_util } from '@tensorflow/tfjs-core';\nimport { getGlsIDifferences } from
 './gls_version';\nimport { GPGPUProgram } from './gpgpu_math';\n\nexport class Im2ColPackedProgram
 implements GPGPUProgram {\n variableNames = ['A'];\n packedInputs = true;\n packedOutput = true;\n outputShape: number[];\n userCode: string;\n\n constructor(\n outputShape: number[], inputShape: number[],\n convInfo: backend_util.Conv2DInfo) {\n this.outputShape = outputShape;\n\n const {\n filterWidth,\n inChannels,\n strideWidth,\n strideHeight,\n padInfo,\n outWidth,\n dilationWidth,\n dilationHeight,\n dataFormat\n } = convInfo;\n const {left, top} = padInfo;\n const itemsPerBlockRow =
 inChannels * filterWidth;\n const glsl = getGlsIDifferences();\n const isChannelsLast = dataFormat ===
 'channelsLast';\n const rowDim = isChannelsLast ? 0 : 1;\n const colDim = isChannelsLast ? 1 : 2;\n\n let
 unrolled = ``;\n\n for (let row = 0; row <= 1; row++) {\n for (let col = 0; col <= 1; col++) {\n unrolled +=
`\n blockIndex = rc.y + ${col};\n pos = rc.x + ${row};\n if (blockIndex < ${outputShape[1]} &&
pos < ${outputShape[0]}) {\n offsetY = int(blockIndex / (${outWidth})) * ${strideHeight} - ${\n top};\n d0 = offsetY + ${dilationHeight} * (pos / ${itemsPerBlockRow});\n if (d0 <
${inputShape[rowDim]} && d0 >= 0) {\n offsetX = int(mod(float(blockIndex), ${outWidth}.) * ${\n strideWidth}. - ${left}.);\n d1 = offsetX + ${dilationWidth}
* (int(mod(float(pos), ${\n itemsPerBlockRow}.) / ${inChannels}.));\n if (d1 <
${inputShape[colDim]} && d1 >= 0) {\n ch = int(mod(float(pos), ${inChannels}.));\n if
 ($isChannelsLast) {\n innerDims = vec2(d1, ch);\n result[${row * 2 + col}] = getChannel(\n getA(d0, int(innerDims.x),\n int(innerDims.y), innerDims);\n } else {\n innerDims = vec2(d0, d1);\n result[${row * 2 + col}] = getChannel(\n getA(ch,\n int(innerDims.x),\n int(innerDims.y)), innerDims);\n }\n }\n }\n }\n }\n\n this.userCode = `\n void main() {\n ivec2 rc = getOutputCoords();\n vec4 result =
vec4(0);\n int blockIndex, pos, offsetY, d0, offsetX, d1, ch;\n vec2 innerDims;\n ${unrolled}\n ${glsl.output} = result;\n }\n `;\n}\n\n\"/>\n\n * @license\n * Copyright 2020 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport { backend_util, env, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { MathBackendWebGL }
 from './backend_webgl';\nimport { Im2ColPackedProgram } from './im2col_packed_gpu';\nimport
 { mapActivationToShaderProgram }
 from './kernel_utils/kernel_funcs_utils';\nimport { MatMulPackedProgram } from './mulmat_packed_gpu';\nimport
 * as webgl_util from './webgl_util';\nimport { batchMatMulImpl, MATMUL_SHARED_DIM_THRESHOLD }
 from './BatchMatMul_impl';\nimport { identity } from './Identity';\nimport { reshape } from './Reshape';\n\ninterface Conv2DConfig {\n x: TensorInfo,\n filter: TensorInfo,\n convInfo: backend_util.Conv2DInfo,\n backend:
 MathBackendWebGL,\n bias?: TensorInfo,\n preluActivationWeights?: TensorInfo,\n leakyreluAlpha?: number,\n activation?: backend_util.Activation;\n}\n\n// For 1x1 kernels that iterate through every point in the input,
convolution\n// can be expressed as matrix multiplication (without need for memory\n// remapping).\n\nexport
```



```

function conv2dByMatMul({\n x,\n filter,\n convInfo,\n backend,\n bias = null,\n preluActivationWeights =
null,\n leakyreluAlpha = 0,\n activation = null\n}: Conv2DConfig) {\n // Reshapes conv2D input to 2D tensors,
uses
 matMul and then reshape the\n // result from 2D to 4D.\n const xShape = x.shape;\n const xTexData =
backend.texData.get(x.dataId);\n const sharedMatMulDim = convInfo.inChannels;\n const outerShapeX =
xShape[0] * xShape[1] * xShape[2];\n const outerShapeFilter = convInfo.outChannels;\n const isChannelsLast =
convInfo.dataFormat === 'channelsLast';\n const transposeA = false;\n const transposeB = false;\n\n let out:
TensorInfo;\n const intermediates: TensorInfo[] = [];\n\n // TODO: Once reduction ops are packed, batchMatMul
will always be packed\n // and we can remove this condition.\n const batchMatMulWillBeUnpacked =\n (outerShapeX === 1 || outerShapeFilter === 1) &&\n sharedMatMulDim >
MATMUL_SHARED_DIM_THRESHOLD;\n const reshapeWillBeExpensive = xShape[2] % 2 !== 0 &&
!xTexData.isPacked;\n\n if (batchMatMulWillBeUnpacked || !env().getBool('WEBGL_LAZILY_UNPACK') ||\n !env().getBool('WEBGL_PACK_BINARY_OPERATIONS')) {\n !reshapeWillBeExpensive) {\n
 const targetShape = isChannelsLast ? xShape[0] * xShape[1] * xShape[2] :\n xShape[0]
* xShape[2] * xShape[3];\n const xReshaped = reshape({\n inputs: {x},\n backend,\n attrs: {shape: [1,
targetShape, convInfo.inChannels]}\n });\n const filterReshaped = reshape({\n inputs: {x: filter},\n
backend,\n attrs: {shape: [1, convInfo.inChannels, convInfo.outChannels]}\n });\n const result =
batchMatMulImpl({\n a: xReshaped,\n b: filterReshaped,\n transposeA,\n transposeB,\n backend,\n
bias,\n activation,\n preluActivationWeights,\n leakyreluAlpha\n });\n\n out = reshape(\n {inputs:
{x: result}, backend, attrs: {shape: convInfo.outShape}});\n\n intermediates.push(xReshaped);\n
intermediates.push(filterReshaped);\n intermediates.push(result);\n } else {\n // Following optimization is
specific to packed |x| with odd row count\n // (For
 example, in channelLast mode, 'row count' refers to x.shape[2]):\n // we avoid expensive packed 2x2 reshape by
padding row count to next,\n // even number. When x.shape[2] is odd, the result of packed batchMatMul is\n //
the same (has the same texture layout and values in the texture) as\n // it is for even x.shape[2] + 1. We make
the odd-rows tensor to look like\n // even-rows tensor before the operation and, after the batchMatMul,\n // fix
the even-rows result to have odd number of rows.\n const targetShape = isChannelsLast ?\n xShape[0] *
xShape[1] * (xShape[2] + 1) :\n xShape[0] * xShape[2] * (xShape[3] + 1);\n const xReshaped: TensorInfo =
{\n dataId: x.dataId,\n shape: [1, targetShape, convInfo.inChannels],\n dtype: x.dtype\n }; \n //
xTexData.shape gets referenced from GPGPUBinary.inShapeInfos.\n // Decrementing row count, after
batchMatMul->...->compileProgram leads to\n // invalid row count within the reference
in GPGPUBinary.inShapeInfos.\n // Alternative fix would be to provide a copy to GPGPUBinary.inShapeInfos\n
// in compileProgram method, but that would affect compilation of all\n // programs - instead, provide a copy here,
with even row count, before\n // calling batchMatMul->...->compileProgram and after that, the original\n //
xTexData.shape is restored.\n const originalXTexDataShape = xTexData.shape;\n xTexData.shape =
xTexData.shape.slice();\n xTexData.shape[xTexData.shape.length - 2]++; \n util.assert(\n
webgl_util.isReshapeFree(xTexData.shape, xReshaped.shape),\n () => `packed reshape ${xTexData.shape} to
${\n xReshaped.shape} isn't free`);\n const filterReshaped = reshape({\n inputs: {x: filter},\n
backend,\n attrs: {shape: [1, convInfo.inChannels, convInfo.outChannels]}\n });\n
intermediates.push(filterReshaped);\n const pointwiseConv = batchMatMulImpl({\n a: xReshaped,\n b:
filterReshaped,\n
 backend,\n transposeA,\n transposeB,\n bias,\n activation,\n preluActivationWeights,\n
leakyreluAlpha\n });\n\n const pointwiseConvTexData = backend.texData.get(pointwiseConv.dataId);\n
util.assert(\n pointwiseConvTexData.isPacked,\n () => 'batchMatMul result is expected to be packed');\n
// Restore the input shape to original.\n xTexData.shape = originalXTexDataShape;\n // Set the output shape -
there is no need for expensive reshape as data\n // layout is already correct.\n pointwiseConvTexData.shape =
convInfo.outShape;\n\n out = identity({inputs: {x: pointwiseConv}, backend});\n out.shape =
convInfo.outShape;\n\n intermediates.push(pointwiseConv);\n }\n\n for (const i of intermediates) {\n

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backend.disposeIntermediateTensorInfo(i);\n } \n\n return out;\n}\n\n// Implements the im2row algorithm as
outlined in \"High Performance Convolutional Neural Networks for Document Processing\" (Suvisoft,
2006)\nexport function conv2dWithIm2Row({\n x,\n filter,\n convInfo,\n backend,\n bias = null,\n preluActivationWeights = null,\n leakyreluAlpha = 0,\n activation = null\n}: Conv2DConfig) {\n // Rearranges
conv2d input so each block to be convolved over forms the\n // column of a new matrix with shape [filterWidth *
filterHeight * \n // inChannels, outHeight * outWidth]. The filter is also rearranged so each\n // output channel
forms a row of a new matrix with shape [outChannels,\n // filterWidth * filterHeight * inChannels]. The
convolution is then\n // computed by multiplying these matrices and reshaping the result.\n const {\n filterWidth,\n filterHeight,\n inChannels,\n outWidth,\n outHeight,\n dataFormat\n } = convInfo;\n\n const isChannelsLast = dataFormat === 'channelsLast';\n\n const sharedDim = filterWidth * filterHeight *
inChannels;\n const numCols = outHeight * outWidth;\n const x2ColShape = [sharedDim, numCols];\n const
transposeA
= true;\n const transposeB = false;\n\n const intermediates: TensorInfo[] = [];\n\n const xSqueezed =\n reshape({inputs: [x], backend, attrs: {shape: x.shape.slice(1)}});\n const w2Row = reshape({\n inputs: [x:
filter],\n backend,\n attrs: {shape: [1, sharedDim, util.sizeFromShape(filter.shape) / sharedDim]}\n });\n\n intermediates.push(xSqueezed);\n intermediates.push(w2Row);\n\n const im2ColProgram =\n new
Im2ColPackedProgram(x2ColShape, xSqueezed.shape, convInfo);\n const im2Col =
backend.runWebGLProgram(im2ColProgram, [xSqueezed], 'float32');\n const im2ColReshaped = reshape({\n inputs: [x: im2Col],\n backend,\n attrs: {shape: [1, x2ColShape[0], x2ColShape[1]]}\n });\n\n intermediates.push(im2Col);\n intermediates.push(im2ColReshaped);\n\n const hasBias = bias != null;\n const
hasPreluActivationWeights = preluActivationWeights != null;\n const hasLeakyreluAlpha = activation ===
'leakyrelu';\n const fusedActivation =\n activation ?
mapActivationToShaderProgram(activation, true) : null;\n const matmulProgram = new MatMulPackedProgram(\n im2ColReshaped.shape as [number, number, number],\n w2Row.shape as [number, number, number],\n [1,
numCols, convInfo.outChannels], transposeA, transposeB, hasBias,\n fusedActivation,
hasPreluActivationWeights, hasLeakyreluAlpha);\n const inputs: TensorInfo[] = [im2ColReshaped, w2Row];\n if
(bias) {\n inputs.push(bias);\n }\n if (hasPreluActivationWeights) {\n inputs.push(preluActivationWeights);\n }\n if (hasLeakyreluAlpha) {\n const $leakyreluAlpha = backend.makeTensorInfo(\n [], 'float32',\n util.createScalarValue(leakyreluAlpha as {} as 'float32', 'float32'));\n inputs.push($leakyreluAlpha);\n }\n intermediates.push($leakyreluAlpha);\n }\n const product = backend.runWebGLProgram(matmulProgram, inputs,
'float32');\n\n const outShape = isChannelsLast ?\n [1, outHeight, outWidth, convInfo.outChannels] :\n [1,
convInfo.outChannels,
outHeight, outWidth];\n const out =\n reshape({inputs: {x: product}, backend, attrs: {shape: outShape}});\n\n intermediates.push(product);\n for (const i of intermediates) {\n backend.disposeIntermediateTensorInfo(i);\n }\n\n return out;\n}\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under
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License.\n *

```

```

=====\n
*/\n\nimport
{ backend_util, Conv2D, Conv2DAttrs, Conv2DInputs, env, KernelConfig, KernelFunc, TensorInfo } from
'@tensorflow/tfjs-core';\n\nimport { MathBackendWebGL } from '../backend_webgl';\nimport { Conv2DProgram }
from '../conv_gpu';\nimport { conv2dByMatMul, conv2dWithIm2Row } from './Conv2D_impl';\nimport { reshape }
from './Reshape';\n\nexport function conv2d({\n args:\n {inputs: Conv2DInputs, attrs: Conv2DAttrs, backend:
MathBackendWebGL}) {\n const {inputs, backend, attrs} = args;\n const {x, filter} = inputs;\n const {strides, pad,

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dataFormat, dilations, dimRoundingMode} = attrs;\n\n const $dataFormat =
backend_util.convertConv2DDataFormat(dataFormat);\n\n const convInfo = backend_util.computeConv2DInfo(\n
x.shape as [number, number, number, number],\n\n filter.shape as [number, number, number, number], strides,
dilations, pad,\n\n dimRoundingMode, false /* depthwise */, $dataFormat);\n\n let out: TensorInfo;\n\n if
(convInfo.filterHeight === 1 && convInfo.filterWidth ===
1 &&\n\n convInfo.dilationHeight === 1 && convInfo.dilationWidth === 1 &&\n\n convInfo.strideHeight ===
1 && convInfo.strideWidth === 1 &&\n\n (convInfo.padInfo.type === 'SAME' || convInfo.padInfo.type ===
'VALID')) {\n\n out = conv2dByMatMul({x, filter, convInfo, backend});\n\n } else if
(env().getBool('WEBGL_CONV_IM2COL') && x.shape[0] === 1) {\n\n out = conv2dWithIm2Row({x, filter,
convInfo, backend});\n\n } else {\n\n const program = new Conv2DProgram(convInfo);\n\n out =
backend.runWebGLProgram(program, [x, filter], 'float32');\n\n }\n\n const outReshaped =\n\n reshape({inputs: {x:
out}, backend, attrs: {shape: convInfo.outShape}});\n\n backend.disposeIntermediateTensorInfo(out);\n\n return
outReshaped;\n\n}\n\n\nexport const conv2DConfig: KernelConfig = {\n\n kernelName: Conv2D,\n\n backendName:
'webgl',\n\n kernelFunc: conv2d as {} as KernelFunc,\n\n};\n\n","/**\n\n * @license\n\n * Copyright 2017 Google LLC. All
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the specific language governing permissions and\n\n * limitations under the License.\n\n *
=====
*\n\n\nimport {backend_util} from '@tensorflow/tfjs-core';\n\nimport {GPGPUProgram} from
'./gpgpu_math';\n\n\nexport class Conv2DDerFilterProgram implements GPGPUProgram {\n\n variableNames = ['x',
'dy'];\n\n outputShape: number[];\n\n userCode: string;\n\n\n constructor(convInfo: backend_util.Conv2DInfo) {\n\n
this.outputShape = convInfo.filterShape;\n\n\n const strideHeight = convInfo.strideHeight;\n\n
const strideWidth = convInfo.strideWidth;\n\n const padTop = convInfo.padInfo.top;\n\n const padLeft =
convInfo.padInfo.left;\n\n const isChannelsLast = convInfo.dataFormat === 'channelsLast';\n\n\n this.userCode =
`\n\n void main() {\n\n ivec4 coords = getOutputCoords();\n\n int wR = coords.x;\n\n int wC = coords.y;\n\n
int d1 = coords.z;\n\n int d2 = coords.w;\n\n\n // Convolve x(?, ?, d1) with dy(:, :, d2) to get dw(wR, wC, d1,
d2).\n\n // ? = to be determined. : = across all values in that axis.\n\n float dotProd = 0.0;\n\n\n for (int b = 0;
b < ${convInfo.batchSize}; b++) {\n\n for (int yR = 0; yR < ${convInfo.outHeight}; yR++) {\n\n int xR =
wR + yR * ${strideHeight} - ${padTop};\n\n\n if (xR < 0 || xR >= ${convInfo.inHeight}) {\n\n
continue;\n\n } \n\n\n for (int yC = 0; yC < ${convInfo.outWidth}; yC++) {\n\n int xC = wC + yC *
${strideWidth} - ${padLeft};\n\n\n if (xC < 0 || xC >= ${convInfo.inWidth}) {\n\n continue;\n\n } \n\n\n if
(${isChannelsLast}) {\n\n float dyValue = getDy(b, yR, yC, d2);\n\n float xValue = getX(b, xR, xC,
d1);\n\n dotProd += (xValue * dyValue);\n\n } else {\n\n float dyValue = getDy(b, d2, yR,
yC);\n\n float xValue = getX(b, d1, xR, xC);\n\n dotProd += (xValue * dyValue);\n\n } \n\n\n }\n\n }\n\n }\n\n
setOutput(dotProd);\n\n }\n\n `;\n\n }\n\n}\n\n\nexport class Conv2DDerInputProgram
implements GPGPUProgram {\n\n variableNames = ['dy', 'W'];\n\n outputShape: number[];\n\n userCode: string;\n\n\n
constructor(convInfo: backend_util.Conv2DInfo) {\n\n this.outputShape = convInfo.inShape;\n\n\n const
filterHeight = convInfo.filterHeight;\n\n const filterWidth = convInfo.filterWidth;\n\n const strideHeight =
convInfo.strideHeight;\n\n const strideWidth
= convInfo.strideWidth;\n\n const isChannelsLast = convInfo.dataFormat === 'channelsLast';\n\n\n const padTop =
filterHeight - 1 - convInfo.padInfo.top;\n\n const padLeft = filterWidth - 1 - convInfo.padInfo.left;\n\n\n const
rowDim = isChannelsLast ? 1 : 2;\n\n const colDim = isChannelsLast ? 2 : 3;\n\n const channelDim =
isChannelsLast ? 3 : 1;\n\n\n this.userCode = `\n\n const ivec2 pads = ivec2(${padTop}, ${padLeft});\n\n\n void
main() {\n\n ivec4 coords = getOutputCoords();\n\n int batch = coords[0];\n\n int d1 =

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coords[{$channelDim}];\n\n ivec2 dyCorner = ivec2(coords[{$rowDim}], coords[{$colDim}]) - pads;\n int
dyRCorner = dyCorner.x;\n int dyCCorner = dyCorner.y;\n\n // Convolve dy(?, ?, d2) with w(:, :, d1, d2) to
compute dx(xR, xC, d1).\n // ? = to be determined. := across all values in that axis.\n float dotProd = 0.0;\n for (int wR = 0; wR < {$filterHeight}; wR++) {\n float dyR = float(dyRCorner
+ wR) / {$strideHeight}.0;\n\n if (dyR < 0.0 || dyR >= {$convInfo.outHeight}.0 || fract(dyR) > 0.0) {\n
continue;\n }\n int idyR = int(dyR);\n\n int wRPerm = {$filterHeight} - 1 - wR;\n\n for (int
wC = 0; wC < {$filterWidth}; wC++) {\n float dyC = float(dyCCorner + wC) / {$strideWidth}.0;\n\n
if (dyC < 0.0 || dyC >= {$convInfo.outWidth}.0 ||\n fract(dyC) > 0.0) {\n continue;\n }\n
 int idyC = int(dyC);\n\n int wCPerm = {$filterWidth} - 1 - wC;\n\n for (int d2 = 0; d2 <
{$convInfo.outChannels}; d2++) {\n if ({$isChannelsLast}) {\n float xValue = getDy(batch,
idyR, idyC, d2);\n float wValue = getW(wRPerm, wCPerm, d1, d2);\n dotProd += xValue *
wValue;\n } else {\n float xValue = getDy(batch, d2, idyR, idyC);\n float wValue =
getW(wRPerm,
wCPerm, d1, d2);\n dotProd += xValue * wValue;\n }\n }\n }\n }\n
setOutput(dotProd);\n}\n\n`;\n}\n}\n}\n}\n\nexport class Conv3DDerFilterProgram implements GPGPUProgram {\n
variableNames = ['x', 'dy'];\noutputShape: number[];\nuserCode: string;\n\nconstructor(convInfo:
backend_util.Conv3DInfo) {\n this.outputShape = convInfo.filterShape;\n\n const strideDepth =
convInfo.strideDepth;\n const strideHeight = convInfo.strideHeight;\n const strideWidth =
convInfo.strideWidth;\n const padFront = convInfo.padInfo.front;\n const padTop = convInfo.padInfo.top;\n
const padLeft = convInfo.padInfo.left;\n\n this.userCode = `\n void main() {\n ivec5 coords =
getOutputCoords();\n int wF = coords.x;\n int wR = coords.y;\n int wC = coords.z;\n int d1 =
coords.w;\n int d2 = coords.u;\n\n float dotProd = 0.0;\n for (int b = 0; b < {$convInfo.batchSize};
b++) {\n for (int yF = 0; yF < {$convInfo.outDepth}; yF++) {\n int xF = wF + yF * {$strideDepth} -
{$padFront};\n\n if (xF < 0 || xF >= {$convInfo.inDepth}) {\n continue;\n }\n\n for (int
yR = 0; yR < {$convInfo.outHeight}; yR++) {\n int xR = wR + yR * {$strideHeight} - {$padTop};\n\n
 if (xR < 0 || xR >= {$convInfo.inHeight}) {\n continue;\n }\n\n for (int yC = 0; yC <
{$convInfo.outWidth}; yC++) {\n int xC = wC + yC * {$strideWidth} - {$padLeft};\n\n if (xC <
0 || xC >= {$convInfo.inWidth}) {\n continue;\n }\n\n float dyValue = getDy(b, yF,
yR, yC, d2);\n float xValue = getX(b, xF, xR, xC, d1);\n dotProd += (xValue * dyValue);\n
 }\n }\n }\n }\n setOutput(dotProd);\n }\n\n`;\n}\n}\n}\n}\n\nexport
class Conv3DDerInputProgram implements GPGPUProgram {\n variableNames = ['dy', 'W'];\n outputShape:
number[];\n userCode: string;\n\n constructor(convInfo: backend_util.Conv3DInfo) {\n this.outputShape =
convInfo.inShape;\n\n const filterDepth = convInfo.filterDepth;\n const filterHeight = convInfo.filterHeight;\n
const filterWidth = convInfo.filterWidth;\n const strideDepth = convInfo.strideDepth;\n const strideHeight =
convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n\n const padFront = filterDepth - 1 -
convInfo.padInfo.front;\n const padTop = filterHeight - 1 - convInfo.padInfo.top;\n const padLeft = filterWidth -
1 - convInfo.padInfo.left;\n\n this.userCode = `\n const ivec3 pads = ivec3({$padFront}, {$padTop},
{$padLeft});\n\n void main() {\n ivec5 coords = getOutputCoords();\n int batch = coords.x;\n int d1
= coords.u;\n\n ivec3 dyCorner = ivec3(coords.y, coords.z, coords.w)
- pads;\n int dyFCorner = dyCorner.x;\n int dyRCorner = dyCorner.y;\n int dyCCorner =
dyCorner.z;\n\n float dotProd = 0.0;\n for (int wF = 0; wF < {$filterDepth}; wF++) {\n float dyF =
float(dyFCorner + wF) / {$strideDepth}.0;\n\n if (dyF < 0.0 || dyF >= {$convInfo.outDepth}.0 || fract(dyF) >
0.0) {\n continue;\n }\n int idyF = int(dyF);\n\n int wFPerm = {$filterDepth} - 1 - wF;\n\n
 for (int wR = 0; wR < {$filterHeight}; wR++) {\n float dyR = float(dyRCorner + wR) /
{$strideHeight}.0;\n\n if (dyR < 0.0 || dyR >= {$convInfo.outHeight}.0 ||\n fract(dyR) > 0.0) {\n
 continue;\n }\n int idyR = int(dyR);\n\n int wRPerm = {$filterHeight} - 1 - wR;\n\n
 for (int wC = 0; wC < {$filterWidth}; wC++) {\n float dyC = float(dyCCorner + wC) /
{$strideWidth}.0;\n\n if (dyC < 0.0 || dyC

```

```

>= ${convInfo.outWidth}.0 ||\n fract(dyC) > 0.0) {\n continue;\n }\n int idyC =
int(dyC);\n int wCPerm = ${filterWidth} - 1 - wC;\n for (int d2 = 0; d2 <
${convInfo.outChannels}; d2++) {\n float xValue = getDy(batch, idyF, idyR, idyC, d2);\n float
wValue = getW(wFPerm, wRPerm, wCPerm, d1, d2);\n dotProd += xValue * wValue;\n }\n
}\n }\n }\n setOutput(dotProd);\n }\n `;\n }\n }\n \n", "/*\n * @license\n * Copyright 2020 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

```

```

=====
*\n\nimport { backend_util, Conv2DBackpropFilter, Conv2DBackpropFilterAttrs, Conv2DBackpropFilterInputs,
KernelConfig, KernelFunc } from '@tensorflow/tfjs-core';\n\nimport { MathBackendWebGL } from
'./backend_webgl';\n\nimport { Conv2DDerFilterProgram } from './conv_backprop_gpu';\n\nexport function
conv2DBackpropFilter(args: {\n inputs: Conv2DBackpropFilterInputs,\n attrs: Conv2DBackpropFilterAttrs,\n backend: MathBackendWebGL\n}) {\n const { inputs, backend, attrs } = args;\n const { x, dy } = inputs;\n const
{ strides, pad, dataFormat, dimRoundingMode, filterShape } = attrs;\n\n const $dataFormat =
backend_util.convertConv2DDataFormat(dataFormat);\n const convInfo = backend_util.computeConv2DInfo(\n
 x.shape as [number, number, number, number], filterShape, strides,\n 1 /* dilations */, pad,
dimRoundingMode, false /* depthwise */, \n $dataFormat);\n\n const program = new
Conv2DDerFilterProgram(convInfo);\n return backend.runWebGLProgram(program, [x, dy],
'float32');\n}\n\nexport const conv2DBackpropFilterConfig: KernelConfig = {\n kernelName:
Conv2DBackpropFilter,\n backendName: 'webgl',\n kernelFunc: conv2DBackpropFilter as {} as
KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
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Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n
* See the License for the specific language governing permissions and\n * limitations under the License.\n *

```

```

=====
*\n\nimport { backend_util, Conv2DBackpropInput, Conv2DBackpropInputAttrs, Conv2DBackpropInputInputs,
KernelConfig, KernelFunc } from '@tensorflow/tfjs-core';\n\nimport { MathBackendWebGL } from
'./backend_webgl';\n\nimport { Conv2DDerInputProgram } from './conv_backprop_gpu';\n\nexport function
conv2DBackpropInput(args: {\n inputs: Conv2DBackpropInputInputs,\n attrs: Conv2DBackpropInputAttrs,\n backend: MathBackendWebGL\n}) {\n const { inputs, backend, attrs } = args;\n const { dy, filter } = inputs;\n const
{ inputShape, strides, pad, dataFormat, dimRoundingMode } = attrs;\n\n const $dataFormat =
backend_util.convertConv2DDataFormat(dataFormat);\n const convInfo = backend_util.computeConv2DInfo(\n
inputShape, filter.shape as [number, number, number, number], strides,\n 1 /* dilations
*/, pad, dimRoundingMode, false, $dataFormat);\n\n const program = new Conv2DDerInputProgram(convInfo);\n
return backend.runWebGLProgram(program, [dy, filter], 'float32');\n}\n\nexport const
conv2DBackpropInputConfig: KernelConfig = {\n kernelName: Conv2DBackpropInput,\n backendName:
'webgl',\n kernelFunc: conv2DBackpropInput as {} as KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2020
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may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,

```

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```
=====
*\n\nimport {backend_util, Conv3D, Conv3DAttrs, Conv3DInputs, KernelConfig, KernelFunc} from
'@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\n\nimport {Conv3DProgram}
from '../conv_gpu';\n\nexport function conv3D(\n args:\n {inputs: Conv3DInputs, attrs: Conv3DAttrs,
backend: MathBackendWebGL}) {\n const {inputs, backend, attrs} = args;\n const {x, filter} = inputs;\n const
{strides, pad, dilations} = attrs;\n\n const convInfo = backend_util.computeConv3DInfo(\n x.shape as [number,
number, number, number, number],\n filter.shape as [number, number, number, number, number], strides,\n dilations, pad);\n\n const program = new Conv3DProgram(convInfo);\n return
backend.runWebGLProgram(program, [x, filter], 'float32');\n\n}\n\nexport const conv3DConfig: KernelConfig = {\n
kernelName: Conv3D,\n backendName: 'webgl',\n kernelFunc: conv3D as {} as KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
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=====
*\n\nimport {backend_util, Conv3DBackpropFilterV2, Conv3DBackpropFilterV2Attrs,
Conv3DBackpropFilterV2Inputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\n\nimport
{MathBackendWebGL} from '../backend_webgl';\n\nimport {Conv3DDerFilterProgram} from
'../conv_backprop_gpu';\n\nexport
function conv3DBackpropFilterV2(args: {\n inputs: Conv3DBackpropFilterV2Inputs,\n attrs:
Conv3DBackpropFilterV2Attrs,\n backend: MathBackendWebGL\n}) {\n const {inputs, backend, attrs} = args;\n
const {x, dy} = inputs;\n const {strides, pad, filterShape} = attrs;\n\n const convInfo =
backend_util.computeConv3DInfo(\n x.shape as [number, number, number, number, number], filterShape,
strides,\n 1 /* dilations */, pad);\n\n const program = new Conv3DDerFilterProgram(convInfo);\n return
backend.runWebGLProgram(program, [x, dy], 'float32');\n\n}\n\nexport const conv3DBackpropFilterV2Config:
KernelConfig = {\n kernelName: Conv3DBackpropFilterV2,\n backendName: 'webgl',\n kernelFunc:
conv3DBackpropFilterV2 as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this
file except in compliance with the License.\n * You
may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required
by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\"
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====
*\n\nimport {backend_util, Conv3DBackpropInputV2, Conv3DBackpropInputV2Attrs,
Conv3DBackpropInputV2Inputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\n\nimport
{MathBackendWebGL} from '../backend_webgl';\n\nimport {Conv3DDerInputProgram} from
'../conv_backprop_gpu';\n\nexport function conv3DBackpropInput(args: {\n inputs:
Conv3DBackpropInputV2Inputs,\n attrs: Conv3DBackpropInputV2Attrs,\n backend: MathBackendWebGL\n})
{\n const {inputs, backend, attrs} = args;\n const {dy, filter}
= inputs;\n const {pad, strides, inputShape} = attrs;\n\n const convInfo = backend_util.computeConv3DInfo(\n
inputShape, filter.shape as [number, number, number, number, number],\n strides, 1 /* dilations */, pad);\n\n
const program = new Conv3DDerInputProgram(convInfo);\n return backend.runWebGLProgram(program, [dy,
```

```

filter], 'float32');\n}\n\nexport const conv3DBackpropInputConfig: KernelConfig = {\n kernelName:
Conv3DBackpropInputV2,\n backendName: 'webgl',\n kernelFunc: conv3DBackpropInput as {} as
KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
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Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n
 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License
for the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport { Cos, KernelConfig } from '@tensorflow/tfjs-core';\n\nimport { CHECK_NAN_SNIPPET_UNARY,
unaryKernelFunc } from './kernel_utils/kernel_funcs_utils';\n\nconst COS = CHECK_NAN_SNIPPET_UNARY +
`\n return cos(x);\n`;\n\nexport const cos = unaryKernelFunc({ opSnippet: COS });\n\nexport const cosConfig:
KernelConfig = {\n kernelName: Cos,\n backendName: 'webgl',\n kernelFunc: cos,\n};\n", "/*\n * @license\n *
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 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport { Cosh, KernelConfig } from '@tensorflow/tfjs-core';\n\nimport { unaryKernelFunc } from
'./kernel_utils/kernel_funcs_utils';\n\nconst COSH = `\n float e2x = exp(-x);\n return (e2x + 1.0 / e2x) /
2.0;\n`;\n\nexport const cosh = unaryKernelFunc({ opSnippet: COSH });\n\nexport const coshConfig: KernelConfig
= {\n kernelName: Cosh,\n backendName: 'webgl',\n kernelFunc: cosh,\n};\n", "/*\n * @license\n * Copyright
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 * you may not use this file except in compliance with the License.\n * You may
obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by
applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\"
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport { GPGPUProgram } from './gpgpu_math';\n\nexport class CropAndResizeProgram implements
GPGPUProgram {\n variableNames = ['Image', 'Boxes', 'BoxInd'];\n outputShape: number[] = [];\n userCode:
string;\n\n constructor(\n imageShape: [number, number, number, number], boxShape: [number, number],\n
 cropSize: [number, number], method: 'bilinear'|'nearest',\n extrapolationValue: number) {\n const [batch,
imageHeight, imageWidth, depth] = imageShape;\n const [numBoxes,
] = boxShape;\n const [cropHeight, cropWidth] = cropSize;\n this.outputShape = [numBoxes, cropHeight,
cropWidth, depth];\n const methodId = method === 'bilinear' ? 1 : 0;\n\n const [inputHeightFloat,
inputWidthFloat] =\n [`${imageHeight - 1}.0`, `${imageWidth - 1}.0`];\n\n const [heightRatio, heightScale,
inY] = cropHeight > 1 ?\n [\n `${(imageHeight - 1) / (cropHeight - 1)}`,\n '(y2-y1) * height_ratio',\n
 `y1*${inputHeightFloat} + float(y)*(height_scale)`,\n] : [\n '0.0',\n '0.0',\n `0.5 *
(y1+y2) * ${inputHeightFloat}`, \n];\n const [widthRatio, widthScale, inX] = cropWidth > 1 ?\n [\n
`${(imageWidth - 1) / (cropWidth - 1)}`,\n '(x2-x1) * width_ratio',\n `x1*${inputWidthFloat} +
float(x)*(width_scale)`,\n] : [\n '0.0',\n '0.0',\n `0.5 * (x1+x2) * ${inputWidthFloat}`, \n
];\n\n // Reference
implementation\n // tslint:disable-next-line:max-line-length\n //
https://github.com/tensorflow/tensorflow/blob/master/tensorflow/core/kernels/crop_and_resize_op_gpu.cu.cc\n

```

```

this.userCode = `
 const float height_ratio = float(${heightRatio});
 const float width_ratio = float(${widthRatio});
 void main() {
 ivec4 coords = getOutputCoords();
 int b = coords[0];
 int y = coords[1];
 int x = coords[2];
 int d = coords[3];
 // get box vals
 float y1 = getBoxes(b,0);
 float x1 = getBoxes(b,1);
 float y2 = getBoxes(b,2);
 float x2 = getBoxes(b,3);
 // get image in batch index
 int bInd = round(getBoxInd(b));
 if(bInd < 0 || bInd >= ${batch}) {
 return;
 }
 float height_scale = ${heightScale};
 float width_scale = ${widthScale};
 float in_y = ${inY};
 if(in_y < 0.0 || in_y > ${inputHeightFloat}) {
 setOutput(float(${extrapolationValue}));
 return;
 }
 float in_x = ${inX};
 if(in_x < 0.0 || in_x > ${inputWidthFloat}) {
 setOutput(float(${extrapolationValue}));
 return;
 }
 ivec2 sourceFracIndexCR = vec2(in_x,in_y);
 if(${methodId} == 1) {
 // Compute the four integer indices.
 ivec2 sourceFloorCR = ivec2(sourceFracIndexCR);
 ivec2 sourceCeilCR = ivec2(ceil(sourceFracIndexCR));
 float topLeft = getImage(b, sourceFloorCR.y, sourceFloorCR.x, d);
 float bottomLeft = getImage(b, sourceCeilCR.y, sourceFloorCR.x, d);
 float topRight = getImage(b, sourceFloorCR.y, sourceCeilCR.x, d);
 float bottomRight = getImage(b, sourceCeilCR.y, sourceCeilCR.x, d);
 ivec2 fracCR = sourceFracIndexCR - vec2(sourceFloorCR);
 float top = topLeft + (topRight - topLeft) * fracCR.x;
 float bottom = bottomLeft + (bottomRight - bottomLeft) * fracCR.x;
 float newValue = top + (bottom - top) * fracCR.y;
 setOutput(newValue);
 } else {
 // Compute the coordinators of nearest neighbor point.
 ivec2 sourceNearestCR = ivec2(floor((sourceFracIndexCR + vec2(0.5,0.5))));
 float newValue = getImage(b, sourceNearestCR.y, sourceNearestCR.x, d);
 setOutput(newValue);
 }
 }
}
`
`/**
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 * Copyright 2020 Google LLC. All Rights Reserved.
 * Licensed under the Apache License, Version 2.0 (the "License");
 * you may not use this file except in compliance with the License.
 * You may obtain a copy of the License at
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 * Unless required by applicable law or agreed to in writing, software
 * distributed under the License is distributed on an "AS IS" BASIS,
 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
 * See the License for the specific language governing permissions and
 * limitations under the License.
 */
`
=====
`
`
import { CropAndResize, CropAndResizeAttrs, CropAndResizeInputs, KernelConfig, KernelFunc, TensorInfo } from '@tensorflow/tfjs-core';
import { MathBackendWebGL } from '../backend_webgl';
import { CropAndResizeProgram } from './crop_and_resize_gpu';
export const cropAndResize = (args: { inputs: CropAndResizeInputs, backend: MathBackendWebGL, attrs: CropAndResizeAttrs }): TensorInfo => {
 const { inputs, backend, attrs } = args;
 const { image, boxes, boxInd } = inputs;
 const { cropSize, method, extrapolationValue } = attrs;
 const program = new CropAndResizeProgram(
 image.shape as [number, number, number, number],
 boxes.shape as [number, number],
 cropSize,
 method,
 extrapolationValue);
 return backend.runWebGLProgram(program, [image, boxes, boxInd], 'float32');
}
export const cropAndResizeConfig: KernelConfig = {
 kernelName: CropAndResize,
 backendName: 'webgl',
 kernelFunc: cropAndResize as {} as KernelFunc
};
`
`/**
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 * distributed under the License is distributed on an "AS IS" BASIS,
 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
 * See the License for the specific language governing permissions and
 * limitations under the License.
 */
`
=====
`
import { GPGPUContext } from './gpgpu_context';
import { GPGPUProgram } from './gpgpu_math';
import { getCoordsDataType } from

```



```

'./shader_compiler';\n\nexport class CumSumProgram implements GPGPUProgram {\n variableNames = ['x'];\n outputShape: number[];\n userCode: string;\n\n // Caching uniform location for speed.\n index: WebGLUniformLocation;\n\n constructor(shape: number[], exclusive: boolean, reverse: boolean) {\n this.outputShape = shape;\n const rank = shape.length;\n const val = exclusive ? '0.0' : `getX(${getCoords(rank, 'coords')})`;\n const length = shape[shape.length - 1];\n let condition = ";\n let idxString = ";\n // When exclusive is set, the cumsum op becomes roll op that copies the\n // value from the previous index based on the direction specified by the\n // reverse flag.\n if (exclusive) {\n condition = reverse ? `end != ${length - 1}` : `end != 0`;\n idxString = reverse ? `end + 1` : `end - 1`;\n } else {\n condition = reverse ? `end + pow2 < ${length}` : `end >= pow2`;\n idxString = (reverse ? `end + pow2` : `end - pow2`);\n }\n\n this.userCode = `\n uniform float index;\n void main() {\n ${getCoordsDataType(rank)} coords = getOutputCoords();\n int end = ${getFinalCoord(rank, 'coords')};\n float val = ${val};\n int pow2 = int(pow(2.0, index));\n if (${condition}) {\n int idx = ${idxString};\n ${getFinalCoord(rank, 'coords')} = idx;\n val += getX(${getCoords(rank, 'coords')});\n }\n setOutput(val);\n }\n`;\n\n getCustomSetupFunc(index: number) {\n return (gpgpu: GPGPUContext, webGLProgram: WebGLProgram) => {\n if (this.index === null) {\n this.index = gpgpu.getUniformLocation(webGLProgram, 'index');\n }\n gpgpu.gl.uniform1f(this.index, index);\n };\n }\n\n function getCoords(rank: number, name: string): string {\n if (rank === 1) {\n return `${name}`;\n } else if (rank === 2) {\n return `${name}.x, ${name}.y`;\n } else if (rank === 3) {\n return `${name}.x, ${name}.y, ${name}.z`;\n } else if (rank === 4) {\n return `${name}.x, ${name}.y, ${name}.z, ${name}.w`;\n } else {\n throw Error(`Cumulative sum for rank ${rank} is not yet supported`);\n }\n }\n\n function getFinalCoord(rank: number, name: string): string {\n if (rank === 1) {\n return `${name}`;\n } else if (rank === 2) {\n return `${name}.y`;\n } else if (rank === 3) {\n return `${name}.z`;\n } else if (rank === 4) {\n return `${name}.w`;\n } else {\n throw Error(`Cumulative sum for rank ${rank} is not yet supported`);\n }\n }\n\n /**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS"\n * BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n =====\n\n *\n import {backend_util, Cumsum, CumsumAttrs, CumsumInputs, KernelConfig, KernelFunc, TensorInfo} from '@tensorflow/tfjs-core';\n import {MathBackendWebGL} from './backend_webgl';\n import {CumSumProgram} from './cumsum_gpu';\n import {identity} from './Identity';\n import {transpose} from './Transpose';\n\n export function cumsum(\n args: {\n inputs: CumsumInputs, backend: MathBackendWebGL, attrs: CumsumAttrs\n },\n TensorInfo {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {axis, exclusive, reverse} = attrs;\n\n const xRank = x.shape.length;\n const permutation = backend_util.getAxesPermutation([axis], xRank);\n\n let permutedX = x;\n if (permutation !== null) {\n permutedX = transpose({inputs: {x}, backend, attrs: {perm: permutation}});\n }\n\n const permutedAxis = backend_util.getInnerMostAxes(1, xRank)[0];\n\n if (permutedAxis !== xRank - 1) {\n throw new Error(\n `WebGL cumsum shader expects an inner-most axis=${\n x.shape.length - 1\n } ` +\n `but got axis=${axis}`);\n }\n\n const size = permutedX.shape[permutedAxis];\n let result = identity({inputs: {x: permutedX}, backend});\n // Use cumsum parallel algorithm, ref:\n https://developer.nvidia.com/gpugems/gpugems3/part-vi-gpu-computing/chapter-39-parallel-prefix-sum-scan-cuda\n\n for (let i = 0; i <= Math.ceil(Math.log2(size)) - 1; i++) {\n const program = new CumSumProgram(permutedX.shape, false, reverse);\n const customSetup = program.getCustomSetupFunc(i);\n const prevResult = result;\n result =\n backend.runWebGLProgram(program, [result], result.dtype, customSetup);\n backend.disposeIntermediateTensorInfo(prevResult);\n }\n\n // For

```

```

exclusive cumsum, shift the end result in the direction of sum\n // and add 0 to the front index.\n if (exclusive) {\n
const program = new CumSumProgram(permutedX.shape, exclusive, reverse);\n const prevResult = result;\n
result = backend.runWebGLProgram(program, [result], result.dtype);\n
backend.disposeIntermediateTensorInfo(prevResult);\n }\n\n if (permutation != null) {\n const
reversePermutation = backend_util.getUndoAxesPermutation(permutation);\n const reverseTransposedResult =
transpose(\n {inputs: {x: result}, backend, attrs: {perm: reversePermutation}});\n\n
backend.disposeIntermediateTensorInfo(result);\n backend.disposeIntermediateTensorInfo(permutedX);\n\n
return reverseTransposedResult;\n }\n\n return result;\n}\n\nexport const cumsumConfig: KernelConfig = {\n
kernelName: Cumsum,\n backendName: 'webgl',\n kernelFunc: cumsum as {} as KernelFunc\n};\n"/**\n *
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under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with
the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *
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distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
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*\n\nimport {DenseBincount, DenseBincountAttrs, DenseBincountInputs, KernelConfig, KernelFunc, TensorInfo,
TypedArray} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\n\nimport
{bincountImplCPU, bincountReduceImplCPU} from '../kernel_utils/shared';\n\nexport function denseBincount(args:
{\n inputs: DenseBincountInputs,\n
backend: MathBackendWebGL,\n attrs: DenseBincountAttrs\n}): TensorInfo {\n const {inputs, backend, attrs} =
args;\n const {x, weights} = inputs;\n const {size, binaryOutput} = attrs;\n\n if (x.shape.length === 1) {\n const
xVals = backend.readSync(x.dataId) as TypedArray;\n const weightsVals = backend.readSync(weights.dataId) as
TypedArray;\n\n const outVals =\n bincountImplCPU(xVals, weightsVals, weights.dtype, weights.shape,
size);\n\n return backend.makeTensorInfo([size], weights.dtype, outVals);\n } else if (x.shape.length === 2) {\n
const xBuf = backend.bufferSync(x);\n const weightsBuf = backend.bufferSync(weights);\n\n const outBuf =
bincountReduceImplCPU(xBuf, weightsBuf, size, binaryOutput);\n\n return
backend.makeTensorInfo(outBuf.shape, weights.dtype, outBuf.values);\n }\n\n throw new Error(\n `Error in
denseBincount: input must be at most rank` +\n ` ${x.shape.length}.`);\n}\n\nexport const
denseBincountConfig:

```

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KernelConfig = {\n kernelName: DenseBincount,\n backendName: 'webgl',\n kernelFunc: denseBincount as {} as
KernelFunc\n};\n"/**\n *
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express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *

```

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=====
*\n\nimport {GPGPUProgram} from './gpgpu_math';\n\nexport class DepthToSpaceProgram implements
GPGPUProgram {\n variableNames = ['x'];\n outputShape:
number[] = [];\n userCode: string;\n blockSize: number;\n dataFormat: string;\n\n constructor(\n outputShape:
number[], blockSize: number, dataFormat: 'NHWC'|'NCHW') {\n this.outputShape = outputShape;\n
this.blockSize = blockSize;\n this.dataFormat = dataFormat;\n this.userCode =`\n void main() {\n ivec4
coords = getOutputCoords();\n int b = coords[0];\n int h = ${this.getHeightCoordString()};\n int w =
${this.getWidthCoordString()};\n int d = ${this.getDepthCoordString()};\n\n int in_h = h / ${blockSize};\n
int offset_h = imod(h, ${blockSize});\n int in_w = w / ${blockSize};\n int offset_w = imod(w,

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 int offset_d = (offset_h * ${blockSize} + offset_w) * ${this.getOutputDepthSize()};
 int in_d = d + offset_d;
 float result = ${this.getInputSamplingString()};
 setOutput(result);
}

private getHeightCoordString(): string {
 if (this.dataFormat === 'NHWC') {
 return `coords[1]`;
 } else {
 return `coords[2]`;
 }
}

private getWidthCoordString(): string {
 if (this.dataFormat === 'NHWC') {
 return `coords[2]`;
 } else {
 return `coords[3]`;
 }
}

private getDepthCoordString(): string {
 if (this.dataFormat === 'NHWC') {
 return `coords[3]`;
 } else {
 return `coords[1]`;
 }
}

private getOutputDepthSize(): number {
 if (this.dataFormat === 'NHWC') {
 return this.outputShape[3];
 } else {
 return this.outputShape[1];
 }
}

private getInputSamplingString(): string {
 if (this.dataFormat === 'NHWC') {
 return `getX(b, in_h, in_w, in_d)`;
 } else {
 return `getX(b, in_d, in_h, in_w)`;
 }
}
}

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=====
import {DepthToSpace, DepthToSpaceAttrs, DepthToSpaceInputs, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';
import {MathBackendWebGL} from '../backend_webgl';
import {DepthToSpaceProgram} from '../depth_to_space_gpu';
export function depthToSpace(args: {inputs: DepthToSpaceInputs, backend: MathBackendWebGL, attrs: DepthToSpaceAttrs}): TensorInfo {
 const {inputs, backend, attrs} = args;
 const {x} = inputs;
 const {blockSize, dataFormat} = attrs;
 util.assert(blockSize > 1, () => `blockSize should be > 1 for depthToSpace, but was: ${blockSize}`);
 const batchSize = x.shape[0];
 const inputHeight = (dataFormat === 'NHWC') ? x.shape[1] : x.shape[2];
 const inputWidth = (dataFormat === 'NHWC') ? x.shape[2] : x.shape[3];
 const inputDepth = (dataFormat === 'NHWC') ? x.shape[3] : x.shape[1];
 const outputHeight = inputHeight * blockSize;
 const outputWidth = inputWidth * blockSize;
 const outputDepth = inputDepth / (blockSize * blockSize);
 const outputShape = (dataFormat === 'NHWC') ? [batchSize, outputHeight, outputWidth, outputDepth] : [batchSize, outputDepth, outputHeight, outputWidth];
 const program = new DepthToSpaceProgram(outputShape, blockSize, dataFormat);
 return backend.runWebGLProgram(program, [x], x.dtype);
}

export const depthToSpaceConfig: KernelConfig = {
 kernelName: DepthToSpace,
 backendName: 'webgl',
 kernelFunc: depthToSpace as {} as KernelFunc
};

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=====
import {backend_util} from '@tensorflow/tfjs-core';
import {GPGPUProgram} from '../gpgpu_math';
export class DepthwiseConv2DProgram implements GPGPUProgram {
 variableNames = ['x', 'W'];
 outputShape: number[];
 userCode: string;
 constructor(convInfo: backend_util.Conv2DInfo, addBias = false, activation: string = null, hasPreluActivation = false, hasLeakyReluAlpha = false) {
 this.outputShape = convInfo.outShape;
 const xNumRows = convInfo.inHeight;
 const xNumCols = convInfo.inWidth;
 const padTop = convInfo.padInfo.top;
 const padLeft = convInfo.padInfo.left;
 const strideHeight = convInfo.strideHeight;

```

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const strideWidth = convInfo.strideWidth;\n const dilationHeight = convInfo.dilationHeight;\n const
dilationWidth = convInfo.dilationWidth;\n const filterHeight = convInfo.filterHeight;\n const filterWidth =
convInfo.filterWidth;\n const channelMul = convInfo.outChannels / convInfo.inChannels;\n\n let
activationSnippet = ", applyActivationSnippet = ";\n if (activation) {\n if (hasPreluActivation) {\n
activationSnippet = `float activation(float a) {\n float b = getPreluActivationWeightsAtOutCoords();\n
 ${activation}\n }`; \n } else if (hasLeakyReluAlpha) {\n activationSnippet = `float activation(float
a) {\n float b = getLeakyreluAlphaAtOutCoords();\n ${activation}\n }`; \n } else {\n
activationSnippet = `\n float activation(float x) {\n ${activation}\n }\n `;\n }\n\n
applyActivationSnippet = `result = activation(result);`\n }\n\n const addBiasSnippet = addBias ? 'result +=
getBiasAtOutCoords():';\n if (addBias) {\n this.variableNames.push('bias');\n }\n\n if
(hasPreluActivation) {\n this.variableNames.push('preluActivationWeights');\n }\n if (hasLeakyReluAlpha)
{\n this.variableNames.push('leakyreluAlpha');\n }\n\n this.userCode = `\n ${activationSnippet}\n\n
const ivec2 strides = ivec2(${strideHeight}, ${strideWidth});\n const ivec2 pads = ivec2(${padTop},
${padLeft});\n\n void main() {\n ivec4
coords = getOutputCoords();\n int batch = coords.x;\n ivec2 xRCCorner = coords.yz * strides - pads;\n
int d2 = coords.w;\n int d1 = d2 / ${channelMul};\n int q = d2 - d1 * ${channelMul};\n\n int xRCorner
= xRCCorner.x;\n int xCCorner = xRCCorner.y;\n\n // Convolve x(?, ?, d1) with w(:, :, d1, q) to get y(yR,
yC, d2).\n // ? = to be determined. := across all values in that axis.\n float dotProd = 0.0;\n // TO
DO(dsmilkov): Flatten the two for loops and vec4 the operations.\n for (int wR = 0; wR < ${filterHeight};
wR++) {\n int xR = xRCorner + wR * ${dilationHeight};\n\n if (xR < 0 || xR >= ${xNumRows}) {\n
 continue;\n }\n\n for (int wC = 0; wC < ${filterWidth}; wC++) {\n int xC = xCCorner + wC *
${dilationWidth};\n if (xC < 0 || xC >= ${xNumCols}) {\n continue;\n }\n\n float
xVal = getX(batch, xR,
xC, d1);\n float wVal = getW(wR, wC, d1, q);\n dotProd += xVal * wVal;\n }\n }\n
float result = dotProd;\n ${addBiasSnippet}\n ${applyActivationSnippet}\n setOutput(result);\n }\n
`;\n }\n}\n\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the
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License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless
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on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====
*/\n\nimport
{backend_util, util} from '@tensorflow/tfjs-core';\n\nimport {GPGPUProgram} from './gpgpu_math';\n\nexport
class DepthwiseConvPacked2DProgram implements GPGPUProgram {\n variableNames = ['x', 'W'];\n packedInputs = true;\n packedOutput = true;\n outputShape: number[];\n userCode: string;\n constructor(\n convInfo: backend_util.Conv2DInfo, addBias = false,\n activation: string = null, hasPreluActivation = false,\n hasLeakyReluAlpha = false) {\n this.outputShape = convInfo.outShape;\n\n const xNumRows =
convInfo.inHeight;\n const xNumCols = convInfo.inWidth;\n const padTop = convInfo.padInfo.top;\n const
padLeft = convInfo.padInfo.left;\n const strideHeight = convInfo.strideHeight;\n const strideWidth =
convInfo.strideWidth;\n const dilationHeight = convInfo.dilationHeight;\n const dilationWidth =
convInfo.dilationWidth;\n const filterHeight = convInfo.filterHeight;\n const filterWidth =
convInfo.filterWidth;\n const texelsAcross
= filterWidth;\n\n let mainLoop = `int xR; int xC; int xCOffset;`\n\n for (let r = 0; r < filterHeight; r++) {\n
for (let c = 0; c < filterWidth; c++) {\n mainLoop += `\n vec4 xTexelR${r}C${c * 2} = vec4(0.);\n
vec4 wR${r}C${c} = vec4(0.);\n vec4 xR${r}C${c} = vec4(0.);`\n }\n }\n\n /**\n * This vectorized
implementation works by gathering the values needed for\n * each output channel's dot product into vec4's and

```

```

then multiplying them * all together (this happens in the final double for-loop below). Most of * the main
loop consists of constructing these vec4's with the minimum * number of texture2D calls, which means making
use of all four returned * values from a texture2D call at once.*
for (let r = 0; r < filterHeight; r++) {
 for (let texelC = 0; texelC < texelsAcross; texelC++) {
 const c = texelC * 2;
 mainLoop += `
xR = xRCorner + ${r *
dilationHeight};
xC = xCCorner + ${c * dilationWidth};
`
 if (strideWidth === 1) {
 if
(c < filterWidth) {
 // If padding is odd, the outer texels have to be composed.
 if (padLeft % 2 ===
1) {
 // TODO: Ensure vec4 previous does not result in redundant sample,
 // and avoid setting
xTexelRC's that exceed the boundary in the
 // first place rather than resetting them to vec4(0)).
 // To compute xCOffset:
 // - If padding is odd, we must add 1 to ensure we ask for an
 // even-
 numbered row.
 // - We subtract 2 to access the previous texel.
 mainLoop += `
xCOffset = xC + 1;
if(xR >= 0 && xR < ${xNumRows} && xCOffset >= 0 && xCOffset < ${
xNumCols}) {
 xTexelR${r}C${c} = getX(batch, xR, xCOffset, d1);
}
// Need to
manually
clear unused channels in case
// we're reading from recycled texture.
if(xCOffset + 1 >=
${xNumCols}) {
 xTexelR${r}C${c}.zw = vec2(0.);
}
} else {
xTexelR${r}C${c} = vec4(0.);
}
xCOffset = xC + 1 - 2;
if(xR >= 0 && xR <
${xNumRows} && xCOffset >= 0 && xCOffset < ${
xNumCols}) {
 vec4 previous =
getX(batch, xR, xCOffset, d1);
// Need to manually clear unused channels in case
// we're
reading from recycled texture.
if(xCOffset + 1 >= ${xNumCols}) {
 previous.zw =
vec2(0.);
}
xR${r}C${c} = vec4(previous.zw, xTexelR${r}C${c}.xy);
} else
{
 xR${r}C${c} = vec4(0, 0, xTexelR${r}C${c}.xy);
}
`
 }
 // Padding is even, so xRC corresponds to a single texel.
 mainLoop += `
if(xR >=
0 && xR < ${xNumRows} && xC >= 0 && xC < ${xNumCols}) {
 xTexelR${r}C${c} = getX(batch,
xR, xC, d1);
} else {
 xTexelR${r}C${c} = vec4(0.);
}
`
 xR${r}C${c} = xTexelR${r}C${c};
 `
 }
 if (c + 1 < filterWidth) {
 // If
dilation is even, the second entry should match the first
 // (either both are composed or both are single
samples). But if
 // dilation is odd, then the second entry should be the opposite
 // of the first (if
the first is composed, the second is a single
 // sample, and vice versa.)
 const nextTexelOffset =
padLeft % 2 === 0 ?
util.nearestLargerEven(dilationWidth) :
dilationWidth;
if ((dilationWidth % 2 === 0 && padLeft % 2 === 1) ||
(dilationWidth % 2 !== 0 && padLeft % 2
!== 1)) {
 mainLoop += `
xCOffset = xC + ${padLeft % 2} + ${nextTexelOffset};
if(xR >= 0 && xR < ${xNumRows} &&
xCOffset >= 0 && xCOffset < ${xNumCols}) {
 xTexelR${r}C${c + 2} = getX(batch, xR, xCOffset, d1);
}
`
 }
 // If dilation
> 1 then the xRC's will not be able to share any
 // values, so each xRC will require two unique calls to
getX.
 if (dilationWidth > 1) {
 mainLoop += `
xCOffset -= 2;
if(xR >= 0 && xR < ${xNumRows} &&
xCOffset >= 0 && xCOffset < ${xNumCols}) {
 xTexelR${r}C${c} = getX(batch, xR, xCOffset, d1);
} else {
 xTexelR${r}C${c}
= vec4(0.);
}
`
 }
 xR${r}C${c + 1}
= vec4(
xTexelR${r}C${c}.zw, xTexelR${r}C${c + 2}.xy);
} else {
mainLoop += `
xCOffset = xC + ${nextTexelOffset};
if(xR >= 0 && xR <
${xNumRows} &&
xCOffset >= 0 && xCOffset < ${xNumCols}) {
 xTexelR${r}C${c
+ 2} = getX(batch, xR, xCOffset, d1);
}
xR${r}C${c + 1} = xTexelR${r}C${c + 2};
`
 }
 }
 } else { // stride > 1
 if (c < filterWidth) {
 mainLoop
+= `
if(xR >= 0 && xR < ${xNumRows}) {
 `
 }
 // Depending on whether padLeft is
even or odd, we want either the
 // xy or zw channels from X texels for xR${r}C${c}.
 If padLeft is
 // even, xR${r}C${c + 1} is simply the zw channels of texels we've
 // already
sampled. But if padLeft is odd, xR${r}C${c + 1}.zw will
 // need to come from the xy channels of a new

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texel, hence the `vec4\n // final` initialized below.\n if (padLeft % 2 === 1) {\n mainLoop +=
\n xCOffset = xC + 1 - ${strideWidth};\n if(xCOffset >= 0 && xCOffset < ${xNumCols}) {\n
xTexelR${r}C${c} = getX(batch, xR, xCOffset, d1);\n } else {\n xTexelR${r}C${c} =
vec4(0.);\n }\n\n if(xC + 1 >= 0 && xC + 1 < ${xNumCols}) {\n xTexelR${r}C${c +
2} = getX(batch, xR, xC + 1, d1);\n } else {\n xTexelR${r}C${c + 2} = vec4(0.);\n
}\n\n xR${r}C${c} = vec4(\n xTexelR${r}C${c}.zw, xTexelR${r}C${c + 2}.zw);\n
`;\n\n
if (c + 1 < filterWidth) {\n mainLoop += `\n vec4 final = vec4(0.);\n
xCOffset = xC + 1 + ${strideWidth};\n if(xCOffset >= 0 && xCOffset < ${xNumCols}) {\n
final = getX(batch, xR, xCOffset, d1);\n }\n xR${r}C${c + 1} = vec4(xTexelR${r}C${c +
2}.xy, final.xy);\n `;\n }\n } else {\n mainLoop += `\n if(xC >= 0 && xC <
${xNumCols}) {\n xTexelR${r}C${c} = getX(batch, xR, xC, d1);\n } else {\n
xTexelR${r}C${c} = vec4(0.);\n }\n\n xCOffset = xC + ${strideWidth};\n if(xCOffset
>= 0 && xCOffset < ${xNumCols}) {\n xTexelR${r}C${c + 2} = getX(batch, xR, xCOffset, d1);\n
} else {\n xTexelR${r}C${c + 2} = vec4(0.);\n }\n\n xR${r}C${c}
= vec4(\n xTexelR${r}C${c}.xy, xTexelR${r}C${c + 2}.xy);\n `;\n\n if (c + 1 <
filterWidth) {\n mainLoop += `\n xR${r}C${c + 1} = vec4(\n
xTexelR${r}C${c}.zw, xTexelR${r}C${c + 2}.zw);\n `;\n }\n }\n\n mainLoop +=
`};\n }\n }\n\n if (c < filterWidth) {\n mainLoop += `\n vec4 wTexelR${r}C${c} =
getW(${r}, ${c}, d1, q);\n wR${r}C${c} = vec4(wTexelR${r}C${c}.xz, wTexelR${r}C${c}.xz);\n
`;\n\n if (c + 1 < filterWidth) {\n mainLoop += `\n vec4 wTexelR${r}C${c + 1} = getW(${r},
${c + 1}, d1, q);\n wR${r}C${c + 1} =\n vec4(wTexelR${r}C${c + 1}.xz, wTexelR${r}C${c +
1}.xz);`\n }\n }\n }\n\n for (let r = 0; r < filterHeight; r++) {\n for (let c = 0; c < filterWidth;
c++) {\n mainLoop +=
`.dotProd += xR${r}C${c} * wR${r}C${c};`;}\n }\n\n let activationSnippet = ", applyActivationSnippet =
";\n if (activation) {\n if (hasPreluActivation) {\n activationSnippet = `vec4 activation(vec4 a) {\n
vec4 b = getPreluActivationWeightsAtOutCoords();\n ${activation}\n `;\n } else if
(hasLeakyReluAlpha) {\n activationSnippet = `vec4 activation(vec4 a) {\n vec4 b =
getLeakyreluAlphaAtOutCoords();\n ${activation}\n `;\n } else {\n activationSnippet = `vec4
activation(vec4 x) {\n ${activation}\n `;\n }\n\n applyActivationSnippet = `result =
activation(result);`;}\n }\n\n const addBiasSnippet = addBias ? 'result += getBiasAtOutCoords():';`\n if
(addBias) {\n this.variableNames.push('bias');\n }\n\n if (hasPreluActivation) {\n
this.variableNames.push('preluActivationWeights');\n }\n\n if (hasLeakyReluAlpha) {\n
this.variableNames.push('leakyreluAlpha');\n
}\n\n this.userCode = `\n ${activationSnippet}\n\n const ivec2 strides = ivec2(${strideHeight},
${strideWidth});\n const ivec2 pads = ivec2(${padTop}, ${padLeft});\n\n void main() {\n\n ivec4 coords
= getOutputCoords();\n int batch = coords.x;\n ivec2 xRCCorner = coords.yz * strides - pads;\n int d2
= coords.w;\n int d1 = d2;\n int q = 0;\n int xRCorner = xRCCorner.x;\n int xCCorner =
xRCCorner.y;\n\n vec4 dotProd = vec4(0.);\n\n ${mainLoop}\n\n vec4 result = dotProd;\n
${addBiasSnippet}\n ${applyActivationSnippet}\n\n setOutput(result);\n }\n `;\n }\n }\n\n"/**\n *
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=====

```

```

*\n\nimport {backend_util, DepthwiseConv2dNative, DepthwiseConv2dNativeAttrs,
DepthwiseConv2dNativeInputs, env, KernelConfig, KernelFunc, util} from '@tensorflow/tfjs-core';\n\nimport
{MathBackendWebGL} from './backend_webgl';\n\nimport {DepthwiseConv2DProgram} from
'./conv_gpu_depthwise';\n\nimport {DepthwiseConvPacked2DProgram} from
'./conv_packed_gpu_depthwise';\n\nexport function depthwiseConv2dNative(args: {\n inputs:
DepthwiseConv2dNativeInputs,\n attrs: DepthwiseConv2dNativeAttrs,\n backend: MathBackendWebGL\n}) {\n
const {inputs, backend,
 attrs} = args;\n const {x, filter} = inputs;\n const {strides, pad, dilations, dimRoundingMode} = attrs;\n\n let
 $dilations = dilations;\n if ($dilations == null) {\n $dilations = [1, 1];\n }\n\n util.assert(\n
backend_util.eitherStridesOrDilationsAreOne(strides, $dilations),\n () => 'Error in depthwiseConv2d: Either
strides or dilations must be '+\n `1. Got strides ${strides} and dilations '${dilations}'`);\n\n const convInfo =
backend_util.computeConv2DInfo(\n x.shape as [number, number, number, number],\n filter.shape as
[number, number, number, number], strides, $dilations,\n pad, dimRoundingMode, true /* depthwise */);\n\n let
program: DepthwiseConv2DProgram|DepthwiseConvPacked2DProgram;\n if
(env().getBool('WEBGL_PACK_DEPTHWISECONV') && convInfo.strideWidth <= 2 &&\n
convInfo.outChannels / convInfo.inChannels === 1) {\n program = new
DepthwiseConvPacked2DProgram(convInfo);\n } else {\n program = new
DepthwiseConv2DProgram(convInfo);\n
 }\n\n return backend.runWebGLProgram(program, [x, filter], 'float32');\n}\n\nexport const
depthwiseConv2dNativeConfig: KernelConfig = {\n kernelName: DepthwiseConv2dNative,\n backendName:
'webgl',\n kernelFunc: depthwiseConv2dNative as {} as KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2018
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====*\n
*\n\nimport {backend_util} from '@tensorflow/tfjs-core';\n\nimport {GPGPUProgram} from
'./gpgpu_math';\n\nexport class DepthwiseConv2DDerFilterProgram implements GPGPUProgram {\n
variableNames = ['x', 'dy'];\n outputShape: number[];\n userCode: string;\n\n constructor(convInfo:
backend_util.Conv2DInfo) {\n this.outputShape = convInfo.filterShape;\n\n const strideHeight =
convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n const padTop = convInfo.padInfo.top;\n
const padLeft = convInfo.padInfo.left;\n const channelMul = convInfo.outChannels / convInfo.inChannels;\n\n
this.userCode = `\n void main() {\n ivec4 coords = getOutputCoords();\n int wR = coords.x;\n int
wC = coords.y;\n int d1 = coords.z;\n int dm = coords.w;\n int d2 = d1 * ${channelMul} + dm;\n\n
float dotProd = 0.0;\n\n // TO DO: Vec4 over the batch size\n for (int b = 0; b < ${convInfo.batchSize};
b++) {\n
 for (int yR = 0; yR < ${convInfo.outHeight}; yR++) {\n int xR = wR + yR * ${strideHeight} -
${padTop};\n if (xR < 0 || xR >= ${convInfo.inHeight}) {\n continue;\n }\n for (int
yC = 0; yC < ${convInfo.outWidth}; yC++) {\n int xC = wC + yC * ${strideWidth} - ${padLeft};\n if
(xC < 0 || xC >= ${convInfo.inWidth}) {\n continue;\n }\n float dyValue = getDy(b,
yR, yC, d2);\n float xValue = getX(b, xR, xC, d1);\n dotProd += (xValue * dyValue);\n }\n
 }\n }\n setOutput(dotProd);\n }\n `;\n}\n\nexport class DepthwiseConv2DDerInputProgram
implements GPGPUProgram {\n variableNames = ['dy', 'W'];\n outputShape: number[];\n userCode: string;\n\n constructor(convInfo: backend_util.Conv2DInfo) {\n this.outputShape = convInfo.inShape;\n\n const
filterHeight = convInfo.filterHeight;\n

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const filterWidth = convInfo.filterWidth;\n const strideHeight = convInfo.strideHeight;\n const strideWidth =
convInfo.strideWidth;\n\n const padTop = filterHeight - 1 - convInfo.padInfo.top;\n const padLeft = filterWidth
- 1 - convInfo.padInfo.left;\n const channelMul = convInfo.outChannels / convInfo.inChannels;\n\n
this.userCode = `
const ivec2 pads = ivec2(${padTop}, ${padLeft});\n\n void main() {\n ivec4 coords =
getOutputCoords();\n int batch = coords[0];\n int d1 = coords[3];\n ivec2 dyCorner = coords.yz -
pads;\n int dyRCorner = dyCorner.x;\n int dyCCorner = dyCorner.y;\n\n float dotProd = 0.0;\n\n
for (int wR = 0; wR < ${filterHeight}; wR++) {\n float dyR = float(dyRCorner + wR) / ${strideHeight}.0;\n
if (dyR < 0.0 || dyR >= ${convInfo.outHeight}.0 || fract(dyR) > 0.0) {\n continue;\n }\n int
idyR = int(dyR);\n int wRPerm = ${filterHeight}
- 1 - wR;\n\n for (int wC = 0; wC < ${filterWidth}; wC++) {\n float dyC = float(dyCCorner + wC) /
${strideWidth}.0;\n if (dyC < 0.0 || dyC >= ${convInfo.outWidth}.0 ||\n fract(dyC) > 0.0) {\n
continue;\n }\n int idyC = int(dyC);\n\n int wCPerm = ${filterWidth} - 1 - wC;\n\n //
TO DO: Vec4 over the channelMul\n for (int dm = 0; dm < ${channelMul}; dm++) {\n int d2 = d1 *
${channelMul} + dm;\n float xValue = getDy(batch, idyR, idyC, d2);\n float wValue =
getW(wRPerm, wCPerm, d1, dm);\n dotProd += xValue * wValue;\n }\n }\n }\n }
setOutput(dotProd);\n }\n `;\n }
\n\n", /*\n * @license\n * Copyright 2020 Google LLC. All Rights
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except in compliance with the License.\n

```

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```

=====\n
*\n\nimport {backend_util, DepthwiseConv2dNativeBackpropFilter, DepthwiseConv2dNativeBackpropFilterAttrs,
DepthwiseConv2dNativeBackpropFilterInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\n\nimport
{MathBackendWebGL} from '../backend_webgl';\n\nimport {DepthwiseConv2DDerFilterProgram} from
'./conv_backprop_gpu_depthwise';\n\nexport function depthwiseConv2dNativeBackpropFilter(args: {\n inputs:
DepthwiseConv2dNativeBackpropFilterInputs,\n attrs: DepthwiseConv2dNativeBackpropFilterAttrs,\n
backend: MathBackendWebGL\n}) {\n const {inputs, backend, attrs} = args;\n const {x, dy} = inputs;\n const
{strides, dilations, pad, dimRoundingMode, filterShape} = attrs;\n\n const convInfo =
backend_util.computeConv2DInfo(\n x.shape as [number, number, number, number], filterShape, strides,\n
dilations, pad, dimRoundingMode, true /* depthwise */);\n\n const program = new
DepthwiseConv2DDerFilterProgram(convInfo);\n return backend.runWebGLProgram(program, [x, dy],
'float32');\n}\n\nexport const depthwiseConv2dNativeBackpropFilterConfig: KernelConfig = {\n kernelName:
DepthwiseConv2dNativeBackpropFilter,\n backendName: 'webgl',\n kernelFunc:
depthwiseConv2dNativeBackpropFilter as {} as KernelFunc\n};\n\n", /*\n * @license\n * Copyright 2020 Google
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WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *

```

```

=====\n
*\n\nimport {backend_util, DepthwiseConv2dNativeBackpropInput, DepthwiseConv2dNativeBackpropInputAttrs,
DepthwiseConv2dNativeBackpropInputInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\n\nimport
{MathBackendWebGL} from '../backend_webgl';\n\nimport {DepthwiseConv2DDerInputProgram} from
'./conv_backprop_gpu_depthwise';\n\nexport function depthwiseConv2dNativeBackpropInput(args: {\n inputs:
DepthwiseConv2dNativeBackpropInputInputs,\n attrs: DepthwiseConv2dNativeBackpropInputAttrs,\n backend:

```



```

MathBackendWebGL\n))
{\n const {inputs, backend, attrs} = args;\n const {dy, filter} = inputs;\n const {strides, dilations, pad,
dimRoundingMode, inputShape} = attrs;\n\n const convInfo = backend_util.computeConv2DInfo(\n inputShape,
filter.shape as [number, number, number, number], strides,\n dilations, pad, dimRoundingMode, true /*
depthwise */);\n\n const program = new DepthwiseConv2DDerInputProgram(convInfo);\n return
backend.runWebGLProgram(program, [dy, filter], 'float32');\n}\n\nexport const
depthwiseConv2dNativeBackpropInputConfig: KernelConfig = {\n kernelName:
DepthwiseConv2dNativeBackpropInput,\n backendName: 'webgl',\n kernelFunc:
depthwiseConv2dNativeBackpropInput as {} as KernelFunc\n};\n"/**\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not
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distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n */
=====
\n
*/\n\nimport {GPGPUProgram} from './gpgpu_math';\n\nexport class DiagProgram implements GPGPUProgram
{\n variableNames = ['X'];\n outputShape: number[];\n userCode: string;\n\n constructor(size: number) {\n
this.outputShape = [size, size];\n this.userCode = `\n void main() {\n ivec2 coords = getOutputCoords();\n
float val = coords[0] == coords[1] ? getX(coords[0]) : 0.0;\n setOutput(val);\n }\n `;\n }\n}\n"/**\n
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BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n */
=====
\n
*/\n\nimport {Diag, DiagInputs, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-
core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\n\nimport {DiagProgram} from
'./diag_gpu';\n\nimport {reshape} from './Reshape';\n\nexport function diag(args: {inputs: DiagInputs, backend:
MathBackendWebGL}):\n TensorInfo {\n const {inputs, backend} = args;\n const
{x} = inputs;\n\n const outShape = [...x.shape, ...x.shape];\n const xSize = util.sizeFromShape(x.shape);\n\n
const flat = reshape({inputs: {x}, backend, attrs: {shape: [xSize]}});\n\n const program = new DiagProgram(xSize);\n
const res = backend.runWebGLProgram(program, [flat], flat.dtype);\n\n const out = reshape({inputs: {x: res},
backend, attrs: {shape: outShape}});\n\n backend.disposeIntermediateTensorInfo(flat);\n
backend.disposeIntermediateTensorInfo(res);\n\n return out;\n}\n\nexport const diagConfig: KernelConfig = {\n
kernelName: Diag,\n backendName: 'webgl',\n kernelFunc: diag as {} as KernelFunc\n};\n"/**\n * @license\n *
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WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n */
=====
\n
*/\n\nimport {backend_util} from '@tensorflow/tfjs-core';\n\nimport {GPGPUProgram} from
'./gpgpu_math';\n\nexport class Dilation2DProgram implements GPGPUProgram {\n variableNames = ['x', 'W'];\n

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outputShape: number[];\n userCode: string;\n\n constructor(convInfo: backend_util.Conv2DInfo) {\n
this.outputShape = convInfo.outShape;\n\n const {\n inHeight,\n inWidth,\n padInfo,\n strideHeight,\n
 strideWidth,\n filterHeight,\n filterWidth,\n dilationHeight,\n dilationWidth\n } = convInfo;\n\n
const {top: padTop, left: padLeft} = padInfo;\n\n this.userCode = `\n const ivec2
strides = ivec2({strideHeight}, {strideWidth});\n const ivec2 pads = ivec2({padTop}, {padLeft});\n
const float neg_infinity = -3.4e38;\n\n void main() {\n ivec4 coords = getOutputCoords();\n int batch =
coords.x;\n int d1 = coords.w;\n ivec2 outTopLeftCorner =\n coords.yz * strides - pads;\n int
hBeg = outTopLeftCorner.x;\n int wBeg = outTopLeftCorner.y;\n\n float curVal = neg_infinity;\n for
(int h = 0; h < ${filterHeight}; h++) {\n int hIn = hBeg + h * ${dilationHeight};\n\n if (hIn >= 0 && hIn
< ${inHeight}) {\n for (int w = 0; w < ${filterWidth}; w++) {\n int wIn = wBeg + w *
${dilationWidth};\n\n if (wIn >= 0 && wIn < ${inWidth}) {\n float xVal = getX(batch, hIn, wIn,
d1);\n float wVal = getW(h, w, d1);\n float val = xVal + wVal;\n if (val > curVal) {\n
 curVal =
val;\n }\n }\n }\n }\n\n float result = curVal;\n setOutput(result);\n
}\n `;\n }\n}\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
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on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====\n
*/\n\nimport {backend_util, Dilation2D, Dilation2DAttrs, Dilation2DInputs, KernelConfig, KernelFunc,
TensorInfo}
from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\n\nimport
{Dilation2DProgram} from '../dilation_gpu';\n\nimport {reshape} from './Reshape';\n\nexport function
dilation2D(args: {\n inputs: Dilation2DInputs,\n attrs: Dilation2DAttrs,\n backend: MathBackendWebGL\n}) {\n
const {inputs, backend, attrs} = args;\n const {x, filter} = inputs;\n const {strides, pad, dilations} =
attrs;\n\n const
convInfo = backend_util.computeDilation2DInfo(\n x.shape as [number, number, number, number],\n
filter.shape as [number, number, number], strides, pad,\n 'NHWC' /* dataFormat */, dilations);\n let out:
TensorInfo;\n\n const program = new Dilation2DProgram(convInfo);\n out =
backend.runWebGLProgram(program, [x, filter], 'float32');\n\n const outReshaped =\n reshape({inputs: {x: out},
backend, attrs: {shape: convInfo.outShape}});\n backend.disposeIntermediateTensorInfo(out);\n\n return
outReshaped;\n}\n\nexport const dilation2DConfig: KernelConfig
= {\n kernelName: Dilation2D,\n backendName: 'webgl',\n kernelFunc: dilation2D as { } as
KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
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on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====\n
*/\n\nimport {Elu, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\n\nimport {unaryKernelFunc} from
../kernel_utils/kernel_funcs_utils;\n\nconst ELU = `return
(x >= 0.0) ? x : (exp(x) - 1.0);`\n\nconst ELU_PACKED = `\n vec4 result;\n\n result.r = (x.r >= 0.0) ? x.r :
(exp(x.r) - 1.0);\n result.g = (x.g >= 0.0) ? x.g : (exp(x.g) - 1.0);\n result.b = (x.b >= 0.0) ? x.b : (exp(x.b) - 1.0);\n
result.a = (x.a >= 0.0) ? x.a : (exp(x.a) - 1.0);\n return result;`\n\nconst elu = unaryKernelFunc({opSnippet:

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ELU, packedOpSnippet: ELU_PACKED));\n\nexport const eluConfig: KernelConfig = {\n kernelName: Elu,\n backendName: 'webgl',\n kernelFunc: elu as {} as KernelFunc\n};\n", "/**\n * @license\n * Copyright 2020 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

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=====\n
*\n\nimport {EluGrad, EluGradInputs, env, KernelConfig, KernelFunc, TensorInfo} from '@tensorflow/tfjs-
core';\n\nimport {MathBackendWebGL} from './backend_webgl';\nimport {BinaryOpProgram} from
 './binaryop_gpu';\nimport {BinaryOpPackedProgram} from './binaryop_packed_gpu';\n\nconst ELU_DER = `return
(b >= 1.0) ? a : a * (b + 1.0);`\n\nconst ELU_DER_PACKED = `\n vec4 bGTEZero = vec4(greaterThanEqual(b,
vec4(0.)));
\n return (bGTEZero * a) + ((vec4(1.0) - bGTEZero) * (a * (b + vec4(1.0)))));\n`;
\n\nexport const eluGrad
=\n (args: {inputs: EluGradInputs, backend: MathBackendWebGL}): TensorInfo => {\n const {inputs,
backend} = args;\n const {dy, y} = inputs;\n\n const program =
env().getBool('WEBGL_PACK_BINARY_OPERATIONS')
? \n new BinaryOpPackedProgram(ELU_DER_PACKED, dy.shape, y.shape) : \n new
BinaryOpProgram(ELU_DER, dy.shape, y.shape);\n return backend.runWebGLProgram(program, [dy, y],
dy.dtype);\n };\n\nexport const eluGradConfig: KernelConfig = {\n kernelName: EluGrad,\n backendName:
'webgl',\n kernelFunc: eluGrad as {} as KernelFunc\n};\n", "/**\n * @license\n * Copyright 2020 Google LLC. All
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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* =====\n
*\n\nimport {Equal, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\nimport {binaryKernelFunc} from
 './kernel_utils/kernel_funcs_utils';\n\nconst PACKED_EQUAL = `\n return vec4(equal(a, b));\n`;
\n\nconst EQUAL
= `return float(a == b);`\n\nexport const equal = binaryKernelFunc(\n {opSnippet: EQUAL, packedOpSnippet:
PACKED_EQUAL, dtype: 'bool'});\n\nexport const equalConfig: KernelConfig = {\n kernelName: Equal,\n backendName:
'webgl',\n kernelFunc: equal as {} as KernelFunc\n};\n", "/**\n * @license\n * Copyright 2020
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express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *

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=====\n
*\n\nimport {backend_util, Erf, KernelConfig} from '@tensorflow/tfjs-core';\nimport {unaryKernelFunc} from
 './kernel_utils/kernel_funcs_utils';\n\nconst ERF = `\n // Error function is calculated approximately with elementary
function.\n // See \"Handbook of Mathematical Functions with Formulas,\n // Graphs, and Mathematical Tables\",
Abramowitz and Stegun.\n float p = ${backend_util.ERF_P};\n float a1 = ${backend_util.ERF_A1};\n float a2 =
${backend_util.ERF_A2};\n float a3 = ${backend_util.ERF_A3};\n float a4 = ${backend_util.ERF_A4};\n float
a5 = ${backend_util.ERF_A5};\n\n float sign = sign(x);\n x = abs(x);\n float t = 1.0 / (1.0 + p * x);\n return sign *
(1.0 - (((((a5*t

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+ a4)*t) + a3)*t + a2)*t + a1)*t*exp(-x*x));\n`; \n\nexport const erf = unaryKernelFunc({opSnippet:
ERF});\n\nexport const erfConfig: KernelConfig = {\n kernelName: Erf,\n backendName: 'webgl',\n kernelFunc:
erf,\n};\n";\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache
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BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
===== \n
*\n\nimport {ExpandDims, ExpandDimsAttrs, ExpandDimsInputs,
KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from
'./backend_webgl';\n\nimport {reshape} from './Reshape';\n\nexport function expandDims(args: {\n inputs:
ExpandDimsInputs,\n attrs: ExpandDimsAttrs,\n backend: MathBackendWebGL\n}): TensorInfo {\n const
{inputs, attrs, backend} = args;\n const {dim} = attrs;\n const {input} = inputs;\n const inputRank =
input.shape.length;\n const newShape = input.shape.slice();\n let $dim = dim;\n if (dim < 0) {\n // Negative value
is counted from the tail of rank.\n util.assert(\n -(inputRank + 1) <= dim,\n () => `Axis must be in the
interval [${-(inputRank + 1)}, ${\n inputRank}]);\n $dim = inputRank + dim + 1;\n }\n newShape.splice($dim, 0, 1);\n return reshape({inputs: {x: input}, backend, attrs: {shape:
newShape}});\n}\n\nexport const expandDimsConfig: KernelConfig = {\n kernelName: ExpandDims,\n backendName: 'webgl',\n kernelFunc: expandDims
as { } as KernelFunc,\n};\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed
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on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
===== \n
*\n\nimport {GPGPUProgram} from './gpgpu_math';\n\nexport class FFTProgram implements GPGPUProgram {\n variableNames = ['real', 'imag'];\n outputShape: number[];\n userCode: string;\n constructor(\n component:
'real'|'imag', inputShape:
[number, number],\n inverse: boolean) {\n const innerDim = inputShape[1];\n this.outputShape =
inputShape;\n const exponentMultiplierSnippet =\n inverse ? `2.0 * ${Math.PI}` : `-.2.0 * ${Math.PI}`;\n const resultDenominator = inverse ? `${innerDim}.0` : '1.0';\n let opString: string;\n if (component === 'real')
{\n opString = 'return real * expR - imag * expI;'\n } else if (component === 'imag') {\n opString = 'return
real * expI + imag * expR;'\n } else {\n throw new Error(\n `FFT component must be either "real" or
"imag", got ${component}.`);\n }\n this.userCode = `\n const float exponentMultiplier =
${exponentMultiplierSnippet};\n float unaryOpComplex(float real, float expR, float imag, float expI) {\n
${opString}\n }\n float mulMatDFT(int batch, int index) {\n float indexRatio = float(index) /
float(${innerDim});\n float exponentMultiplierTimesIndexRatio =\n exponentMultiplier * indexRatio;\n float result = 0.0;\n for (int i = 0; i < ${innerDim}; i++) {\n
// x = (-2|2 * PI / N) * index * i;\n float x = exponentMultiplierTimesIndexRatio * float(i);\n float
expR = cos(x);\n float expI = sin(x);\n float real = getReal(batch, i);\n float imag = getImag(batch,
i);\n result +=\n unaryOpComplex(real, expR, imag, expI) / ${resultDenominator};\n }\n }\n return result;\n }\n void main() {\n ivec2 coords = getOutputCoords();\n setOutput(mulMatDFT(coords[0], coords[1]));\n }\n }\n};\n"/**\n * @license\n * Copyright 2020 Google
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use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *

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=====
*\n\nimport {TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from
'./backend_webgl';\n\nimport {FFTProgram} from './fft_gpu';\n\nimport {complex} from './Complex';\n\nimport
{reshape} from './Reshape';\n\n\nexport function fftImpl(\n x: TensorInfo, inverse: boolean, backend:
MathBackendWebGL): TensorInfo {\n const xData = backend.texData.get(x.dataId);\n\n const inputSize =
util.sizeFromShape(x.shape);\n // Collapse all outer dimensions to a single batch dimension.\n const
innerDimensionSize = x.shape[x.shape.length - 1];\n const batch = inputSize / innerDimensionSize;\n\n const input2D = reshape(\n {inputs: {x}, backend, attrs: {shape: [batch, innerDimensionSize]}});\n\n const
xShape = input2D.shape as [number, number];\n const realProgram = new FFTProgram('real', xShape, inverse);\n const
imagProgram = new FFTProgram('imag', xShape, inverse);\n\n const inputs = [\n {\n dataId:
xData.complexTensorInfos.real.dataId,\n dtype: xData.complexTensorInfos.real.dtype,\n shape: xShape\n
 },\n {\n dataId: xData.complexTensorInfos.imag.dataId,\n dtype: xData.complexTensorInfos.imag.dtype,\n
 shape: xShape\n }\n];\n\n const realPart = backend.runWebGLProgram(realProgram, inputs, 'float32');\n const
imagPart = backend.runWebGLProgram(imagProgram, inputs, 'float32');\n\n const complexOutput =\n complex({inputs: {real: realPart, imag: imagPart}, backend});\n\n backend.disposeIntermediateTensorInfo(realPart);\n backend.disposeIntermediateTensorInfo(imagPart);\n\n const
complexOutputReshaped
= \n reshape({inputs: {x: complexOutput}, backend, attrs: {shape: x.shape}});\n\n backend.disposeIntermediateTensorInfo(input2D);\n backend.disposeIntermediateTensorInfo(complexOutput);\n\n return complexOutputReshaped;\n}\n\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n *
Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {FFT, FFTInputs, KernelConfig,
TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from './backend_webgl';\n\nimport
{fftImpl} from './FFT_impl';\n\n\nexport function fft(args: {inputs: FFTInputs, backend: MathBackendWebGL}):
TensorInfo {\n const {inputs, backend} = args;\n const {input} = inputs;\n\n return fftImpl(input, false /* inverse
*/, backend);\n}\n\n\nexport const fftConfig: KernelConfig = {\n kernelName: FFT,\n backendName: 'webgl',\n
kernelFunc: fft\n};\n\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under
the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n
* See the License for the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {GPGPUContext} from './gpgpu_context';\n\nimport {GPGPUProgram} from './gpgpu_math';\n\n\nexport
class FillProgram implements GPGPUProgram {\n variableNames: string[];\n outputShape: number[] = [];\n userCode:
string;\n\n valueLoc: WebGLUniformLocation;\n\n constructor(shape: number[], value: number) {\n this.variableNames = ['x'];\n this.outputShape = shape;\n\n this.userCode = `\n uniform float value;\n void

```

```

main() {\n // Input can be obtained from uniform value.\n setOutput(value);\n };\n }\n\ngetCustomSetupFunc(value: number) {\n return (gpgpu: GPGPUContext, webGLProgram: WebGLProgram) =>\n {\n if (this.valueLoc == null) {\n this.valueLoc = gpgpu.getUniformLocationNoThrow(webGLProgram,\n 'value');\n }\n gpgpu.gl.uniform1f(this.valueLoc,\n value);\n };\n }\n}\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed\n * under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the\n * License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n * on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n * implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n * License.\n *
=====
*\n\nimport {Fill, FillAttrs, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport\n{MathBackendWebGL} from '../backend_webgl';\nimport {FillProgram} from '../fill_gpu';\nexport function\nfill(args:\n {backend: MathBackendWebGL, attrs: FillAttrs});\n TensorInfo {\n const {backend, attrs} = args;\n const\n {shape, value} = attrs;\n let {dtype} = attrs;\n dtype = dtype || util.inferDtype(value);\n\n if (dtype === 'string')\n {\n // String type should be handled in CPU memory.\n const values = util.getArrayFromDType(dtype,\n util.sizeFromShape(shape));\n values.fill(value as string);\n return backend.makeTensorInfo(shape, dtype,\n values);\n } else {\n const program = new FillProgram(shape, value as number);\n const customSetup =\n program.getCustomSetupFunc(value as number);\n return backend.runWebGLProgram(program, [], dtype,\n customSetup);\n }\n}\n\nexport const fillConfig: KernelConfig = {\n kernelName: Fill,\n backendName: 'webgl',\n kernelFunc: fill as { } as KernelFunc\n};\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights\n * Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file\n * except in compliance\n * with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-\n * 2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is\n * distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either\n * express or implied.\n * See the License for the specific language governing permissions and\n * limitations under\n * the License.\n *
=====
*\n\nimport {GPGPUProgram} from '../gpgpu_math';\nexport class FlipLeftRightProgram implements\nGPGPUProgram {\n variableNames = ['Image'];\n outputShape: number[] = [];\n userCode: string;\n\n constructor(imageShape: [number, number, number, number]) {\n const imageWidth = imageShape[2];\n this.outputShape = imageShape;\n\n this.userCode = `\n void main() {\n ivec4 coords =\n getOutputCoords();\n int x = coords[2];\n\n int coordX = ${imageWidth} - x;\n float outputValue;\n if(coordX >= 0 && coordX <\n ${imageWidth}) {\n outputValue = getImage(coords[0], coords[1], coordX, coords[3]);\n } else {\n outputValue = getImage(coords[0], coords[1], coords[2], coords[3]);\n }\n setOutput(outputValue);\n }\n };\n}\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under\n * the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the\n * License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n * on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n * implied.\n * See the License for the specific language governing permissions and\n * limitations\n * under the License.\n *
=====
*\n\nimport {KernelConfig, Tensor4D} from '@tensorflow/tfjs-core';\nimport {FlipLeftRight, FlipLeftRightInputs}

```

```

from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from './backend_webgl';\nimport
{FlipLeftRightProgram} from './flip_left_right_gpu';\n\nexport const flipLeftRightConfig: KernelConfig = {\n
kernelName: FlipLeftRight,\n backendName: 'webgl',\n kernelFunc: ((inputs, backend) => {\n const {image} =
inputs as FlipLeftRightInputs;\n const webglBackend = backend as MathBackendWebGL;\n\n const program =
new FlipLeftRightProgram((image as Tensor4D).shape);\n const output =
webglBackend.runWebGLProgram(program, [image], image.dtype);\n return output;\n });\n\n"},"/*\n *
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2.0 (the "License");\n * you may not use this file except in compliance with
the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *
\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is
distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *
=====
*\n\nimport {FloorDiv, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\n\nimport {binaryKernelFunc}
from './kernel_utils/kernel_funcs_utils';\n\n// We use native integer division to deal with floating point imprecision.
Since\n// we implement floor division and glsl implements truncated division, we\n// correct for this by subtracting 1
from result when the result is negative and\n// there is a remainder.\n\nconst INT_DIV = ` float s = sign(a) *
sign(b);\n
int ia = round(a);\n int ib = round(b);\n if (ib != 0) {\n // Windows (D3D) wants guaranteed non-zero int division
at compile-time.\n return float(idiv(ia, ib, s));\n } else {\n return NAN;\n }`;\n\nconst INT_DIV_PACKED =
`\n ivec4 ia = round(a);\n ivec4 ib = round(b);\n bvec4 cond = notEqual(ib, ivec4(0));\n ivec4 result = ivec4(0);\n
vec4 s = sign(a) * sign(b);\n\n // Windows (D3D) wants guaranteed non-zero int division at compile-time.\n if
(cond[0]) {\n result[0] = idiv(ia[0], ib[0], s[0]);\n }\n if (cond[1]) {\n result[1] = idiv(ia[1], ib[1], s[1]);\n }\n if
(cond[2]) {\n result[2] = idiv(ia[2], ib[2], s[2]);\n }\n if (cond[3]) {\n result[3] = idiv(ia[3], ib[3], s[3]);\n }\n
return vec4(result);\n`;\n\nexport const floorDiv = binaryKernelFunc(\n {opSnippet: INT_DIV, packedOpSnippet:
INT_DIV_PACKED, dtype: 'int32'});\n\nexport const floorDivConfig: KernelConfig = {\n kernelName:
FloorDiv,\n backendName: 'webgl',\n kernelFunc: floorDiv
as { } as KernelFunc\n};\n\n"},"/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed
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distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====
*\n\nimport {getGlslDifferences} from './../glsl_version';\nimport {GPGPUProgram} from
'./../gpgpu_math';\n\nexport class FromPixelsProgram implements GPGPUProgram {\n variableNames = ['A'];\n
userCode: string;\n outputShape: number[];\n\n constructor(outputShape:
number[]) {\n const glsl = getGlslDifferences();\n const [height, width,] = outputShape;\n this.outputShape =
outputShape;\n this.userCode = `\n void main() {\n ivec3 coords = getOutputCoords();\n int texR =
coords[0];\n int texC = coords[1];\n int depth = coords[2];\n vec2 uv = (vec2(texC, texR) + halfCR) /
vec2(${width}.0, ${height}.0);\n\n vec4 values = ${glsl.texture2D}(A, uv);\n float value;\n if (depth
== 0) {\n value = values.r;\n } else if (depth == 1) {\n value = values.g;\n } else if (depth == 2)
{\n value = values.b;\n } else if (depth == 3) {\n value = values.a;\n }\n\n setOutput(floor(value * 255.0 + 0.5));\n }\n `;\n }\n\n"},"/*\n * @license\n * Copyright 2018 Google LLC.
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file except in

```

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software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES  
OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language  
governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\n\nimport {getGslDifferences} from '././gsl_version';\nimport {GPGPUProgram} from '././gpgpu_math';\n\nexport class FromPixelsPackedProgram implements GPGPUProgram {\n variableNames = ['A'];\n userCode: string;\n outputShape: number[];\n packedInputs = false;\n packedOutput = true;\n\n constructor(outputShape: number[]) {\n const gsl = getGslDifferences();\n const [height, width,] = outputShape;\n this.outputShape = outputShape;\n\n this.userCode = `\n void main() {\n ivec3 coords = getOutputCoords();\n int texR = coords[0];\n int texC = coords[1];\n int depth = coords[2];\n\n vec4 result = vec4(0.);\n for(int row=0; row<=1; row++) {\n for(int col=0; col<=1; col++) {\n texC = coords[1] + row;\n depth = coords[2] + col;\n\n vec2 uv = (vec2(texC, texR) + halfCR) /\n vec2(${width}.0, ${height}.0);\n vec4 values = ${gsl.texture2D}(A, uv);\n float value;\n if (depth == 0) {\n value = values.r;\n } else if (depth == 1) {\n value = values.g;\n } else if (depth == 2) {\n value = values.b;\n } else if (depth == 3) {\n value = values.a;\n }\n\n result[row * 2 + col] = floor(value * 255.0 + 0.5);\n }\n }\n ${gsl.output} = result;\n }\n `;\n }\n}\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n*\n\nimport {env, KernelConfig, KernelFunc, TensorInfo} from '@tensorflow/tfjs-core';\nimport {FromPixels, FromPixelsAttrs, FromPixelsInputs} from '@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from './backend_webgl';\nimport {TextureUsage} from './tex_util';\nimport {FromPixelsProgram} from './FromPixels_utils/from_pixels_gpu';\nimport {FromPixelsPackedProgram} from './FromPixels_utils/from_pixels_packed_gpu';\n\nexport const fromPixelsConfig: KernelConfig = {\n kernelName: FromPixels,\n backendName: 'webgl',\n kernelFunc: fromPixels as KernelFunc,\n};\n\nlet fromPixels2DContext: CanvasRenderingContext2D;\n\nfunction fromPixels(args: {\n inputs: FromPixelsInputs,\n backend: MathBackendWebGL,\n attrs: FromPixelsAttrs\n}): TensorInfo {\n const {inputs, backend, attrs} = args;\n let {pixels} = inputs;\n const {numChannels} = attrs;\n\n const isVideo = typeof (HTMLVideoElement) !== 'undefined' &&\n pixels instanceof HTMLVideoElement;\n const isImage = typeof (HTMLImageElement) !== 'undefined' &&\n pixels instanceof HTMLImageElement;\n const isImageBitmap = typeof (ImageBitmap) !== 'undefined' &&\n pixels instanceof ImageBitmap;\n const [width, height] = isVideo ? [\n (pixels as HTMLVideoElement).videoWidth,\n (pixels as HTMLVideoElement).videoHeight\n] : [\n pixels.width, pixels.height\n];\n const texShape: [number, number] = [height, width];\n const outShape = [height, width, numChannels];\n\n if (isImage || isVideo || isImageBitmap) {\n if (fromPixels2DContext == null) {\n fromPixels2DContext = document.createElement('canvas').getContext('2d');\n }\n\n fromPixels2DContext.canvas.width = width;\n fromPixels2DContext.canvas.height = height;\n fromPixels2DContext.drawImage(\n pixels as HTMLVideoElement | HTMLImageElement | ImageBitmap,\n 0, 0, width, height);\n pixels = fromPixels2DContext.canvas;\n }\n\n const tempPixelHandle = backend.makeTensorInfo(texShape, 'int32');\n // This is a byte texture with pixels.\n backend.texData.get(tempPixelHandle.dataId).usage =
```



```
TextureUsage.PIXELS;\n backend.gpgpu.uploadPixelDataToTexture(\n
backend.getTexture(tempPixelHandle.dataId), pixels as ImageData);\n const program
= env().getBool('WEBGL_PACK') ?\n new FromPixelsPackedProgram(outShape) :\n new
FromPixelsProgram(outShape);\n const res = backend.runWebGLProgram(program, [tempPixelHandle], 'int32');\n
backend.disposeData(tempPixelHandle.dataId);\n return res;\n}\n", "/*\n * @license\n * Copyright 2020 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
```

```
=====\n
*\n\nimport
{ backend_util, env, FusedConv2D, FusedConv2DAttrs, FusedConv2DInputs, KernelConfig, KernelFunc,
TensorInfo, util } from '@tensorflow/tfjs-core';\n\nimport { MathBackendWebGL } from '../backend_webgl';\n\nimport
{ Conv2DProgram } from '../conv_gpu';\n\nimport { mapActivationToShaderProgram } from
'./kernel_utils/kernel_funcs_utils';\n\nimport { conv2dByMatMul, conv2dWithIm2Row } from
'./Conv2D_impl';\n\nimport { reshape } from './Reshape';\n\n\nexport function fusedConv2d(args: {\n inputs:
FusedConv2DInputs,\n attrs: FusedConv2DAttrs,\n backend: MathBackendWebGL\n}) {\n const { inputs,
backend, attrs } = args;\n const { x, filter, bias, preluActivationWeights } = inputs;\n const {\n strides,\n pad,\n
dataFormat,\n dilations,\n dimRoundingMode,\n activation,\n leakyreluAlpha\n } = attrs;\n\n const
$dataFormat = backend_util.convertConv2DDataFormat(dataFormat);\n const convInfo =
backend_util.computeConv2DInfo(\n x.shape as [number, number, number, number],\n filter.shape
as [number, number, number, number], strides, dilations, pad,\n dimRoundingMode, false /* depthwise */,\n
$dataFormat);\n let out: TensorInfo;\n const intermediates: TensorInfo[] = [];\n\n if (convInfo.filterHeight === 1
&& convInfo.filterWidth === 1 &&\n convInfo.dilationHeight === 1 && convInfo.dilationWidth === 1 &&\n
convInfo.strideHeight === 1 && convInfo.strideWidth === 1 &&\n (convInfo.padInfo.type === 'SAME' ||
convInfo.padInfo.type === 'VALID')) {\n out = conv2dByMatMul({\n x,\n filter,\n convInfo,\n
backend,\n bias,\n activation,\n preluActivationWeights,\n leakyreluAlpha\n });\n } else if
(env().getBool('WEBGL_CONV_IM2COL') && x.shape[0] === 1) {\n out = conv2dWithIm2Row({\n x,\n
filter,\n convInfo,\n backend,\n bias,\n activation,\n preluActivationWeights,\n leakyreluAlpha\n
});\n } else {\n const hasBias = bias != null;\n const hasPreluActivationWeights
= preluActivationWeights != null;\n const hasLeakyreluAlpha = activation === 'leakyrelu';\n const
fusedActivation =\n activation ? mapActivationToShaderProgram(activation, false) : null;\n const program =
new Conv2DProgram(\n convInfo, hasBias, fusedActivation, hasPreluActivationWeights,\n
hasLeakyreluAlpha);\n const inputs: TensorInfo[] = [x, filter];\n if (bias) {\n inputs.push(bias);\n }\n if
(preluActivationWeights) {\n inputs.push(preluActivationWeights);\n }\n if (hasLeakyreluAlpha) {\n
const $leakyreluAlpha = backend.makeTensorInfo(\n [], 'float32',\n
util.createScalarValue(leakyreluAlpha as { } as 'float32', 'float32'));\n inputs.push($leakyreluAlpha);\n
intermediates.push($leakyreluAlpha);\n }\n out = backend.runWebGLProgram(program, inputs, 'float32');\n
}\n\n const outReshaped =\n reshape({inputs: {x: out}, backend, attrs: {shape: convInfo.outShape}});\n\n
intermediates.push(out);\n
intermediates.forEach(t => backend.disposeIntermediateTensorInfo(t));\n\n return outReshaped;\n}\n\n\nexport
const fusedConv2DConfig: KernelConfig = {\n kernelName: FusedConv2D,\n backendName: 'webgl',\n
kernelFunc: fusedConv2d as { } as KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
```

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```
=====\n*\n\nimport
 {backend_util, env, FusedDepthwiseConv2D, FusedDepthwiseConv2DAttrs, FusedDepthwiseConv2DInputs,
 KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from './backend_webgl';\nimport {DepthwiseConv2DProgram} from './conv_gpu_depthwise';\nimport {DepthwiseConvPacked2DProgram} from './conv_packed_gpu_depthwise';\nimport {mapActivationToShaderProgram} from './kernel_utils/kernel_funcs_utils';\n\nexport function fusedDepthwiseConv2D(args: {\n inputs: FusedDepthwiseConv2DInputs,\n attrs: FusedDepthwiseConv2DAttrs,\n backend: MathBackendWebGL\n}) {\n const {inputs, backend, attrs} = args;\n const {x, filter, bias, preluActivationWeights} = inputs;\n const {strides, pad, dilations, dimRoundingMode, activation, leakyreluAlpha} =\n attrs;\n const intermediates: TensorInfo[] = [];\n let $dilations = dilations;\n if ($dilations == null) {\n $dilations = [1, 1];\n }\n util.assert(\n backend_util.eitherStridesOrDilationsAreOne(strides, $dilations),\n () => 'Error in depthwiseConv2d: Either strides or dilations must be ' +\n `1. Got strides ${strides} and dilations '${dilations}'`);\n const convInfo = backend_util.computeConv2DInfo(\n x.shape as [number, number, number, number],\n filter.shape as [number, number, number, number],\n strides, $dilations,\n pad, dimRoundingMode, true /* depthwise */);\n const shouldPackDepthwiseConv =\n env().getBool('WEBGL_PACK_DEPTHWISECONV') &&\n convInfo.strideWidth <= 2 &&\n convInfo.outChannels / convInfo.inChannels === 1;\n const fusedActivation = activation ?\n mapActivationToShaderProgram(activation, shouldPackDepthwiseConv) :\n null;\n const programInputs: TensorInfo[] = [x, filter];\n const hasBias = bias != null;\n const hasPreluActivationWeights =\n preluActivationWeights != null;\n const hasLeakyreluAlpha = activation === 'leakyrelu';\n if (hasBias) {\n programInputs.push(bias);\n }\n if (hasPreluActivationWeights) {\n programInputs.push(preluActivationWeights);\n }\n if (hasLeakyreluAlpha) {\n const $leakyreluAlpha = backend.makeTensorInfo(\n [], 'float32',\n util.createScalarValue(leakyreluAlpha as { } as 'float32', 'float32'));\n programInputs.push($leakyreluAlpha);\n intermediates.push($leakyreluAlpha);\n }\n let program:\n DepthwiseConv2DProgram|DepthwiseConvPacked2DProgram;\n if (shouldPackDepthwiseConv) {\n program =\n new DepthwiseConvPacked2DProgram(\n convInfo, hasBias, fusedActivation, hasPreluActivationWeights,\n hasLeakyreluAlpha);\n } else {\n program =\n new DepthwiseConv2DProgram(\n convInfo, hasBias, fusedActivation, hasPreluActivationWeights,\n hasLeakyreluAlpha);\n }\n const result =\n backend.runWebGLProgram(program, programInputs, 'float32');\n intermediates.forEach(t =>\n backend.disposeIntermediateTensorInfo(t));\n return result;\n}\n\nexport const fusedDepthwiseConv2DConfig:\n KernelConfig = {\n kernelName: FusedDepthwiseConv2D,\n backendName: 'webgl',\n kernelFunc:\n fusedDepthwiseConv2D as { } as KernelFunc,\n};\n\n/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *\n *=====\n*\nimport {GPGPUProgram} from './gpgpu_math';\nimport {getCoordsDataType} from './shader_compiler';\n\nexport class GatherNDProgram implements GPGPUProgram {\n variableNames = ['x', 'indices'];\n outputShape: number[];\n userCode: string;\n constructor(\n private sliceDim: number, private strides: number[], shape: number[]) {\n this.outputShape =
```

```

shape;\n const stridesType = getCoordsDataType(strides.length);\n const dtype =
getCoordsDataType(shape.length);\n const strideString = this.sliceDim > 1 ? 'strides[j]' : 'strides';\n
this.userCode = `
 ${stridesType} strides = ${stridesType}(${this.strides});\n void main() {\n
${dtype} coords = getOutputCoords();\n int flattenIndex = 0;\n for (int j = 0; j < ${this.sliceDim}; j++)
{\n
 int index = round(getIndices(coords[0], j));\n flattenIndex += index * ${strideString};\n }\n
 setOutput(getX(flattenIndex, coords[1]));\n }\n `;\n }\n }\n\n", "/*\n * @license\n * Copyright 2020
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *

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=====
*\n\nimport { backend_util, GatherNd, GatherNdInputs, KernelConfig, KernelFunc, TensorInfo, util } from
'@tensorflow/tfjs-core';\n\nimport { MathBackendWebGL } from './backend_webgl';\nimport { GatherNDProgram }
from './gather_nd_gpu';\nimport { reshape } from './Reshape';\n\nexport function gatherNd(\n args: { inputs:
GatherNdInputs, backend: MathBackendWebGL }): TensorInfo {\n const { inputs, backend }
= args;\n const { params, indices } = inputs;\n\n const indicesShape = indices.shape;\n const sliceRank =
indicesShape[indicesShape.length - 1];\n\n const [resultShape, numSlices, sliceSize, strides] =\n
backend_util.prepareAndValidate(params, indices);\n\n const flattenIndices = reshape(\n { inputs: { x: indices },
backend, attrs: { shape: [numSlices, sliceRank] } });\n const flattenX = reshape({\n inputs: { x: params },\n
backend,\n attrs: { shape: [(util.sizeFromShape(params.shape) / sliceSize), sliceSize] }\n });\n\n const program =\n new GatherNDProgram(sliceRank, strides, [numSlices, sliceSize]);\n const res = backend.runWebGLProgram(\n
program, [flattenX, flattenIndices], flattenX.dtype);\n\n const reshaped =\n reshape({ inputs: { x: res }, backend,
attrs: { shape: resultShape } });\n\n backend.disposeIntermediateTensorInfo(flattenIndices);\n
backend.disposeIntermediateTensorInfo(flattenX);\n backend.disposeIntermediateTensorInfo(res);\n\n return
reshaped;\n}\n\nexport
const gatherNdConfig: KernelConfig = {\n kernelName: GatherNd,\n backendName: 'webgl',\n kernelFunc:
gatherNd as { } as KernelFunc\n};\n\n", "/*\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n *
Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

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```

=====
*\n\nimport { GPGPUProgram } from './gpgpu_math';\nimport { getCoordsDataType } from
'/shader_compiler';\n\nexport class
GatherProgram implements GPGPUProgram {\n variableNames = ['A', 'indices'];\n outputShape: number[];\n
userCode: string;\n rank: number;\n\n constructor(aShape: number[], outputShape: number[]) {\n
this.outputShape = outputShape;\n this.rank = outputShape.length;\n const dtype =
getCoordsDataType(this.rank);\n const sourceCoords = getSourceCoords(aShape, 2);\n\n this.userCode = `\n
void main() {\n ${dtype} resRC = getOutputCoords();\n setOutput(getA(${sourceCoords}));\n }\n `;\n
}\n\n\n// The input and output are always flattened into rank 4 tensors.\nfunction getSourceCoords(aShape:
number[], axis: number): string {\n const currentCoords = ['resRC.x', 'resRC.y', 'resRC.z', 'resRC.w'];\n const
sourceCoords = [];\n for (let i = 0; i < aShape.length; i++) {\n if (i === 2) {\n
sourceCoords.push('int(getIndices(resRC.x, resRC.z))');\n } else {\n
sourceCoords.push(`${currentCoords[i]}`);\n }\n }\n return sourceCoords.join();\n}\n\n", "/*\n

```

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```
=====\n*\n\nimport { backend_util, GatherV2, GatherV2Attrs, GatherV2Inputs, KernelConfig, KernelFunc, TensorInfo, TypedArray, util } from '@tensorflow/tfjs-core';\nimport { MathBackendWebGL } from './backend_webgl';\nimport { GatherProgram } from './gather_gpu';\nimport { gatherV2ImplCPU } from './kernel_utils/shared';\nimport { reshape } from './Reshape';\n\nexport function gatherV2(args: {\n inputs: GatherV2Inputs,\n backend: MathBackendWebGL,\n attrs: GatherV2Attrs\n}): TensorInfo {\n const { inputs, backend, attrs } = args;\n const { x, indices } = inputs;\n const { axis, batchDims } = attrs;\n const parsedAxis = util.parseAxisParam(axis, x.shape)[0];\n const shapeInfo = backend_util.segment_util.collectGatherOpShapeInfo(\n x, indices, parsedAxis, batchDims);\n const indicesSize = util.sizeFromShape(indices.shape);\n const toDispose = [];\n const flattenX = reshape({\n inputs: { x },\n backend,\n attrs: {\n shape: [\n shapeInfo.batchSize, shapeInfo.outerSize, shapeInfo.dimSize,\n shapeInfo.sliceSize\n]\n }\n });\n const flattenIndex = reshape({\n inputs: { x: indices },\n backend,\n attrs: { shape: [shapeInfo.batchSize, indicesSize / shapeInfo.batchSize] }\n });\n toDispose.push(flattenX);\n toDispose.push(flattenIndex);\n const flattenOutputShape = [\n shapeInfo.batchSize, shapeInfo.outerSize, indicesSize / shapeInfo.batchSize,\n shapeInfo.sliceSize\n];\n if (backend.shouldExecuteOnCPU([x, indices]) || x.dtype === 'string') {\n const indicesBuf = backend.bufferSync(flattenIndex);\n const xBuf = backend.bufferSync(flattenX);\n const outBuf = gatherV2ImplCPU(xBuf, indicesBuf, flattenOutputShape);\n toDispose.forEach(t => backend.disposeIntermediateTensorInfo(t));\n return backend.makeTensorInfo(\n shapeInfo.outputShape, outBuf.dtype, outBuf.values as TypedArray);\n }\n const program = new GatherProgram(flattenX.shape, flattenOutputShape);\n const res = backend.runWebGLProgram(\n program, [flattenX, flattenIndex], flattenX.dtype);\n toDispose.push(res);\n const reshaped = reshape(\n { inputs: { x: res }, backend, attrs: { shape: shapeInfo.outputShape } });\n toDispose.forEach(t => backend.disposeIntermediateTensorInfo(t));\n return reshaped;\n}\n\nexport const gatherV2Config: KernelConfig = {\n kernelName: 'gatherV2',\n backendName: 'webgl',\n kernelFunc: gatherV2 as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport { GreaterEqual, KernelConfig, KernelFunc } from '@tensorflow/tfjs-core';\nimport { binaryKernelFunc } from './kernel_utils/kernel_funcs_utils';\n\nconst GREATER_EQUAL = `return float(a >= b);`\nconst GREATER_EQUAL_PACKED = `\n return vec4(greaterThanEqual(a, b));`\n\nexport const greaterEqual = binaryKernelFunc({\n opSnippet: GREATER_EQUAL,\n packedOpSnippet: GREATER_EQUAL_PACKED,\n dtype: 'bool'\n});\n\nexport const greaterEqualConfig: KernelConfig = {\n kernelName: 'GreaterEqual',\n backendName: 'webgl',\n kernelFunc: greaterEqual as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
```

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```
=====
*import {IFFT, IFFTInputs, KernelConfig, TensorInfo} from '@tensorflow/tfjs-core';
import {MathBackendWebGL} from '../backend_webgl';
import {fftImpl} from '../FFT_impl';
export function
ifft(args: {inputs: IFFTInputs, backend: MathBackendWebGL}):
TensorInfo {
 const {inputs, backend} =
 args;
 const {input} = inputs;
 return fftImpl(input, true /* inverse */, backend);
}
export const ifftConfig:
KernelConfig = {
 kernelName: IFFT,
 backendName: 'webgl',
 kernelFunc: ifft,
};
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 * limitations under the License.
 */
=====
```

```
=====
*import {IsFinite, KernelConfig} from '@tensorflow/tfjs-core';
import {unaryKernelFunc} from
../kernel_utils/kernel_funcs_utils;
const IS_FINITE = `return float(!isnan(x) && !isinf(x));`;
export const
isFinite = unaryKernelFunc({opSnippet: IS_FINITE, dtype: 'bool'});
export const isFiniteConfig: KernelConfig
= {
 kernelName: IsFinite,
 backendName: 'webgl',
 kernelFunc: isFinite,
};
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 * language governing permissions and
 * limitations under the License.
 */
=====
```

```
=====
*import {IsInf, KernelConfig} from '@tensorflow/tfjs-core';
import {unaryKernelFunc} from
../kernel_utils/kernel_funcs_utils;
const IS_INF = `return float(isinf(x));`;
export const isInf =
unaryKernelFunc({opSnippet: IS_INF, dtype: 'bool'});
export const isInfConfig: KernelConfig = {
 kernelName: IsInf,
 backendName: 'webgl',
 kernelFunc: isInf,
};
/**
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 * limitations under the License.
 */
=====
```

```
=====
*import {IsNaN, KernelConfig} from '@tensorflow/tfjs-core';
import {unaryKernelFunc} from
../kernel_utils/kernel_funcs_utils;
const IS_NAN = `return float(isnan(x));`;
export const isNaN =
unaryKernelFunc({opSnippet: IS_NAN, dtype: 'bool'});
export const isNaNConfig: KernelConfig = {
 kernelName: IsNaN,
 backendName: 'webgl',
 kernelFunc: isNaN,
};
/**
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 *
 */
=====
```

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```
=====
*import {KernelConfig, KernelFunc, LessEqual} from '@tensorflow/tfjs-core';import {binaryKernelFunc}
from './kernel_utils/kernel_funcs_utils';export const LESS_EQUAL = `return float(a <= b);`;export const
LESS_EQUAL_PACKED
= `return vec4(lessThanEqual(a, b));`;export const lessEqual = binaryKernelFunc({opSnippet:
LESS_EQUAL, packedOpSnippet: LESS_EQUAL_PACKED, dtype: 'bool'});export const lessEqualConfig:
KernelConfig = {kernelName: LessEqual, backendName: 'webgl', kernelFunc: lessEqual as { } as
KernelFunc};"/** @license Copyright 2020 Google LLC. All Rights Reserved. Licensed under the
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implied. See the License for the specific language governing permissions and limitations under the
License.
```

```
=====
*import {KernelConfig, KernelFunc, LinSpace, LinSpaceAttrs, TensorInfo} from '@tensorflow/tfjs-
core';import {MathBackendWebGL} from './backend_webgl';import {linSpaceImplCPU} from
 './kernel_utils/shared';export function linSpace(args: {backend: MathBackendWebGL, attrs:
LinSpaceAttrs}): TensorInfo {const {backend, attrs} = args;const {start, stop, num} = attrs; // TODO:
Use CPU implementation due to the precision problem in Safari. const outVals = linSpaceImplCPU(start, stop,
num);return backend.makeTensorInfo([outVals.length, 'float32', outVals]);}export const linSpaceConfig:
KernelConfig = {kernelName: LinSpace, backendName: 'webgl', kernelFunc: linSpace as { } as
KernelFunc};"/** @license Copyright 2020 Google LLC. All Rights Reserved. Licensed under the
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distributed on an "AS IS" BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied. See the License for the specific language governing permissions and limitations under
the License.
```

```
=====
*import {KernelConfig, Log1p} from '@tensorflow/tfjs-core';import {unaryKernelFunc} from
 './kernel_utils/kernel_funcs_utils';const LOG1P = `return log(1.0 + x);`;export const log1p =
unaryKernelFunc({opSnippet: LOG1P});export const log1pConfig: KernelConfig = {kernelName: Log1p, n
backendName: 'webgl', kernelFunc: log1p,};"/** @license Copyright 2020 Google LLC. All Rights
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```

```
=====
*import {KernelConfig, KernelFunc, LogicalAnd} from '@tensorflow/tfjs-core';import
{binaryKernelFunc} from './kernel_utils/kernel_funcs_utils';const LOGICAL_AND = `return float(a >= 1.0 &&
b >= 1.0);`;const LOGICAL_AND_PACKED = `return vec4(vec4(greaterThanEqual(a, vec4(1.0))) *)`
```

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vec4(greaterThanEqual(b, vec4(1.0)))));n`;\n\nexport const logicalAnd = binaryKernelFunc({\n
 opSnippet: LOGICAL_AND,\n packedOpSnippet: LOGICAL_AND_PACKED,\n dtype: 'bool'\n});\n\nexport
const logicalAndConfig: KernelConfig = {\n kernelName: LogicalAnd,\n backendName: 'webgl',\n kernelFunc:
logicalAnd as { } as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n *
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http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport { KernelConfig,
 LogicalNot } from '@tensorflow/tfjs-core';\nimport { unaryKernelFunc } from
'./kernel_utils/kernel_funcs_utils';\n\nconst LOGICAL_NOT = `return float(!(x >= 1.0));`; \n\nexport const
logicalNot = unaryKernelFunc({ opSnippet: LOGICAL_NOT });\n\nexport const logicalNotConfig: KernelConfig =
{\n kernelName: LogicalNot,\n backendName: 'webgl',\n kernelFunc: logicalNot,\n};\n", "/*\n * @license\n *
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under
the License.\n *
=====\n
*\n\nimport { KernelConfig, KernelFunc, LogicalOr } from '@tensorflow/tfjs-core';\n\nimport { binaryKernelFunc }
from './kernel_utils/kernel_funcs_utils';\n\nconst LOGICAL_OR = `return float(a >= 1.0 || b >= 1.0);`; \n\nconst
LOGICAL_OR_PACKED = `\n return min(\n vec4(greaterThanEqual(a, vec4(1.0))) +\n vec4(greaterThanEqual(b, vec4(1.0))),\n vec4(1.0));\n`; \n\nexport const logicalOr = binaryKernelFunc(\n
 { opSnippet: LOGICAL_OR, packedOpSnippet: LOGICAL_OR_PACKED, dtype: 'bool' });\n\nexport const
logicalOrConfig: KernelConfig = {\n kernelName: LogicalOr,\n backendName: 'webgl',\n kernelFunc: logicalOr
as { } as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n * Licensed
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport { GPGPUProgram } from './gpgpu_math';\n\nexport class LRNProgram implements GPGPUProgram
{\n variableNames = ['x'];\n outputShape: number[] = [];\n userCode: string;\n\n constructor(\n xShape:
number[], radius: number, bias: number, alpha: number,\n beta: number) {\n const rad = radius;\n const
maxD = xShape[3] - 1;\n this.outputShape = xShape;\n\n // optimize pow(bias + alpha * sum, -beta)\n // src:
https://github.com/tensorflow/tensorflow/.. \n // blob/26033a1644a9c4a5fbc3170ab2e864b6a4ccd4ca/..\n
 // tensorflow/core/kernels/mkl_lrn_op.cc#L320\n let powOperator;\n const basis = `float(${bias}) +
float(${alpha}) * sum`;\n if (beta === 0.5) {\n powOperator = `inversesqrt(${basis})`; \n } else if (beta ===
1.0) {\n powOperator = `1.0/(${basis})`; \n } else {\n powOperator = `exp(log(${basis}) * float(-
${beta}))`; \n } \n\n this.userCode = `\n void main() {\n ivec4 coords = getOutputCoords();\n int b =
coords[0];\n int r = coords[1];\n int c = coords[2];\n int d = coords[3];\n float x = getX(b, r, c, d);\n

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float sum = 0.0;\n for (int j = -${rad}; j <= ${rad}; j++) {\n int idx = d + j;\n if (idx >= 0 && idx <= ${maxD}) {\n float z = getX(b, r, c, idx);\n sum += z * z;\n }\n }\n float val = x * ${powOperator};\n setOutput(val);\n }\n};\n}\n}\n"/**\n * @license\n * Copyright 2019 Google LLC.\n All Rights

```

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=====\n
*\n\nimport {GPGPUProgram} from './gpgpu_math';\n\nexport class LRNPackedProgram implements GPGPUProgram {\n variableNames = ['x'];\n outputShape: number[] = [];\n userCode: string;\n packedInputs = true;\n packedOutput = true;\n\n constructor(\n xShape: number[], radius: number, bias: number, alpha: number,\n beta: number) {\n const rad = radius;\n const maxD = xShape[3] - 1;\n this.outputShape = xShape;\n\n // optimize pow(bias + alpha * sum, -beta)\n // src: https://github.com/tensorflow/tensorflow/.. // blob/26033a1644a9c4a5fbc3170ab2e864b6a4ccd4ca/.. // tensorflow/core/kernels/mkl_lrn_op.cc#L320\n let powOperator;\n const basis = `float(${bias}) + float(${alpha}) * sum`;\n if (beta === 0.5) {\n powOperator = `inversesqrt(${basis})`;\n } else if (beta === 1.0) {\n powOperator = `1.0/(${basis})`;\n } else {\n powOperator = `exp(log(${basis}) * float(-${beta}))`;\n }\n\n this.userCode = `\n void main() {\n ivec4 coords = getOutputCoords();\n int b = coords.x;\n int r = coords.y;\n int c = coords.z;\n int d = coords.w;\n\n bool hasNextCol = d < ${this.outputShape[3]};\n bool hasNextRow = c < ${this.outputShape[2]};\n\n vec4 sum = vec4(0.);\n vec4 xFragAtOutputCoords = getX(b, r, c, d);\n\n vec4 xAtOutputCoords = vec4(\n getChannel(xFragAtOutputCoords, vec2(c, d)),\n hasNextCol ?\n getChannel(xFragAtOutputCoords, vec2(c, d + 1)) : 0.0,\n hasNextRow ?\n getChannel(xFragAtOutputCoords, vec2(c + 1, d)) : 0.0,\n (hasNextRow && hasNextCol) ?\n getChannel(xFragAtOutputCoords, vec2(c + 1, d + 1)) : 0.0\n);\n\n int firstChannel = d - ${rad};\n vec2 cache = vec2(0.);\n if(firstChannel >= 0){\n vec4 firstChannelFrag = getX(b, r, c, firstChannel);\n cache.x = getChannel(firstChannelFrag, vec2(c, firstChannel));\n if(hasNextRow){\n cache.y = getChannel(firstChannelFrag, vec2(c + 1, firstChannel));\n }\n }\n\n ivec2 depth = ivec2(d, d + 1);\n for (int j = - ${rad}; j <= ${rad}; j++) {\n ivec2 idx = depth + j;\n bvec2 aboveLowerBound = greaterThanEqual(idx, ivec2(0));\n bvec2 belowUpperBound = lessThanEqual(idx, ivec2(${maxD}));\n bool depthInRange = aboveLowerBound.x && belowUpperBound.x;\n bool depthPlusOneInRange = aboveLowerBound.y && belowUpperBound.y;\n\n if(depthInRange || depthPlusOneInRange){\n vec4 z = vec4(0.);\n vec4 xFragAtCurrentDepth;\n z.xz = cache.xy;\n if(depthPlusOneInRange && hasNextCol){\n xFragAtCurrentDepth = idx.y != d ?\n getX(b, r, c, idx.y) : xFragAtOutputCoords;\n z.y = getChannel(xFragAtCurrentDepth, vec2(c, idx.y));\n if(hasNextRow){\n z.w = getChannel(xFragAtCurrentDepth, vec2(c + 1, idx.y));\n }\n }\n cache.xy = z.yw;\n sum += z * z;\n }\n }\n vec4 result = xAtOutputCoords * ${powOperator};\n setOutput(result);\n }\n `;\n}\n}\n}\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights

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=====
*\n\nimport {env, KernelConfig, KernelFunc, LRN, LRNAttrs, LRNInputs, TensorInfo} from '@tensorflow/tfjs-
core';\n\nimport {MathBackendWebGL} from './backend_webgl';\nimport {LRNProgram} from
 './lrn_gpu';\nimport {LRNPackedProgram} from './lrn_packed_gpu';\n\nexport const lrn =\n (args: {inputs:
LRNInputs, backend: MathBackendWebGL,
attrs: LRNAttrs});\n TensorInfo => {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n
 const {depthRadius, bias, alpha, beta} = attrs;\n\n const program =
env().getBool('WEBGL_PACK_NORMALIZATION') ?\n new LRNPackedProgram(x.shape, depthRadius,
bias, alpha, beta) :\n new LRNProgram(x.shape, depthRadius, bias, alpha, beta);\n return
backend.runWebGLProgram(program, [x], x.dtype);\n };\n\n// tslint:disable-next-line: variable-name\nexport
const LRNConfig: KernelConfig = {\n kernelName: LRN,\n backendName: 'webgl',\n kernelFunc: lrn as { } as
KernelFunc\n};\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
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law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {GPGPUProgram} from './gpgpu_math';\n\nexport class LRNGradProgram implements
GPGPUProgram {\n variableNames = ['inputImage', 'outputImage', 'dy'];\n outputShape: number[] = [];\n
 userCode: string;\n depthRadius: number;\n bias: number;\n alpha: number;\n beta: number;\n depth: number;\n\n
 constructor(\n inputShape: number[], depthRadius: number, bias: number, alpha: number,\n beta: number) {\n
 this.outputShape = inputShape;\n this.depth = inputShape[3];\n this.depthRadius = depthRadius;\n
 this.bias =
bias;\n this.alpha = alpha;\n this.beta = beta;\n this.userCode
= `\n void main() {\n ivec4 coords = getOutputCoords();\n int b = coords[0];\n int r = coords[1];\n
 int c = coords[2];\n\n float result = 0.0;\n for (int d = 0; d < ${this.depth}; ++d) {\n int depthBegin =
int(max(0.0, float(d - ${depthRadius}));\n int depthEnd = int(min(float(${this.depth}),\n float(d +
${depthRadius} + 1));\n\n const int MIN_DEPTH_BEGIN = 0;\n const int MAX_DEPTH_END =
${this.depth};\n\n float norm = 0.0;\n for (int k = MIN_DEPTH_BEGIN; k < MAX_DEPTH_END;\n
 ++k) {\n if (k < depthBegin){\n continue;\n }\n else if (k >= depthBegin && k <
depthEnd) {\n norm += getInputImage(b, r, c, k) * getInputImage(b, r, c, k);\n }\n else {\n
 break;\n }\n }\n\n norm = float(${alpha}) * norm + float(${bias});\n\n for(int k =
MIN_DEPTH_BEGIN;\n k < MAX_DEPTH_END; ++k){\n if (k < depthBegin){\n continue;\n }\n else if (k >=
depthBegin && k < depthEnd){\n float dyi = -2.0 * float(${alpha})\n * float(${beta})\n *
getInputImage(b, r, c, k) * getOutputImage(b, r, c, d)\n / norm;\n if (k == d) {\n dyi +=
pow(norm, -1.0 * ${beta});\n }\n if (k == coords[3]) {\n dyi *= getDy(b, r, c, d);\n
 result += dyi;\n }\n }\n else {\n break;\n }\n }\n
 setOutput(result);\n }\n `;\n }\n}\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n
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distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *
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*\n\nimport { KernelConfig, KernelFunc, LRNGrad, LRNGradAttrs, LRNGradInputs, TensorInfo } from
'@tensorflow/tfjs-core';\n\nimport { MathBackendWebGL } from './backend_webgl';\nimport { LRNGradProgram }
from './lrn_grad_gpu';\n\nexport const lrnGrad = (args: {\n inputs: LRNGradInputs,\n backend:
MathBackendWebGL,\n attrs: LRNGradAttrs\n}): TensorInfo => {\n const { inputs, backend, attrs } = args;\n const
{x, y, dy} = inputs;\n const { depthRadius, bias, alpha, beta } = attrs;\n\n const program = new
LRNGradProgram(x.shape, depthRadius, bias, alpha, beta);\n
 return backend.runWebGLProgram(program, [x, y, dy], x.dtype);\n};\n\n// tslint:disable-next-line: variable-
name\nexport const LRNGradConfig: KernelConfig = {\n kernelName: LRNGrad,\n backendName: 'webgl',\n
kernelFunc: lrnGrad as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport { KernelFunc,
Max, MaxAttrs, MaxInputs, TensorInfo } from '@tensorflow/tfjs-core';\nimport { backend_util, KernelConfig,
TypedArray, util } from '@tensorflow/tfjs-core';\nimport { MathBackendWebGL } from
'./backend_webgl';\nimport { maxImplCPU } from './kernel_utils/shared';\nimport { maxImpl } from
'./Max_impl';\nimport { transposeImpl, transposeImplCPU } from './Transpose_impl';\n\nexport function max(\n
args: {\n inputs: MaxInputs, backend: MathBackendWebGL, attrs: MaxAttrs\n}): TensorInfo {\n const { inputs,
backend, attrs } = args;\n const { x } = inputs;\n const { reductionIndices, keepDims } = attrs;\n\n const xRank =
x.shape.length;\n const origAxes = util.parseAxisParam(reductionIndices, x.shape);\n let axes = origAxes;\n
const permutedAxes = backend_util.getAxesPermutation(axes, xRank);\n const maxInputIsTransposed =
permutedAxes !== null;\n const shouldExecuteOnCPU = backend.shouldExecuteOnCPU([x]);\n\n let maxInput =
x;\n if (maxInputIsTransposed) {\n if (shouldExecuteOnCPU) {\n const xTexData = backend.texData.get(maxInput.dataId);\n const values = xTexData.values as
TypedArray;\n\n const newShape: number[] = new Array(xRank);\n for (let i = 0; i < newShape.length; i++) {\n
 newShape[i] = x.shape[permutedAxes[i]];\n }\n const maxInputValues =\n transposeImplCPU(values, x.shape, x.dtype, permutedAxes, newShape);\n\n maxInput =
backend.makeTensorInfo(newShape, x.dtype);\n const maxInputData = backend.texData.get(maxInput.dataId);\n
 maxInputData.values = maxInputValues;\n } else {\n maxInput = transposeImpl(x, permutedAxes,
backend);\n }\n\n axes = backend_util.getInnerMostAxes(axes.length, xRank);\n }\n\n backend_util.assertAxesAreInnerMostDims('max', axes, xRank);\n const [maxOutShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(maxInput.shape, axes);\n let outShape = maxOutShape;\n if
(keepDims) {\n // rather than reshape at the end, set the target
shape here.\n outShape = backend_util.expandShapeToKeepDim(maxOutShape, origAxes);\n }\n\n let out;\n if
(shouldExecuteOnCPU) {\n const xTexData = backend.texData.get(maxInput.dataId);\n const values =
xTexData.values as TypedArray;\n\n const outValues =\n maxImplCPU(values,
util.sizeFromShape(reduceShape), outShape, x.dtype);\n\n out = backend.makeTensorInfo(outShape, x.dtype);\n
const outData = backend.texData.get(out.dataId);\n outData.values = outValues;\n } else {\n out =
maxImpl(maxInput, reduceShape, outShape, backend);\n }\n\n if (maxInputIsTransposed) {\n backend.disposeIntermediateTensorInfo(maxInput);\n }\n\n return out;\n}\n\nexport const maxConfig:
KernelConfig = {\n kernelName: Max,\n backendName: 'webgl',\n kernelFunc: max as {} as
KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
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=====\n*\nimport {backend_util, KernelConfig, KernelFunc, MaxPool, MaxPoolAttrs, MaxPoolInputs, TensorInfo, util}
from '@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from '../backend_webgl';\nimport
{Pool2DProgram} from '../pool_gpu';\nimport {assertNotComplex} from '../webgl_util';\nimport {identity} from
'./Identity';\nexport function maxPool(args: {\n inputs: MaxPoolInputs,\n backend: MathBackendWebGL,\n attrs: MaxPoolAttrs\n}): TensorInfo {\n const
 {inputs, backend, attrs} = args;\n const {x} = inputs;\n assertNotComplex(x, 'maxPool');\n const {filterSize,
 strides, pad, dimRoundingMode} = attrs;\n const dilations = 1;\n util.assert(\n backend_util.eitherStridesOrDilationsAreOne(strides, dilations),\n () => 'Error in maxPool: Either strides or
dilations must be 1. ' +\n `Got strides ${strides} and dilations '${dilations}'`);\n const convInfo =
 backend_util.computePool2DInfo(\n x.shape as [number, number, number, number], filterSize, strides,\n dilations, pad, dimRoundingMode);\n if (convInfo.filterWidth === 1 && convInfo.filterHeight === 1 &&\n util.arraysEqual(convInfo.inShape, convInfo.outShape)) {\n return identity({inputs: {x}, backend});\n }\n const
 maxPoolProgram = new Pool2DProgram(convInfo, 'max', false);\n return
 backend.runWebGLProgram(maxPoolProgram, [x], x.dtype);\n}\nexport const maxPoolConfig: KernelConfig =
{\n kernelName: MaxPool,\n backendName: 'webgl',\n
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 kernelFunc: maxPool as { } as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
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```
=====\n*\nimport {backend_util, KernelConfig, KernelFunc, MaxPool3D, MaxPool3DAttrs, MaxPool3DInputs,
TensorInfo} from '@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from '../backend_webgl';\nimport
{Pool3DProgram} from '../pool_gpu';\nexport
function maxPool3d(args: {\n inputs: MaxPool3DInputs,\n backend: MathBackendWebGL,\n attrs:
 MaxPool3DAttrs\n}): TensorInfo {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const
 {filterSize, strides, pad, dataFormat, dimRoundingMode} = attrs;\n const dilations: [number, number, number] = [1,
 1, 1];\n const convInfo = backend_util.computePool3DInfo(\n x.shape as [number, number, number, number,
 number], filterSize, strides,\n dilations, pad, dimRoundingMode, dataFormat);\n const maxPoolProgram = new
 Pool3DProgram(convInfo, 'max', false);\n return backend.runWebGLProgram(maxPoolProgram, [x],
 x.dtype);\n}\nexport const maxPool3DConfig: KernelConfig = {\n kernelName: MaxPool3D,\n backendName:
 'webgl',\n kernelFunc: maxPool3d as { } as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2017 Google LLC.
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express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *
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*\n\nimport {backend_util} from '@tensorflow/tfjs-core';\nimport {GPGPUProgram} from
'./gpgpu_math';\n\nexport class MaxPool2DBackpropProgram implements GPGPUProgram {\n variableNames =
['dy', 'maxPos'];\n outputShape: number[];\n userCode: string;\n\n constructor(convInfo:
backend_util.Conv2DInfo) {\n this.outputShape = convInfo.inShape;\n const strideHeight =
convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n const dilationHeight
= convInfo.dilationHeight;\n const effectiveFilterHeight = convInfo.effectiveFilterHeight;\n const
effectiveFilterWidth = convInfo.effectiveFilterWidth;\n const padTop = effectiveFilterHeight - 1 -
convInfo.padInfo.top;\n const padLeft = effectiveFilterWidth - 1 - convInfo.padInfo.left;\n\n const lastIndex =
effectiveFilterHeight * effectiveFilterWidth - 1;\n this.userCode = `\n const ivec2 pads = ivec2(${padTop},
${padLeft});\n\n void main() {\n ivec4 coords = getOutputCoords();\n int b = coords[0];\n int d =
coords[3];\n\n ivec2 dyRCCorner = coords.yz - pads;\n int dyRCorner = dyRCCorner.x;\n int
dyCCorner = dyRCCorner.y;\n\n // Convolve dy(?, ?, d) with pos mask(:, :, d) to get dx(xR, xC, d).\n // ? =
to be determined. := across all values in that axis.\n float dotProd = 0.0;\n for (int wR = 0; wR <
${effectiveFilterHeight};\n wR += ${dilationHeight}) {\n float
dyR = float(dyRCorner + wR) / ${strideHeight}.0;\n\n if (dyR < 0.0 || dyR >= ${convInfo.outHeight}.0 ||
fract(dyR) > 0.0) {\n continue;\n }\n int idyR = int(dyR);\n\n for (int wC = 0; wC <
${effectiveFilterWidth}; wC++) {\n float dyC = float(dyCCorner + wC) / ${strideWidth}.0;\n\n if
(dyC < 0.0 || dyC >= ${convInfo.outWidth}.0 ||\n fract(dyC) > 0.0) {\n continue;\n }\n int idyC = int(dyC);\n\n float dyValue = getDy(b, idyR, idyC, d);\n int maxPosValue = ${lastIndex} -
int(getMaxPos(b, idyR, idyC, d));\n\n // Get the current value, check it against the value from the\n //
position matrix.\n int curPosValue = wR * ${effectiveFilterWidth} + wC;\n float mask =
float(maxPosValue == curPosValue ? 1.0 : 0.0);\n dotProd += dyValue * mask;\n }\n }\n }\n }\n}\n\nexport class MaxPool3DBackpropProgram implements GPGPUProgram {\n variableNames =
['dy', 'maxPos'];\n outputShape: number[];\n userCode: string;\n\n constructor(convInfo:
backend_util.Conv3DInfo) {\n this.outputShape = convInfo.inShape;\n const strideDepth =
convInfo.strideDepth;\n const strideHeight = convInfo.strideHeight;\n const strideWidth =
convInfo.strideWidth;\n const dilationDepth = convInfo.dilationDepth;\n const dilationHeight =
convInfo.dilationHeight;\n const dilationWidth = convInfo.dilationWidth;\n const effectiveFilterDepth =
convInfo.effectiveFilterDepth;\n const effectiveFilterHeight = convInfo.effectiveFilterHeight;\n const
effectiveFilterWidth = convInfo.effectiveFilterWidth;\n const padFront = effectiveFilterDepth - 1 -
convInfo.padInfo.front;\n const padTop = effectiveFilterHeight - 1 - convInfo.padInfo.top;\n const padLeft =
effectiveFilterWidth - 1 - convInfo.padInfo.left;\n\n const lastIndex
= effectiveFilterDepth * effectiveFilterHeight * effectiveFilterWidth - 1;\n this.userCode = `\n const
ivec3 pads = ivec3(${padFront}, ${padTop}, ${padLeft});\n\n void main() {\n ivec5 coords =
getOutputCoords();\n int batch = coords.x;\n int ch = coords.u;\n\n ivec3 dyCorner = ivec3(coords.y,
coords.z, coords.w) - pads;\n int dyDCorner = dyCorner.x;\n int dyRCorner = dyCorner.y;\n int
dyCCorner = dyCorner.z;\n\n // Convolve dy(?, ?, ?, ch) with pos mask(:, :, :, d) to get\n // dx(xD, xR, xC,
ch).\n // ? = to be determined. := across all values in that axis.\n float dotProd = 0.0;\n\n for (int wD =
0; wD < ${effectiveFilterDepth};\n wD += ${dilationDepth}) {\n float dyD = float(dyDCorner + wD) /
${strideDepth}.0;\n\n if (dyD < 0.0 || dyD >= ${convInfo.outDepth}.0 || fract(dyD) > 0.0) {\n continue;\n }\n int idyD = int(dyD);\n\n for (int wR = 0; wR < ${effectiveFilterHeight};\n wR += ${dilationHeight}) {\n float dyR =
float(dyRCorner + wR) / ${strideHeight}.0;\n\n if (dyR < 0.0 || dyR >= ${convInfo.outHeight}.0 ||\n fract(dyR) > 0.0) {\n continue;\n }\n int idyR = int(dyR);\n\n for (int wC = 0; wC <
${effectiveFilterWidth};\n wC += ${dilationWidth}) {\n float dyC = float(dyCCorner + wC) /
${strideWidth}.0;\n\n if (dyC < 0.0 || dyC >= ${convInfo.outWidth}.0 ||\n fract(dyC) > 0.0) {\n continue;\n }\n int idyC = int(dyC);\n\n float dyValue = getDy(batch, idyD, idyR,

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idyC, ch);\n int maxPosValue = ${lastIndex} -\n int(getMaxPos(batch, idyD, idyR, idyC,
ch));\n // Get the current value, check it against the value from the\n // position matrix.\n int curPosValue =\n wD * ${effectiveFilterHeight} * ${effectiveFilterWidth} +\n wR\n * ${effectiveFilterWidth} + wC;\n float mask = float(maxPosValue == curPosValue ? 1.0 : 0.0);\n dotProd += dyValue * mask;\n }\n }\n }\n setOutput(dotProd);\n }\n `;\n }\n }\n @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a\n copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable\n law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n the specific language governing permissions and\n * limitations\n under the License.\n *

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*\nimport {backend_util, KernelConfig, KernelFunc, MaxPool3DGrad, MaxPool3DGradAttrs,
MaxPool3DGradInputs, TensorInfo} from '@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from
'../backend_webgl';\nimport {MaxPool3DBackpropProgram} from '../max_pool_backprop_gpu';\nimport
{Pool3DProgram} from '../pool_gpu';\n\nexport function maxPool3DGrad(args: {\n inputs:
MaxPool3DGradInputs,\n backend: MathBackendWebGL,\n attrs: MaxPool3DGradAttrs\n}): TensorInfo {\n
const {inputs, backend, attrs} = args;\n const {dy, input} = inputs;\n const x = input;\n const {filterSize, strides,
pad, dimRoundingMode} = attrs;\n const dilations: [number, number, number] = [1, 1, 1];\n\n const convInfo =
backend_util.computePool3DInfo(\n x.shape as [number, number, number, number, number], filterSize, strides,\n dilations, pad, dimRoundingMode);\n\n const maxPool3dPositionsProgram =\n new Pool3DProgram(convInfo, 'max', true /* get positions */);\n const maxPool3dPositions =\n backend.runWebGLProgram(maxPool3dPositionsProgram, [x], x.dtype);\n const maxPoolBackpropProgram = new
MaxPool3DBackpropProgram(convInfo);\n const result = backend.runWebGLProgram(\n
maxPoolBackpropProgram, [dy, maxPool3dPositions], x.dtype);\n
backend.disposeIntermediateTensorInfo(maxPool3dPositions);\n return result;\n}\n\nexport const
maxPoolGrad3DConfig: KernelConfig = {\n kernelName: MaxPool3DGrad,\n backendName: 'webgl',\n
kernelFunc: maxPool3DGrad as {} as KernelFunc\n};\n\n", "/**\n * @license\n * Copyright 2020 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under
the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY
KIND, either express or implied.\n * See the License for the specific language governing permissions and\n *
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```

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=====\n
*\nimport {backend_util, KernelConfig, KernelFunc, MaxPoolGrad, MaxPoolGradAttrs, MaxPoolGradInputs,
TensorInfo} from '@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from '../backend_webgl';\nimport
{MaxPool2DBackpropProgram} from '../max_pool_backprop_gpu';\nimport {Pool2DProgram} from
'../pool_gpu';\nimport {assertNotComplex} from '../webgl_util';\n\nexport function maxPoolGrad(args: {\n inputs:
MaxPoolGradInputs,\n backend: MathBackendWebGL,\n attrs: MaxPoolGradAttrs\n}): TensorInfo {\n
const {inputs, backend, attrs} = args;\n const {dy, input, output} = inputs;\n const x = input;\n
assertNotComplex([input, output], 'maxPoolGrad');\n const {filterSize,
strides, pad, dimRoundingMode} = attrs;\n\n const convInfo = backend_util.computePool2DInfo(\n x.shape as
[number, number, number, number], filterSize, strides,\n 1 /* dilations */, pad, dimRoundingMode);\n const
getPositions = true;\n const maxPoolPositionsProgram =\n new Pool2DProgram(convInfo, 'max',
getPositions);\n const maxPoolPositions: TensorInfo =\n

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backend.runWebGLProgram(maxPoolPositionsProgram, [x], x.dtype);\n\n const maxPoolBackPropProgram = new
MaxPool2DBackpropProgram(convInfo);\n const result = backend.runWebGLProgram(\n
maxPoolBackPropProgram, [dy, maxPoolPositions], x.dtype);\n
backend.disposeIntermediateTensorInfo(maxPoolPositions);\n return result;\n}\n\nexport const
maxPoolGradConfig: KernelConfig = {\n kernelName: MaxPoolGrad,\n backendName: 'webgl',\n kernelFunc:
maxPoolGrad as { } as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the
'License');\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an 'AS IS' BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport { backend_util, TensorInfo } from '@tensorflow/tfjs-core';\n\nimport { MathBackendWebGL } from
'./backend_webgl';\n\nimport { Pool2DProgram } from './pool_gpu';\n\nexport function maxPoolWithArgmaxImpl(\n
x: TensorInfo, includeBatchInIndex: boolean,\n convInfo: backend_util.Conv2DInfo,\n backend:
MathBackendWebGL): TensorInfo[] {\n let program = new Pool2DProgram(convInfo, 'max', false);\n
const poolOutput = backend.runWebGLProgram(program, [x], 'float32');\n\n program = new
Pool2DProgram(convInfo, 'max', true, true, includeBatchInIndex);\n const indexOutput =
backend.runWebGLProgram(program, [x], 'float32');\n return [poolOutput, indexOutput];\n}\n", "/*\n *
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport
{MaxPoolWithArgmax, MaxPoolWithArgmaxAttrs, MaxPoolWithArgmaxInputs} from '@tensorflow/tfjs-
core';\n\nimport { backend_util, KernelConfig, util } from '@tensorflow/tfjs-core';\n\nimport { MathBackendWebGL }
from './backend_webgl';\n\nimport { maxPoolWithArgmaxImpl } from './MaxPoolWithArgmax_impl';\n\nexport
const maxPoolWithArgmaxConfig: KernelConfig = {\n kernelName: MaxPoolWithArgmax,\n backendName:
'webgl',\n kernelFunc: ({inputs, attrs, backend}) => {\n const {x} = inputs as MaxPoolWithArgmaxInputs;\n
const {filterSize, strides, pad, includeBatchInIndex} =\n attrs as { } as MaxPoolWithArgmaxAttrs;\n const
webglBackend = backend as MathBackendWebGL;\n\n util.assert(\n x.shape.length === 4,\n () => `Error
in maxPool: input must be rank 4 but got rank ${\n x.shape.length}`);\n const dilations: [number, number]
= [1, 1];\n util.assert(\n backend_util.eitherStridesOrDilationsAreOne(strides, dilations),\n () => `Error in
maxPool: Either strides or dilations must be 1.` +\n `Got strides ${strides} and dilations '${dilations}'`);\n
const convInfo = backend_util.computePool2DInfo(\n x.shape as [number, number, number, number],
filterSize, strides,\n dilations, pad);\n\n const [result, indexes] =\n maxPoolWithArgmaxImpl(x,
includeBatchInIndex, convInfo, webglBackend);\n return [result, indexes];\n } }\n};\n", "/*\n *
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agreed to in writing, software\n * distributed under the License is distributed on an 'AS IS' BASIS,\n *
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language governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\n\nimport {TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from './backend_webgl';\nimport {reduce} from '../kernel_utils/reduce';\nimport {reshape} from './kernels/Reshape';\n\nexport function meanImpl(\n x: TensorInfo, reduceShape: number[], outShape: number[],\n backend: MathBackendWebGL): TensorInfo {\n const inSize = util.sizeFromShape(reduceShape);\n const xSize = util.sizeFromShape(x.shape);\n const batchSize = xSize / inSize;\n const reshapedInput =\n reshape({inputs: {x}, attrs: {shape: [batchSize, inSize]}, backend});\n const reduced = reduce(reshapedInput, 'float32', 'mean', backend);\n const reshapedOutput =\n reshape({inputs: {x: reduced}, attrs: {shape: outShape}, backend});\n backend.disposeIntermediateTensorInfo(reshapedInput);\n backend.disposeIntermediateTensorInfo(reduced);\n\n return reshapedOutput;\n}\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n*\n\nimport {backend_util, KernelConfig, Mean, MeanAttrs, MeanInputs, TensorInfo, TypedArray, util} from '@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from './backend_webgl';\nimport {meanImpl} from './Mean_impl';\nimport {transposeImpl, transposeImplCPU} from './Transpose_impl';\n\nexport const meanConfig: KernelConfig = {\n kernelName: Mean,\n backendName: 'webgl',\n kernelFunc: ({inputs, attrs, backend}) => {\n const {x} = inputs as MeanInputs;\n const {keepDims, axis} = attrs as {} as MeanAttrs;\n const webglBackend = backend as MathBackendWebGL;\n const xRank = x.shape.length;\n const origAxes = util.parseAxisParam(axis, x.shape);\n let axes = origAxes;\n const permutedAxes = backend_util.getAxesPermutation(axes, xRank);\n const meanInputIsTransposed = permutedAxes != null;\n const shouldExecuteOnCPU = webglBackend.shouldExecuteOnCPU([x]);\n const intermediates: TensorInfo[] = [];\n let meanInput = x;\n if (meanInputIsTransposed) {\n if (shouldExecuteOnCPU) {\n const xTexData = webglBackend.texData.get(meanInput.dataId);\n const values = xTexData.values as TypedArray;\n const newShape: number[] = new Array(xRank);\n for (let i = 0; i < newShape.length; i++) {\n newShape[i] = x.shape[permutedAxes[i]];\n }\n const meanInputValues =\n transposeImplCPU(values, x.shape, x.dtype, permutedAxes, newShape);\n meanInput = webglBackend.makeTensorInfo(newShape, x.dtype);\n const meanInputData = webglBackend.texData.get(meanInput.dataId);\n meanInputData.values = meanInputValues;\n } else {\n meanInput = transposeImpl(x, permutedAxes, webglBackend);\n }\n intermediates.push(meanInput);\n axes = backend_util.getInnerMostAxes(axes.length, xRank);\n }\n backend_util.assertAxesAreInnerMostDims('sum', axes, xRank);\n const [meanOutShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(meanInput.shape, axes);\n let outShape = meanOutShape;\n if (keepDims) {\n // rather than reshape at the end, set the target shape here.\n outShape = backend_util.expandShapeToKeepDim(meanOutShape, origAxes);\n }\n const out = meanImpl(meanInput, reduceShape, outShape, webglBackend);\n for (const i of intermediates) {\n webglBackend.disposeIntermediateTensorInfo(i);\n }\n return out;\n }\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n */
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```
=====\n\n*\n\nimport { backend_util, KernelConfig, KernelFunc, Min, MinAttrs, MinInputs, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { MathBackendWebGL } from './backend_webgl';\nimport { reduce } from './kernel_utils/reduce';\nimport { reshape } from './Reshape';\nimport { transpose } from './Transpose';\n\nexport function min(\n args: { inputs: MinInputs, backend: MathBackendWebGL, attrs: MinAttrs }):\n TensorInfo {\n const { inputs, backend, attrs } = args;\n const { x } = inputs;\n const { axis, keepDims } = attrs;\n\n const xRank = x.shape.length;\n\n const origAxes = util.parseAxisParam(axis, x.shape);\n let axes = origAxes;\n const permutedAxes = backend_util.getAxesPermutation(axes, xRank);\n let permutedX = x;\n if (permutedAxes !== null) {\n permutedX = transpose({ inputs: { x }, backend, attrs: { perm: permutedAxes } });\n axes = backend_util.getInnerMostAxes(axes.length, x.shape.length);\n }\n\n backend_util.assertAxesAreInnerMostDims('min', axes, xRank);\n const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(permutedX.shape, axes);\n const inSize = util.sizeFromShape(reduceShape);\n const a2D =\n reshape({ inputs: { x: permutedX }, backend, attrs: { shape: [-1, inSize] } });\n const reduced = reduce(a2D, a2D.dtype, 'min', backend);\n let res;\n if (keepDims) {\n const newShape = backend_util.expandShapeToKeepDim(outShape, origAxes);\n res = reshape({ inputs: { x: reduced }, backend, attrs: { shape: newShape } });\n } else {\n res = reshape({ inputs: { x: reduced }, backend, attrs: { shape: outShape } });\n }\n\n backend.disposeIntermediateTensorInfo(a2D);\n backend.disposeIntermediateTensorInfo(reduced);\n\n if (permutedAxes !== null) {\n backend.disposeIntermediateTensorInfo(permutedX);\n }\n\n return res;\n}\n\nexport const minConfig: KernelConfig = {\n kernelName: Min,\n backendName: 'webgl',\n kernelFunc: min as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n\n*\n\nimport { GPGPUProgram } from './gpgpu_math';\nimport { getCoordsDataType } from './shader_compiler';\n\nexport class MirrorPadProgram implements GPGPUProgram {\n variableNames = ['x'];\n outputShape: number[];\n userCode: string;\n\n constructor(\n xShape: number[],\n paddings: Array<number, number>,\n mode: 'reflect'|'symmetric') {\n this.outputShape = paddings.map((p, i) => p[0] /* beforePad */ + xShape[i] + p[1] /* afterPad */);\n const rank = xShape.length;\n const dtype = getCoordsDataType(rank);\n const start = paddings.map(p => p[0]).join(',');\n const end = paddings.map((p, i) => p[0] + xShape[i]).join(',');\n const unpackedCoords = ['coords[0]', 'coords[1]', 'coords[2]', 'coords[3]'].slice(0, rank);\n const offset = mode === 'reflect' ? 0 : 1;\n\n if (rank === 1) {\n this.userCode =\n `\n int start = ${start};\n int end = ${end};\n void main() {\n int outC = getOutputCoords();\n if (outC < start) {\n outC = start * 2 - outC - ${offset};\n } else if (outC >= end) {\n outC = (end - 1) * 2 - outC + ${offset};\n }\n setOutput(getX(outC - start));\n }\n `;\n return;\n }\n\n this.userCode =\n `\n ${dtype} start = ${dtype}(${start});\n ${dtype} end = ${dtype}(${end});\n void main() {\n ${dtype} outC = getOutputCoords();\n for (int i = 0; i < ${rank}; i++) {\n if (outC[i] < start[i]) {\n outC[i] = start[i] * 2 - outC[i] - ${offset};\n } else if (outC[i] >= end[i]) {\n outC[i] = (end[i] - 1) * 2 - outC[i] + ${offset};\n }\n }\n ${dtype} coords = outC - start;\n setOutput(getX(${unpackedCoords}));\n }\n `;\n }\n}\n\n"/**\n * @license\n * Copyright 2020 Google LLC.
```



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```
=====\n*\n\nimport {GPGPUProgram} from './gpgpu_math';\nimport {getChannels} from './packing_util';\nimport {getCoordsDataType} from './shader_compiler';\n\n/**\n * Example shader code for\n * `mirrorPad(tf.tensor1d([1, 2, 3], 'int32'), [[2, 2]], 'reflect')`\n * \n * \n * const int start = int(2);\n * const int end = int(5);\n * \n * void main()\n * {\n * int outputLoc = getOutputCoords();\n * vec4 result = vec4(0.);\n * int rc = outputLoc;\n * int source = rc;\n * if (source < start) {\n * source = start * 2 - source - 0;\n * } else if (source >= end)\n * {\n * source = (end - 1) * 2 - source + 0;\n * }\n * source -= start;\n * result[0] =\n * getChannel(getX(source), source);\n * rc += 1;\n * if (rc < 6) {\n * int source = rc;\n * if (source < start)\n * {\n * source = start * 2 - source - 0;\n * } else if (source >= end) {\n * source = (end - 1) * 2 -\n * source + 0;\n * }\n * source -= start;\n * result[1] = getChannel(getX(source), source);\n * }\n * setOutput(result);\n * }\n * \n */\n\nexport class MirrorPadPackedProgram implements\nGPGPUProgram {\n variableNames = ['x'];\n packedInputs = true;\n packedOutput = true;\n outputShape:\n number[];\n userCode: string;\n\n constructor(\n xShape: number[],\n paddings: Array<[number, number]>,\n mode: 'reflect'|'symmetric') {\n this.outputShape = paddings.map(\n (p, i) => p[0] /* beforePad */ + xShape[i]\n + p[1] /* afterPad */);\n const rank = xShape.length;\n const dtype = getCoordsDataType(rank);\n\n const start\n = paddings.map(p => p[0]).join(',');\n const end = paddings.map((p, i) => p[0] + xShape[i]).join(',');\n const\n coords = getChannels('rc', rank);\n const source\n = getChannels('source', rank);\n const cLimit = `${coords[rank - 1]} < ${this.outputShape[rank - 1]}`;\n const\n innerDims =\n rank === 1 ? 'source' : `vec2(${source.slice(-2).join()})`;\n const offset = mode === 'reflect' ?\n 0 : 1;\n\n let mainLoop = `;\n if (rank === 1) {\n const padSetup = `\n ${dtype} source = rc;\n if\n (source < start) {\n source = start * 2 - source - ${offset};\n } else if (source >= end) {\n source =\n (end - 1) * 2 - source + ${offset};\n }\n source -= start;\n `;\n mainLoop = `\n ${dtype} rc =\n outputLoc;\n ${padSetup}\n result[0] = getChannel(getX(${source.join()}), ${innerDims});\n ${coords[rank - 1]} += 1;\n if (${cLimit}) {\n ${padSetup}\n result[1] =\n getChannel(getX(${source.join()}), ${innerDims});\n }\n `;\n } else {\n const padSetup = `\n ${dtype} source = rc;\n ${dtype} lt = ${dtype}(lessThan(source,\n start));\n ${dtype} gte = ${dtype}(greaterThanEqual(source, end));\n ${dtype} orig = 1 - (lt + gte);\n source = orig * source +\n lt * (start * 2 - source - ${offset}) +\n gte * ((end - 1) * 2 - source +\n ${offset});\n source -= start;\n `;\n\n mainLoop = `\n ${dtype} rc = outputLoc;\n ${padSetup}\n result[0] = getChannel(getX(${source.join()}), ${innerDims});\n ${coords[rank - 1]} += 1;\n if (${cLimit}) {\n ${padSetup}\n result[1] = getChannel(getX(${source.join()}), ${innerDims});\n }\n }\n rc = outputLoc;\n ${coords[rank - 2]} += 1;\n if (${coords[rank - 2]} < ${this.outputShape[rank -\n 2]}) {\n ${padSetup}\n result[2] = getChannel(getX(${source.join()}), ${innerDims});\n }\n ${coords[rank - 1]} += 1;\n if (${cLimit}) {\n ${padSetup}\n result[3] =\n getChannel(getX(${source.join()}),\n ${innerDims});\n }\n }\n `;\n }\n\n this.userCode = `\n const ${dtype} start =\n ${dtype}(${start});\n const ${dtype} end = ${dtype}(${end});\n\n void main() {\n ${dtype} outputLoc =\n getOutputCoords();\n vec4 result = vec4(0.);\n ${mainLoop}\n setOutput(result);\n }\n `;\n }\n\n /**\n *\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You
```

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```
* =====\n*\n*\nimport {env, KernelConfig, KernelFunc, MirrorPad, MirrorPadAttrs, MirrorPadInputs, TensorInfo} from\n '@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from './backend_webgl';\nimport {MirrorPadProgram}\n from './mirror_pad_gpu';\nimport {MirrorPadPackedProgram} from './mirror_pad_packed_gpu';\n\nexport const\n mirrorPadKernelFunc: (params: {\n inputs: MirrorPadInputs,\n backend: MathBackendWebGL,\n attrs:\n MirrorPadAttrs\n}) => TensorInfo = ({inputs, backend, attrs}) => {\n const {x} = inputs;\n const {paddings,\n mode} = attrs;\n\n const program = env().getBool('WEBGL_PACK_ARRAY_OPERATIONS') ?\n new\n MirrorPadPackedProgram(x.shape, paddings, mode) :\n new MirrorPadProgram(x.shape, paddings, mode);\n\n const output = backend.runWebGLProgram(program, [x], x.dtype);\n\n return output;\n};\n\nexport const\n mirrorPadConfig: KernelConfig = {\n kernelName: MirrorPad,\n backendName:\n 'webgl',\n kernelFunc: mirrorPadKernelFunc as {\n } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020\n Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you\n may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n governing permissions and\n * limitations under the License.\n *
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```
===== \n*\n*\nimport {KernelConfig, KernelFunc, Mod} from '@tensorflow/tfjs-core';\nimport\n {CHECK_NAN_SNIPPET} from './binaryop_packed_gpu';\nimport {binaryKernelFunc} from\n './kernel_utils/kernel_funcs_utils';\n\nconst\n MOD = `if (b == 0.0) return NaN;\n return mod(a, b);`\n\nconst MOD_PACKED = `\n vec4 result = mod(a, b);\n vec4 isNaN = vec4(equal(b, vec4(0.0)));\n ` +\n CHECK_NAN_SNIPPET +`\n return result;\n`\n\nexport const\n mod = binaryKernelFunc({\n opSnippet: MOD,\n packedOpSnippet: MOD_PACKED,\n});\n\nexport const\n modConfig: KernelConfig = {\n kernelName: Mod,\n backendName: 'webgl',\n kernelFunc: mod as {\n } as\n KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n * Licensed under the\n Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the\n License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or\n implied.\n * See the License for the\n specific language governing permissions and\n * limitations under the License.\n *
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===== \n*\n*\nimport {GPGPUContext} from './gpgpu_context';\nimport {GPGPUProgram} from './gpgpu_math';\n\nexport\n class MultinomialProgram implements GPGPUProgram {\n variableNames = ['probs'];\n outputShape: number[];\n userCode: string;\n\n // Caching uniform location for speed.\n seedLoc: WebGLUniformLocation;\n\n constructor(batchSize: number, numOutcomes: number, numSamples: number) {\n this.outputShape = [batchSize,\n numSamples];\n\n this.userCode =`\n uniform float seed;\n void main() {\n ivec2 coords =\n getOutputCoords();\n int batch = coords[0];\n float r = random(seed);\n float cdf = 0.0;\n\n for\n (int i = 0; i < ${numOutcomes} - 1; i++) {\n cdf += getProbs(batch, i);\n\n if (r < cdf) {\n setOutput(float(i));\n return;\n }\n }\n\n // If no other event happened, last event happened.\n setOutput(float(${numOutcomes} -\n 1));\n }\n `;\n\n getCustomSetupFunc(seed: number) {\n return (gpgpu: GPGPUContext,\n webGLProgram: WebGLProgram) => {\n if (this.seedLoc == null) {\n this.seedLoc =
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gpgpu.getUniformLocation(webGLProgram, 'seed');\n }\n gpgpu.gl.uniform1f(this.seedLoc, seed);\n };\n }\n}\n", "/\*\*\n \* @license\n \* Copyright 2020 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the \"License\");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \* http://www.apache.org/licenses/LICENSE-2.0\n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific

language governing permissions and\n \* limitations under the License.\n \*

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=====\n*\n\nimport { RealDiv } from '@tensorflow/tfjs-core';\nimport { KernelConfig } from '@tensorflow/tfjs-core';\nimport { binaryKernelFunc } from './kernel_utils/kernel_funcs_utils';\n\n// Without the equality check div produces 0.9999 for a = b, which when\n// floored can cause errors.\nconst DIV = \nif (a == b) {\n return 1.0;\n};\nreturn a / b;\n\n// We do the same as in ./binaryop_gpu, with vec4 and ivec4.\n// On Linux, the vectorized implementation produces NaNs when a and b are 0.\nconst DIV_PACKED = \n// vec4 one = vec4(equal(a, b));\n// return one + (vec4(1.0) - one) * a / b;\nvec4 result = a / b;\nif(a.x == b.x) {\n result.x = 1.;\n }\nif(a.y == b.y) {\n result.y = 1.;\n }\nif(a.z == b.z) {\n result.z = 1.;\n }\nif(a.w == b.w) {\n result.w = 1.;\n }\n\nreturn result;\n\n\nexport const realDiv
```

```
= binaryKernelFunc(\n {opSnippet: DIV, packedOpSnippet: DIV_PACKED, checkOutOfBounds: true});\n\nexport const realDivConfig: KernelConfig = {\n kernelName: RealDiv,\n backendName: 'webgl',\n kernelFunc: realDiv,\n};\n", "/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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=====\n*\n\nimport { backend_util, KernelConfig, KernelFunc, Softmax, SoftmaxAttrs, SoftmaxInputs, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { MathBackendWebGL } from './backend_webgl';\nimport { exp } from './Exp';\nimport { max } from './Max';\nimport { realDiv } from './RealDiv';\nimport { reshape } from './Reshape';\nimport { sub } from './Sub';\nimport { sum } from './Sum';\n\nexport function softmax(args: {\n inputs: SoftmaxInputs,\n backend: MathBackendWebGL,\n attrs: SoftmaxAttrs\n}): TensorInfo {\n const {inputs, backend, attrs} = args;\n const {logits} = inputs;\n const {dim} = attrs;\n const axes = util.parseAxisParam([dim], logits.shape);\n const maxLogit = max({\n inputs: {x: logits},\n backend,\n attrs: {reductionIndices: axes, keepDims: false}\n });\n const expandedShape = backend_util.expandShapeToKeepDim(maxLogit.shape, axes);\n const maxLogitsReshaped =\n reshape({inputs: {x: maxLogit}, backend, attrs: {shape: expandedShape}});\n const a =\n sub({inputs: {a: logits, b: maxLogitsReshaped}, backend}) as TensorInfo;\n const b = exp({inputs: {x: a}, backend}) as TensorInfo;\n const sumExp =\n sum({inputs: {x: b}, backend, attrs: {axis: axes, keepDims: false}});\n const sumExpReshaped =\n reshape({inputs: {x: sumExp}, backend, attrs: {shape: expandedShape}});\n const res =\n realDiv({inputs: {a: b, b: sumExpReshaped}, backend}) as TensorInfo;\n backend.disposeIntermediateTensorInfo(maxLogit);\n backend.disposeIntermediateTensorInfo(maxLogitsReshaped);\n backend.disposeIntermediateTensorInfo(a);\n backend.disposeIntermediateTensorInfo(b);\n backend.disposeIntermediateTensorInfo(sumExp);\n backend.disposeIntermediateTensorInfo(sumExpReshaped);\n return res;\n}\n\nexport const softmaxConfig: KernelConfig = {\n kernelName: Softmax,\n backendName: 'webgl',\n kernelFunc: softmax as {} as KernelFunc\n};\n", "/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n
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```
=====\n\n*\n\nimport { KernelConfig, KernelFunc, Multinomial, MultinomialAttrs, MultinomialInputs, TensorInfo } from\n '@tensorflow/tfjs-core';\nimport { MathBackendWebGL } from './backend_webgl';\nimport\n {MultinomialProgram} from './multinomial_gpu';\nimport {softmax} from './Softmax';\nexport function\n multinomial(args: {\n inputs: MultinomialInputs,\n backend: MathBackendWebGL,\n attrs: MultinomialAttrs\n}): TensorInfo\n {\n const {inputs, backend, attrs} = args;\n const {logits} = inputs;\n const {numSamples, seed, normalized} =\n attrs;\n\n const probs = normalized ?\n logits : softmax(\n {inputs: {logits}, backend, attrs: {dim:\n logits.shape.length - 1}});\n const batchSize = probs.shape[0];\n const numOutcomes = probs.shape[1];\n const\n program = new MultinomialProgram(batchSize, numOutcomes, numSamples);\n const customSetup =\n program.getCustomSetupFunc(seed);\n\n const res = backend.runWebGLProgram(program, [probs], 'int32',\n customSetup);\n if (!normalized) {\n backend.disposeIntermediateTensorInfo(probs);\n }\n return\n res;\n}\n\nexport const multinomialConfig: KernelConfig = {\n kernelName: Multinomial,\n backendName:\n 'webgl',\n kernelFunc: multinomial as {\n } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC.\n All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this\n file except
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```
=====\n\n*\n\nimport { backend_util, kernel_impls, KernelConfig, KernelFunc, NonMaxSuppressionV3,\n NonMaxSuppressionV3Attrs, NonMaxSuppressionV3Inputs, TypedArray } from '@tensorflow/tfjs-core';\nconst\n nonMaxSuppressionV3Impl = kernel_impls.nonMaxSuppressionV3Impl;\nimport { MathBackendWebGL } from\n './backend_webgl';\nexport function nonMaxSuppressionV3(args: {\n inputs: NonMaxSuppressionV3Inputs,\n backend: MathBackendWebGL,\n attrs: NonMaxSuppressionV3Attrs\n})\n {\n backend_util.warn(\n 'tf.nonMaxSuppression() in webgl locks the UI thread. ' +\n 'Call\n tf.nonMaxSuppressionAsync() instead');\n\n const {inputs, backend, attrs} = args;\n const {boxes, scores} =\n inputs;\n const {maxOutputSize, iouThreshold, scoreThreshold} =\n attrs;\n\n const boxesVals =\n backend.readSync(boxes.dataId) as TypedArray;\n const scoresVals = backend.readSync(scores.dataId) as\n TypedArray;\n\n const {selectedIndices} = nonMaxSuppressionV3Impl(\n boxesVals, scoresVals,\n maxOutputSize, iouThreshold, scoreThreshold);\n\n return backend.makeTensorInfo(\n [selectedIndices.length],\n 'int32', new Int32Array(selectedIndices));\n}\n\nexport const nonMaxSuppressionV3Config: KernelConfig = {\n kernelName: NonMaxSuppressionV3,\n backendName: 'webgl',\n kernelFunc: nonMaxSuppressionV3 as {\n } as\n KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the\n Apache License, Version 2.0 (the \"License\");\n
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=====\n\n

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*\n\nimport {backend_util, kernel_impls, KernelConfig, KernelFunc, NonMaxSuppressionV4,
NonMaxSuppressionV4Attrs, NonMaxSuppressionV4Inputs, TensorInfo, TypedArray} from '@tensorflow/tfjs-
core';\nconst nonMaxSuppressionV4Impl = kernel_impls.nonMaxSuppressionV4Impl;\n\nimport
{MathBackendWebGL} from './backend_webgl';\n\nexport function nonMaxSuppressionV4(args: {\n inputs:
NonMaxSuppressionV4Inputs,\n backend: MathBackendWebGL,\n
attrs: NonMaxSuppressionV4Attrs\n}): [TensorInfo, TensorInfo] {\n backend_util.warn(\n
'tf.nonMaxSuppression() in webgl locks the UI thread. ' +\n 'Call tf.nonMaxSuppressionAsync() instead');\n\n
const {inputs, backend, attrs} = args;\n const {boxes, scores} = inputs;\n const {maxOutputSize, iouThreshold,
scoreThreshold, padToMaxOutputSize} =\n attrs;\n\n const boxesVals = backend.readSync(boxes.dataId) as
TypedArray;\n const scoresVals = backend.readSync(scores.dataId) as TypedArray;\n\n const {selectedIndices,
validOutputs} = nonMaxSuppressionV4Impl(\n boxesVals, scoresVals, maxOutputSize, iouThreshold,
scoreThreshold,\n padToMaxOutputSize);\n\n return [\n backend.makeTensorInfo(\n
[selectedIndices.length], 'int32', new Int32Array(selectedIndices)),\n backend.makeTensorInfo([], 'int32', new
Int32Array([validOutputs]))\n];\n}\n\nexport const nonMaxSuppressionV4Config: KernelConfig = {\n
kernelName: NonMaxSuppressionV4,\n
backendName: 'webgl',\n kernelFunc: nonMaxSuppressionV4 as {} as KernelFunc\n};\n", "/*\n * @license\n *
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {backend_util, kernel_impls, KernelConfig, KernelFunc, NonMaxSuppressionV5,
NonMaxSuppressionV5Attrs, NonMaxSuppressionV5Inputs, TensorInfo, TypedArray} from '@tensorflow/tfjs-
core';\n\nconst
nonMaxSuppressionV5Impl = kernel_impls.nonMaxSuppressionV5Impl;\n\nimport {MathBackendWebGL} from
'./backend_webgl';\n\nexport function nonMaxSuppressionV5(args: {\n inputs: NonMaxSuppressionV5Inputs,\n
backend: MathBackendWebGL,\n attrs: NonMaxSuppressionV5Attrs\n}): [TensorInfo, TensorInfo] {\n
backend_util.warn(\n 'tf.nonMaxSuppression() in webgl locks the UI thread. ' +\n 'Call
tf.nonMaxSuppressionAsync() instead');\n\n const {inputs, backend, attrs} = args;\n const {boxes, scores} =
inputs;\n const {maxOutputSize, iouThreshold, scoreThreshold, softNmsSigma} = attrs;\n\n const boxesVals =
backend.readSync(boxes.dataId) as TypedArray;\n const scoresVals = backend.readSync(scores.dataId) as
TypedArray;\n\n const maxOutputSizeVal = maxOutputSize;\n const iouThresholdVal = iouThreshold;\n const
scoreThresholdVal = scoreThreshold;\n const softNmsSigmaVal = softNmsSigma;\n\n const {selectedIndices,
selectedScores} = nonMaxSuppressionV5Impl(\n boxesVals,
scoresVals, maxOutputSizeVal, iouThresholdVal,\n scoreThresholdVal, softNmsSigmaVal);\n\n return [\n
backend.makeTensorInfo(\n [selectedIndices.length], 'int32', new Int32Array(selectedIndices)),\n
backend.makeTensorInfo(\n [selectedScores.length], 'float32', new Float32Array(selectedScores))\n
];\n}\n\nexport const nonMaxSuppressionV5Config: KernelConfig = {\n kernelName: NonMaxSuppressionV5,\n
backendName: 'webgl',\n kernelFunc: nonMaxSuppressionV5 as {} as KernelFunc\n};\n", "/*\n * @license\n *
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OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions
and\n * limitations under the License.\n *

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=====
*\n\nimport {GPGPUProgram} from './gpgpu_math';\n\nexport class OneHotProgram implements GPGPUProgram
{\n variableNames = ['indices'];\n outputShape: number[];\n userCode: string;\n\n // Caching uniform location for
speed.\n seedLoc: WebGLUniformLocation;\n\n constructor(\n numIndices: number, depth: number, onValue:
number, offValue: number) {\n this.outputShape = [numIndices, depth];\n\n this.userCode = `
void main()
{\n ivec2 coords = getOutputCoords();\n int index = round(getIndices(coords.x));\n
setOutput(mix(float(${offValue}), float(${onValue})),\n float(index == coords.y));\n
}\n `;\n
}\n}\n",`/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
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=====
*\n\nimport {KernelConfig, KernelFunc, OneHot, OneHotAttrs, OneHotInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from './backend_webgl';\n\nimport {OneHotProgram}
from './onehot_gpu';\n\nimport {reshape} from './Reshape';\n\nexport const oneHot = (args: {\n inputs:
OneHotInputs,\n backend: MathBackendWebGL,\n attrs:
OneHotAttrs\n}): TensorInfo => {\n const {inputs, backend, attrs} = args;\n const {indices} = inputs;\n const
{depth, onValue, offValue} = attrs;\n\n const indicesSize = util.sizeFromShape(indices.shape);\n const program =
new OneHotProgram(indicesSize, depth, onValue, offValue);\n const reshaped =\n reshape({inputs: {x:
indices}, backend, attrs: {shape: [indicesSize]}});\n const result = backend.runWebGLProgram(program,
[reshaped], indices.dtype);\n backend.disposeIntermediateTensorInfo(reshaped);\n\n const outShape =
[...indices.shape, depth];\n const out = reshape({inputs: {x: result}, backend, attrs: {shape: outShape}});\n
backend.disposeIntermediateTensorInfo(result);\n return out;\n};\n\nexport const oneHotConfig: KernelConfig =
{\n kernelName: OneHot,\n backendName: 'webgl',\n kernelFunc: oneHot as {} as KernelFunc\n};\n",`/*\n *
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WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *

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=====
*\n\nimport {KernelConfig, KernelFunc, TensorInfo, ZerosLike, ZerosLikeInputs} from '@tensorflow/tfjs-
core';\n\nimport {MathBackendWebGL} from './backend_webgl';\n\nimport {complex} from './Complex';\n\nimport
{fill} from './Fill';\n\nimport {imag} from './Imag';\n\nimport {real} from './Real';\n\nexport function zerosLike(\n
args: {\n inputs: ZerosLikeInputs, backend: MathBackendWebGL\n}): TensorInfo {\n const {inputs,
backend} = args;\n const {x} = inputs;\n\n if (x.dtype === 'complex64') {\n const realPart = real({inputs: {input:
x}, backend});\n const r = zerosLike({inputs: {x: realPart}, backend});\n const imagPart = imag({inputs: {input:
x}, backend});\n const i = zerosLike({inputs: {x: imagPart}, backend});\n\n const result = complex({inputs:
{real: r, imag: i}, backend});\n\n backend.disposeIntermediateTensorInfo(realPart);\n
backend.disposeIntermediateTensorInfo(r);\n backend.disposeIntermediateTensorInfo(imagPart);\n
backend.disposeIntermediateTensorInfo(i);\n\n return result;\n } else {\n return fill({\n attrs: {\n shape:
x.shape,\n dtype: x.dtype,\n value: x.dtype === 'string' ? " : 0\n },\n backend\n });\n }\n}\n\nexport
const zerosLikeConfig: KernelConfig = {\n kernelName: ZerosLike,\n backendName: 'webgl',\n kernelFunc:
zerosLike as {} as KernelFunc\n};\n",`/*\n * @license\n * Copyright 2020 Google LLC. All

```

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```
=====\n*\n\nimport {KernelConfig, KernelFunc, OnesLike, OnesLikeInputs, TensorInfo} from '@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from '../backend_webgl';\nimport {complex} from './Complex';\nimport {fill} from './Fill';\nimport {imag} from './Imag';\nimport {real} from './Real';\nimport {zerosLike} from './ZerosLike';\n\nexport\nfunction onesLike(\n args: {inputs: OnesLikeInputs, backend: MathBackendWebGL}): TensorInfo {\n const {inputs, backend} = args;\n const {x} = inputs;\n if (x.dtype === 'string') {\n throw new Error('onesLike is not supported under string dtype');\n } else if (x.dtype === 'complex64') {\n const realPart = real({inputs: {input: x}, backend});\n const r = onesLike({inputs: {x: realPart}, backend});\n const imagPart = imag({inputs: {input: x}, backend});\n const i = zerosLike({inputs: {x: imagPart}, backend});\n const result = complex({inputs: {real: r, imag: i}, backend});\n backend.disposeIntermediateTensorInfo(realPart);\n backend.disposeIntermediateTensorInfo(r);\n backend.disposeIntermediateTensorInfo(imagPart);\n backend.disposeIntermediateTensorInfo(i);\n return result;\n } else {\n // TODO(cais, smilkov): Add WebGL shader for onesLike.\n // https://github.com/tensorflow/tfjs/issues/1293\n return fill({attrs: {shape: x.shape, dtype: x.dtype, value: 1}, backend});\n }\n}\n\nexport const onesLikeConfig: KernelConfig = {\n kernelName: OnesLike,\n backendName: 'webgl',\n kernelFunc: onesLike as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport {KernelConfig, KernelFunc, Pack, PackAttrs, PackInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from '../backend_webgl';\nimport {concat} from './Concat';\nimport {expandDims} from './ExpandDims';\n\nexport function pack(\n args: {inputs: PackInputs, backend: MathBackendWebGL, attrs: PackAttrs}):\n TensorInfo {\n const {inputs, backend, attrs} = args;\n const {axis} = attrs;\n if (inputs.length === 1) {\n return expandDims(\n {inputs: {input: inputs[0]}, backend, attrs: {dim: axis}});\n }\n const shape = inputs[0].shape;\n const dtype = inputs[0].dtype;\n inputs.forEach(t => {\n util.assertShapesMatch(\n shape, t.shape,\n 'All tensors passed to stack must have matching shapes');\n util.assert(\n dtype === t.dtype,\n () => 'All tensors passed to stack must have matching dtypes');\n });\n const intermediateTensorInfos: TensorInfo[] = [];\n const expandedTensors = inputs.map(t => {\n const expandedT =\n expandDims({inputs: {input: t}, backend, attrs: {dim: axis}});\n intermediateTensorInfos.push(expandedT);\n return expandedT;\n });\n const result = concat({inputs: expandedTensors, backend, attrs: {axis}});\n intermediateTensorInfos.forEach(\n t => backend.disposeIntermediateTensorInfo(t);\n);\n return result;\n}\n\nexport const packConfig: KernelConfig = {\n kernelName: Pack,\n backendName: 'webgl',\n kernelFunc: pack as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
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```
=====
*
import {GPGPUProgram} from './gpgpu_math';
import {getCoordsDataType} from './shader_compiler';
export class PadProgram implements GPGPUProgram {
 variableNames = ['x'];
 outputShape: number[];
 userCode: string;
 constructor(xShape: number[], paddings: Array<number, number>,
 constantValue: number) {
 this.outputShape = paddings.map((p, i) => p[0] /* beforePad */ + xShape[i] + p[1] /* afterPad */);
 const rank = xShape.length;
 const type = getCoordsDataType(rank);
 const start = paddings.map(p => p[0]).join(',');
 const end = paddings.map((p, i) => p[0] + xShape[i]).join(',');
 const unpackedCoords = ['coords[0]', 'coords[1]', 'coords[2]', 'coords[3]'].slice(0, rank);
 if (rank === 1) {
 this.userCode = `int start = ${start};
 int end = ${end};
 void main() {
 int outC = getOutputCoords();
 if (outC < start || outC >= end) {
 setOutput(float(${constantValue}));
 } else {
 setOutput(getX(outC - start));
 }
 }
 return;`;
 }
 this.userCode = ` ${type} start = ${type}(${start});
 ${type} end = ${type}(${end});
 void main() {
 ${type} outC = getOutputCoords();
 if (any(lessThan(outC, start)) || any(greaterThanEqual(outC, end))) {
 setOutput(float(${constantValue}));
 } else {
 ${type} coords = outC - start;
 setOutput(getX(${unpackedCoords}));
 }
 }`;
 }
}
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```
=====
*
import {GPGPUProgram} from './gpgpu_math';
import {getChannels} from './packing_util';
import {getCoordsDataType} from './shader_compiler';
export class PadPackedProgram implements GPGPUProgram {
 variableNames = ['x'];
 packedInputs = true;
 packedOutput = true;
 outputShape: number[];
 userCode: string;
 constructor(xShape: number[], paddings: Array<number, number>,
 constantValue: number) {
 this.outputShape = paddings.map((p, i) => p[0] /* beforePad */ + xShape[i] + p[1] /* afterPad */);
 const rank = xShape.length;
 const dtype = getCoordsDataType(rank);
 const start = paddings.map(p => p[0]).join(',');
 const end = paddings.map((p, i) => p[0] + xShape[i]).join(',');
 const coords = getChannels('rc', rank);
 const source = getChannels('source', rank);
 const cLimit = `${coords[rank - 1]} < ${this.outputShape[rank - 1]}`;
 const innerDims = rank === 1 ? 'source' : `vec2(${source.slice(-2).join(',')})`;
 const componentSetup = [`${dtype} rc = outputLoc;`, `${coords[rank - 1]} += 1;`
 if (cLimit) {
 `rank === 1 ? " : "`;
 `rc = outputLoc;`
 `${coords[rank - 2]} += 1;`
 }
 if (coords[rank - 2] < this.outputShape[rank - 2]) {
 `rank === 1 ? " : "`
 `${coords[rank - 1]} += 1;`
 }
 if (cLimit) {
 `];`
 }
 const paddingArea = rank === 1 ? `rc < start || rc >= end` : `any(lessThan(rc, start)) || any(greaterThanEqual(rc, end))`;
 let mainLoop = `for (let i = 0, j = rank === 1 ? 2 : 4; i < j; i++) {
 mainLoop += ` ${componentSetup[i]}
 if (${paddingArea}) {
 result[${i}] = float(${constantValue});
 } else {
 ${dtype} source = rc - start;
 result[${i}] = getChannel(getX(${source.join()}), ${innerDims});
 }
 }`;
 mainLoop += (rank === 1 ? ` : `)`;
 this.userCode = `const ${dtype} start = ${dtype}(${start});
 const ${dtype} end = ${dtype}(${end});
 void main() {
 ${dtype} outputLoc = getOutputCoords();
 vec4 result = vec4(0.);
 ${mainLoop}
 setOutput(result);
 }`;
 }
}
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```
=====\n*\n\nimport {env, KernelConfig, KernelFunc, PadV2, PadV2Attrs, PadV2Inputs, TensorInfo} from\n '@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from '../backend_webgl';\nimport {PadProgram} from\n '../pad_gpu';\nimport {PadPackedProgram} from '../pad_packed_gpu';\n\nexport const padV2 = (\n args: {inputs:\n PadV2Inputs, backend: MathBackendWebGL, attrs: PadV2Attrs}): \n TensorInfo => {\n const {inputs,\n backend, attrs} = args;\n const {x} = inputs;\n const {paddings, constantValue} = attrs;\n const\n program = env().getBool('WEBGL_PACK_ARRAY_OPERATIONS') ?\n new\n PadPackedProgram(x.shape, paddings, constantValue) :\n new PadProgram(x.shape, paddings,\n constantValue);\n return backend.runWebGLProgram(program, [x], x.dtype);\n };\n\nexport const\n padV2Config: KernelConfig = {\n kernelName: PadV2,\n backendName: 'webgl',\n kernelFunc: padV2 as {} as\n KernelFunc\n};\n", /*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the\n Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the\n License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n Unless required by applicable law or agreed to in writing, software\n distributed under the License is distributed\n on an \"AS IS\" BASIS,\n WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n implied.\n See the License for the specific language governing permissions\n and\n limitations under the License.\n *\n */
```

```
=====\n*\n\nimport {KernelConfig, KernelFunc, Pow} from '@tensorflow/tfjs-core';\nimport\n {CHECK_NAN_SNIPPET} from '../binaryop_packed_gpu';\nimport {binaryKernelFunc} from\n '../kernel_utils/kernel_funcs_utils';\n\nconst POW = (\n a: number, b: number): number => {\n if(a < 0.0 && floor(b) < b)\n return NaN;\n if (b\n == 0.0)\n return 1.0;\n return (round(mod(b, 2.0)) != 1) ?\n pow(abs(a), b) : sign(a) * pow(abs(a),\n b);\n };\n\nconst POW_PACKED = (\n // isModRound1 has 1 for components with round(mod(b, 2.0)) == 1, 0\n otherwise.\n vec4 isModRound1 = vec4(equal(round(mod(b, 2.0)), ivec4(1)));\n vec4 multiplier = sign(a) *\n isModRound1 + (vec4(1.0) - isModRound1);\n vec4 result = multiplier * pow(abs(a), b);\n // Ensure that a^0 = 1,\n including 0^0 = 1 as this correspond to TF and JS\n bvec4 isExpZero = equal(b, vec4(0.0));\n result.r =\n isExpZero.r ? 1.0 : result.r;\n result.g = isExpZero.g ? 1.0 : result.g;\n result.b = isExpZero.b ? 1.0 : result.b;\n result.a = isExpZero.a ? 1.0 :\n result.a;\n vec4 isNaN = vec4(lessThan(a, vec4(0.0))) * vec4(lessThan(floor(b), b));\n CHECK_NAN_SNIPPET +\n return result;\n);\n\nexport const pow = (\n binaryKernelFunc({opSnippet: POW,\n packedOpSnippet: POW_PACKED});\n\nexport const powConfig: KernelConfig = {\n kernelName: Pow,\n backendName: 'webgl',\n kernelFunc: pow as {} as\n KernelFunc\n};\n", /*\n * @license\n * Copyright 2020\n Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you\n may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n Unless required by applicable law or agreed to in writing,\n software\n distributed under the License is distributed on an \"AS IS\" BASIS,\n WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either\n express or implied.\n See the License for the specific language governing permissions and\n limitations under\n the License.\n *\n */
```

```
=====\n*\n\nimport {KernelConfig, KernelFunc, Range, RangeAttrs, TensorInfo} from '@tensorflow/tfjs-core';\nimport\n {MathBackendWebGL} from '../backend_webgl';\nimport {rangeImplCPU} from '../kernel_utils/shared';\n\nexport const range = (\n args: {backend: MathBackendWebGL, attrs: RangeAttrs}): TensorInfo => {\n const {backend,\n attrs} = args;\n const {start, stop, step, dtype} = attrs;\n const values = rangeImplCPU(start, stop, step,
```

```

dtype);\n return backend.makeTensorInfo([values.length], dtype, values);\n });\n\nexport const rangeConfig:
KernelConfig = {\n kernelName: Range,\n backendName: 'webgl',\n kernelFunc: range as {} as
KernelFunc\n};\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version
2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a
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law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {KernelConfig, Reciprocal} from '@tensorflow/tfjs-core';\nimport {unaryKernelFunc} from
'./kernel_utils/kernel_funcs_utils';\n\nconst RECIPROCAL = `return 1.0 / x;`;\n\nexport const reciprocal =
unaryKernelFunc({opSnippet: RECIPROCAL});\n\nexport const reciprocalConfig: KernelConfig = {\n
kernelName: Reciprocal,\n backendName: 'webgl',\n kernelFunc: reciprocal,\n};\n"/**\n
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {KernelConfig, KernelFunc, Relu} from '@tensorflow/tfjs-core';\nimport {unaryKernelFunc} from
'./kernel_utils/kernel_funcs_utils';\nimport {CHECK_NAN_SNIPPET} from './unaryop_gpu';\n\nconst RELU =
CHECK_NAN_SNIPPET + `\n return (x < 0.0) ? 0.0 : x;\n`;\n\nconst RELU_PACKED =
`\n vec4 result = x * vec4(greaterThanEqual(x, vec4(0.0)));\n bvec4 isNaN = isnan(x);\n result.r = isNaN.r ?
x.r : result.r;\n result.g = isNaN.g ? x.g : result.g;\n result.b = isNaN.b ? x.b : result.b;\n result.a =
isNaN.a ? x.a :
result.a;\n\n return result;\n`;\n\nexport const relu =\n unaryKernelFunc({opSnippet: RELU, packedOpSnippet:
RELU_PACKED});\n\nexport const reluConfig: KernelConfig = {\n kernelName: Relu,\n backendName:
'webgl',\n kernelFunc: relu as {} as KernelFunc\n};\n"/**\n * @license\n * Copyright 2020 Google LLC. All
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OR CONDITIONS
OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions
and\n * limitations under the License.\n *
=====\n
*/\n\nimport {KernelConfig, KernelFunc, Relu6} from '@tensorflow/tfjs-core';\nimport {unaryKernelFunc} from
'./kernel_utils/kernel_funcs_utils';\nimport {CHECK_NAN_SNIPPET} from './unaryop_gpu';\n\nconst RELU6 =
CHECK_NAN_SNIPPET + `\n return (x < 0.0) ? 0.0 : min(6.0, x);\n`;\n\nconst RELU6_PACKED = `\n vec4
result = min(x, vec4(6.)) * vec4(greaterThanEqual(x, vec4(0.0)));\n bvec4 isNaN = isnan(x);\n result.r =
isNaN.r ?
x.r : result.r;\n result.g = isNaN.g ? x.g : result.g;\n result.b = isNaN.b ? x.b : result.b;\n result.a =
isNaN.a ? x.a :
result.a;\n\n return result;\n`;\n\nexport const relu6 =\n unaryKernelFunc({opSnippet: RELU6, packedOpSnippet:
RELU6_PACKED});\n\nexport const relu6Config: KernelConfig = {\n kernelName: Relu6,\n backendName:
'webgl',\n kernelFunc: relu6 as {} as KernelFunc\n};\n"/**\n * @license\n * Copyright 2017 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this
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```
=====\n*\n\nimport {GPGPUProgram} from './gpgpu_math';\n\nexport class ResizeBilinearProgram implements\nGPGPUProgram {\n variableNames = ['A'];\n outputShape: number[] = [];\n userCode: string;\n\n constructor(\n inputShape: [number, number, number, number], newHeight: number,\n newWidth: number, alignCorners:\nboolean, halfPixelCenters: boolean) {\n const [batch, oldHeight, oldWidth, depth] = inputShape;\n this.outputShape = [batch, newHeight, newWidth, depth];\n const effectiveInSize: [number, number] = [\n (alignCorners && newHeight > 1) ? oldHeight - 1 : oldHeight,\n (alignCorners && newWidth > 1) ? oldWidth - 1 : oldWidth\n];\n const effectiveOutSize: [number, number] = [\n (alignCorners && newHeight > 1) ?\n newHeight - 1 : newHeight,\n (alignCorners && newWidth > 1) ? newWidth - 1 : newWidth\n];\n let\n sourceFracIndexRC: string;\n if (halfPixelCenters) {\n sourceFracIndexRC =\n `(vec2(yRC) + vec2(0.5))\n * effectiveInputOverOutputRatioRC` +\n ` - vec2(0.5)`;\n } else {\n sourceFracIndexRC = `vec2(yRC) *\n effectiveInputOverOutputRatioRC`;\n }\n this.userCode = `\n const vec2\n effectiveInputOverOutputRatioRC\n = vec2(\n ${effectiveInSize[0] / effectiveOutSize[0]},\n ${effectiveInSize[1] / effectiveOutSize[1]});\n const vec2 inputShapeRC = vec2(${oldHeight}.0, ${oldWidth}.0);\n void main() {\n ivec4 coords =\n getOutputCoords();\n int b = coords[0];\n int d = coords[3];\n ivec2 yRC = coords.yz;\n //\n Fractional source index.\n vec2 sourceFracIndexRC = ${sourceFracIndexRC};\n // Compute the four\n integer indices.\n ivec2 sourceFloorRC = ivec2(max(sourceFracIndexRC, vec2(0.0)));\n ivec2\n sourceCeilRC = ivec2(\n min(inputShapeRC - 1.0, ceil(sourceFracIndexRC)));\n float topLeft = getA(b,\n sourceFloorRC.x, sourceFloorRC.y, d);\n float bottomLeft = getA(b, sourceCeilRC.x, sourceFloorRC.y, d);\n float topRight = getA(b, sourceFloorRC.x, sourceCeilRC.y, d);\n float bottomRight = getA(b, sourceCeilRC.x,\n sourceCeilRC.y, d);\n vec2 fracRC = sourceFracIndexRC\n - vec2(sourceFloorRC);\n float top = topLeft + (topRight - topLeft) * fracRC.y;\n float bottom =\n bottomLeft + (bottomRight - bottomLeft) * fracRC.y;\n float newValue = top + (bottom - top) * fracRC.x;\n setOutput(newValue);\n }\n `;\n }\n}\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights\n Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file\n except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n governing permissions and\n * limitations under the License.\n *\n\n=====\n*\n\nimport {GPGPUProgram} from './gpgpu_math';\n\nexport class ResizeBilinearPackedProgram implements\nGPGPUProgram {\n variableNames = ['A'];\n packedInputs = true;\n packedOutput = true;\n outputShape:\nnumber[] = [];\n userCode: string;\n\n constructor(\n inputShape: [number, number, number, number],\n newHeight: number,\n newWidth: number, alignCorners: boolean, halfPixelCenters: boolean) {\n const [batch,\noldHeight, oldWidth, depth] = inputShape;\n this.outputShape = [batch, newHeight, newWidth, depth];\n const\n effectiveInSize: [number, number] = [\n (alignCorners && newHeight > 1) ? oldHeight - 1 : oldHeight,\n (alignCorners && newWidth > 1) ? oldWidth - 1 : oldWidth\n];\n const\n effectiveOutSize: [number, number]\n = [\n (alignCorners && newHeight > 1) ? newHeight - 1 : newHeight,\n (alignCorners && newWidth > 1) ?\n newWidth - 1 : newWidth\n];\n let\n sourceFracIndexRC: string;\n if (halfPixelCenters) {\n sourceFracIndexRC = `(vec3(yRC) + vec3(0.5)) *` +\n `effectiveInputOverOutputRatioRC - vec3(0.5)`;\n } else {\n sourceFracIndexRC = `vec3(yRC) * effectiveInputOverOutputRatioRC`;\n }\n this.userCode =`\n const vec3 effectiveInputOverOutputRatioRC = vec3(\n ${effectiveInSize[0] / effectiveOutSize[0]},\n ${effectiveInSize[1] / effectiveOutSize[1]},\n ${effectiveInSize[1] / effectiveOutSize[1]});\n const vec3`
```

```

inputShapeRC = vec3(${oldHeight}.0, ${oldWidth}.0,\n ${oldWidth}.0);\n\n float
getAValue(int b, int r, int c, int d) {\n return getChannel(getA(b, r, c, d), vec2(c, d));\n }\n\n void main()
{\n ivec4 coords = getOutputCoords();\n int b = coords[0];\n int d = coords[3];\n // Calculate
values for next column in yRC.z.\n ivec3 yRC = coords.yzz + ivec3(0, 0, 1);\n // Fractional source
index.\n vec3 sourceFracIndexRC
= ${sourceFracIndexRC};\n // Compute the four integer indices.\n ivec3 sourceFloorRC =
ivec3(max(sourceFracIndexRC, vec3(0.0)));\n ivec3 sourceCeilRC = ivec3(\n min(inputShapeRC - 1.0,
ceil(sourceFracIndexRC));\n // Should we calculate next column and row elements in 2x2 packed cell.\n
bool hasNextCol = d < ${depth - 1};\n bool hasNextRow = coords.z < ${newWidth - 1};\n // In parallel,
construct four corners for all four components in\n // packed 2x2 cell.\n vec4 topLeft = vec4(\n
getAValue(b, sourceFloorRC.x, sourceFloorRC.y, d),\n hasNextCol ? getAValue(b, sourceFloorRC.x,
sourceFloorRC.y, d + 1)\n : 0.0,\n hasNextRow ? getAValue(b, sourceFloorRC.x,
sourceFloorRC.z, d)\n : 0.0,\n (hasNextRow && hasNextCol) ?\n getAValue(b,
sourceFloorRC.x, sourceFloorRC.z, d + 1) : 0.0);\n vec4 bottomLeft = vec4(\n getAValue(b,
sourceCeilRC.x, sourceFloorRC.y, d),\n hasNextCol ? getAValue(b, sourceCeilRC.x, sourceFloorRC.y, d +
1)\n : 0.0,\n hasNextRow ? getAValue(b, sourceCeilRC.x, sourceFloorRC.z, d)\n :
0.0,\n (hasNextRow && hasNextCol) ?\n getAValue(b, sourceCeilRC.x, sourceFloorRC.z, d + 1) :
0.0);\n vec4 topRight = vec4(\n getAValue(b, sourceFloorRC.x, sourceCeilRC.y, d),\n hasNextCol
? getAValue(b, sourceFloorRC.x, sourceCeilRC.y, d + 1)\n : 0.0,\n hasNextRow ? getAValue(b,
sourceFloorRC.x, sourceCeilRC.z, d)\n : 0.0,\n (hasNextRow && hasNextCol) ?\n getAValue(b, sourceFloorRC.x, sourceCeilRC.z, d + 1) :
0.0);\n vec4 bottomRight = vec4(\n getAValue(b, sourceCeilRC.x, sourceCeilRC.y, d),\n hasNextCol
? getAValue(b, sourceCeilRC.x,
sourceCeilRC.y, d + 1)\n : 0.0,\n hasNextRow
? getAValue(b, sourceCeilRC.x, sourceCeilRC.z, d)\n : 0.0,\n (hasNextRow && hasNextCol) ?\n getAValue(b, sourceCeilRC.x, sourceCeilRC.z, d + 1) :
0.0);\n vec3 fracRC = sourceFracIndexRC -
vec3(sourceFloorRC);\n vec4 top = mix(topLeft, topRight, fracRC.yzz);\n vec4 bottom =
mix(bottomLeft, bottomRight, fracRC.yzz);\n vec4 newValue = mix(top, bottom, fracRC.x);\n setOutput(newValue);\n }\n `;\n }\n }\n\n",/*\n * @license\n * Copyright 2020 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *
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OR CONDITIONS OF ANY
KIND, either express or implied.\n * See the License for the specific language governing permissions and\n *
limitations under the License.\n *
=====\n
*\n\nimport {env, KernelConfig, KernelFunc, ResizeBilinear, ResizeBilinearAttrs, ResizeBilinearInputs,
TensorInfo} from '@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from '../backend_webgl';\nimport
{ResizeBilinearProgram} from './resize_bilinear_gpu';\nimport {ResizeBilinearPackedProgram} from
'./resize_bilinear_packed_gpu';\n\nexport function resizeBilinear(args: {\n inputs: ResizeBilinearInputs,\n
backend: MathBackendWebGL,\n attrs: ResizeBilinearAttrs\n}): TensorInfo {\n const {inputs, backend, attrs} =
args;\n const {images} = inputs;\n const {alignCorners, halfPixelCenters, size} = attrs;\n const [newHeight,
newWidth] = size;\n const program = env().getBool('WEBGL_PACK_IMAGE_OPERATIONS') ?\n new
ResizeBilinearPackedProgram(\n images.shape as [number, number, number, number], newHeight, newWidth,\n
alignCorners,
halfPixelCenters) : \n new ResizeBilinearProgram(\n images.shape as [number, number, number, number],
newHeight, newWidth,\n alignCorners, halfPixelCenters);\n return backend.runWebGLProgram(program,
[images], 'float32');\n }\n\nexport const resizeBilinearConfig: KernelConfig = {\n kernelName: ResizeBilinear,\n

```

backendName: 'webgl',\n kernelFunc: resizeBilinear as { } as KernelFunc\n};\n", "/\*\n \* @license\n \* Copyright 2018 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the \"License\");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \* http://www.apache.org/licenses/LICENSE-2.0\n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS

OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

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=====
*\n\nimport {GPGPUProgram} from './gpgpu_math';\n\nexport class ResizeBilinearBackpropProgram implements
GPGPUProgram {\n variableNames = ['dy'];\n outputShape: number[] = [];\n userCode: string;\n\n constructor(\n dyShape: [number, number, number, number],\n inputShape: [number, number, number, number],\n alignCorners: boolean) {\n this.outputShape = inputShape;\n const [, xHeight, xWidth,] = inputShape;\n const [, yHeight, yWidth] = dyShape;\n\n // In the backwards pass, we want to find the pixels that were generated for\n // each pixel in the input image the forward pass and add the corresponding\n // coefficient from dy to the gradient (with some interpolation).\n\n const effectiveXSize: [number, number] = [\n (alignCorners\n && yHeight > 1) ? xHeight - 1 : xHeight,\n (alignCorners && yWidth > 1) ? xWidth - 1 : xWidth\n];\n\n const effectiveYSize: [number, number] = [\n (alignCorners && yHeight > 1) ? yHeight - 1 : yHeight,\n (alignCorners && yWidth > 1) ? yWidth - 1 : yWidth\n];\n\n const heightScale = effectiveXSize[0] /\n effectiveYSize[0];\n const widthScale = effectiveXSize[1] / effectiveYSize[1];\n\n const invHeightScale = 1 /\n heightScale;\n const invWidthScale = 1 / widthScale;\n\n // This defines the size of the window of values around\n a particular\n // index in dy that we want to search for contributions to dx.\n const winHeight =\n (Math.ceil(invHeightScale) * 2) + 2;\n const winWidth = (Math.ceil(invWidthScale) * 2) + 2;\n\n this.userCode =`\n void main() {\n ivec4 coords = getOutputCoords();\n int b = coords[0];\n int d = coords[3];\n int r = coords[1];\n int c = coords[2];\n\n float accumulator\n = 0.0;\n\n const float heightScale = float(${heightScale});\n const float widthScale =\n float(${widthScale});\n\n const float invHeightScale = float(${invHeightScale});\n const float\n invWidthScale = float(${invWidthScale});\n\n const int winHeight = int(${winHeight});\n const int\n winWidth = int(${winWidth});\n\n // Compute bounds for where in dy we will look\n float startRLerp =\n floor(float(r) * invHeightScale);\n int startDyR = int(startRLerp - float(winHeight / 2));\n\n float startCLerp\n = floor(float(c) * invWidthScale);\n int startDyC = int(startCLerp - float(winWidth / 2));\n\n // Loop over\n dy\n for (int dyROffset = 0; dyROffset < winHeight; dyROffset++) {\n int dyR = dyROffset +\n startDyR;\n\n // Guard against the window exceeding the bounds of dy\n if (dyR < 0 || dyR >=\n ${yHeight}) {\n continue;\n }\n\n for (int dyCOffset = 0; dyCOffset\n < winWidth; dyCOffset++) {\n int dyC = dyCOffset + startDyC;\n\n // Guard against the window\n exceeding the bounds of dy\n if (dyC < 0 || dyC >= ${yWidth}) {\n continue;\n }\n\n float dxR = float(dyR) * heightScale;\n int topDxRIndex = int(floor(dxR));\n int bottomDxRIndex =\n int(min(ceil(dxR), ${xHeight} - 1).0);\n float dxRLerp = dxR - float(topDxRIndex);\n float\n inverseDxRLerp = 1.0 - dxRLerp;\n\n float dxC = float(dyC) * widthScale;\n int leftDxCIndex =\n int(floor(dxC));\n int rightDxCIndex = int(min(ceil(dxC), ${xWidth} - 1).0);\n float dxCLerp = dxC -\n float(leftDxCIndex);\n float inverseDxClerp = 1.0 - dxCLerp;\n\n if (r == topDxRIndex && c ==\n leftDxCIndex) {\n // topLeft\n accumulator +=\n getDy(b, dyR, dyC, d) * inverseDxRLerp\n * inverseDxClerp;\n\n }\n\n if (r == topDxRIndex && c == rightDxCIndex) {\n // topRight\n accumulator +=\n getDy(b, dyR, dyC, d) * inverseDxRLerp * dxCLerp;\n }\n\n if (r == bottomDxRIndex && c ==\n leftDxCIndex) {\n // bottomLeft\n accumulator += getDy(b, dyR, dyC, d) * dxRLerp *\n inverseDxClerp;\n }\n\n if (r == bottomDxRIndex && c == rightDxCIndex) {\n //\n bottomRight\n accumulator += getDy(b, dyR, dyC, d) * dxRLerp * dxCLerp;\n }\n }\n }\n }\n }\n}

```

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// End loop over dy\n\n setOutput(accumulator);\n }\n }\n}\n", "/*\n * @license\n * Copyright
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applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\"
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport { KernelConfig, KernelFunc, ResizeBilinearGrad, ResizeBilinearGradAttrs, ResizeBilinearGradInputs,
TensorInfo } from '@tensorflow/tfjs-core';\n\nimport { MathBackendWebGL } from '../backend_webgl';\n\nimport
{ ResizeBilinearBackpropProgram } from '../resize_bilinear_backprop_gpu';\n\nexport function
resizeBilinearGrad(args: {\n inputs: ResizeBilinearGradInputs,\n backend: MathBackendWebGL,\n attrs:
ResizeBilinearGradAttrs\n}): TensorInfo {\n const { inputs, backend, attrs } = args;\n const { images, dy } = inputs;\n
const { alignCorners } = attrs;\n\n const program = new ResizeBilinearBackpropProgram(\n
 dy.shape as [number, number, number, number],\n images.shape as [number, number, number, number],
alignCorners);\n\n return backend.runWebGLProgram(program, [dy], dy.dtype);\n}\n\nexport const
resizeBilinearGradConfig: KernelConfig = {\n kernelName: ResizeBilinearGrad,\n backendName: 'webgl',\n
kernelFunc: resizeBilinearGrad as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2018 Google LLC. All
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governing permissions and\n * limitations under the
License.\n *
=====
*\n\nimport { GPGPUProgram } from './gpgpu_math';\n\nexport class ResizeNearestNeighborProgram implements
GPGPUProgram {\n variableNames = ['A'];\n outputShape: number[] = [];\n userCode: string;\n\n constructor(\n
 inputShape: [number, number, number, number], newHeight: number,\n newWidth: number, alignCorners:
boolean, halfPixelCenters: boolean) {\n const [batch, oldHeight, oldWidth, depth] = inputShape;\n
this.outputShape = [batch, newHeight, newWidth, depth];\n\n const effectiveInSize: [number, number] = [\n
 (alignCorners && newHeight > 1) ? oldHeight - 1 : oldHeight,\n (alignCorners && newWidth > 1) ? oldWidth -
1 : oldWidth\n];\n\n const effectiveOutSize: [number, number] = [\n
 (alignCorners && newHeight > 1) ?
newHeight - 1 : newHeight,\n (alignCorners && newWidth > 1) ? newWidth - 1 : newWidth\n];\n\n // When
align corners is false,
we rounds the value with floor.\n const roundBase = alignCorners ? '0.5' : '0.0';\n\n let sourceFracIndexRC:
string;\n if (halfPixelCenters) {\n sourceFracIndexRC =\n `max((vec2(yRC) + vec2(0.5)) *
effectiveInputOverOutputRatioRC` +\n `, vec2(0.0))`;\n } else {\n sourceFracIndexRC = `vec2(yRC) *
effectiveInputOverOutputRatioRC`;\n }\n this.userCode = `\n const vec2 effectiveInputOverOutputRatioRC
= vec2(\n ${effectiveInSize[0] / effectiveOutSize[0]},\n ${effectiveInSize[1] / effectiveOutSize[1]});\n
const vec2 inputShapeRC = vec2(${oldHeight}.0, ${oldWidth}.0);\n\n void main() {\n ivec4 coords =
getOutputCoords();\n int b = coords[0];\n int d = coords[3];\n ivec2 yRC = coords.yz;\n\n //
Fractional source index.\n vec2 sourceFracIndexRC = ${sourceFracIndexRC};\n\n // Compute the
coordinators of nearest neighbor point.\n ivec2 sourceNearestRC = ivec2(\n
 min(inputShapeRC - 1.0, floor(sourceFracIndexRC + ${roundBase}));\n float newValue = getA(b,
sourceNearestRC.x, sourceNearestRC.y, d);\n\n setOutput(newValue);\n }\n }\n}\n", "/*\n *
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```

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```
=====
*
\nimport {KernelConfig, KernelFunc, ResizeNearestNeighbor, ResizeNearestNeighborAttrs,
ResizeNearestNeighborInputs, TensorInfo} from '@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from
'./backend_webgl';\nimport {ResizeNearestNeighborProgram} from './resize_nearest_neighbor_gpu';\nexport
function resizeNearestNeighbor(args: {\n inputs: ResizeNearestNeighborInputs,\n backend:
MathBackendWebGL,\n attrs: ResizeNearestNeighborAttrs}): TensorInfo {\n const {inputs, backend, attrs} =
args;\n const {images} = inputs;\n const {alignCorners, halfPixelCenters, size} = attrs;\n const [newHeight,
newWidth] = size;\n const program = new ResizeNearestNeighborProgram(\n images.shape as [number,
number, number, number], newHeight, newWidth,\n alignCorners, halfPixelCenters);\n return
backend.runWebGLProgram(program, [images], images.dtype);\n}\nexport const resizeNearestNeighborConfig:
KernelConfig = {\n kernelName: ResizeNearestNeighbor,\n backendName: 'webgl',\n kernelFunc:
resizeNearestNeighbor as {} as KernelFunc\n};
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* limitations under the License.
=====
*
\nimport {GPGPUProgram} from './gpgpu_math';\nexport class ResizeNearestNeighborBackpropProgram
implements GPGPUProgram {\n variableNames = ['dy'];\n outputShape: number[] = [];\n userCode: string;\n constructor(\n dyShape: [number, number, number, number],\n inputShape: [number, number, number, number], alignCorners: boolean) {\n this.outputShape = inputShape;\n const [xHeight, xWidth,] = inputShape;\n const [yHeight, yWidth] = dyShape;\n // In the backwards pass,
we want to find the pixels that were generated for
// each pixel in the input image the forward pass and add the
corresponding
// coefficient from dy to the gradient (with some interpolation).\n const effectiveXSize:
[number, number] = [\n (alignCorners && yHeight > 1) ? xHeight - 1 : xHeight,\n (alignCorners && yWidth
> 1) ? xWidth - 1 : xWidth\n];\n const effectiveYSize: [number, number] = [\n (alignCorners && yHeight
> 1) ? yHeight - 1 : yHeight,\n (alignCorners && yWidth > 1) ? yWidth - 1 : yWidth\n];\n const
heightScale = effectiveXSize[0] / effectiveYSize[0];\n const widthScale = effectiveXSize[1] /
effectiveYSize[1];\n const invHeightScale = 1 / heightScale;\n const invWidthScale = 1 /
widthScale;\n // This defines the size of the window of values around a particular
// index in dy that we want
to search for contributions to dx.\n const winHeight = (Math.ceil(invHeightScale) * 2) + 2;\n const winWidth =
(Math.ceil(invWidthScale) * 2) + 2;\n this.userCode = `\n void main() {\n ivec4 coords =
getOutputCoords();\n int b = coords[0];\n int d = coords[3];\n int r = coords[1];\n int c =
coords[2];\n float accumulator = 0.0;\n const float heightScale = float(${heightScale});\n const
float widthScale = float(${widthScale});\n const float invHeightScale = float(${invHeightScale});\n const
float invWidthScale = float(${invWidthScale});\n const int winHeight = int(${winHeight});\n const int
winWidth = int(${winWidth});\n // Compute bounds for where in dy we will look\n float startRLerp =
floor(float(r) * invHeightScale);\n int startDyR =
int(floor(startRLerp - float(winHeight / 2)));\n float startCLerp = floor(float(c) * invWidthScale);\n int
startDyC = int(floor(startCLerp - float(winWidth / 2)));\n // Loop over dy\n for (int dyROffset = 0;
dyROffset < winHeight; dyROffset++) {\n int dyR = dyROffset + startDyR;\n // Guard against the
window exceeding the bounds of dy\n if (dyR < 0 || dyR >= ${yHeight}) {\n continue;\n }\n }\n }`
}
```

```

for (int dyCOffset = 0; dyCOffset < winWidth; dyCOffset++) {\n int dyC = dyCOffset + startDyC;\n\n// Guard against the window exceeding the bounds of dy\n if (dyC < 0 || dyC >= ${yWidth}) {\ncontinue;\n }\n float sourceFracRow =\n float(${effectiveXSize[0]}) *\n(float(dyR) / float(${effectiveYSize[0]}));\n float sourceFracCol =\n float(${effectiveXSize[1]}) *\n (float(dyC)\n/ float(${effectiveYSize[1]}));\n int sourceNearestRow = int(min(\n float(int(${xHeight}) - 1),\n ${alignCorners} ? float(round(sourceFracRow)) : float(floor(sourceFracRow)));\n int sourceNearestCol = int(min(\n float(int(${xWidth}) - 1),\n ${alignCorners} ?\nfloat(round(sourceFracCol)) : float(floor(sourceFracCol)));\n if (r ==\nsourceNearestRow && c == sourceNearestCol) {\n accumulator += getDy(b, dyR, dyC, d);\n }\n }\n // End loop over dy\n setOutput(accumulator);\n }\n }\n\n * \n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is\n * distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either\n * express or implied.\n * See the License for the specific language governing permissions and\n * limitations under\n * the License.\n * \n\n=====\n\n*\n\nimport {KernelConfig, KernelFunc, ResizeNearestNeighborGrad, ResizeNearestNeighborGradAttrs,\nResizeNearestNeighborGradInputs, TensorInfo} from '@tensorflow/tfjs-core';\nimport {MathBackendWebGL}\nfrom './backend_webgl';\nimport {ResizeNearestNeighborBackpropProgram} from\n './resize_nearest_neighbor_backprop_gpu';\n\nexport function resizeNearestNeighborGrad(args: {\n inputs:\nResizeNearestNeighborGradInputs,\n backend: MathBackendWebGL,\n attrs:\nResizeNearestNeighborGradAttrs\n}): TensorInfo {\n const {inputs, backend, attrs} =\nargs;\n const {images, dy} = inputs;\n const {alignCorners} = attrs;\n\n const program = new\nResizeNearestNeighborBackpropProgram(\n dy.shape as [number, number, number, number],\n images.shape\nas [number, number, number, number], alignCorners);\n return backend.runWebGLProgram(program, [dy,\ndy.dtype]);\n}\n\nexport const resizeNearestNeighborGradConfig: KernelConfig = {\n kernelName:\nResizeNearestNeighborGrad,\n backendName: 'webgl',\n kernelFunc: resizeNearestNeighborGrad as {} as\nKernelFunc\n};\n\n * \n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n * Licensed under the\n * Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the\n * License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n * on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR\n * CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing\n * permissions and\n * limitations under the License.\n * \n\n=====\n\n*\n\nimport {GPGPUProgram} from './gpgpu_math';\nimport {getCoordsDataType} from\n './shader_compiler';\n\nexport class ReverseProgram implements GPGPUProgram {\n variableNames = ['x'];\n outputShape: number[];\n userCode: string;\n\n constructor(xShape: number[], axis: number[]) {\n const rank =\nxShape.length;\n if (rank > 4) {\n throw new Error(\n `WebGL backend: Reverse of rank-${rank} tensor\nis not yet supported`);\n }\n this.outputShape = xShape;\n\n if (rank === 1) {\n this.userCode = `\nvoid main() {\n int coord = getOutputCoords();\n setOutput(getX(${xShape[0]} - coord - 1));\n }\n`;\n return;\n }\n\n const getInCoord = (i: number) => {\n if (axis.indexOf(i)\n!==- 1 && xShape[i] !== 1) {\n return `${xShape[i]} - coords[${i}] - 1`;\n }\n return `coords[${i}]`;\n};\n\n const inCoords = xShape.map((_, i) => getInCoord(i)).join(',');\n const type =\ngetCoordsDataType(rank);\n\n this.userCode = `\nvoid main() {\n ${type} coords = getOutputCoords();\n`

```



setOutput(getX(\${inCoords}));\n } \n `;\n }\n}\n", "/\*\n \* @license\n \* Copyright 2019 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the "License");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \* \n \* http://www.apache.org/licenses/LICENSE-2.0\n \* \n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an "AS IS" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\n\nimport {GPGPUProgram} from './gpgpu_math';\nimport {getChannels} from './packing_util';\nimport {getCoordsDataType} from './shader_compiler';\n\nexport class ReversePackedProgram implements GPGPUProgram {\n variableNames = ['x'];\n outputShape: number[];\n userCode: string;\n packedInputs = true;\n packedOutput = true;\n\n constructor(xShape: number[], axis: number[]) {\n const rank = xShape.length;\n if (rank > 4) {\n throw new Error(`WebGL backend: Reverse of rank-${rank} tensor is not yet supported`);\n }\n this.outputShape = xShape;\n const channels = getChannels('rc', rank);\n const nextColumn = `${channels[rank - 1]} + 1 < ${this.outputShape[rank - 1]}`;\n const nextRow = `${channels[rank - 2]} + 1 < ${this.outputShape[rank - 2]}`;\n const type = getCoordsDataType(rank);\n if (rank === 1) {\n this.userCode = `\n void main() {\n int rc = getOutputCoords();\n vec4 result = vec4(0);\n result.r = getChannel(getX(${xShape[0]} - rc - 1),\n ${xShape[0]} - rc - 1);\n if (${nextColumn}) {\n result.g = getChannel(getX(${xShape[0]} - (rc + 1) - 1),\n ${xShape[0]} - (rc + 1) - 1);\n }\n setOutput(result);\n }\n `;\n } else {\n this.userCode = `\n void main() {\n ${type} rc = getOutputCoords();\n vec4 result = vec4(0);\n result.r = ${getR(channels.slice())};\n if (${nextColumn}) {\n result.g = ${getG(channels.slice())};\n }\n if (${nextRow}) {\n result.b = ${getB(channels.slice())};\n if (${nextColumn}) {\n result.a = ${getA(channels.slice())};\n }\n }\n setOutput(result);\n }\n `;\n }\n\n function getR(channels: string[]): string {\n return getChannel(channels);\n }\n\n function getG(channels: string[]): string {\n channels[rank - 1] = '(' + channels[rank - 1] + ` + 1`;\n return getChannel(channels);\n }\n\n function getB(channels: string[]): string {\n channels[rank - 2] = '(' + channels[rank - 2] + ` + 1`;\n return getChannel(channels);\n }\n\n function getA(channels: string[]): string {\n channels[rank - 1] = '(' + channels[rank - 1] + ` + 1`;\n channels[rank - 2] = '(' + channels[rank - 2] + ` + 1`;\n return getChannel(channels);\n }\n\n function getChannel(channels: string[]): string {\n const inCoordsArray = xShape.map((_, i) => getInCoord(i, channels));\n const inCoords = inCoordsArray.join(',');\n const innerDims = inCoordsArray.slice(-2).join(',');\n return `getChannel(getX(${inCoords}), vec2(${innerDims}))`;\n }\n\n function getInCoord(i: number, channels1: string[]): string {\n if (axis.indexOf(i) !== -1 && xShape[i] !== 1) {\n return `${xShape[i]} - ${channels1[i]} - 1`;\n } else {\n return `${channels1[i]}`;\n }\n }\n }\n}\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport {env, KernelConfig, KernelFunc, Reverse, ReverseAttrs, ReverseInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from './backend_webgl';\nimport {ReverseProgram} from './reverse_gpu';\nimport {ReversePackedProgram} from './reverse_packed_gpu';\nimport {identity} from './Identity';\n\nexport function
```

```

reverse(args: {\n inputs: ReverseInputs,\n backend: MathBackendWebGL,\n attrs: ReverseAttrs\n}): TensorInfo
{\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {dims} = attrs;\n\n const xRank =
x.shape.length;\n\n const $dims = util.parseAxisParam(dims, x.shape);\n if (xRank === 0) {\n return
identity({inputs: {x}, backend});\n }\n\n const program =
env().getBool('WEBGL_PACK_ARRAY_OPERATIONS') ?\n new ReversePackedProgram(x.shape, $dims) :\n new ReverseProgram(x.shape, $dims);\n\n return backend.runWebGLProgram(program, [x],
x.dtype);\n}\n\nexport const reverseConfig: KernelConfig = {\n kernelName: Reverse,\n backendName: 'webgl',\n kernelFunc: reverse as { } as KernelFunc\n};\n", "/*\n * @license\n
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=====
*\n\nimport {backend_util} from '@tensorflow/tfjs-core';\nimport {GPGPUProgram} from
'/gpgpu_math';\n\nexport class RotateProgram implements GPGPUProgram {\n variableNames = ['Image'];\n
outputShape: number[] = [];\n userCode: string;\n\n constructor(\n imageShape: [number, number, number,
number], radians: number,\n fillValue: number|[number, number, number],\n center: number|[number,
number]) {\n const imageHeight = imageShape[1];\n const imageWidth = imageShape[2];\n const sinFactor =
Math.sin(radians).toFixed(3);\n const cosFactor = Math.cos(radians).toFixed(3);\n this.outputShape =
imageShape;\n\n const [centerX, centerY] =\n backend_util.getImageCenter(center, imageHeight,
imageWidth);\n const centerXString = centerX.toFixed(3);\n const centerYString = centerY.toFixed(3);\n let
fillSnippet = '';\n if (typeof fillValue === 'number') {\n fillSnippet = `float outputValue =
${fillValue.toFixed(2)};`\n } else {\n fillSnippet = `\n vec3 fill = vec3(${fillValue.join(',')});\n float
outputValue = fill[coords[3]];`\n }\n\n this.userCode = `\n void main() {\n ivec4 coords =
getOutputCoords();\n int x = coords[2];\n int y = coords[1];\n float coordXFloat
= (float(x) - ${centerXString}) * ${\n cosFactor} - (float(y) - ${centerYString}) * ${sinFactor};\n float
coordYFloat = (float(x) - ${centerXString}) * ${\n sinFactor} + (float(y) - ${centerYString}) * ${cosFactor};\n
int coordX = int(round(coordXFloat + ${centerXString}));\n int coordY = int(round(coordYFloat +
${centerYString}));\n ${fillSnippet}\n if(coordX >= 0 && coordX < ${imageWidth} && coordY >= 0
&& coordY < ${\n imageHeight}) {\n outputValue = getImage(coords[0], coordY, coordX, coords[3]);\n
}\n setOutput(outputValue);\n }\n `;\n }\n }\n", "/*\n * @license\n * Copyright 2020 Google LLC.
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=====
*\n\nimport {KernelConfig, Tensor4D} from '@tensorflow/tfjs-core';\nimport {RotateWithOffset,
RotateWithOffsetAttrs, RotateWithOffsetInputs} from '@tensorflow/tfjs-core';\nimport {MathBackendWebGL}
from './backend_webgl';\nimport {RotateProgram} from './rotate_gpu';\n\nexport const rotateWithOffsetConfig:
KernelConfig = {\n kernelName: RotateWithOffset,\n backendName: 'webgl',\n kernelFunc: ({inputs, attrs,
backend}) => {\n const {image} = inputs as RotateWithOffsetInputs;\n const {radians, fillValue, center} = attrs
as { } as RotateWithOffsetAttrs;\n const webglBackend = backend as MathBackendWebGL;\n\n const program = new RotateProgram(\n
(image as Tensor4D).shape, radians, fillValue, center);\n const
output = webglBackend.runWebGLProgram(program, [image], image.dtype);\n return output;\n }\n};\n", "/*\n *

```

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```
=====\n*\n\nimport {KernelConfig, Round} from '@tensorflow/tfjs-core';\nimport\n {unaryKernelFunc} from '../kernel_utils/kernel_funcs_utils';\n\nconst ROUND = \n // OpenGL ES does not\n support round function.\n // The algorithm is based on banker's rounding.\n float base = floor(x);\n if ((x - base) <\n 0.5) {\n return floor(x);\n } else if ((x - base) > 0.5) {\n return ceil(x);\n } else {\n if (mod(base, 2.0) === 0.0)\n {\n return base;\n } else {\n return base + 1.0;\n }\n }\n\nexport const round =\n unaryKernelFunc({opSnippet: ROUND});\n\nexport const roundConfig: KernelConfig = {\n kernelName:\n Round,\n backendName: 'webgl',\n kernelFunc: round,\n};\n\n/**\n * @license\n * Copyright 2018 Google LLC.\n All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this\n file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to\n in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT\n WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific\n language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport {GPGPUProgram} from './gpgpu_math';\nimport {getCoordsDataType} from\n './shader_compiler';\n\nexport class ScatterProgram implements GPGPUProgram {\n variableNames = ['updates',\n 'indices', 'defaultValue'];\n outputShape: number[];\n userCode: string;\n\n constructor(\n updateSize: number,\n sliceDim: number, indicesRank: number, updatesRank: number, strides: number[], shape: number[],\n summingDupeIndex = true) {\n this.outputShape = shape;\n const stridesType =\n getCoordsDataType(strides.length);\n const dtype = getCoordsDataType(shape.length);\n let indicesString = \";\n if (indicesRank\n === 1) {\n indicesString = 'i';\n } else if (indicesRank === 2) {\n indicesString = 'i, j';\n }\n const\n indicesSnippet = `getIndices(${indicesString})`;\n let updatesString = \";\n if (updatesRank === 1) {\n updatesString = 'i';\n } else if (updatesRank === 2) {\n updatesString = 'i, coords[1]';\n }\n const\n updatesSnippet = `getUpdates(${updatesString})`;\n const strideString = sliceDim > 1 ? 'strides[j] : 'strides';\n this.userCode = `\n ${stridesType} strides = ${stridesType}(${strides});\n void main() {\n ${dtype}\n coords = getOutputCoords();\n float sum = 0.0;\n bool found = false;\n for (int i = 0; i <\n ${updateSize}; i++) {\n int flattenedIndex = 0;\n for (int j = 0; j < ${sliceDim}; j++) {\n int\n index = round(${indicesSnippet});\n flattenedIndex += index * ${strideString};\n }\n if\n (flattenedIndex == coords[0])\n {\n sum += ${updatesSnippet};\n found = true;\n }\n }\n setOutput(mix(getDefaultValue(), sum, float(found)));\n }\n `;\n }\n\n /**\n * @license\n * Copyright\n 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport {backend_util, KernelConfig, KernelFunc, ScatterNd, ScatterNdAttrs,
```

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ScatterNdInputs, TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from
'./backend_webgl';\nimport {ScatterProgram} from './scatter_gpu';\nimport {reshape} from './Reshape';\n\nexport
function scatterNd(args: {\n inputs: ScatterNdInputs,\n backend: MathBackendWebGL,\n attrs:
ScatterNdAttrs\n}): TensorInfo {\n const {inputs, backend, attrs} = args;\n const {indices, updates} = inputs;\n
const {shape} = attrs;\n\n const {sliceRank, numUpdates, sliceSize, strides, outputSize} =\n
backend_util.calculateShapes(updates, indices, shape);\n\n const flattenShape = [outputSize / sliceSize,
sliceSize];\n\n if (outputSize === 0) {\n return backend.makeTensorInfo(shape, indices.dtype);\n }\n\n const
flattenIndices = reshape(\n {inputs: {x: indices}, backend, attrs: {shape: [numUpdates, sliceRank]}});\n const
flattenX = reshape(\n {inputs: {x: updates}, backend, attrs: {shape: [numUpdates, sliceSize]}});\n\n const
defaultValue = backend.makeTensorInfo(\n
 [], 'float32', new Float32Array([0])); // scalar(0)\n const program = new ScatterProgram(\n numUpdates,
sliceRank, flattenIndices.shape.length, flattenX.shape.length,\n strides, flattenShape);\n const res =
backend.runWebGLProgram(\n program, [flattenX, flattenIndices, defaultValue], flattenX.dtype);\n\n const
reshaped = reshape({inputs: {x: res}, backend, attrs: {shape}});\n\n backend.disposeIntermediateTensorInfo(flattenIndices);\n
backend.disposeIntermediateTensorInfo(flattenX);\n backend.disposeIntermediateTensorInfo(res);\n backend.disposeIntermediateTensorInfo(defaultValue);\n\n return
reshaped;\n}\n\nexport const scatterNdConfig: KernelConfig = {\n kernelName: ScatterNd,\n backendName:
'webgl',\n kernelFunc: scatterNd as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2017 Google LLC.
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distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n */
=====\n
*/\nimport {GPGPUProgram} from './gpgpu_math';\nimport {getCoordsDataType} from
'./shader_compiler';\n\nexport class SelectProgram implements GPGPUProgram {\n variableNames = ['c', 'a', 'b'];\n
outputShape: number[];\n userCode: string;\n\n constructor(cRank: number, shape: number[], rank: number) {\n
this.outputShape = shape;\n\n let cCoords;\n let abCoords;\n if (rank > 4) {\n throw Error(`Where for rank
${rank} is not yet supported`);\n }\n\n if (rank === 1) {\n abCoords = `resRC`;\n cCoords = `resRC`;\n } else {\n const currentCoords =
['resRC.x', 'resRC.y', 'resRC.z', 'resRC.w'];\n const cCoordVars = [];\n const abCoordVars = [];\n for (let i
= 0; i < shape.length; i++) {\n abCoordVars.push(`${currentCoords[i]}`);\n if (i < cRank) {\n
cCoordVars.push(`${currentCoords[i]}`);\n }\n }\n cCoords = cCoordVars.join();\n abCoords =
abCoordVars.join();\n }\n\n const dtype = getCoordsDataType(rank);\n\n this.userCode = `\n void main()\n
{\n ${dtype} resRC = getOutputCoords();\n float cVal = getC(${cCoords});\n if (cVal >= 1.0) {\n
setOutput(getA(${abCoords}));\n } else {\n setOutput(getB(${abCoords}));\n }\n}\n`;\n
}\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache
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not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n */
=====\n
*/\nimport {KernelConfig, KernelFunc, Select, SelectInputs, TensorInfo, upcastType} from '@tensorflow/tfjs-core';\n
import {MathBackendWebGL} from './backend_webgl';\nimport {SelectProgram} from

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./select_gpu';\n\nexport function select(args: {inputs: SelectInputs, backend: MathBackendWebGL}):\nTensorInfo {\n const {inputs, backend} = args;\n const {condition, t, e} = inputs;\n\n const program =\n new\n SelectProgram(condition.shape.length,\n t.shape, t.shape.length);\n return backend.runWebGLProgram(\n program, [condition, t, e], upcastType(t.dtype,\n e.dtype));\n}\n\nexport const selectConfig: KernelConfig = {\n kernelName: Select,\n backendName: 'webgl',\n kernelFunc: select as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights\n * Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file\n * except in compliance with the License.\n * You may obtain a copy of the License at\n *

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=====*\n\n*/\n\nimport {backend_util, KernelConfig, Selu} from '@tensorflow/tfjs-core';\nimport {unaryKernelFunc} from\n './kernel_utils/kernel_funcs_utils';\n\nconst SELU =`\n // Stable and Attracting Fixed Point (0, 1) for Normalized\n // Weights.\n // see: https://arxiv.org/abs/1706.02515\n float scaleAlpha =\n ${backend_util.SELU_SCALEALPHA};\n float scale = ${backend_util.SELU_SCALE};\n return (x >= 0.0) ?\n scale * x : scaleAlpha * (exp(x) - 1.0);\n`;\n\nexport const selu = unaryKernelFunc({opSnippet: SELU});\n\nexport\n const seluConfig: KernelConfig = {\n kernelName: Selu,\n backendName: 'webgl',\n kernelFunc:\n selu,\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the\n * Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the\n * License.\n * You may obtain a copy of the License at\n *

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=====*\n\n*/\n\nimport {KernelConfig, Sigmoid} from '@tensorflow/tfjs-core';\nimport {unaryKernelFunc} from\n './kernel_utils/kernel_funcs_utils';\n\nconst SIGMOID =`\n return 1.0 / (1.0 + exp(-1.0 * x));\n`;\n\nexport const sigmoid = unaryKernelFunc({opSnippet: SIGMOID});\n\nexport const sigmoidConfig: KernelConfig = {\n kernelName: Sigmoid,\n backendName: 'webgl',\n kernelFunc: sigmoid,\n};\n\n"/**\n * @license\n * Copyright\n * 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License\n * at\n *

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=====*\n\n*/\n\nimport {KernelConfig, Sign} from '@tensorflow/tfjs-core';\nimport {unaryKernelFunc} from\n './kernel_utils/kernel_funcs_utils';\n\n// Sign does not propagate NaNs.\nconst SIGN =`\n if (isnan(x)) { return\n 0.0; }\n return sign(x);\n`;\n\nexport const sign = unaryKernelFunc({opSnippet: SIGN});\n\nexport const\n signConfig: KernelConfig = {\n kernelName: Sign,\n backendName: 'webgl',\n kernelFunc: sign,\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License,\n * Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may\n * obtain a copy of the License at\n *

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=====*\n\n*/

```

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=====
*\n\nimport {KernelConfig, Sin} from '@tensorflow/tfjs-core';\n\nimport {CHECK_NAN_SNIPPET_UNARY,
unaryKernelFunc} from './kernel_utils/kernel_funcs_utils';\n\nconst SIN = CHECK_NAN_SNIPPET_UNARY +
\n return sin(x);\n`;\n\nexport const sin = unaryKernelFunc({opSnippet: SIN});\n\nexport const sinConfig:
KernelConfig = {\n kernelName: Sin,\n backendName: 'webgl',\n kernelFunc:
sin,\n};\n", "/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache
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may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required
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BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {KernelConfig, Sinh} from '@tensorflow/tfjs-core';\nimport {unaryKernelFunc} from
'./kernel_utils/kernel_funcs_utils';\n\nconst SINH = `\n float e2x = exp(x);\n return (e2x - 1.0 / e2x) /
2.0;\n`;\n\nexport const sinh = unaryKernelFunc({opSnippet: SINH});\n\nexport
const sinhConfig: KernelConfig = {\n kernelName: Sinh,\n backendName: 'webgl',\n kernelFunc:
sinh,\n};\n", "/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless
required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====
*\n\nimport {KernelConfig, Softplus} from '@tensorflow/tfjs-core';\nimport {unaryKernelFunc} from
'./kernel_utils/kernel_funcs_utils';\n\nconst SOFTPLUS
= `\n float epsilon = 1.1920928955078125e-7;\n float threshold = log(epsilon) + 2.0;\n bool too_large = x > -
threshold;\n bool too_small = x < threshold;\n\n float result;\n float exp_x = exp(x);\n\n if (too_large){\n result
= x;\n }\n else if (too_small){\n result = exp_x;\n }\n else{\n result = log(exp_x + 1.0);\n }\n return
result;\n`;\n\nexport const softplus = unaryKernelFunc({opSnippet: SOFTPLUS});\n\nexport const softplusConfig:
KernelConfig = {\n kernelName: Softplus,\n backendName: 'webgl',\n kernelFunc: softplus,\n};\n", "/**\n *
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2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a
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IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {backend_util, KernelConfig, KernelFunc, SpaceToBatchND, SpaceToBatchNDAttrs,
SpaceToBatchNDInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from
'./backend_webgl';\n\nimport {padV2} from './PadV2';\nimport {reshape} from './Reshape';\nimport {transpose}
from './Transpose';\n\nexport const spaceToBatchND = (args: {\n inputs: SpaceToBatchNDInputs,\n backend:
MathBackendWebGL,\n attrs: SpaceToBatchNDAttrs\n}): TensorInfo => {\n const {inputs, backend, attrs} =
args;\n const {x} = inputs;\n const {blockShape, paddings} = attrs;\n\n util.assert(\n x.shape.length <= 4,\n () => 'spaceToBatchND for rank > 4 with a WebGL backend not ' +\n 'implemented
yet');\n\n const prod = blockShape.reduce((a, b) => a * b);\n\n const completePaddings: Array<[number, number]>
= [[0, 0]];\n completePaddings.push(...paddings as Array<[number, number]>);\n for (let i = 1 +
blockShape.length; i < x.shape.length; ++i) {\n completePaddings.push([0, 0]);\n }\n\n const toDispose = [];\n

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const paddedX = padV2({\n inputs: {x},\n backend,\n attrs: {paddings: completePaddings, constantValue:
0}\n });\n\n const reshapedPaddedShape =\n backend_util.getReshaped(paddedX.shape, blockShape, prod,
false);\n\n const permutedReshapedPaddedPermutation = backend_util.getPermuted(\n
reshapedPaddedShape.length, blockShape.length, false);\n\n const flattenShape =\n backend_util.getReshapedPermuted(paddedX.shape, blockShape, prod, false);\n\n const reshapedPaddedX =
reshape(\n {inputs: {x: paddedX}, backend, attrs: {shape: reshapedPaddedShape}});\n\n const paddedXT =
transpose({\n inputs: {x: reshapedPaddedX},\n backend,\n attrs: {perm: permutedReshapedPaddedPermutation}\n });\n\n const result =\n reshape({inputs:
{x: paddedXT}, backend, attrs: {shape: flattenShape}});\n\n toDispose.push(paddedX);\n
toDispose.push(reshapedPaddedX);\n toDispose.push(paddedXT);\n\n toDispose.forEach(t =>
backend.disposeIntermediateTensorInfo(t));\n\n return result;\n};\n\nexport const spaceToBatchNDConfig:
KernelConfig = {\n kernelName: SpaceToBatchND,\n backendName: 'webgl',\n kernelFunc: spaceToBatchND as
{} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
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on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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=====\n
*/\n\nimport {backend_util, KernelConfig, KernelFunc, SparseToDense, SparseToDenseAttrs,
SparseToDenseInputs, TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from
'./backend_webgl';\n\nimport {ScatterProgram} from './scatter_gpu';\n\nimport {reshape} from './Reshape';\n\nexport
function sparseToDense(args: {\n inputs: SparseToDenseInputs,\n backend: MathBackendWebGL,\n attrs:
SparseToDenseAttrs\n}): TensorInfo {\n const {inputs, backend, attrs} = args;\n const {sparseIndices,
sparseValues, defaultValue} = inputs;\n const {outputShape} = attrs;\n\n const {sliceRank, numUpdates, strides,
outputSize} =\n backend_util.calculateShapes(sparseValues, sparseIndices, outputShape);\n\n const
sumDupeIndices = false;\n\n const program = new ScatterProgram(\n numUpdates, sliceRank, sparseIndices.shape.length,\n
sparseValues.shape.length, strides, [outputSize, 1], sumDupeIndices);\n\n const res =
backend.runWebGLProgram(\n program, [sparseValues, sparseIndices, defaultValue], sparseValues.dtype);\n\n
const reshaped =\n reshape({inputs: {x: res}, backend, attrs: {shape: outputShape}});\n\n
backend.disposeIntermediateTensorInfo(res);\n return reshaped;\n}\n\nexport const sparseToDenseConfig:
KernelConfig = {\n kernelName: SparseToDense,\n backendName: 'webgl',\n kernelFunc: sparseToDense as {} as
KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
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software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {backend_util, KernelConfig, KernelFunc, SplitV, SplitVAttrs, SplitVInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from './backend_webgl';\n\nimport {slice} from
'./Slice';\n\nexport function splitV(\n args:\n {inputs: SplitVInputs, backend: MathBackendWebGL, attrs:
SplitVAttrs\n}): TensorInfo[] {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const
{numOrSizeSplits, axis} = attrs;\n\n const $axis = util.parseAxisParam(axis, x.shape)[0];\n const splitSizes =
backend_util.prepareSplitSize(x, numOrSizeSplits, $axis);\n\n const xRank = x.shape.length;\n const

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begin = new Array(xRank).fill(0);\n const size = x.shape.slice();\n\n return splitSizes.map(s => {\n const
sliceSize = [...size];\n sliceSize[$axis] = s;\n const sliceT =\n slice({inputs: {x}, backend, attrs: {begin, size:
sliceSize}});\n begin[$axis] += s;\n return sliceT;\n });\n}\n\nexport const splitVConfig: KernelConfig = {\n
kernelName: SplitV,\n backendName: 'webgl',\n kernelFunc: splitV as {} as KernelFunc\n};\n", "/*\n *
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law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License
for the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {KernelConfig, KernelFunc, Sqrt} from '@tensorflow/tfjs-core';\nimport {UnaryKernelFunc} from
'./kernel_utils/kernel_funcs_utils';\n\nconst Sqrt = `return sqrt(x)`;\n\nexport const sqrt =
UnaryKernelFunc({opSnippet: Sqrt});\n\nexport const sqrtConfig: KernelConfig = {\n kernelName: Sqrt,\n
backendName: 'webgl',\n kernelFunc: sqrt as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019
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* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License
for the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {KernelConfig, Square} from '@tensorflow/tfjs-core';\nimport {UnaryKernelFunc} from
'./kernel_utils/kernel_funcs_utils';\n\nconst Square = `return x * x`;\n\nexport const square =
UnaryKernelFunc({opSnippet: SQUARE});\n\nexport const squareConfig: KernelConfig = {\n kernelName:
Square,\n backendName: 'webgl',\n kernelFunc: square,\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC.
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {KernelConfig, KernelFunc, Step, StepAttrs, TensorInfo, UnaryInputs} from '@tensorflow/tfjs-
core';\nimport {MathBackendWebGL} from './backend_webgl';\nimport {CHECK_NAN_SNIPPET,
UnaryOpProgram} from './unaryop_gpu';\n\nexport function step(\n {inputs, attrs, backend}: {\n inputs:
UnaryInputs, attrs: StepAttrs, backend: MathBackendWebGL};\n TensorInfo {\n const {x} = inputs;\n const
opSnippet = CHECK_NAN_SNIPPET + `\n return x > 0.0 ? 1.0 : float(${attrs.alpha});\n `;\n const program =
new UnaryOpProgram(x.shape, opSnippet);\n return backend.runWebGLProgram(program, [x],
x.dtype);\n })\n\nexport const
stepConfig: KernelConfig = {\n kernelName: Step,\n backendName: 'webgl',\n kernelFunc: step as {} as
KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n * Licensed under the
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on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

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*/\n\nimport {GPGPUProgram} from './gpgpu_math';\nimport {getCoordsDataType} from
'/shader_compiler';\n\nexport class StridedSliceProgram implements GPGPUProgram
{\n variableNames = ['x'];\n outputShape: number[];\n userCode: string;\n\n constructor(begin: number[], strides:
number[], size: number[]) {\n this.outputShape = size;\n const rank = size.length;\n const inputDtype =
getCoordsDataType(size.length);\n const dtype = getCoordsDataType(size.length);\n\n let newCoords = ";\n if
(rank === 1) {\n newCoords = 'coords * strides + begin';\n } else {\n let outputAxis = 0;\n newCoords
=\n size.map((_, i) => {\n outputAxis++;\n return size.length === 1 ?\n `coords
* strides[${i}] + begin[${i}]` :\n `coords[${outputAxis - 1}] * strides[${i}] + begin[${i}]`;\n })\n .join(';');\n }\n\n this.userCode = `\n ${inputDtype} begin = ${inputDtype}(${begin});\n
${inputDtype} strides = ${inputDtype}(${strides});\n\n void main() {\n ${dtype} coords =
getOutputCoords();\n setOutput(getX(${newCoords}));\n
 }\n `;\n }\n}\n\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under
the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
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on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====
*/\n\nimport {buffer, KernelConfig, KernelFunc, Rank, slice_util, StridedSlice, StridedSliceAttrs,
StridedSliceInputs, TensorBuffer, TensorInfo, TypedArray} from '@tensorflow/tfjs-core';\nimport
{MathBackendWebGL} from './backend_webgl';\nimport
{stridedSliceImplCPU} from './kernel_utils/shared';\nimport {StridedSliceProgram} from
'./strided_slice_gpu';\nimport {reshape} from './Reshape';\nimport {slice} from './Slice';\n\nexport function
stridedSlice(args: {\n inputs: StridedSliceInputs,\n backend: MathBackendWebGL,\n attrs: StridedSliceAttrs\n}):
TensorInfo {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {\n begin,\n end,\n strides,\n beginMask,\n endMask,\n ellipsisMask,\n newAxisMask,\n shrinkAxisMask\n } = attrs;\n\n const {nonStrided, $begin, $strides, size, newShape, outShape} =\n slice_util.sliceInfo(\n x.shape, begin,
end, strides, beginMask, endMask, ellipsisMask,\n newAxisMask, shrinkAxisMask);\n\n const $x =
reshape({inputs: {x}, backend, attrs: {shape: newShape}});\n\n let result;\n if (nonStrided) {\n const sliced =\n slice({inputs: {x: $x}, backend, attrs: {begin: $begin, size}});\n result = reshape({inputs:
{x: sliced}, backend, attrs: {shape: outShape}});\n\n backend.disposeIntermediateTensorInfo(sliced);\n } else if
(outShape.some(axis => axis === 0)) {\n result = backend.makeTensorInfo(outShape, x.dtype, []);\n } else {\n const
shouldExecuteOnCPU = backend.shouldExecuteOnCPU([$x]);\n if (shouldExecuteOnCPU) {\n const
xTexData = backend.texData.get($x.dataId);\n const values = xTexData.values as TypedArray;\n const xBuf
= buffer($x.shape, $x.dtype, values) as TensorBuffer<Rank>;\n const resultValues =\n stridedSliceImplCPU(outShape, xBuf, $strides, $begin);\n result = backend.makeTensorInfo(outShape, $x.dtype,
resultValues.values);\n } else {\n const program = new StridedSliceProgram($begin, $strides, outShape);\n result = backend.runWebGLProgram(program, [$x], $x.dtype);\n }\n }\n\n const resultReshaped =\n reshape({inputs: {x: result}, backend, attrs: {shape: outShape}});\n\n backend.disposeIntermediateTensorInfo($x);\n
 backend.disposeIntermediateTensorInfo(result);\n\n return resultReshaped;\n}\n\nexport const stridedSliceConfig:
KernelConfig = {\n kernelName: StridedSlice,\n backendName: 'webgl',\n kernelFunc: stridedSlice as {\n KernelFunc\n };
}\n\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
=====

```

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```
=====\n*\n\nimport { KernelConfig,\n Tan } from '@tensorflow/tfjs-core';\nimport { unaryKernelFunc } from '../kernel_utils/kernel_funcs_utils';\nconst TAN = `return tan(x)`;\nexport const tan = unaryKernelFunc({opSnippet: TAN});\nexport const tanConfig:\n KernelConfig = {\n kernelName: Tan,\n backendName: 'webgl',\n kernelFunc: tan,\n };`;\n\n/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n*\n\nimport { KernelConfig, Tanh } from '@tensorflow/tfjs-core';\nimport { unaryKernelFunc } from\n '../kernel_utils/kernel_funcs_utils';\nconst TANH = `\n float e2x = exp(-2.0 * abs(x));\n return sign(x) * (1.0 -\n e2x) / (1.0 + e2x);\n`;\nexport const tanh = unaryKernelFunc({opSnippet: TANH});\nexport const tanhConfig:\n KernelConfig = {\n kernelName: Tanh,\n backendName: 'webgl',\n kernelFunc: tanh,\n };`;\n\n/**\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the\n * License for the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n*\n\nimport { GPGPUProgram } from './gpgpu_math';\nimport { getCoordsDataType } from\n './shader_compiler';\nexport class TileProgram implements GPGPUProgram {\n variableNames = ['A'];\n outputShape: number[];\n userCode: string;\n rank: number;\n\n constructor(aShape: number[], reps: number[]) {\n const outputShape: number[] = new Array(aShape.length);\n for (let i = 0; i < outputShape.length; i++) {\n outputShape[i] = aShape[i] * reps[i];\n }\n this.outputShape = outputShape;\n this.rank =\n outputShape.length;\n const dtype = getCoordsDataType(this.rank);\n const sourceCoords =\n getSourceCoords(aShape);\n this.userCode = `\n void main() {\n ${dtype} resRC = getOutputCoords();\n setOutput(getA(${sourceCoords}));\n }\n`;\n\n function getSourceCoords(aShape:\n number[]): string {\n const rank = aShape.length;\n if (rank > 5) {\n throw Error(`Tile for rank ${rank} is not yet\n supported`);\n }\n if (rank === 1) {\n return `imod(resRC, ${aShape[0]}`;\n }\n const currentCoords =\n ['resRC.x', 'resRC.y', 'resRC.z', 'resRC.w', 'resRC.u'];\n const sourceCoords = [];\n for (let i = 0; i <\n aShape.length; i++) {\n sourceCoords.push(`imod(${currentCoords[i]}, ${aShape[i]}`);\n }\n return\n sourceCoords.join();\n }\n }\n\n /**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed\n * under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the\n * License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n * on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express\n * or implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n * License.\n */
```

```
=====\n*\n\nimport { buffer, KernelConfig, KernelFunc, TensorInfo, Tile, TileAttrs, TileInputs, util } from\n '@tensorflow/tfjs-core';\nimport { MathBackendWebGL } from '../backend_webgl';\nimport { tileImplCPU } from
```

```

'./kernel_utils/shared';\nimport {TileProgram} from './tile_gpu';\n\nexport function tile(\n params: {inputs:
TileInputs, backend: MathBackendWebGL, attrs: TileAttrs});\n \n TensorInfo {\n const {inputs, backend, attrs} =
params;\n const {x} = inputs;\n const {reps} = attrs;\n\n if (x.dtype === 'string') {\n // Even though string tensor
is always on CPU, just to be consistent on how\n // to access tensor data.\n const data =
backend.readSync(x.dataId) as Uint8Array[];\n const decodedData = data.map(d => util.decodeString(d));\n const buf = buffer(x.shape,
x.dtype, decodedData);\n const outBuf = tileImplCPU(buf, reps);\n return
backend.makeTensorInfo(outBuf.shape, outBuf.dtype, outBuf.values);\n }\n\n const program = new
TileProgram(x.shape, reps);\n const output = backend.runWebGLProgram(program, [x], x.dtype);\n\n return
output;\n }\n\n export const tileConfig: KernelConfig = {\n kernelName: Tile,\n backendName: 'webgl',\n kernelFunc: tile as {} as KernelFunc,\n };}\n\n /**\n * @license\n * Copyright 2020 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the 'License');\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an 'AS IS' BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *\n =====\n\n */\n\n import {KernelConfig, KernelFunc, NumericDataType, TensorInfo, TopK, TopKAttrs, TopKInputs,
TypedArray} from '@tensorflow/tfjs-core';\n\n import {MathBackendWebGL} from './backend_webgl';\n\n import
{topKImplCPU} from './kernel_utils/shared';\n\n export function topK(\n args: {inputs: TopKInputs, backend:
MathBackendWebGL, attrs: TopKAttrs});\n \n TensorInfo[] {\n const {inputs, backend, attrs} = args;\n const {x} =
inputs;\n const {k, sorted} = attrs;\n\n const xVals = backend.readSync(x.dataId) as TypedArray;\n const
[allTopKVals, allTopKIndices] =\n topKImplCPU(xVals, x.shape, x.dtype as NumericDataType, k, sorted);\n\n return [\n backend.makeTensorInfo(\n allTopKVals.shape, allTopKVals.dtype, allTopKVals.values),\n backend.makeTensorInfo(\n allTopKIndices.shape, allTopKIndices.dtype, allTopKIndices.values)\n];\n }\n\n export const topKConfig: KernelConfig = {\n kernelName: TopK,\n backendName: 'webgl',\n kernelFunc: topK as {} as KernelFunc,\n };}\n\n /**\n * @license\n * Copyright 2020 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the License);\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an AS IS BASIS,\n * WITHOUT WARRANTIES OR
CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing
permissions and\n * limitations under the License.\n *\n =====\n\n */\n\n import {KernelConfig, KernelFunc, TensorInfo, Unique, UniqueAttrs, UniqueInputs} from '@tensorflow/tfjs-
core';\n\n import {MathBackendWebGL}
from './backend_webgl';\n\n import {uniqueImplCPU} from './kernel_utils/shared';\n\n import {assertNotComplex}
from './webgl_util';\n\n export function unique(\n args: {\n inputs: UniqueInputs, attrs: UniqueAttrs, backend:
MathBackendWebGL});\n \n TensorInfo[] {\n const {inputs, attrs, backend} = args;\n const {axis} = attrs;\n const
{x} = inputs;\n assertNotComplex(x, 'unique');\n\n // For now, always forward calculation to the CPU backend.\n console.warn(\n 'WARNING: '\n 'UI might be locked temporarily as data is being downloaded');\n const
values = backend.readSync(x.dataId);\n const {outputValues, outputShape, indices} =\n uniqueImplCPU(values,
axis, x.shape, x.dtype);\n return [\n backend.makeTensorInfo(outputShape, x.dtype, outputValues),\n backend.makeTensorInfo([indices.length], 'int32', indices),\n];\n }\n\n export const uniqueConfig: KernelConfig =
{\n kernelName: Unique,\n backendName: 'webgl',\n kernelFunc: unique as {}
as KernelFunc,\n };}\n\n /**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under
the Apache License, Version 2.0 (the 'License');\n * you may not use this file except in compliance with the

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```
=====\n*\n\nimport {KernelConfig, KernelFunc, TensorInfo, Unpack, UnpackAttrs, UnpackInputs} from\n '@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from './backend_webgl';\nimport {reshape} from './Reshape';\nimport {slice} from './Slice';\n\nexport function\n unpack(\n args:\n {inputs: UnpackInputs, backend: MathBackendWebGL, attrs: UnpackAttrs});\n TensorInfo[] {\n const {inputs, backend, attrs} = args;\n const {value} = inputs;\n let {axis} = attrs;\n\n if (axis < 0) {\n axis += value.shape.length;\n }\n\n const x = value;\n const xRank = x.shape.length;\n\n const num =\n value.shape[axis];\n const outShape: number[] = new Array(xRank - 1);\n let outIndex = 0;\n for (let i = 0; i < xRank; i++) {\n if (i !== axis) {\n outShape[outIndex++] = x.shape[i];\n }\n }\n\n const toDispose = [];\n\n const begin = new Array(xRank).fill(0);\n const size = x.shape.slice();\n size[axis] = 1;\n const res: TensorInfo[] =\n new Array(num);\n for (let i = 0; i < res.length; i++) {\n begin[axis] = i;\n const sliced = slice({inputs: {x},\n backend, attrs: {begin, size}});\n const reshaped =\n reshape({inputs: {x: sliced}, backend, attrs: {shape:\n outShape}});\n res[i] = reshaped;\n\n toDispose.push(sliced);\n }\n\n toDispose.forEach(t => backend.disposeIntermediateTensorInfo(t));\n return res;\n }\n\nexport const\n unpackConfig: KernelConfig = {\n kernelName: Unpack,\n backendName: 'webgl',\n kernelFunc: unpack as {} as\n KernelFunc\n }; \n /*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the\n * Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the\n * License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport {backend_util} from\n '@tensorflow/tfjs-core';\nimport {GPGPUProgram} from './gpgpu_math';\n\nexport class SegmentOpProgram\n implements GPGPUProgram {\n variableNames = ['x', 'segmentIds'];\n outputShape: number[];\n userCode:\n string;\n\n constructor(\n segOpInfo: backend_util.segment_util.SegOpInfo,\n segOpType:\n 'unsortedSegmentSum') {\n const windowSize = segOpInfo.windowSize;\n const batchSize =\n segOpInfo.batchSize;\n const inSize = segOpInfo.inSize;\n const numSegments = segOpInfo.numSegments;\n\n const outSize = numSegments * Math.ceil(inSize / windowSize);\n this.outputShape = [batchSize, outSize];\n\n const initializationValue = '0.0';\n const returnValue = `sumValue`;\n\n const windowSizeNearestVec4 =\n Math.floor(windowSize / 4) * 4;\n const windowSizeVec4Remainder = windowSize % 4;\n\n const\n updateSnippet = `\n sumValue += dot(values, segFilter);\n `;\n\n let checkValueOutOfBounds = \";\n if\n (inSize % windowSize > 0) {\n checkValueOutOfBounds\n = `\n if (inIdx < 0 || inIdx >= ${inSize}) {\n return initializationValue;\n }\n `;\n }\n\n let\n checkSegmentIdOutOfBounds = \";\n if (inSize % windowSize > 0) {\n checkSegmentIdOutOfBounds = `\n if (inIdx < 0 || inIdx >= ${inSize}) {\n return -1.0;\n }\n `;\n }\n\n this.userCode = `\n const float\n initializationValue = ${initializationValue};\n\n float getValue(int batch, int inIdx) {\n ${checkValueOutOfBounds}\n return getX(batch, inIdx);\n }\n\n float getSegmentIdAtIndex(int inIdx)\n {\n ${checkSegmentIdOutOfBounds}\n return getSegmentIds(inIdx);\n }\n\n void main() {\n ivec2 coords = getOutputCoords();\n int batch = coords[0];\n int outIdx = coords[1];\n int inOffset =\n int(floor(float(outIdx) / float(\n ${numSegments})) * float(${windowSize}));\n int currentSeg =\n int(mod(float(outIdx), float(${numSegments})));`;\n }\n}
```

```

float sumValue = 0.0;\n\n for (int i = 0; i < ${windowSizeNearestVec4}; i += 4) {\n int inIdx =
inOffset + i;\n vec4 values = vec4(\n getValue(batch, inIdx),\n getValue(batch, inIdx + 1),\n getValue(batch, inIdx + 2),\n getValue(batch, inIdx + 3)\n);\n\n vec4 segFilter = vec4(\n int(getSegmentIdAtIndex(inIdx)) == currentSeg ? 1 : 0,\n int(getSegmentIdAtIndex(inIdx + 1)) ==
currentSeg ? 1 : 0,\n int(getSegmentIdAtIndex(inIdx + 2)) == currentSeg ? 1 : 0,\n int(getSegmentIdAtIndex(inIdx + 3)) == currentSeg ? 1 : 0\n);\n\n ${updateSnippet}\n }\n\n int
inIdx = inOffset + ${windowSizeNearestVec4};\n if (${windowSizeVec4Remainder} == 1) {\n vec4
values = vec4(\n getValue(batch, inIdx),\n initializationValue,\n initializationValue,\n initializationValue\n);\n\n int inIdxSeg = int(getSegmentIdAtIndex(inIdx));\n\n vec4 segFilter = vec4(\n int(getSegmentIdAtIndex(inIdx)) == currentSeg ? 1 : 0,\n 0,\n 0,\n 0\n);\n\n ${updateSnippet}\n } else if (${windowSizeVec4Remainder} == 2) {\n vec4 values = vec4(\n getValue(batch, inIdx),\n getValue(batch, inIdx + 1),\n initializationValue,\n initializationValue\n);\n\n vec4 segFilter = vec4(\n int(getSegmentIdAtIndex(inIdx)) ==
currentSeg ? 1 : 0,\n int(getSegmentIdAtIndex(inIdx + 1)) == currentSeg ? 1 : 0,\n 0,\n 0\n);\n\n ${updateSnippet}\n } else if (${windowSizeVec4Remainder} == 3) {\n vec4 values =
vec4(\n getValue(batch, inIdx),\n getValue(batch, inIdx + 1),\n getValue(batch, inIdx + 2),\n initializationValue\n);\n\n vec4 segFilter = vec4(\n int(getSegmentIdAtIndex(inIdx)) == currentSeg ? 1 : 0,\n int(getSegmentIdAtIndex(inIdx + 1)) == currentSeg ? 1 : 0,\n int(getSegmentIdAtIndex(inIdx + 2)) ==
currentSeg ? 1 : 0,\n 0\n);\n\n ${updateSnippet}\n }\n\n setOutput(${returnValue});\n}\n`;\n}\n}\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions
and\n * limitations under the License.\n *
=====\n
*/\n\nimport { backend_util, DataType, KernelConfig, KernelFunc, sumOutType, TensorInfo,
UnsortedSegmentSum, UnsortedSegmentSumAttrs, UnsortedSegmentSumInputs, util } from '@tensorflow/tfjs-
core';\n\nimport { MathBackendWebGL } from './backend_webgl';\nimport { SegmentOpProgram } from
'./segment_gpu';\nimport { range } from './Range';\nimport { reshape } from './Reshape';\nimport { tile } from
'./Tile';\nimport { transpose } from './Transpose';\n\nexport function unsortedSegmentSum(args: {\n inputs:
UnsortedSegmentSumInputs,\n backend: MathBackendWebGL,\n attrs: UnsortedSegmentSumAttrs\n}):
TensorInfo {\n const { inputs, backend, attrs } = args;\n const { x, segmentIds } = inputs;\n const { numSegments } =
attrs;\n\n const xRank = x.shape.length;\n\n const toDispose = [];\n\n let axis = 0;\n const permutation =
backend_util.getAxesPermutation([axis], xRank);\n\n let
permutedX = x;\n if (permutation != null) {\n permutedX = transpose({ inputs: { x }, backend, attrs: { perm:
permutation } });\n toDispose.push(permutedX);\n axis = backend_util.getInnerMostAxes(1, xRank)[0];\n }\n\n const outShape = backend_util.segment_util.computeOutShape(\n permutedX.shape, axis, numSegments);\n const inSize = util.sizeFromShape([permutedX.shape[axis]]);\n const a2D =\n reshape({ inputs: { x: permutedX },
backend, attrs: { shape: [-1, inSize] } });\n toDispose.push(a2D);\n\n const outputDType =
sumOutType(x.dtype);\n\n const segOpCompute =\n (x: TensorInfo, segOpType: 'unsortedSegmentSum',
segmentIds: TensorInfo,\n dtype: DataType, numSegments: number): TensorInfo => {\n const batchSize =
x.shape[0];\n const inSize = x.shape[1];\n const windowSize =\n backend_util.segment_util.segOpComputeOptimalWindowSize(\n inSize, numSegments);\n const
segOpInfo = { windowSize, inSize, batchSize, numSegments };\n

```

```

const program = new SegmentOpProgram(segOpInfo, segOpType);\n const output =
backend.compileAndRun(program, [x, segmentIds], dtype);\n toDispose.push(output);\n // No need to run
another GPGPU program.\n if (output.shape[1] === numSegments) {\n return output;\n }\n const
rangeInfo = range({\n backend,\n attrs: {start: 0, stop: numSegments, step: 1, dtype: 'float32'}\n });\n
const tileInfo = tile({\n inputs: {x: rangeInfo},\n backend,\n attrs: {reps: [inSize /
windowSize]}\n });\n toDispose.push(rangeInfo);\n toDispose.push(tileInfo);\n const result =\n segOpCompute(output, segOpType, tileInfo, dtype, numSegments);\n return result;\n};\nconst
segOpResult = segOpCompute(\n a2D, 'unsortedSegmentSum', segmentIds, outputDType, numSegments);\n\n
const reshaped =\n reshape({inputs: {x: segOpResult},
backend, attrs: {shape: outShape}});\n\n
let result = reshaped;\n if (permutation != null) {\n
toDispose.push(reshaped);\n const perm = backend_util.getUndoAxesPermutation(permutation);\n result =
transpose({inputs: {x: result}, backend, attrs: {perm}});\n }\n\n
toDispose.forEach(t =>
backend.disposeIntermediateTensorInfo(t);\n return result;\n}\n\n
export const unsortedSegmentSumConfig:
KernelConfig = {\n kernelName: UnsortedSegmentSum,\n backendName: 'webgl',\n kernelFunc:
unsortedSegmentSum as {} as KernelFunc\n};\n\n
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software\n * distributed under the License is distributed on an 'AS IS' BASIS,\n
* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License
for the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\n
import {KernelConfig, registerKernel} from '@tensorflow/tfjs-core';\n\n
import {_fusedMatMulConfig} from
'./kernels/_FusedMatMul';\n\n
import {absConfig} from './kernels/Abs';\n\n
import {acosConfig} from
'./kernels/Acos';\n\n
import {acoshConfig} from './kernels/Acosh';\n\n
import {addConfig} from './kernels/Add';\n\n
import {addNConfig} from './kernels/AddN';\n\n
import {allConfig} from './kernels/All';\n\n
import {anyConfig} from
'./kernels/Any';\n\n
import {argMaxConfig} from './kernels/ArgMax';\n\n
import {argMinConfig} from
'./kernels/ArgMin';\n\n
import {asinConfig} from './kernels/Asin';\n\n
import {asinhConfig} from
'./kernels/Asinh';\n\n
import {atanConfig} from './kernels/Atan';\n\n
import {atan2Config} from
'./kernels/Atan2';\n\n
import {atanhConfig}
from './kernels/Atanh';\n\n
import {avgPoolConfig} from './kernels/AvgPool';\n\n
import {avgPool3DConfig} from
'./kernels/AvgPool3D';\n\n
import {avgPoolGrad3DConfig} from './kernels/AvgPool3DGrad';\n\n
import
{avgPoolGradConfig} from './kernels/AvgPoolGrad';\n\n
import {batchMatMulConfig} from
'./kernels/BatchMatMul';\n\n
import {batchNormConfig} from './kernels/BatchNorm';\n\n
import
{batchToSpaceNDConfig} from './kernels/BatchToSpaceND';\n\n
import {bincountConfig} from
'./kernels/Bincount';\n\n
import {castConfig} from './kernels/Cast';\n\n
import {ceilConfig} from './kernels/Ceil';\n\n
import
{clipByValueConfig} from './kernels/ClipByValue';\n\n
import {complexConfig} from './kernels/Complex';\n\n
import
{complexAbsConfig} from './kernels/ComplexAbs';\n\n
import {concatConfig} from './kernels/Concat';\n\n
import
{conv2DConfig} from './kernels/Conv2D';\n\n
import {conv2DBackpropFilterConfig} from
'./kernels/Conv2DBackpropFilter';\n\n
import {conv2DBackpropInputConfig} from
'./kernels/Conv2DBackpropInput';\n\n
import {conv3DConfig} from
'./kernels/Conv3D';\n\n
import {conv3DBackpropFilterV2Config} from './kernels/Conv3DBackpropFilterV2';\n\n
import
{conv3DBackpropInputConfig} from './kernels/Conv3DBackpropInputV2';\n\n
import {cosConfig} from
'./kernels/Cos';\n\n
import {coshConfig} from './kernels/Cosh';\n\n
import {cropAndResizeConfig} from
'./kernels/CropAndResize';\n\n
import {cumsumConfig} from './kernels/Cumsum';\n\n
import {denseBincountConfig}
from './kernels/DenseBincount';\n\n
import {depthToSpaceConfig} from './kernels/DepthToSpace';\n\n
import
{depthwiseConv2dNativeConfig} from './kernels/DepthwiseConv2dNative';\n\n
import
{depthwiseConv2dNativeBackpropFilterConfig} from './kernels/DepthwiseConv2dNativeBackpropFilter';\n\n
import

```

```

{depthwiseConv2dNativeBackpropInputConfig} from './kernels/DepthwiseConv2dNativeBackpropInput';\nimport
{diagConfig} from './kernels/Diag';\nimport {dilation2DConfig} from './kernels/Dilation2D';\nimport {eluConfig}
from './kernels/Elu';\nimport {eluGradConfig} from './kernels/EluGrad';\nimport {equalConfig}
from './kernels/Equal';\nimport {erfConfig} from './kernels/Erf';\nimport {expConfig} from './kernels/Exp';\nimport
{expandDimsConfig} from './kernels/ExpandDims';\nimport {expm1Config} from './kernels/Expm1';\nimport
{fftConfig} from './kernels/FFT';\nimport {fillConfig} from './kernels/Fill';\nimport {flipLeftRightConfig} from
 './kernels/FlipLeftRight';\nimport {floorConfig} from './kernels/Floor';\nimport {floorDivConfig} from
 './kernels/FloorDiv';\nimport {fromPixelsConfig} from './kernels/FromPixels';\nimport {fusedConv2DConfig} from
 './kernels/FusedConv2D';\nimport {fusedDepthwiseConv2DConfig} from
 './kernels/FusedDepthwiseConv2D';\nimport {gatherNdConfig} from './kernels/GatherNd';\nimport
{gatherV2Config} from './kernels/GatherV2';\nimport {greaterConfig} from './kernels/Greater';\nimport
{greaterEqualConfig} from './kernels/GreaterEqual';\nimport {identityConfig} from './kernels/Identity';\nimport
{ifftConfig} from './kernels/IFFT';\nimport {imagConfig} from './kernels/Imag';\nimport
{isFiniteConfig} from './kernels/IsFinite';\nimport {isInfConfig} from './kernels/IsInf';\nimport {isNaNConfig}
from './kernels/IsNaN';\nimport {leakyReluConfig} from './kernels/LeakyRelu';\nimport {lessConfig} from
 './kernels/Less';\nimport {lessEqualConfig} from './kernels/LessEqual';\nimport {linSpaceConfig} from
 './kernels/LinSpace';\nimport {logConfig} from './kernels/Log';\nimport {log1pConfig} from
 './kernels/Log1p';\nimport {logicalAndConfig} from './kernels/LogicalAnd';\nimport {logicalNotConfig} from
 './kernels/LogicalNot';\nimport {logicalOrConfig} from './kernels/LogicalOr';\nimport {LRNConfig} from
 './kernels/LRN';\nimport {LRNGradConfig} from './kernels/LRNGrad';\nimport {maxConfig} from
 './kernels/Max';\nimport {maximumConfig} from './kernels/Maximum';\nimport {maxPoolConfig} from
 './kernels/MaxPool';\nimport {maxPool3DConfig} from './kernels/MaxPool3D';\nimport {maxPoolGrad3DConfig}
from './kernels/MaxPool3DGrad';\nimport {maxPoolGradConfig} from './kernels/MaxPoolGrad';\nimport
{maxPoolWithArgmaxConfig} from './kernels/MaxPoolWithArgmax';\nimport {meanConfig} from
 './kernels/Mean';\nimport {minConfig} from './kernels/Min';\nimport {minimumConfig} from
 './kernels/Minimum';\nimport {mirrorPadConfig} from './kernels/MirrorPad';\nimport {modConfig} from
 './kernels/Mod';\nimport {multinomialConfig} from './kernels/Multinomial';\nimport {multiplyConfig} from
 './kernels/Multiply';\nimport {negConfig} from './kernels/Neg';\nimport {nonMaxSuppressionV3Config} from
 './kernels/NonMaxSuppressionV3';\nimport {nonMaxSuppressionV4Config} from
 './kernels/NonMaxSuppressionV4';\nimport {nonMaxSuppressionV5Config} from
 './kernels/NonMaxSuppressionV5';\nimport {notEqualConfig} from './kernels/NotEqual';\nimport {oneHotConfig}
from './kernels/OneHot';\nimport {onesLikeConfig} from './kernels/OnesLike';\nimport {packConfig} from
 './kernels/Pack';\nimport {padV2Config} from './kernels/PadV2';\nimport {powConfig} from
 './kernels/Pow';\nimport {preluConfig} from './kernels/Prelu';\nimport
{prodConfig} from './kernels/Prod';\nimport {rangeConfig} from './kernels/Range';\nimport {realConfig} from
 './kernels/Real';\nimport {realDivConfig} from './kernels/RealDiv';\nimport {reciprocalConfig} from
 './kernels/Reciprocal';\nimport {reluConfig} from './kernels/Relu';\nimport {relu6Config} from
 './kernels/Relu6';\nimport {reshapeConfig} from './kernels/Reshape';\nimport {resizeBilinearConfig} from
 './kernels/ResizeBilinear';\nimport {resizeBilinearGradConfig} from './kernels/ResizeBilinearGrad';\nimport
{resizeNearestNeighborConfig} from './kernels/ResizeNearestNeighbor';\nimport
{resizeNearestNeighborGradConfig} from './kernels/ResizeNearestNeighborGrad';\nimport {reverseConfig} from
 './kernels/Reverse';\nimport {rotateWithOffsetConfig} from './kernels/RotateWithOffset';\nimport {roundConfig}
from './kernels/Round';\nimport {rsqrtConfig} from './kernels/Rsqrt';\nimport {scatterNdConfig} from
 './kernels/ScatterNd';\nimport {selectConfig} from './kernels/Select';\nimport
{seluConfig} from './kernels/Selu';\nimport {sigmoidConfig} from './kernels/Sigmoid';\nimport {signConfig} from
 './kernels/Sign';\nimport {sinConfig} from './kernels/Sin';\nimport {sinhConfig} from './kernels/Sinh';\nimport
{sliceConfig} from './kernels/Slice';\nimport {softmaxConfig} from './kernels/Softmax';\nimport {softplusConfig}
from './kernels/Softplus';\nimport {spaceToBatchNDConfig} from './kernels/SpaceToBatchND';\nimport

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{sparseToDenseConfig} from './kernels/SparseToDense';\nimport {splitVConfig} from './kernels/SplitV';\nimport
{sqrtConfig} from './kernels/Sqrt';\nimport {squareConfig} from './kernels/Square';\nimport
{squaredDifferenceConfig} from './kernels/SquaredDifference';\nimport {stepConfig} from './kernels/Step';\nimport
{stridedSliceConfig} from './kernels/StridedSlice';\nimport {subConfig} from './kernels/Sub';\nimport {sumConfig}
from './kernels/Sum';\nimport {tanConfig} from './kernels/Tan';\nimport {tanhConfig} from './kernels/Tanh';\nimport
{tileConfig}
from './kernels/Tile';\nimport {topKConfig} from './kernels/TopK';\nimport {transposeConfig} from
 './kernels/Transpose';\nimport {uniqueConfig} from './kernels/Unique';\nimport {unpackConfig} from
 './kernels/Unpack';\nimport {unsortedSegmentSumConfig} from './kernels/UnsortedSegmentSum';\nimport
{zerosLikeConfig} from './kernels/ZerosLike';\n\n// List all kernel configs here\nconst kernelConfigs:
KernelConfig[] = [\n \n LRNConfig,\n LRNGradConfig,\n _fusedMatMulConfig,\n absConfig,\n acosConfig,\n
 acoshConfig,\n addConfig,\n addNConfig,\n allConfig,\n anyConfig,\n argMaxConfig,\n argMinConfig,\n
 asinConfig,\n asinhConfig,\n atan2Config,\n atanConfig,\n atanhConfig,\n avgPool3DConfig,\n
 avgPoolConfig,\n avgPoolGrad3DConfig,\n avgPoolGradConfig,\n batchMatMulConfig,\n batchNormConfig,\n
 batchToSpaceNDConfig,\n bincountConfig,\n castConfig,\n ceilConfig,\n clipByValueConfig,\n
 complexAbsConfig,\n complexConfig,\n concatConfig,\n conv2DBackpropFilterConfig,\n
 conv2DBackpropInputConfig,\n conv2DConfig,\n conv3DBackpropFilterV2Config,\n
 conv3DBackpropInputConfig,\n conv3DConfig,\n cosConfig,\n coshConfig,\n cropAndResizeConfig,\n
 cumsumConfig,\n denseBincountConfig,\n depthToSpaceConfig,\n
 depthwiseConv2dNativeBackpropFilterConfig,\n depthwiseConv2dNativeBackpropInputConfig,\n
 depthwiseConv2dNativeConfig,\n diagConfig,\n dilation2DConfig,\n eluConfig,\n eluGradConfig,\n
 equalConfig,\n erfConfig,\n expConfig,\n expandDimsConfig,\n expm1Config,\n fftConfig,\n fillConfig,\n
 flipLeftRightConfig,\n floorConfig,\n floorDivConfig,\n fromPixelsConfig,\n fusedConv2DConfig,\n
 fusedDepthwiseConv2DConfig,\n gatherNdConfig,\n gatherV2Config,\n greaterConfig,\n greaterEqualConfig,\n
 identityConfig,\n ifftConfig,\n imagConfig,\n isFiniteConfig,\n isInfConfig,\n isNaNConfig,\n
 leakyReluConfig,\n lessConfig,\n lessEqualConfig,\n linspaceConfig,\n log1pConfig,\n logConfig,\n
 logicalAndConfig,\n logicalNotConfig,\n
 logicalOrConfig,\n maxConfig,\n maxPool3DConfig,\n maxPoolConfig,\n maxPoolGrad3DConfig,\n
 maxPoolGradConfig,\n maxPoolWithArgmaxConfig,\n maximumConfig,\n meanConfig,\n minConfig,\n
 minimumConfig,\n mirrorPadConfig,\n modConfig,\n multinomialConfig,\n multiplyConfig,\n negConfig,\n
 nonMaxSuppressionV3Config,\n nonMaxSuppressionV4Config,\n nonMaxSuppressionV5Config,\n
 notEqualConfig,\n oneHotConfig,\n onesLikeConfig,\n packConfig,\n padV2Config,\n powConfig,\n
 preluConfig,\n prodConfig,\n rangeConfig,\n realConfig,\n realDivConfig,\n reciprocalConfig,\n relu6Config,\n
 reluConfig,\n reshapeConfig,\n resizeBilinearConfig,\n resizeBilinearGradConfig,\n
 resizeNearestNeighborConfig,\n resizeNearestNeighborGradConfig,\n reverseConfig,\n rotateWithOffsetConfig,\n
 roundConfig,\n rsqrtConfig,\n scatterNdConfig,\n selectConfig,\n seluConfig,\n sigmoidConfig,\n signConfig,\n
 sinConfig,\n sinhConfig,\n sliceConfig,\n softmaxConfig,\n
 softplusConfig,\n spaceToBatchNDConfig,\n sparseToDenseConfig,\n splitVConfig,\n sqrtConfig,\n
 squareConfig,\n squaredDifferenceConfig,\n stepConfig,\n stridedSliceConfig,\n subConfig,\n sumConfig,\n
 tanConfig,\n tanhConfig,\n tileConfig,\n topKConfig,\n transposeConfig,\n uniqueConfig,\n unpackConfig,\n
 unsortedSegmentSumConfig,\n zerosLikeConfig\n];\n\nfor (const kernelConfig of kernelConfigs) {\n
 registerKernel(kernelConfig);\n}\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n *
Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the

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```
=====
*
* tslint:disable
* Properties of an Any. *
* export declare interface IAny {
* Any typeUrl *
* typeUrl?: (string|null);
* Any value *
* value?: (Uint8Array|null);
* DataType enum. *
* export enum DataType {
* 'DT_INVALID' = 0,
* 'DT_FLOAT' = 1,
* 'DT_DOUBLE' = 2,
* 'DT_INT32' = 3,
* 'DT_UINT8' = 4,
* 'DT_INT16' = 5,
* 'DT_INT8' = 6,
* 'DT_STRING' = 7,
* 'DT_COMPLEX64' = 8,
* 'DT_INT64' = 9,
* 'DT_BOOL' = 10,
* 'DT_QINT8' = 11,
* 'DT_QUINT8' = 12,
* 'DT_QINT32' = 13,
* 'DT_BFLOAT16' = 14,
* 'DT_FLOAT_REF' = 101,
* 'DT_DOUBLE_REF' = 102,
* 'DT_INT32_REF' = 103,
* 'DT_UINT8_REF' = 104,
* 'DT_INT16_REF' = 105,
* 'DT_INT8_REF' = 106,
* 'DT_STRING_REF' = 107,
* 'DT_COMPLEX64_REF' = 108,
* 'DT_INT64_REF' = 109,
* 'DT_BOOL_REF' = 110,
* 'DT_QINT8_REF' = 111,
* 'DT_QUINT8_REF' = 112,
* 'DT_QINT32_REF' = 113,
* 'DT_BFLOAT16_REF' = 114
* }
* Properties of a TensorShape. *
* export declare interface ITensorShape {
* TensorShape dim *
* dim?: (TensorShape.IDim[]|null);
* TensorShape unknownRank *
* unknownRank?: (boolean|null);
* }
* export namespace TensorShape {
* Properties of a Dim. *
* export declare interface IDim {
* Dim size *
* size?: (number|string|null);
* Dim name *
* name?: (string|null);
* }
* Properties of a Tensor. *
* export declare interface ITensor {
* Tensor dtype *
* dtype?: (DataType|null);
* Tensor tensorShape *
* tensorShape?: (ITensorShape|null);
* Tensor versionNumber *
* versionNumber?: (number|null);
* Tensor tensorContent *
* tensorContent?: (Uint8Array|null);
* Tensor floatVal *
* floatVal?: (number[]|null);
* Tensor doubleVal *
* doubleVal?: (number[]|null);
* Tensor intVal *
* intVal?: (number[]|null);
* Tensor stringVal *
* stringVal?: (Uint8Array[]|null);
* Tensor scomplexVal *
* scomplexVal?: (number[]|null);
* Tensor int64Val *
* int64Val?: ((number | string)[]|null);
* Tensor boolVal *
* boolVal?: (boolean[]|null);
* Tensor uint32Val *
* uint32Val?: (number[]|null);
* Tensor uint64Val *
* uint64Val?: ((number | string)[]|null);
* }
* Properties of an AttrValue. *
* export declare interface IAttrValue {
* AttrValue list *
* list?: (AttrValue.IListValue|null);
* AttrValue s *
* s?: (string|null);
* AttrValue i *
* i?: (number|string|null);
* AttrValue f *
* f?: (number|null);
* AttrValue b *
* b?: (boolean|null);
* AttrValue type *
* type?: (DataType|null);
* AttrValue shape *
* shape?: (ITensorShape|null);
* AttrValue tensor *
* tensor?: (ITensor|null);
* AttrValue placeholder *
* placeholder?: (string|null);
* }
* export namespace AttrValue {
* Properties of a ListValue. *
* export declare interface IListValue {
* ListValue s *
* s?: (string[]|null);
* ListValue i *
* i?: ((number | string)[]|null);
* ListValue f *
* f?: (number[]|null);
* ListValue b *
* b?: (boolean[]|null);
* ListValue type *
* type?: (DataType[]|null);
* ListValue shape *
* shape?: (ITensorShape[]|null);
* ListValue tensor *
* tensor?: (ITensor[]|null);
* ListValue func *
* func?: (INameAttrList[]|null);
* }
* Properties of a NameAttrList. *
* export declare interface INameAttrList {
* NameAttrList name *
* name?: (string|null);
* NameAttrList attr *
* attr?: ({[k: string]: IAttrValue}|null);
* }
* Properties of a NodeDef. *
* export declare interface INodeDef {
* NodeDef name *
* name?: (string|null);
* NodeDef op *
* op?: (string|null);
* NodeDef input *
* input?: (string[]|null);
* NodeDef device *
* device?: (string|null);
* NodeDef attr *
* attr?: ({[k: string]: IAttrValue}|null);
* }
* Properties of a VersionDef. *
* export declare interface IVersionDef {
* VersionDef producer *
* producer?: (number|null);
* VersionDef minConsumer *
* minConsumer?: (number|null);
* VersionDef badConsumers *
* badConsumers?: (number[]|null);
* }
* Properties of a GraphDef. *
* export declare interface IGraphDef {
* GraphDef node *
* node?: (INodeDef[]|null);
* GraphDef versions *
* versions?: (IVersionDef[]|null);
* GraphDef library *
* library?: (IFunctionDefLibrary|null);
* }
* Properties of a CollectionDef. *
* export declare interface ICollectionDef {
* CollectionDef nodeList *
* nodeList?: (CollectionDef.INodeList[]|null);
* CollectionDef bytesList *
* bytesList?: (CollectionDef.IBytesList[]|null);
* }
* CollectionDef
```

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int64List *^n int64List?: (CollectionDef.IInt64List|null);n^n /** CollectionDef floatList *^n floatList?:
(CollectionDef.IFloatList|null);n^n /** CollectionDef anyList *^n anyList?:
(CollectionDef.IAnyList|null);n^n\nexport namespace CollectionDef {n /** Properties of a NodeList. *^n export
declare interface INodeList {n /** NodeList value *^n value?: (string[]|null);n }n^n /** Properties of a
BytesList. *^n export declare interface IBytesList {n /** BytesList value *^n value?: (Uint8Array[]|null);n
}n^n /** Properties of an Int64List. *^n export declare interface IInt64List {n /** Int64List value *^n value?:
((number | string)|null);n }n^n /** Properties of a FloatList. *^n export declare interface IFloatList {n /**
FloatList value *^n value?: (number[]|null);n }n^n /** Properties of an AnyList. *^n export declare interface
IAnyList {n /** AnyList value *^n value?: (IAny[]|null);n }n}n^n/** Properties
of a SaverDef. *^n\nexport declare interface ISaverDef {n /** SaverDef filenameTensorName *^n
filenameTensorName?: (string|null);n^n /** SaverDef saveTensorName *^n saveTensorName?: (string|null);n^n
/** SaverDef restoreOpName *^n restoreOpName?: (string|null);n^n /** SaverDef maxToKeep *^n
maxToKeep?: (number|null);n^n /** SaverDef sharded *^n sharded?: (boolean|null);n^n /** SaverDef
keepCheckpointEveryNHours *^n keepCheckpointEveryNHours?: (number|null);n^n /** SaverDef version *^n
version?: (SaverDef.CheckpointFormatVersion|null);n^n}n^n\nexport namespace SaverDef {n /**
CheckpointFormatVersion enum. *^n export enum CheckpointFormatVersion { 'LEGACY' = 0, 'V1' = 1, 'V2' =
2 }n}n^n/** Properties of a TensorInfo. *^n\nexport declare interface ITensorInfo {n /** TensorInfo name *^n
name?: (string|null);n^n /** TensorInfo cooSparse *^n cooSparse?: (TensorInfo.ICooSparse|null);n^n /**
TensorInfo dtype *^n dtype?: (DataType|null);n^n /**
TensorInfo tensorShape *^n tensorShape?: (ITensorShape|null);n}n^n\nexport namespace TensorInfo {n /**
Properties of a CooSparse. *^n export declare interface ICooSparse {n /** CooSparse valuesTensorName *^n
valuesTensorName?: (string|null);n^n /** CooSparse indicesTensorName *^n indicesTensorName?:
(string|null);n^n /** CooSparse denseShapeTensorName *^n denseShapeTensorName?: (string|null);n^n
}n}n^n/** Properties of a SignatureDef. *^n\nexport declare interface ISignatureDef {n /** SignatureDef inputs
*^n inputs?: ({[k: string]: ITensorInfo}|null);n^n /** SignatureDef outputs *^n outputs?: ({[k: string]:
ITensorInfo}|null);n^n /** SignatureDef methodName *^n methodName?: (string|null);n}n^n/** Properties of an
AssetFileDef. *^n\nexport declare interface IAssetFileDef {n /** AssetFileDef tensorInfo *^n tensorInfo?:
(ITensorInfo|null);n^n /** AssetFileDef filename *^n filename?: (string|null);n}n^n/** Properties of an OpDef.
*^n\nexport
declare interface IOpDef {n /** OpDef name *^n name?: (string|null);n^n /** OpDef inputArg *^n inputArg?:
(OpDef.IArgDef[]|null);n^n /** OpDef outputArg *^n outputArg?: (OpDef.IArgDef[]|null);n^n /** OpDef attr
*^n attr?: (OpDef.IAttrDef[]|null);n^n /** OpDef deprecation *^n deprecation?:
(OpDef.IOpDeprecation|null);n^n /** OpDef summary *^n summary?: (string|null);n^n /** OpDef description
*^n description?: (string|null);n^n /** OpDef isCommutative *^n isCommutative?: (boolean|null);n^n /** OpDef
isAggregate *^n isAggregate?: (boolean|null);n^n /** OpDef isStateful *^n isStateful?: (boolean|null);n^n /**
OpDef allowsUninitializedInput *^n allowsUninitializedInput?: (boolean|null);n^n}n^n\nexport namespace OpDef {n
/** Properties of an ArgDef. *^n export declare interface IArgDef {n /** ArgDef name *^n name?:
(string|null);n^n /** ArgDef description *^n description?: (string|null);n^n /** ArgDef type *^n type?:
(DataType|null);n^n /** ArgDef typeAttr *^n typeAttr?: (string|null);n^n /** ArgDef numberAttr *^n
numberAttr?: (string|null);n^n /** ArgDef typeListAttr *^n typeListAttr?: (string|null);n^n /** ArgDef isRef
*^n isRef?: (boolean|null);n }n^n /** Properties of an AttrDef. *^n export declare interface IAttrDef {n /**
AttrDef name *^n name?: (string|null);n^n /** AttrDef type *^n type?: (string|null);n^n /** AttrDef
defaultValue *^n defaultValue?: (IAttrValue|null);n^n /** AttrDef description *^n description?:
(string|null);n^n /** AttrDef hasMinimum *^n hasMinimum?: (boolean|null);n^n /** AttrDef minimum *^n
minimum?: (number|string|null);n^n /** AttrDef allowedValues *^n allowedValues?: (IAttrValue|null);n }n^n
/** Properties of an OpDeprecation. *^n export declare interface IOpDeprecation {n /** OpDeprecation version
*^n version?: (number|null);n^n /** OpDeprecation explanation

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*\n explanation?: (string|null);\n } }\n\n** Properties of an OpList. *\nexport declare interface IOpList {\n /** OpList op *\n op?: (IOpDef[]|null);\n }\n\n** Properties of a MetaGraphDef. *\nexport declare interface IMetaGraphDef {\n /** MetaGraphDef metaInfoDef *\n metaInfoDef?: (MetaGraphDef.IMetaInfoDef|null);\n\n /** MetaGraphDef graphDef *\n graphDef?: (IGraphDef|null);\n\n /** MetaGraphDef saverDef *\n saverDef?: (ISaverDef|null);\n\n /** MetaGraphDef collectionDef *\n collectionDef?: ({[k: string]: ICollectionDef}|null);\n\n /** MetaGraphDef signatureDef *\n signatureDef?: ({[k: string]: ISignatureDef}|null);\n\n /** MetaGraphDef assetFileDef *\n assetFileDef?: (IAssetFileDef[]|null);\n }\n\nexport namespace MetaGraphDef {\n /** Properties of a MetaInfoDef. *\n export declare interface IMetaInfoDef {\n /** MetaInfoDef metaGraphVersion *\n metaGraphVersion?: (string|null);\n\n /** MetaInfoDef strippedOpList *\n strippedOpList?: (IOpList|null);\n\n /** MetaInfoDef anyInfo *\n anyInfo?: (IAny|null);\n\n /** MetaInfoDef tags *\n tags?: (string[]|null);\n\n /** MetaInfoDef tensorflowVersion *\n tensorflowVersion?: (string|null);\n\n /** MetaInfoDef tensorflowGitVersion *\n tensorflowGitVersion?: (string|null);\n } }\n\n** Properties of a SavedModel. *\nexport declare interface ISavedModel {\n /** SavedModel savedModelSchemaVersion *\n savedModelSchemaVersion?: (number|string|null);\n\n /** SavedModel metaGraphs *\n metaGraphs?: (IMetaGraphDef[]|null);\n }\n\n** Properties of a FunctionDefLibrary. *\nexport declare interface IFunctionDefLibrary {\n /** FunctionDefLibrary function *\n 'function?': (IFunctionDef[]|null);\n\n /** FunctionDefLibrary gradient *\n gradient?: (IGradientDef[]|null);\n }\n\n** Properties of a FunctionDef. *\nexport declare interface IFunctionDef {\n /** FunctionDef signature *\n signature?: (IOpDef|null);\n\n /** FunctionDef attr *\n attr?: ({[k: string]: IAttrValue}|null);\n\n /** FunctionDef nodeDef *\n nodeDef?: (INodeDef[]|null);\n\n /** FunctionDef ret *\n ret?: ({[k: string]: string}|null);\n }\n\n** Properties of a GradientDef. *\nexport declare interface IGradientDef {\n /** GradientDef functionName *\n functionName?: (string|null);\n\n /** GradientDef gradientFunc *\n gradientFunc?: (string|null);\n }\n\n**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {OpExecutor, OpMapper} from './types';\n\nconst CUSTOM_OPS: {[key: string]: OpMapper} = {};\n\n**\n * Register an Op for graph model executor. This allow you to register\n * TensorFlow custom op or override existing op.\n * Here is an example of registering a new MatMul Op.\n * ```\n * const customMatmul = (node) =>{\n * tf.matMul(\n * node.inputs[0], node.inputs[1],\n * node.attrs['transpose_a'], node.attrs['transpose_b']);\n * tf.registerOp('MatMul', customMatmul);\n * ```\n * The inputs and attrs of the node object is based on the TensorFlow op\n * registry.\n * @param name The Tensorflow Op name.\n * @param opFunc An op function which is called with the current graph node\n * during execution and needs to return a tensor or a list of tensors. The node\n * has the following attributes:\n * - attr: A map from attribute name to its value\n * - inputs: A list of input tensors\n * @doc {heading: 'Models', subheading: 'Op Registry'}\n
*\nexport function registerOp(name: string, opFunc: OpExecutor) {\n const opMapper: OpMapper = {\n tfOpName: name,\n category: 'custom',\n inputs: [],\n attrs: [],\n customExecutor: opFunc\n };\n CUSTOM_OPS[name] = opMapper;\n }\n\n**\n * Retrieve the OpMapper object for the registered op.\n * @param name The Tensorflow Op name.\n * @doc {heading: 'Models', subheading: 'Op Registry'}\n
*\nexport function getRegisteredOp(name: string): OpMapper {\n return CUSTOM_OPS[name];\n }\n\n**\n * Deregister the Op for graph model executor.\n * @param name The Tensorflow Op name.\n * @doc {heading: 'Models', subheading: 'Op Registry'}\n
*\nexport function deregisterOp(name: string) {\n delete CUSTOM_OPS[name];\n }\n\n**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n *

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*/\n\nimport {clone, Tensor, util} from '@tensorflow/tfjs-core';\n\nimport {NamedTensorsMap} from\n'../data/types';\nimport {ExecutionContext} from '../executor/execution_context';\nimport {ResourceManager}\nfrom '../executor/resource_manager';\nimport {Node, ValueType} from './types';\n\nexport function\ngetParamValue(\n paramName: string, node: Node, tensorMap: NamedTensorsMap,\n context:\n ExecutionContext, resourceManager?: ResourceManager): ValueType {\n const inputParam =\n node.inputParams[paramName];\n if (inputParam && inputParam.inputIndexStart !== undefined) {\n const start\n = inputParam.inputIndexStart;\n const end = inputParam.inputIndexEnd === 0 ?\n undefined : \n (inputParam.inputIndexEnd === undefined ? start + 1 :\n inputParam.inputIndexEnd);\n if (inputParam.type === 'tensor') {\n return getTensor(\n node.inputNames[inputParam.inputIndexStart], tensorMap, context,\n resourceManager);\n }\n if\n (inputParam.type === 'tensors') {\n const inputs = node.inputNames.slice(start, end);\n return inputs.map(\n name => getTensor(name, tensorMap, context, resourceManager));\n }\n const tensor = getTensor(\n node.inputNames.slice(start)[0], tensorMap, context, resourceManager);\n const data = tensor.dataSync();\n return inputParam.type\n === 'number' ?\n data[0] : \n util.toNestedArray(tensor.shape, data);\n }\n const attrParam =\n node.attrParams[paramName];\n return attrParam && attrParam.value;\n}\n\n/**\n * Retrieve the tensor from\n tensorsMap based on input name.\n * @param name Node input name\n * @param tensorsMap Tensors map keyed\n by the node\n * @param context contains tensors and information for running the current node.\n * @param\n resourceManager Optional. Contains global resources of the model.\n */\nexport function getTensor(\n name:\n string, tensorsMap: NamedTensorsMap, context: ExecutionContext,\n resourceManager?: ResourceManager):\n Tensor {\n const [nodeName, index] = parseNodeName(name);\n if (resourceManager !== null) {\n const tensor\n = resourceManager.getHashTableHandleByName(nodeName);\n if (tensor !== null) {\n return tensor;\n }\n }\n const contextId = context.currentContextIds.find(contextId => {\n return\n !!tensorsMap[getNodeNameWithContextId(nodeName,\n contextId)];\n });\n return contextId !== undefined ?\n tensorsMap[getNodeNameWithContextId(nodeName,\n contextId)][index] : \n undefined;\n}\n\n/**\n * Retrieve the tensors based on input name for current context.\n * @param\n name Node input name\n * @param tensorsMap Tensors map keyed by the node\n */\nexport function\ngetTensorsForCurrentContext(\n name: string, tensorsMap: NamedTensorsMap,\n context: ExecutionContext):\n Tensor[] {\n return tensorsMap[getNodeNameWithContextId(name, context.currentContextId)];\n}\n\n/**\n * Returns the node name and index from the Node input name.\n * @param\n inputName The input name of the node,\n in format of\n * node_name:output_index, i.e. MatMul:0, if the output_index is not set, it is\n * default to 0.\n */\nexport function\ngetNodeNameAndIndex(\n inputName: string, context?: ExecutionContext): [string, number]\n{\n const [nodeName, index] = parseNodeName(inputName);\n return [\n getNodeNameWithContextId(nodeName, context\n && context.currentContextId),\n index\n];\n}\n\nfunction\ngetNodeNameWithContextId(name: string,\n contextId?: string): string {\n return\n !!contextId ? `${name}-${contextId}` :\n name;\n}\n\nexport function\nparseNodeName(name: string): [string, number] {\n const parts = name.split(':');\n if (parts.length === 1) {\n return\n [name, 0];\n }\n const nodeName = parts[0];\n return\n [nodeName, Number(parts[parts.length -\n 1])];\n}\n\nexport function\nsplit(arr: number[], size: number) {\n const res = [];\n for (let i = 0; i < arr.length; i +=\n size) {\n res.push(arr.slice(i, i + size));\n }\n return\n res;\n}\n\nexport function\ngetPadding(\n node: Node,\n tensorMap: NamedTensorsMap,\n context: ExecutionContext): ValueType {\n let\n pad = getParamValue('pad',
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node, tensorMap, context);\n if (pad === 'explicit') {\n // This is 1d array, we need to convert it to 2d array\n pad = getParamValue('explicitPaddings', node, tensorMap, context);\n const explicitPadding: [\n [number, number], [number, number], [number, number], [number, number]\n] = [[0, 0], [0, 0], [0, 0], [0, 0]];\n for (let i = 0; i < 4; i++) {\n explicitPadding[i][0] = (pad as number[][i * 2]);\n explicitPadding[i][1] = (pad as number[][i * 2 + 1]);\n }\n return explicitPadding;\n }\n return pad;\n}\n\n/*\n * Reuse the tensor if it is marked as keep, otherwise clone the tensor to\n * avoid disposal. This is important for TensorArray and TensorList ops, since\n * internally they use a tensor as the id for TensorArray and TensorList, and\n * to simplify lookup, they also use Tensor.id as the key to the internal map.\n * These id tensors have been marked as kept in the backend, we need avoid clone\n * them in order to create new Tensor.id.\n * @param tensor\n */\nexport function cloneTensor(tensor: Tensor): Tensor {\n return tensor.kept ? tensor : clone(tensor);\n}\n\n/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */

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=====\n\n*\n\nimport {OpMapper} from './types';\n\nexport const json: OpMapper[] = [\n {\n 'tfOpName': 'Add',\n 'category': 'arithmetic',\n 'inputs': [\n {'start': 0, 'name': 'a', 'type': 'tensor'},\n {'start': 1, 'name': 'b', 'type': 'tensor'},\n],\n 'attrs': [\n {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n]\n },\n {\n 'tfOpName': 'AddV2',\n 'category': 'arithmetic',\n 'inputs': [\n {'start': 0, 'name': 'a', 'type': 'tensor'},\n {'start': 1, 'name': 'b', 'type': 'tensor'},\n],\n 'attrs': [\n {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n]\n },\n {\n 'tfOpName': 'AddN',\n 'category': 'arithmetic',\n 'inputs': [{\n 'start': 0, 'end': 0, 'name': 'tensors', 'type': 'tensors'}\n]\n },\n {\n 'tfOpName': 'BiasAdd',\n 'category': 'arithmetic',\n 'inputs': [\n {'start': 0, 'name': 'a', 'type': 'tensor'},\n {'start': 1, 'name': 'b', 'type': 'tensor'},\n],\n 'attrs': [\n {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true},\n {'tfName': 'data_format', 'name': 'dataFormat', 'type': 'string', 'notSupported': true}\n]\n },\n {\n 'tfOpName': 'Sub',\n 'category': 'arithmetic',\n 'inputs': [\n {'start': 0, 'name': 'a', 'type': 'tensor'},\n {'start': 1, 'name': 'b', 'type': 'tensor'},\n],\n 'attrs': [\n {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n]\n },\n {\n 'tfOpName': 'RealDiv',\n 'category': 'arithmetic',\n 'inputs': [\n {'start': 0, 'name': 'a', 'type': 'tensor'},\n {'start': 1, 'name': 'b', 'type': 'tensor'},\n],\n 'attrs': [\n {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n]\n },\n {\n 'tfOpName': 'Div',\n 'category': 'arithmetic',\n 'inputs': [\n {'start': 0, 'name': 'a', 'type': 'tensor'},\n {'start': 1, 'name': 'b', 'type': 'tensor'},\n],\n 'attrs': [\n {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n]\n },\n {\n 'tfOpName': 'DivNoNan',\n 'category': 'arithmetic',\n 'inputs': [\n {'start': 0, 'name': 'a', 'type': 'tensor'},\n {'start': 1, 'name': 'b', 'type': 'tensor'},\n],\n 'attrs': [\n {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n]\n },\n {\n 'tfOpName': 'FloorDiv',\n 'category': 'arithmetic',\n 'inputs': [\n {'start': 0, 'name': 'a', 'type': 'tensor'},\n {'start': 1, 'name': 'b', 'type': 'tensor'},\n],\n 'attrs': [\n {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n]\n },\n {\n 'tfOpName': 'Mul',\n 'category': 'arithmetic',\n 'inputs': [\n {'start': 0, 'name': 'a', 'type': 'tensor'},\n {'start': 1, 'name': 'b', 'type': 'tensor'},\n],\n 'attrs': [\n {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n]\n },\n {\n 'tfOpName': 'Maximum',\n 'category': 'arithmetic',\n 'inputs': [\n {'start': 0, 'name': 'a', 'type': 'tensor'},\n {'start': 1, 'name': 'b', 'type': 'tensor'}\n],\n 'attrs': [\n {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n]\n },\n {\n 'tfOpName': 'Minimum',\n 'category': 'arithmetic',\n 'inputs': [\n {'start': 0, 'name': 'a', 'type': 'tensor'},\n {'start': 1, 'name': 'b', 'type': 'tensor'}\n],\n 'attrs': [\n {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n]\n },\n {\n 'tfOpName': 'Pow',\n 'category': 'arithmetic',\n 'inputs': [\n {'start': 0, 'name': 'a', 'type':

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'./types';\n\n/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n
* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License
for the specific language governing permissions and\n * limitations under the License.\n *
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=====\n\n *\nimport {OpMapper} from './types';\n\nexport const json: OpMapper[] = [\n {\n 'tfOpName': 'EmptyTensorList',\n 'category': 'control',\n 'inputs': [\n {'start': 0, 'name': 'elementShape', 'type': 'shape'},\n {'start': 1, 'name': 'maxNumElements', 'type': 'number'},\n],\n 'attrs': [\n {'tfName': 'element_dtype', 'name': 'elementDType', 'type': 'dtype'}\n],\n {\n 'tfOpName': 'LoopCond',\n 'category': 'control',\n 'inputs': [{\n 'start': 0, 'name': 'pred', 'type': 'tensor'}\n]\n },\n {\n 'tfOpName': 'Switch',\n 'category': 'control',\n 'inputs': [\n {'start': 0, 'name': 'data', 'type': 'tensor'},\n {'start': 1, 'name': 'pred', 'type': 'tensor'}\n]\n },\n {\n 'tfOpName': 'Merge',\n 'category': 'control',\n 'inputs': [{\n 'start': 0, 'end': 0, 'name': 'tensors', 'type': 'tensors'}\n]\n },\n {\n 'tfOpName': 'Enter',\n 'category': 'control',\n 'inputs': [\n {'start': 0, 'name': 'tensor', 'type': 'tensor'},\n],\n 'attrs': [\n {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true},\n {'tfName': 'frame_name', 'name': 'frameName', 'type': 'string'},\n {'tfName': 'is_constant', 'name': 'isConstant', 'type': 'bool'}\n]\n },\n {\n 'tfOpName': 'Exit',\n 'category': 'control',\n 'inputs': [\n {'start': 0, 'name': 'tensor', 'type': 'tensor'},\n],\n 'attrs': [\n {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n]\n },\n {\n 'tfOpName': 'NextIteration',\n 'category': 'control',\n 'inputs': [\n {'start': 0, 'name': 'tensor', 'type': 'tensor'},\n],\n 'attrs': [\n {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n]\n },\n {\n 'tfOpName': 'TensorArrayV3',\n 'category': 'control',\n 'inputs': [\n {'start': 0, 'name': 'size', 'type': 'number'},\n],\n 'attrs': [\n {'tfName': 'dtype', 'name': 'dtype', 'type': 'dtype'},\n {'tfName': 'element_shape', 'name': 'elementShape', 'type': 'shape'},\n {'tfName': 'dynamic_size', 'name': 'dynamicSize', 'type': 'bool'},\n {'tfName': 'clear_after_read', 'name': 'clearAfterRead', 'type': 'bool'},\n {\n 'tfName': 'identical_element_shapes',\n 'name': 'identicalElementShapes',\n 'type': 'bool'\n },\n {\n 'tfName': 'tensor_array_name',\n 'name': 'name',\n 'type': 'string'\n }\n]\n },\n {\n 'tfOpName': 'TensorArrayWriteV3',\n 'category': 'control',\n 'inputs': [\n {'start': 0, 'name': 'tensorArrayId', 'type': 'tensor'},\n {'start': 1, 'name': 'index', 'type': 'number'},\n {'start': 2, 'name': 'tensor', 'type': 'tensor'},\n {\n 'start': 3, 'name': 'flowIn', 'type': 'number',\n },\n],\n 'attrs': [\n {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n]\n },\n {\n 'tfOpName': 'TensorArrayReadV3',\n 'category': 'control',\n 'inputs': [\n {'start': 0, 'name': 'tensorArrayId', 'type': 'tensor'},\n {'start': 1, 'name': 'index', 'type': 'number'},\n {\n 'start': 2, 'name': 'flowIn', 'type': 'number',\n },\n],\n 'attrs': [\n {\n 'tfName': 'dtype',\n 'name': 'dtype',\n 'type': 'dtype',\n 'notSupported': true\n }\n]\n },\n {\n 'tfOpName': 'TensorArrayGatherV3',\n
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implied.\n * See the License for the specific language governing permissions and\n
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{OpMapper} from './types';\n\n/**\n * @license\n * Copyright
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All Rights Reserved.\n * Licensed under the\n * Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the\n * License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law\n * or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n *\n *=====\n\n*/\n\nexport const json: OpMapper[] = [\n {\n 'tfOpName': 'TopKV2',\n 'category': 'evaluation',\n 'inputs': [\n
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=====
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=====
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=====
*\n\nimport {OpMapper} from '../types';\n\nexport const json: OpMapper[] = [\n {\n 'tfOpName': '_FusedMatMul',\n 'category': 'matrices',\n 'inputs': [\n {'start': 0, 'name': 'a', 'type': 'tensor'},\n {'start': 1, 'name': 'b', 'type': 'tensor'},\n {'start': 2, 'end': 0, 'name': 'args', 'type': 'tensors'},\n],\n 'attrs': [\n {'tfName': 'num_args', 'name': 'numArgs', 'type': 'number'},\n {'tfName': 'fused_ops', 'name': 'fusedOps', 'type': 'string[]', 'defaultValue': []},\n {'tfName': 'epsilon', 'name': 'epsilon', 'type': 'number', 'defaultValue': 0.0001},\n {'tfName': 'transpose_a', 'name': 'transposeA', 'type': 'bool', 'defaultValue': false},\n {'tfName': 'transpose_b', 'name': 'transposeB', 'type': 'bool', 'defaultValue': false},\n {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true},\n],\n {\n 'tfOpName': 'MatMul',\n 'category': 'matrices',\n 'inputs': [\n {'start': 0, 'name': 'a', 'type': 'tensor'},\n {'start': 1, 'name': 'b', 'type': 'tensor'},\n],\n 'attrs': [\n {'tfName': 'transpose_a', 'name': 'transposeA', 'type': 'bool', 'defaultValue': false},\n {'tfName': 'transpose_b', 'name': 'transposeB', 'type': 'bool', 'defaultValue': false},\n {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true},\n],\n {\n 'tfOpName': 'BatchMatMul',\n
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OR CONDITIONS OF ANY KIND, either express or implied.\n
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=====
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'type': 'bool',\n 'defaultValue': true,\n 'notSupported': true\n }]\n }];\n", "import {OpMapper} from

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./types';\n\n/\*\*\n \* @license\n \* Copyright 2018 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the \"License\");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \* http://www.apache.org/licenses/LICENSE-2.0\n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

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=====\n*\n\nexport const json: OpMapper[] = [\n {\n 'tfOpName': 'Bincount',\n 'category': 'reduction',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name': 'size', 'type': 'number'},\n {'start': 2, 'name': 'weights',\n 'type': 'tensor'}\n],\n {\n 'tfOpName': 'DenseBincount',\n 'category': 'reduction',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name': 'size', 'type': 'number'},\n {'start': 2, 'name': 'weights', 'type': 'tensor'}\n],\n 'attrs':\n [{ 'tfName': 'binary_output', 'name': 'binaryOutput', 'type':\n 'bool'}]\n },\n {\n 'tfOpName': 'Max',\n 'category': 'reduction',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type':\n 'tensor'},\n {'start': 1, 'name': 'axis', 'type': 'number[]'},\n],\n 'attrs': [{ 'tfName': 'keep_dims', 'name':\n 'keepDims', 'type': 'bool'}]\n },\n {\n 'tfOpName': 'Mean',\n 'category': 'reduction',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name': 'axis', 'type': 'number[]'},\n],\n 'attrs': [{ 'tfName': 'keep_dims', 'name':\n 'keepDims', 'type': 'bool'}]\n },\n {\n 'tfOpName': 'Min',\n 'category': 'reduction',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name': 'axis', 'type': 'number[]'},\n],\n 'attrs': [{ 'tfName':\n 'keep_dims', 'name': 'keepDims', 'type': 'bool'}]\n },\n {\n 'tfOpName': 'Sum',\n 'category': 'reduction',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name': 'axis', 'type':\n 'number[]'},\n],\n 'attrs': [{ 'tfName': 'keep_dims', 'name': 'keepDims', 'type': 'bool'}]\n },\n {\n 'tfOpName': 'All',\n 'category': 'reduction',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name': 'axis',\n 'type': 'number[]'},\n],\n 'attrs': [{ 'tfName': 'keep_dims', 'name': 'keepDims', 'type': 'bool'}]\n },\n {\n 'tfOpName': 'Any',\n 'category': 'reduction',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name': 'axis', 'type': 'number[]'},\n],\n 'attrs': [{ 'tfName': 'keep_dims', 'name': 'keepDims', 'type': 'bool'}]\n },\n {\n 'tfOpName': 'ArgMax',\n 'category': 'reduction',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name': 'axis', 'type': 'number'}\n]\n },\n {\n 'tfOpName': 'ArgMin',\n 'category': 'reduction',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name': 'axis', 'type': 'number'}\n]\n },\n {\n 'tfOpName': 'Prod',\n 'category': 'reduction',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name': 'axis', 'type': 'number[]'},\n],\n 'attrs':\n [{ 'tfName': 'keep_dims', 'name': 'keepDims', 'type': 'bool'}]\n },\n {\n 'tfOpName': 'Cumsum',\n 'category':\n 'reduction',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name': 'axis', 'type': 'number'},\n],\n 'attrs': [\n {'tfName': 'exclusive', 'name': 'exclusive', 'type': 'bool'},\n {'tfName': 'reverse', 'name': 'reverse',\n 'type': 'bool'}\n]\n }\n]\n];\n\nimport {OpMapper} from './types';\n\n/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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=====\n*\n\nexport const json: OpMapper[] = [\n {\n 'tfOpName': 'ConcatV2',\n 'category': 'slice_join',\n 'inputs': [\n {'start': 0, 'end': -1, 'name': 'tensors', 'type': 'tensors'},\n {'start': -1, 'name': 'axis', 'type': 'number'}\n],\n 'attrs':\n [{ 'tfName': 'N', 'name': 'n', 'type': 'number', 'defaultValue': 2}]\n },\n {\n 'tfOpName': 'Concat',\n 'category': 'slice_join',\n 'inputs': [\n {'start': 1, 'end': 0, 'name': 'tensors', 'type': 'tensors'},\n {'start': 0, 'name': 'axis', 'type':\n 'number'}\n],\n 'attrs': [{ 'tfName': 'N', 'name': 'n', 'type': 'number', 'defaultValue': 2}]\n }\n];\n\nimport {OpMapper} from './types';\n\n/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

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=====\n*\n\nexport const json: OpMapper[] = [\n {\n 'tfOpName': 'ConcatV2',\n 'category': 'slice_join',\n 'inputs': [\n {'start': 0, 'end': -1, 'name': 'tensors', 'type': 'tensors'},\n {'start': -1, 'name': 'axis', 'type': 'number'}\n],\n 'attrs':\n [{ 'tfName': 'N', 'name': 'n', 'type': 'number', 'defaultValue': 2}]\n },\n {\n 'tfOpName': 'Concat',\n 'category': 'slice_join',\n 'inputs': [\n {'start': 1, 'end': 0, 'name': 'tensors', 'type': 'tensors'},\n {'start': 0, 'name': 'axis', 'type':\n 'number'}\n],\n 'attrs': [{ 'tfName': 'N', 'name': 'n', 'type': 'number', 'defaultValue': 2}]\n }\n];\n\nimport {OpMapper} from './types';\n\n/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

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'GatherV2',\n 'category': 'slice_join',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name':
'indices', 'type': 'tensor'},\n {'start': 2, 'name': 'axis', 'type': 'number', 'defaultValue': 0}\n],\n 'attrs': [{\n
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1, 'name': 'indices', 'type': 'tensor'},\n],\n 'attrs': [{\n 'tfName': 'validate_indices',\n 'name':
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}]\n },\n {\n 'tfOpName': 'Reverse',\n 'category': 'slice_join',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type':
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]\n },\n {\n 'tfOpName': 'Slice',\n 'category': 'slice_join',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type':
'tensor'},\n {'start': 1, 'name': 'begin', 'type': 'number[]'},\n {'start': 2, 'name': 'size', 'type': 'number[]'}\n]\n
},\n {\n 'tfOpName': 'StridedSlice',\n 'category': 'slice_join',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type':
'tensor'},\n {'start': 1, 'name': 'begin', 'type': 'number[]'},\n {'start': 2, 'name': 'end', 'type': 'number[]'},\n
{'start': 3, 'name': 'strides', 'type': 'number[]'},\n],\n 'attrs':
[\n {\n 'tfName': 'begin_mask',\n 'name': 'beginMask',\n 'type': 'number',\n 'defaultValue': 0\n
},\n {\n 'tfName': 'end_mask',\n 'name': 'endMask',\n 'type': 'number',\n 'defaultValue': 0\n
},\n {\n 'tfName': 'new_axis_mask',\n 'name': 'newAxisMask',\n 'type': 'number',\n
'defaultValue': 0\n },\n {\n 'tfName': 'ellipsis_mask',\n 'name': 'ellipsisMask',\n 'type': 'number',\n
'defaultValue': 0\n },\n {\n 'tfName': 'shrink_axis_mask',\n 'name': 'shrinkAxisMask',\n 'type':
'number',\n 'defaultValue': 0\n }]\n },\n {\n 'tfOpName': 'Pack',\n 'category': 'slice_join',\n 'inputs':
[\n {'start': 0, 'end': 0, 'name': 'tensors', 'type': 'tensors'},\n],\n 'attrs': [\n {'tfName': 'axis', 'name': 'axis',
'type': 'number', 'defaultValue': 0}\n]\n },\n {\n 'tfOpName':
'Unpack',\n 'category': 'slice_join',\n 'inputs': [\n {'start': 0, 'name': 'tensor', 'type': 'tensor'},\n],\n 'attrs': [\n
{'tfName': 'axis', 'name': 'axis', 'type': 'number', 'defaultValue': 0},\n {'tfName': 'num', 'name': 'num',\n
'type': 'number',\n 'defaultValue': 0,\n 'notSupported': true\n }]\n },\n {\n 'tfOpName': 'Tile',\n
'category': 'slice_join',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name': 'reps', 'type':
'number[]'}\n]\n },\n {\n 'tfOpName': 'Split',\n 'category': 'slice_join',\n 'inputs': [\n {'start': 0, 'name':
'axis', 'type': 'number', 'defaultValue': 0},\n {'start': 1, 'name': 'x', 'type': 'tensor'},\n],\n 'attrs': [{\n
'tfName': 'num_split',\n 'name': 'numOrSizeSplits',\n 'type': 'number',\n 'defaultValue': 1\n }]\n },\n {\n
'tfOpName': 'SplitV',\n 'category': 'slice_join',\n
'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name': 'numOrSizeSplits', 'type':
'number[]'},\n {'start': 2, 'name': 'axis', 'type': 'number', 'defaultValue': 0}\n]\n },\n {\n 'tfOpName':
'ScatterNd',\n 'category': 'slice_join',\n 'inputs': [\n {'start': 0, 'name': 'indices', 'type': 'tensor'},\n {'start': 1,
'name': 'values', 'type': 'tensor'},\n {'start': 2, 'name': 'shape', 'type': 'number[]'}\n]\n },\n {\n 'tfOpName':
'GatherNd',\n 'category': 'slice_join',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name':
'indices', 'type': 'tensor'}\n]\n },\n {\n 'tfOpName': 'SparseToDense',\n 'category': 'slice_join',\n 'inputs': [\n
{'start': 0, 'name': 'sparseIndices', 'type': 'tensor'},\n {'start': 1, 'name': 'outputShape', 'type': 'number[]'},\n
{'start': 2, 'name': 'sparseValues', 'type': 'tensor'},\n {'start': 3, 'name':
'defaultValue', 'type': 'tensor'},\n],\n 'attrs': [{\n 'tfName': 'validate_indices',\n 'name': 'validateIndices',\n
'type': 'bool',\n 'defaultValue': false,\n 'notSupported': true\n }]\n }]\n },\n "import {OpMapper} from
'./types';\n\n/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
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*\n\nexport
const json: OpMapper[] = [\n {\n 'tfOpName': 'FFT',\n 'category': 'spectral',\n 'inputs': [{\n 'start': 0, 'name': 'x',
'type': 'tensor'}]\n },\n {\n 'tfOpName': 'IFFT',\n 'category': 'spectral',\n 'inputs': [{\n 'start': 0, 'name': 'x', 'type':
'tensor'}]\n },\n {\n 'tfOpName': 'RFFT',\n 'category': 'spectral',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type':
'tensor'}, {\n 'start': 1, 'name': 'fft_length', 'type': 'number',\n 'notSupported': true\n }\n]\n },\n {\n 'tfOpName': 'IRFFT',\n 'category': 'spectral',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'}, {\n
'start': 1, 'name': 'fft_length', 'type': 'number',\n 'notSupported': true\n }\n]\n
}]\n};\n", "import {OpMapper} from './types';\n\n/**\n * @license\n * Copyright 2018 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may
not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

=====
*\n\nexport const json: OpMapper[] = [\n {\n 'tfOpName': 'Cast',\n 'category': 'transformation',\n 'inputs': [\n
{'start': 0, 'name': 'x', 'type': 'tensor'},\n],\n 'attrs': [\n {\n 'tfName': 'SrcT', 'name': 'sdtype',
'type': 'dtype',\n 'notSupported': true\n },\n {\n 'tfName': 'DstT', 'name': 'dtype', 'type': 'dtype'}\n
]\n },\n {\n 'tfOpName': 'ExpandDims',\n
'category': 'transformation',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name': 'axis',
'type': 'number'}\n]\n },\n {\n 'tfOpName': 'MirrorPad',\n 'category': 'transformation',\n 'inputs': [\n
{'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name': 'padding', 'type': 'number[]'},\n],\n 'attrs': [{\n 'tfName':
'mode', 'name': 'mode', 'type': 'string'}]\n },\n {\n 'tfOpName': 'Pad',\n 'category': 'transformation',\n 'inputs':
[\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name': 'padding', 'type': 'number[]'},\n],\n 'attrs': [{\n 'tfName':
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{'start': 1, 'name': 'padding', 'type': 'number[]'},\n {\n 'start': 2, 'name': 'constantValue', 'type': 'number',\n 'defaultValue': 0\n }\n]\n },\n {\n 'tfOpName': 'Reshape',\n 'category': 'transformation',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type':
'tensor'},\n {'start': 1, 'name': 'shape', 'type': 'number[]'}\n]\n },\n {\n 'tfOpName': 'Squeeze',\n 'category':
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}]\n },\n {\n 'tfOpName': 'SpaceToBatchND',\n 'category': 'transformation',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n
{'start': 1, 'name': 'blockShape', 'type': 'number[]'},\n {'start': 2, 'name': 'paddings', 'type': 'number[]'}\n]\n },\n {\n 'tfOpName': 'BatchToSpaceND',\n 'category': 'transformation',\n 'inputs':
[\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name': 'blockShape', 'type': 'number[]'},\n {'start': 2,
'name': 'crops', 'type': 'number[]'}\n]\n },\n {\n 'tfOpName': 'DepthToSpace',\n 'category': 'transformation',\n
'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n],\n 'attrs': [\n {'tfName': 'block_size', 'name':
'blockSize', 'type': 'number'},\n {'tfName': 'data_format', 'name': 'dataFormat', 'type': 'string'}\n]\n },\n {\n
'tfOpName': 'BroadcastTo',\n 'category': 'transformation',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n
{'start': 1, 'name': 'shape', 'type': 'number[]'},\n],\n 'attrs': []\n }]\n};\n\n", "/**\n * @license\n * Copyright 2018
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may not use this file except in compliance with the License.\n * You may obtain a copy of the License
at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in
writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT
WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *

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*\n\nimport {DataType, env} from '@tensorflow/tfjs-core';\n\nimport * as tensorflow from
'./data/compiled_api';\n\nimport {getRegisteredOp} from './custom_op/register';\nimport {getNodeNameAndIndex}
from './executors/utils';\nimport * as arithmetic from './op_list/arithmetic';\nimport * as basicMath from
'./op_list/basic_math';\nimport * as control from './op_list/control';\nimport * as convolution from
'./op_list/convolution';\nimport * as creation from './op_list/creation';\nimport * as dynamic from
'./op_list/dynamic';\nimport
* as evaluation from './op_list/evaluation';\nimport * as graph from './op_list/graph';\nimport * as hashTable from
'./op_list/hash_table';\nimport * as image from './op_list/image';\nimport * as logical from './op_list/logical';\nimport
* as matrices from './op_list/matrices';\nimport * as normalization from './op_list/normalization';\nimport * as
reduction from './op_list/reduction';\nimport * as sliceJoin from './op_list/slice_join';\nimport * as spectral from
'./op_list/spectral';\nimport * as transformation from './op_list/transformation';\nimport {Graph, InputParamValue,
Node, OpMapper, ParamValue} from './types';\n\nexport class OperationMapper {\n private static _instance:
OperationMapper;\n\n private opMappers: {[key: string]: OpMapper};\n\n // Singleton instance for the mapper\n public static get Instance() {\n return this._instance || (this._instance = new this());\n }\n\n // Loads the op
mapping from the JSON file.\n private constructor() {\n const ops
= [\n arithmetic, basicMath, control, convolution, creation, dynamic,\n evaluation, logical, image, graph,
matrices, normalization, reduction,\n sliceJoin, spectral, transformation, hashTable\n];\n const mappersJson:
OpMapper[] = [].concat(...ops.map(op => op.json));\n\n this.opMappers = mappersJson.reduce<{[key: string]:
OpMapper}>((n (map, mapper: OpMapper) => {\n map[mapper.tfOpName] = mapper;\n return
map;\n },\n {});\n }\n\n // Converts the model inference graph from Tensorflow GraphDef to local\n //
representation for TensorFlow.js API\n transformGraph(\n graph: tensorflow.IGraphDef,\n signature:
tensorflow.ISignatureDef = {}): Graph {\n const tfNodes = graph.node;\n const placeholders: Node[] = [];\n
const weights: Node[] = [];\n const initNodes: Node[] = [];\n const nodes = tfNodes.reduce<{[key: string]:
Node}>((map, node) => {\n map[node.name] = this.mapNode(node);\n if (node.op.startsWith('Placeholder'))
{\n placeholders.push(map[node.name]);\n } else if (node.op === 'Const') {\n
weights.push(map[node.name]);\n } else if (node.input == null || node.input.length === 0) {\n
initNodes.push(map[node.name]);\n }\n return map;\n }, {}, {});\n\n let inputs: Node[] = [];\n const outputs:
Node[] = [];\n let inputNodeNameToKey: {[key: string]: string} = {};\n let outputNodeNameToKey: {[key:
string]: string} = {};\n if (signature != null) {\n inputNodeNameToKey =
this.mapSignatureEntries(signature.inputs);\n outputNodeNameToKey =
this.mapSignatureEntries(signature.outputs);\n }\n const allNodes = Object.keys(nodes);\n
allNodes.forEach(key => {\n const node = nodes[key];\n node.inputNames.forEach(name => {\n const
[nodeName,] = getNodeNameAndIndex(name);\n node.inputs.push(nodes[nodeName]);\n
nodes[nodeName].children.push(node);\n });\n });\n\n // if
signature has not outputs set, add any node that does not have\n // outputs.\n if
(Object.keys(outputNodeNameToKey).length === 0) {\n allNodes.forEach(key => {\n const node =
nodes[key];\n if (node.children.length === 0) {\n outputs.push(node);\n }\n });\n } else {\n
Object.keys(outputNodeNameToKey).forEach(name => {\n const [nodeName,] =
getNodeNameAndIndex(name);\n const node = nodes[nodeName];\n if (node != null) {\n
node.signatureKey = outputNodeNameToKey[name];\n outputs.push(node);\n }\n });\n\n if
(Object.keys(inputNodeNameToKey).length > 0) {\n Object.keys(inputNodeNameToKey).forEach(name => {\n
const [nodeName,] = getNodeNameAndIndex(name);\n const node = nodes[nodeName];\n if (node) {\n
node.signatureKey = inputNodeNameToKey[name];\n inputs.push(node);\n }\n });\n } else {\n
inputs = placeholders;\n
}\n\n let functions = {};\n if (graph.library != null && graph.library.function != null) {\n functions =
graph.library.function.reduce((functions, func) => {\n functions[func.signature.name] =
this.mapFunction(func);\n return functions;\n }, {} as {[key: string]: Graph});\n }\n\n const result: Graph
= {\n nodes, inputs, outputs, weights, placeholders, signature, functions;\n\n if (initNodes.length > 0) {\n

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result.initNodes = initNodes;\n }\n\n return result;\n }\n\n private mapSignatureEntries(entries: {[k: string]:\n tensorflow.ITensorInfo}) {\n return Object.keys(entries || {})\n .reduce<{[key: string]: string}>((prev, curr)\n => {\n prev[entries[curr].name] = curr;\n return prev;\n }, {});\n }\n\n private mapNode(node:\n tensorflow.INodeDef): Node {\n // Unsupported ops will cause an error at run-time (not parse time), since\n // they may not be used by the actual execution subgraph.\n\n const mapper =\n getRegisteredOp(node.op) || this.opMappers[node.op] || {} as OpMapper;\n if (node.attr\n == null) {\n node.attr = {};\n }\n\n const newNode: Node = {\n name: node.name,\n op: node.op,\n category: mapper.category,\n inputNames:\n (node.input ||\n []).map(input => input.startsWith('^') ?\n input.substr(1) : input),\n inputs: [],\n children: [],\n inputParams: {},\n attrParams: {},\n rawAttrs:\n node.attr\n };\n\n if (mapper.inputs != null) {\n newNode.inputParams =\n mapper.inputs.reduce<{[key:\n string]: InputParamValue}>((\n map, param) => {\n map[param.name] = {\n type:\n param.type,\n inputIndexStart: param.start,\n inputIndexEnd: param.end\n };\n return map;\n },\n {});\n }\n\n if (mapper.attrs != null) {\n newNode.attrParams\n =\n mapper.attrs.reduce<{[key: string]: ParamValue}>((map, param) => {\n const type = param.type;\n let value = undefined;\n switch (param.type) {\n case 'string':\n value =\n getStringParam(\n node.attr, param.tfName, param.defaultValue as string);\n if (value ===\n undefined && !!param.tfDeprecatedName) {\n value = getStringParam(\n node.attr,\n param.tfDeprecatedName,\n param.defaultValue as string);\n }\n break;\n case 'string[]':\n value = getStringArrayParam(\n node.attr, param.tfName, param.defaultValue\n as string[]);\n if (value === undefined && !!param.tfDeprecatedName) {\n value =\n getStringArrayParam(\n node.attr, param.tfDeprecatedName,\n param.defaultValue as\n string[]);\n }\n break;\n case 'number':\n value = getNumberParam(\n node.attr,\n param.tfName,\n (param.defaultValue || 0) as number);\n if (value === undefined &&\n !!param.tfDeprecatedName) {\n value = getNumberParam(\n node.attr,\n param.tfDeprecatedName,\n param.defaultValue as number);\n }\n break;\n case 'number[]':\n value = getNumericArrayParam(\n node.attr, param.tfName,\n param.defaultValue as number[]);\n if (value === undefined && !!param.tfDeprecatedName) {\n value =\n getNumericArrayParam(\n node.attr, param.tfDeprecatedName,\n param.defaultValue as number[]);\n }\n break;\n case 'bool':\n value =\n getBoolParam(\n node.attr, param.tfName, param.defaultValue as boolean);\n if (value === undefined &&\n !!param.tfDeprecatedName) {\n value = getBoolParam(\n node.attr,\n param.tfDeprecatedName,\n param.defaultValue as boolean);\n }\n break;\n case 'bool[]':\n value = getBoolArrayParam(\n node.attr, param.tfName, param.defaultValue as\n boolean[]);\n if (value === undefined && !!param.tfDeprecatedName) {\n value =\n getBoolArrayParam(\n node.attr, param.tfDeprecatedName,\n param.defaultValue as\n boolean[]);\n }\n break;\n case 'shape':\n value = getTensorShapeParam(\n node.attr, param.tfName, param.defaultValue as number[]);\n if (value === undefined &&\n !!param.tfDeprecatedName) {\n value = getTensorShapeParam(\n node.attr, param.tfDeprecatedName,\n param.defaultValue as number[]);\n }\n break;\n case 'shape[]':\n value =\n getTensorShapeArrayParam(\n node.attr, param.tfName, param.defaultValue as number[][]);\n if (value === undefined && !!param.tfDeprecatedName) {\n value =\n getTensorShapeArrayParam(\n node.attr, param.tfDeprecatedName,\n param.defaultValue as number[][]);\n }\n break;\n case 'dtype':\n value = getDtypeParam(\n node.attr, param.tfName,\n param.defaultValue as DataType);\n if (value === undefined && !!param.tfDeprecatedName) {\n value =\n getDtypeParam(\n node.attr, param.tfDeprecatedName,\n param.defaultValue

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as DataType);\n }\n break;\n case 'dtype[]':\n value = getDtypeArrayParam(\n node.attr, param.tfName, param.defaultValue as DataType[]);\n if (value === undefined &&\n !!param.tfDeprecatedName) {\n value = getDtypeArrayParam(\n node.attr,\n param.tfDeprecatedName,\n param.defaultValue as DataType[]);\n }\n break;\n case 'func':\n value = getFuncParam(\n node.attr, param.tfName, param.defaultValue as\n string);\n if (value === undefined && !!param.tfDeprecatedName) {\n value = getFuncParam(\n node.attr, param.tfDeprecatedName,\n param.defaultValue as string);\n }\n break;\n case 'tensor':\n case 'tensors':\n break;\n default:\n throw new Error(\n `Unsupported param type: ${param.type} for op:\n ${node.op}`);\n }\n map[param.name] = {value, type};\n return map;\n }, {});\n}\n\nreturn newNode;\n}\n\n// map the TFunctionDef to TFJS graph object\nprivate mapFunction(functionDef:\n tensorflow.IFunctionDef): Graph {\n const tfNodes = functionDef.nodeDef;\n const placeholders: Node[] = [];\n const weights: Node[] = [];\n let nodes: {[key: string]: Node} = {};\n if (tfNodes !== null) {\n nodes =\n tfNodes.reduce<{[key: string]: Node}>((map, node) => {\n map[node.name] = this.mapNode(node);\n if\n (node.op === 'Const') {\n weights.push(map[node.name]);\n }\n return map;\n }, {});\n }\n const inputs: Node[] = [];\n const outputs: Node[] = [];\n functionDef.signature.inputArg.forEach(arg => {\n const [nodeName,] = getNodeNameAndIndex(arg.name);\n const node: Node = {\n name: nodeName,\n op: 'Placeholder',\n inputs: [],\n inputNames: [],\n category: 'graph',\n inputParams: {},\n attrParams: {dtype: {value: parseDtypeParam(arg.type), type:\n 'dtype'}},\n children: []\n }; \n node.signatureKey = arg.name;\n inputs.push(node);\n nodes[nodeName] = node;\n });\n const allNodes = Object.keys(nodes);\n allNodes.forEach(key => {\n const node = nodes[key];\n node.inputNames.forEach(name => {\n const [nodeName,] =\n getNodeNameAndIndex(name);\n node.inputs.push(nodes[nodeName]);\n nodes[nodeName].children.push(node);\n });\n });\n const returnNodeMap = functionDef.ret;\n functionDef.signature.outputArg.forEach(output => {\n const [nodeName, index] =\n getNodeNameAndIndex(returnNodeMap[output.name]);\n const node = nodes[nodeName];\n if (node !== null)\n {\n node.defaultOutput\n = index;\n outputs.push(node);\n }\n });\n const signature = this.mapArgsToSignature(functionDef);\n return {nodes, inputs, outputs, weights, placeholders, signature};\n}\n\nprivate\nmapArgsToSignature(functionDef: tensorflow.IFunctionDef):\n tensorflow.ISignatureDef {\n return {\n methodName: functionDef.signature.name,\n inputs: functionDef.signature.inputArg.reduce(\n (map, arg)\n => {\n map[arg.name] = this.mapArgToTensorInfo(arg);\n return map;\n },\n {})\n as {[key:\n string]: tensorflow.ITensorInfo},\n outputs: functionDef.signature.outputArg.reduce(\n (map, arg) => {\n map[arg.name] = this.mapArgToTensorInfo(arg, functionDef.ret);\n return map;\n },\n {})\n as\n {[key: string]: tensorflow.ITensorInfo},\n };\n}\n\nprivate mapArgToTensorInfo(\n arg:\n tensorflow.OpDef.IArgDef,\n nameMap?: {[key: string]: string}): tensorflow.ITensorInfo\n{\n let name = arg.name;\n if (nameMap !== null) {\n name = nameMap[name];\n }\n return {name,\n dtype: arg.type};\n}\n\n\nexport function decodeBase64(text: string): string {\n const global = env().global;\n if (typeof global.atob !== 'undefined') {\n return global.atob(text);\n } else if (typeof Buffer !== 'undefined') {\n return new Buffer(text, 'base64').toString();\n } else {\n throw new Error(\n 'Unable to decode base64 in this\n environment. ' +\n 'Missing built-in atob() or Buffer()');\n }\n}\n\nexport function parseStringParam(s: []|string,\n keepCase: boolean): string {\n const value =\n Array.isArray(s) ? String.fromCharCode.apply(null, s) :\n decodeBase64(s);\n return keepCase ? value : value.toLowerCase();\n}\n\nexport function getStringParam(\n attrs: {[key: string]: tensorflow.IAttrValue}, name: string, def: string,\n keepCase = false): string {\n const param\n = attrs[name];\n if (param !== null) {\n return\n parseStringParam(param.s, keepCase);\n }\n return def;\n}\n\nexport function getBoolParam(\n attrs: {[key:\n string]: tensorflow.IAttrValue}, name: string,\n def: boolean): boolean {\n const param = attrs[name];\n return\n param ? param.b : def;\n}\n\nexport function getNumberParam(\n attrs: {[key: string]: tensorflow.IAttrValue},

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name: string,\n def: number): number {\n const param = attrs[name] || {};\n const value =\n param['i'] != null ?
param['i'] : (param['f'] != null ? param['f'] : def);\n return (typeof value === 'number') ? value : parseInt(value,
10);\n}\n\nexport function parseDtypeParam(value: string|tensorflow.DataType): DataType {\n if (typeof (value)
=== 'string') {\n // tslint:disable-next-line:no-any\n value = tensorflow.DataType[value as any];\n }\n switch
(value) {\n case tensorflow.DataType.DT_FLOAT:\n return 'float32';\n case
tensorflow.DataType.DT_INT32:\n case tensorflow.DataType.DT_INT64:\n case
tensorflow.DataType.DT_INT8:\n
 case tensorflow.DataType.DT_UINT8:\n return 'int32';\n case tensorflow.DataType.DT_BOOL:\n return
'bool';\n case tensorflow.DataType.DT_DOUBLE:\n return 'float32';\n case
tensorflow.DataType.DT_STRING:\n return 'string';\n default:\n // Unknown dtype error will happen at
runtime (instead of parse time),\n // since these nodes might not be used by the actual subgraph execution.\n
return null;\n }\n}\n\nexport function getFuncParam(\n attrs: {[key: string]: tensorflow.IAttrValue}, name:
string,\n def: string): string {\n const param = attrs[name];\n if (param && param.func) {\n return
param.func.name;\n }\n return def;\n}\n\nexport function getDtypeParam(\n attrs: {[key: string]:
tensorflow.IAttrValue}, name: string,\n def: DataType): DataType {\n const param = attrs[name];\n if (param
&& param.type) {\n return parseDtypeParam(param.type);\n }\n return def;\n}\n\nexport function
getDtypeArrayParam(\n
 attrs: {[key: string]: tensorflow.IAttrValue}, name: string,\n def: DataType[]): DataType[] {\n const param =
attrs[name];\n if (param && param.list && param.list.type) {\n return param.list.type.map(v =>
parseDtypeParam(v));\n }\n return def;\n}\n\nexport function parseTensorShapeParam(shape:
tensorflow.ITensorShape): number[]\n undefined {\n if (shape.unknownRank) {\n return undefined;\n }\n if
(shape.dim != null) {\n return shape.dim.map(\n dim =>\n (typeof dim.size === 'number') ? dim.size :
parseInt(dim.size, 10);\n);\n }\n return [];\n}\n\nexport function getTensorShapeParam(\n attrs: {[key: string]:
tensorflow.IAttrValue}, name: string,\n def?: number[]): number[]\n undefined {\n const param = attrs[name];\n if
(param && param.shape) {\n return parseTensorShapeParam(param.shape);\n }\n return def;\n}\n\nexport
function getNumericArrayParam(\n attrs: {[key: string]: tensorflow.IAttrValue}, name: string,\n def: number[]):
number[] {\n const param = attrs[name];\n if (param) {\n return ((param.list.f && param.list.f.length ?
param.list.f :\n param.list.i) ||\n [])\n .map(v => (typeof v === 'number') ?
v : parseInt(v, 10));\n }\n return def;\n}\n\nexport function getStringArrayParam(\n attrs: {[key: string]:
tensorflow.IAttrValue}, name: string, def: string[],\n keepCase = false): string[] {\n const param = attrs[name];\n
if (param && param.list && param.list.s) {\n return param.list.s.map((v) => {\n return parseStringParam(v,
keepCase);\n });\n }\n return def;\n}\n\nexport function getTensorShapeArrayParam(\n attrs: {[key: string]:
tensorflow.IAttrValue}, name: string,\n def: number[][]): number[][] {\n const param = attrs[name];\n if (param
&& param.list && param.list.shape) {\n return param.list.shape.map((v) => {\n return
parseTensorShapeParam(v);\n });\n }\n return def;\n}\n\nexport function
getBoolArrayParam(\n attrs: {[key: string]: tensorflow.IAttrValue}, name: string,\n def: boolean[]): boolean[]
{\n const param = attrs[name];\n if (param && param.list && param.list.b) {\n return param.list.b;\n }\n return
def;\n}\n\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache
License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You
may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required
by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS"
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {DataType, Tensor}
from '@tensorflow/tfjs-core';\nimport {NamedTensorsMap} from '../data/types';\nimport {ExecutionContext}
from '../executor/execution_context';\nimport {getTensor} from '../executors/utils';\nimport {getBoolArrayParam,
getBoolParam, getDtypeArrayParam, getDtypeParam, getNumberParam, getNumericArrayParam,

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getStringArrayParam, getStringParam, getTensorShapeArrayParam, getTensorShapeParam} from
'./operation_mapper';\nimport {GraphNode, Node, ValueType} from './types';\n\n/**\n * Helper class for lookup
inputs and params for nodes in the model graph.\n */\nexport class NodeValueImpl implements GraphNode {\n
public readonly inputs: Tensor[] = [];\n public readonly attrs: {[key: string]: ValueType} = {};\n constructor(\n
private node: Node, private tensorMap: NamedTensorsMap,\n private context: ExecutionContext) {\n
this.inputs = node.inputNames.map(name => this.getInput(name));\n if (node.rawAttrs != null) {\n this.attrs =
Object.keys(node.rawAttrs)\n
.reduce((attrs: {[key: string]: ValueType}, key) => {\n attrs[key] = this.getAttr(key);\n
return attrs;\n }, {});\n }\n }\n\n /**\n * Return the value of the attribute or input
param.\n * @param name String: name of attribute or input param.\n */\n private getInput(name: string): Tensor
{\n return getTensor(name, this.tensorMap, this.context);\n }\n\n /**\n * Return the value of the attribute or
input param.\n * @param name String: name of attribute or input param.\n */\n private getAttr(name: string,
defaultValue?: ValueType): ValueType {\n const value = this.node.rawAttrs[name];\n if (value.tensor != null)
{\n return getTensor(name, this.tensorMap, this.context);\n }\n if (value.i != null || value.f != null) {\n
return getNumberParam(this.node.rawAttrs, name, defaultValue as number);\n }\n if (value.s != null) {\n
return getStringParam(this.node.rawAttrs,
name, defaultValue as string);\n }\n if (value.b != null) {\n return getBoolParam(this.node.rawAttrs, name,
defaultValue as boolean);\n }\n if (value.shape != null) {\n return getTensorShapeParam(\n
this.node.rawAttrs, name, defaultValue as number[]);\n }\n if (value.type != null) {\n return
getDtypeParam(this.node.rawAttrs, name, defaultValue as DataType);\n }\n if (value.list != null) {\n if
(value.list.i != null || value.list.f != null) {\n return getNumericArrayParam(\n this.node.rawAttrs, name,
defaultValue as number[]);\n }\n if (value.list.s != null) {\n return getStringArrayParam(\n
this.node.rawAttrs, name, defaultValue as string[]);\n }\n if (value.list.shape != null) {\n return
getTensorShapeArrayParam(\n this.node.rawAttrs, name, defaultValue as number[][]);\n }\n if
(value.list.b != null) {\n return getBoolArrayParam(\n
this.node.rawAttrs, name, defaultValue as boolean[]);\n }\n if (value.list.type != null) {\n return
getDtypeArrayParam(\n this.node.rawAttrs, name, defaultValue as DataType[]);\n }\n }\n\n return
defaultValue;\n }\n}\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * \n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n */

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=====\n
*/\n\n/**\n * This file exports ops used by the converters executors. By default it\n * re-exports all ops. In a custom build this
is aliased to a file that will\n * only exports ops for a given model.json.\n */\nexport * from './ops';\n\n"/**\n *
@license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n */

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=====\n
*/\n\nimport {Tensor} from '@tensorflow/tfjs-core';\n//
tslint:disable-next-line: no-imports-from-dist\nimport * as tfOps from '@tensorflow/tfjs-
core/dist/ops/ops_for_converter';\nimport {NamedTensorsMap} from './../data/types';\nimport

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{ExecutionContext} from '../executor/execution_context';\nimport {InternalOpExecutor, Node} from
'./types';\n\nimport {getParamValue} from './utils';\n\nexport const executeOp: InternalOpExecutor =\n (node:
Node, tensorMap: NamedTensorsMap,\n context: ExecutionContext): Tensor[] => {\n switch (node.op) {\n
case 'BiasAdd':\n case 'AddV2':\n case 'Add': {\n return [tfOps.add(\n (getParamValue('a',
node, tensorMap, context) as Tensor),\n getParamValue('b', node, tensorMap, context) as Tensor)];\n
}\n case 'AddN': {\n return [tfOps.addN((\n getParamValue('tensors', node, tensorMap, context) as
Tensor[]))];\n }\n case 'FloorMod':\n case 'Mod':\n return [tfOps.mod(\n
getParamValue('a', node, tensorMap, context) as Tensor,\n getParamValue('b', node, tensorMap,
context) as Tensor)];\n case 'Mul':\n return [tfOps.mul(\n getParamValue('a', node, tensorMap,
context) as Tensor,\n getParamValue('b', node, tensorMap, context) as Tensor)];\n case 'RealDiv':\n
case 'Div': {\n return [tfOps.div(\n getParamValue('a', node, tensorMap, context) as Tensor,\n
getParamValue('b', node, tensorMap, context) as Tensor)];\n }\n case 'DivNoNan': {\n return
[tfOps.divNoNan(\n getParamValue('a', node, tensorMap, context) as Tensor,\n getParamValue('b',
node, tensorMap, context) as Tensor)];\n }\n case 'FloorDiv': {\n return [tfOps.floorDiv(\n
getParamValue('a', node, tensorMap, context) as Tensor,\n getParamValue('b', node, tensorMap, context) as
Tensor)];\n }\n case 'Sub': {\n return [tfOps.sub(\n getParamValue('a', node, tensorMap, context) as
Tensor,\n getParamValue('b', node, tensorMap, context) as Tensor)];\n }\n case 'Minimum': {\n
return [tfOps.minimum(\n getParamValue('a', node, tensorMap, context) as Tensor,\n
getParamValue('b', node, tensorMap, context) as Tensor)];\n }\n case 'Maximum': {\n return
[tfOps.maximum(\n getParamValue('a', node, tensorMap, context) as Tensor,\n getParamValue('b',
node, tensorMap, context) as Tensor)];\n }\n case 'Pow': {\n return [tfOps.pow(\n
getParamValue('a', node, tensorMap, context) as Tensor,\n getParamValue('b', node, tensorMap, context) as
Tensor)];\n }\n case 'SquaredDifference': {\n return [tfOps.squaredDifference(\n
getParamValue('a', node, tensorMap, context)
as Tensor,\n getParamValue('b', node, tensorMap, context) as Tensor)];\n }\n default:\n throw
TypeError(`Node type ${node.op} is not implemented`);\n }\n };\n\nexport const CATEGORY =
'arithmetic';\n", "/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

```

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=====\n
*\n\nimport {Tensor} from '@tensorflow/tfjs-core';\n//
tslint:disable-next-line: no-imports-from-dist\nimport * as tfOps from '@tensorflow/tfjs-
core/dist/ops/ops_for_converter';\n\nimport {NamedTensorsMap} from '../data/types';\n\nimport
{ExecutionContext} from '../executor/execution_context';\nimport {InternalOpExecutor, Node} from
'./types';\n\nimport {getParamValue, getTensor} from './utils';\n\nexport const executeOp: InternalOpExecutor =\n
(node: Node, tensorMap: NamedTensorsMap,\n context: ExecutionContext): Tensor[] => {\n switch (node.op)
{\n case 'Abs':\n case 'ComplexAbs':\n return [tfOps.abs(\n getParamValue('x', node,
tensorMap, context) as Tensor)];\n case 'Acos':\n return [tfOps.acos(\n getParamValue('x', node,
tensorMap, context) as Tensor)];\n case 'Acosh':\n return [tfOps.acosh(\n getParamValue('x', node,
tensorMap, context) as Tensor)];\n case 'Asin':\n return [tfOps.asin(\n
getParamValue('x', node, tensorMap, context) as Tensor)];\n case 'Asinh':\n return [tfOps.asinh(\n
getParamValue('x', node, tensorMap, context) as Tensor)];\n case 'Atan':\n return [tfOps.atan(\n
getParamValue('x', node, tensorMap, context) as Tensor)];\n case 'Atan2':\n return [tfOps.atan2(\n

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 getParamValue('x', node, tensorMap, context) as Tensor,\n
 as Tensor));\n case 'Atanh':\n return [tfOps.atanh(\n
 getParamValue('y', node, tensorMap, context)\n
 as Tensor));\n case 'Ceil':\n return [tfOps.ceil(\n
 getParamValue('x', node, tensorMap, context)\n
 as Tensor));\n case 'Complex':\n return [tfOps.complex(\n
 getParamValue('real', node, tensorMap,\n
 context) as Tensor,\n
 getParamValue('imag', node, tensorMap, context) as Tensor)];\n case\n
 'Cos':\n return [tfOps.cos(\n
 getParamValue('x', node, tensorMap, context) as Tensor)];\n case\n
 'Cosh':\n return [tfOps.cosh(\n
 getParamValue('x', node, tensorMap, context) as Tensor)];\n case\n
 'Elu':\n return [tfOps.elu(\n
 getParamValue('x', node, tensorMap, context) as Tensor)];\n case\n
 'Erf':\n return [tfOps.erf(\n
 getParamValue('x', node, tensorMap, context) as Tensor)];\n case\n
 'Exp':\n return [tfOps.exp(\n
 getParamValue('x', node, tensorMap, context) as Tensor)];\n case\n
 'Expm1': {\n return [tfOps.expm1(\n
 getParamValue('x', node, tensorMap, context) as Tensor)];\n
 }\n case 'Floor':\n return [tfOps.floor(\n
 getParamValue('x', node, tensorMap, context) as\n
 Tensor)];\n case 'Log':\n return [tfOps.log(\n
 getParamValue('x', node, tensorMap, context) as\n
 Tensor)];\n
 case 'Log1p': {\n return [tfOps.log1p(\n
 getParamValue('x', node, tensorMap, context) as\n
 Tensor)];\n }\n case 'Imag':\n return [tfOps.imag(\n
 getParamValue('x', node, tensorMap,\n
 context) as Tensor)];\n\n case 'Neg':\n return [tfOps.neg(\n
 getParamValue('x', node, tensorMap,\n
 context) as Tensor)];\n case 'Reciprocal': {\n return [tfOps.reciprocal(\n
 getParamValue('x', node,\n
 tensorMap, context) as Tensor)];\n }\n case 'Real':\n return [tfOps.real(\n
 getParamValue('x',\n
 node, tensorMap, context) as Tensor)];\n case 'Relu':\n return [tfOps.relu(\n
 getParamValue('x',\n
 node, tensorMap, context) as Tensor)];\n case 'Round': {\n return [tfOps.round(\n
 getParamValue('x', node, tensorMap, context) as Tensor)];\n }\n case 'Selu':\n return [tfOps.selu(\n
 getParamValue('x', node, tensorMap, context) as Tensor)];\n case 'Sigmoid':\n return\n
 [tfOps.sigmoid(\n
 getParamValue('x', node, tensorMap, context) as Tensor)];\n case 'Sin':\n return\n
 [tfOps.sin(\n
 getParamValue('x', node, tensorMap, context) as Tensor)];\n case 'Sign': {\n return\n
 [tfOps.sign(\n
 getParamValue('x', node, tensorMap, context) as Tensor)];\n }\n case 'Sinh': {\n
 return [tfOps.sinh(\n
 getParamValue('x', node, tensorMap, context) as Tensor)];\n }\n case\n
 'Softplus': {\n return [tfOps.softplus(\n
 getParamValue('x', node, tensorMap, context) as Tensor)];\n
 }\n case 'Sqrt': {\n return [tfOps.sqrt(\n
 getParamValue('x', node, tensorMap, context) as\n
 Tensor)];\n }\n case 'Square': {\n return [tfOps.square(\n
 getParamValue('x', node, tensorMap,\n
 context)\n
 as Tensor)];\n }\n case 'Tanh': {\n return [tfOps.tanh(\n
 getParamValue('x', node, tensorMap,\n
 context) as Tensor)];\n }\n case 'Tan':\n return [tfOps.tan(\n
 getParamValue('x', node,\n
 tensorMap, context) as Tensor)];\n case 'ClipByValue':\n return [tfOps.clipByValue(\n
 getParamValue('x', node, tensorMap, context) as Tensor,\n
 getParamValue('clipValueMin', node,\n
 tensorMap, context) as number,\n
 getParamValue('clipValueMax', node, tensorMap, context) as\n
 number)];\n case 'Relu6':\n return [tfOps.relu6(\n
 getParamValue('x', node, tensorMap, context) as\n
 Tensor)];\n case 'Rsqrt':\n return [tfOps.rsqrt(\n
 getTensor(node.inputNames[0], tensorMap,\n
 context))];\n case 'Prod':\n return [tfOps.prod(\n
 getParamValue('x', node, tensorMap, context) as\n
 Tensor,\n
 getParamValue('axes', node, tensorMap, context) as number[])];\n case 'LeakyRelu':\n return\n
 [tfOps.leakyRelu(\n
 getParamValue('x', node, tensorMap, context) as Tensor,\n
 getParamValue('alpha', node, tensorMap, context) as number)];\n case 'Prelu':\n return [tfOps.prelu(\n
 getParamValue('x', node, tensorMap, context) as Tensor,\n
 getParamValue('alpha', node, tensorMap,\n
 context) as Tensor)];\n default:\n throw TypeError(`Node type ${node.op} is not implemented`);\n }\n
 };\n\nexport const CATEGORY = 'basic_math';\n\n/**\n * @license\n * Copyright 2020 Google LLC. All Rights\n
 Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file\n
 except in compliance with the License.\n * You may obtain a copy of the License at\n *

```

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```
=====
*/n/**
 * This differs from util.assertShapesMatch in that it allows values of
 * negative one, an undefined size of a dimension, in a shape to match
 * anything.
 */nimport { Tensor, util } from '@tensorflow/tfjs-core';
*/n/**
 * Used by TensorList and TensorArray to verify if elementShape matches, support
 * negative value as the dimension shape.
 * @param shapeA
 * @param shapeB
 * @param errorMessagePrefix
 */nexport function
assertShapesMatchAllowUndefinedSize(shapeA: number|number[], shapeB: number|number[],
errorMessagePrefix = "): void {
 // constant shape means unknown rank
 if (typeof shapeA === 'number' ||
 typeof shapeB === 'number') {
 return;
 }
 util.assert(shapeA.length === shapeB.length,
 () =>
 errorMessagePrefix + `Shapes ${shapeA} and ${shapeB} must match`);
 for (let i = 0; i < shapeA.length; i++) {
 const dim0 = shapeA[i];
 const dim1 = shapeB[i];
 util.assert(dim0 < 0 || dim1 < 0 || dim0 === dim1,
 () =>
 errorMessagePrefix + `Shapes ${shapeA} and ${shapeB} must match`);
 }
}
*/nexport
function fullDefinedShape(elementShape: number|number[]): boolean {
 if (typeof elementShape === 'number' ||
 elementShape.some(dim => dim < 0)) {
 return false;
 }
 return true;
}
*/n/**
 * Generate the output element shape from the list elementShape, list tensors and input param.
 * @param listElementShape
 * @param tensors
 * @param elementShape
 */nexport function inferElementShape(listElementShape:
number|number[], tensors: Tensor[], elementShape: number|number[]): number[] {
 let partialShape =
 mergeElementShape(listElementShape, elementShape);
 const notfullDefinedShape =
 !fullDefinedShape(partialShape);
 if (notfullDefinedShape && tensors.length === 0) {
 throw new Error(`Tried to calculate elements of an empty list` +
 ` with non-fully-defined elementShape: ${partialShape}`);
 }
 if (notfullDefinedShape) {
 tensors.forEach(tensor => {
 partialShape =
 mergeElementShape(tensor.shape, partialShape);
 });
 }
 if (!fullDefinedShape(partialShape)) {
 throw
 new Error(`Non-fully-defined elementShape: ${partialShape}`);
 }
 return partialShape as
 number[];
}
*/nexport function mergeElementShape(elementShapeA: number|number[], elementShapeB:
number|number[]): number|number[] {
 if (typeof elementShapeA === 'number') {
 return
 elementShapeB;
 }
 if (typeof elementShapeB === 'number') {
 return elementShapeA;
 }
 if (elementShapeA.length !== elementShapeB.length) {
 throw new Error(`Incompatible
 ranks during merge: ${elementShapeA} vs. ${elementShapeB}`);
 }
 const result: number[] = [];
 for (let i = 0; i < elementShapeA.length; ++i) {
 const dim0 = elementShapeA[i];
 const dim1 =
 elementShapeB[i];
 if (dim0 >= 0 && dim1 >= 0 && dim0 !== dim1) {
 throw new Error(`Incompatible
 shape during merge: ${elementShapeA} vs. ${elementShapeB}`);
 }
 result[i] = dim0 >= 0 ? dim0 :
 dim1;
 }
 return result;
}
*/n/**
 * @license
 * Copyright 2018 Google LLC. All Rights Reserved.
 * Licensed under the Apache License, Version 2.0 (the "License");
 * you may not use this file except in
 * compliance with the License.
 * You may obtain a copy of the License at
 */n *

```

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```
=====
*/nimport { concat, DataType, keep, reshape, scalar, slice, stack, Tensor, tensor, tidy, unstack } from
 '@tensorflow/tfjs-core';
*/nimport { assertShapesMatchAllowUndefinedSize } from './tensor_utils';
*/nexport
interface TensorWithState {
 tensor?: Tensor;
 written?: boolean;
 read?: boolean;
 cleared?:
 boolean;
}
*/n/**
 * The TensorArray object keeps an array of Tensors. It allows reading from the array and
 * writing to the array.
 */nexport class TensorArray {
 private tensors: TensorWithState[] = [];
 private closed_ =

```

```

false;\n readonly idTensor: Tensor;\n constructor(\n readonly name: string, readonly dtype: DataType, private
maxSize: number,\n private elementShape: number[], readonly identicalElementShapes: boolean,\n readonly
dynamicSize: boolean,
 readonly clearAfterRead: boolean) {\n this.idTensor = scalar(0);\n keep(this.idTensor);\n }

get id() {\n
return this.idTensor.id;\n }

get closed() {\n return this.closed_;\n }

/**\n * Dispose the tensors and
idTensor and mark the TensorArray as closed.\n */\n clearAndClose(keepIds?: Set<number>) {\n
this.tensors.forEach(tensor => {\n if (keepIds == null || !keepIds.has(tensor.tensor.id)) {\n
tensor.tensor.dispose();\n }\n });\n this.tensors = [];\n this.closed_ = true;\n this.idTensor.dispose();\n
}\n\n size(): number {\n return this.tensors.length;\n }

/**\n * Read the value at location index in the
TensorArray.\n * @param index Number the index to read from.\n */\n read(index: number): Tensor {\n if
(this.closed_) {\n throw new Error(`TensorArray ${this.name} has already been closed.`);\n }\n if (index <
0 || index >= this.size()) {\n throw new Error(`Tried to read from index
${index}, but array size is: ${\n this.size()}`);\n }\n const tensorWithState = this.tensors[index];\n if
(tensorWithState.cleared) {\n throw new Error(\n `TensorArray ${this.name}: Could not read index ${\n
index} twice because it was cleared after a previous read` +\n `(perhaps try setting clear_after_read =
false?).`);\n }\n if (this.clearAfterRead) {\n tensorWithState.cleared = true;\n }\n tensorWithState.read
= true;\n return tensorWithState.tensor;\n }

/**\n * Helper method to read multiple tensors from the
specified indices.\n */\n readMany(indices: number[]): Tensor[] {\n return indices.map(index =>
this.read(index));\n }

/**\n * Write value into the index of the TensorArray.\n * @param index number the
index to write to.\n * @param tensor\n */\n write(index: number, tensor: Tensor) {\n if (this.closed_) {\n
throw new Error(`TensorArray ${this.name} has already
been closed.`);\n }\n if (index < 0 || !this.dynamicSize && index >= this.maxSize) {\n throw new
Error(`Tried to write to index ${\n index}, but array is not resizeable and size is: ${this.maxSize}`);\n }\n const t = this.tensors[index] || {};\n if (tensor.dtype !== this.dtype) {\n throw new Error(`TensorArray ${\n
this.name}: Could not write to TensorArray index ${index},\n because the value dtype is ${\n
tensor.dtype}, but TensorArray dtype is ${this.dtype}`);\n }\n // Set the shape for the first time write to
unknow shape tensor array\n if (this.size() === 0 &&\n (this.elementShape == null || this.elementShape.length
=== 0)) {\n this.elementShape = tensor.shape;\n }\n assertShapesMatchAllowUndefinedSize(\n
this.elementShape, tensor.shape,\n `TensorArray ${this.name}: Could not write to TensorArray index ${\n
index}`);\n if (t.read) {\n throw new Error(\n
 `TensorArray ${this.name}: Could not write to TensorArray index ${\n
index}, because it has already
been read.`);\n }\n if (t.written) {\n throw new Error(\n `TensorArray ${this.name}: Could not write
to TensorArray index ${\n
index}, because it has already been written.`);\n }\n t.tensor = tensor;\n keep(tensor);\n t.written = true;\n this.tensors[index] = t;\n }

/**\n * Helper method to write multiple
tensors to the specified indices.\n */\n writeMany(indices: number[], tensors: Tensor[]) {\n if (indices.length !==
tensors.length) {\n throw new Error(\n `TensorArray ${this.name}: could not write multiple tensors,` +\n
 `because the index size: ${\n
indices.length} is not the same as tensors size: ${\n
tensors.length}`);\n }\n indices.forEach((i, index) => this.write(i, tensors[index]));\n }

/**\n * Return
selected values in the
TensorArray as a packed Tensor. All of\n * selected values must have been written and their shapes must all
match.\n * @param [indices] number[] Optional. Taking values in [0, max_value). If the\n * TensorArray is not
dynamic, max_value=size(). If not specified returns\n * all tensors in the original order.\n * @param [dtype]\n
*/\n gather(indices?: number[], dtype?: DataType): Tensor {\n if (!dtype && dtype !== this.dtype) {\n throw
new Error(`TensorArray dtype is ${\n this.dtype} but gather requested dtype ${dtype}`);\n }\n if
(!indices) {\n indices = [];\n for (let i = 0; i < this.size(); i++) {\n indices.push(i);\n }\n } else {\n
indices = indices.slice(0, this.size());\n }\n if (indices.length === 0) {\n return tensor([],
[0].concat(this.elementShape));\n }\n // Read all the PersistentTensors into a vector to keep track of\n // their
memory.\n const tensors = this.readMany(indices);\n }

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idTensor: Tensor;\n maxNumElements: number;\n\n get id() {\n return this.idTensor.id;\n }\n /**\n *\n * @param tensors list of tensors\n * @param elementShape shape of each tensor, this can be a single number (any\n * shape is allowed) or partial shape (dim = -1).\n * @param elementDtype data type of each tensor\n * @param\n * maxNumElements The maximum allowed size of `tensors`. Defaults to -1\n * meaning that the size of `tensors` is\n * unbounded.\n */\n constructor(\n readonly tensors: Tensor[], readonly elementShape: number|number[],\n readonly elementDtype: DataType, maxNumElements = -1) {\n if (tensors !== null) {\n tensors.forEach(tensor\n => {\n if (elementDtype !== tensor.dtype) {\n throw new Error(`Invalid\n data types; op elements ${\n elementDtype}, but list elements ${\n tensor.dtype}`);\n }\n });\n }\n assertShapesMatchAllowUndefinedSize(\n elementShape, tensor.shape, 'TensorList shape mismatch: ');\n keep(tensor);\n });\n this.idTensor = scalar(0);\n this.maxNumElements = maxNumElements;\n keep(this.idTensor);\n }\n\n /**\n * Get a new TensorList containing a copy of the underlying tensor container.\n */\n copy(): TensorList {\n return new TensorList(\n [...this.tensors], this.elementShape,\n this.elementDtype);\n }\n\n /**\n * Dispose the tensors and idTensor and clear the tensor list.\n */\n clearAndClose(keepIds?: Set<number>) {\n this.tensors.forEach(tensor => {\n if (keepIds == null ||\n !keepIds.has(tensor.id)) {\n tensor.dispose();\n }\n });\n this.tensors.length = 0;\n this.idTensor.dispose();\n }\n\n /**\n * The size of the tensors in the tensor list.\n */\n size() {\n return this.tensors.length;\n }\n\n /**\n * Return a tensor that stacks a list of rank-R tf.Tensors into\n * one rank-(R+1)\n * tf.Tensor.\n * @param elementShape shape of each tensor\n * @param elementDtype data\n * type of each tensor\n * @param numElements the number of elements to stack\n */\n stack(elementShape:\n number[], elementDtype: DataType, numElements = -1):\n Tensor {\n if (elementDtype !== this.elementDtype)\n {\n throw new Error(`Invalid data types; op elements ${\n elementDtype}, but list elements\n ${\n this.elementDtype}`);\n }\n if (numElements !== -1 && this.tensors.length !== numElements) {\n throw\n new Error(`Operation expected a list with ${\n numElements} elements but got a list with ${\n this.tensors.length} elements.`);\n }\n assertShapesMatchAllowUndefinedSize(\n elementShape,\n this.elementShape, 'TensorList shape mismatch: ');\n const outputElementShape =\n inferElementShape(this.elementShape,\n this.tensors, elementShape);\n return tidy(() => {\n const reshapedTensors =\n this.tensors.map(tensor =>\n reshape(tensor, outputElementShape));\n return stack(reshapedTensors, 0);\n });\n }\n\n /**\n * Pop a tensor\n * from the end of the list.\n * @param elementShape shape of the tensor\n * @param elementDtype data type of the\n * tensor\n */\n popBack(elementShape: number[], elementDtype: DataType): Tensor {\n if (elementDtype !==\n this.elementDtype) {\n throw new Error(`Invalid data types; op elements ${\n elementDtype}, but list\n elements ${\n this.elementDtype}`);\n }\n if (this.size() === 0) {\n throw new Error('Trying to pop from an\n empty list.);\n }\n const outputElementShape =\n inferElementShape(this.elementShape, this.tensors,\n elementShape);\n const tensor = this.tensors.pop();\n assertShapesMatchAllowUndefinedSize(\n tensor.shape, elementShape, 'TensorList shape mismatch:\n ');\n return reshape(tensor, outputElementShape);\n }\n\n /**\n * Push a tensor to the end of the list.\n * @param tensor Tensor to be pushed.\n */\n pushBack(tensor: Tensor) {\n if (tensor.dtype !==\n this.elementDtype) {\n throw new Error(`Invalid data types; op elements ${\n tensor.dtype}, but list\n elements ${\n this.elementDtype}`);\n }\n assertShapesMatchAllowUndefinedSize(\n tensor.shape,\n this.elementShape, 'TensorList shape mismatch: ');\n if (this.maxNumElements === this.size()) {\n throw\n new Error(`Trying to push element into a full list.`);\n }\n keep(tensor);\n this.tensors.push(tensor);\n }\n\n /**\n * Update the size of the list.\n * @param size the new size of the list.\n */\n resize(size: number) {\n if\n (size < 0) {\n throw new Error(`\n `TensorListResize expects size to be non-negative. Got: ${\n size}`);\n }\n if (this.maxNumElements !== -1 && size > this.maxNumElements) {\n throw\n new Error(`TensorListResize input size ${\n size} is greater maxNumElement\n ${\n this.maxNumElements}.`);\n }\n this.tensors.length = size;\n }\n\n /**\n * Retrieve the element at the\n * provided index\n * @param elementShape shape of the tensor\n * @param elementDtype dtype of the tensor\n * @param elementIndex index of the tensor\n */\n getItem(elementIndex: number, elementShape: number[],

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elementDtype: DataType);\n Tensor {\n if (elementDtype !== this.elementDtype) {\n throw new
Error(`Invalid data types; op elements ${\n elementDtype}, but list elements ${this.elementDtype}`);\n }\n if (elementIndex < 0 || elementIndex > this.tensors.length) {\n throw new Error(`Trying to access element ${\n elementIndex} in a list with ${this.tensors.length} elements.`);\n }\n if (this.tensors[elementIndex] === null)\n {\n throw new Error(`element at index ${elementIndex} is null.`);\n }\n \n assertShapesMatchAllowUndefinedSize(\n this.tensors[elementIndex].shape, elementShape,\n `TensorList shape mismatch: `);\n const\n outputElementShape =\n inferElementShape(this.elementShape, this.tensors, elementShape);\n return\n reshape(this.tensors[elementIndex], outputElementShape);\n } }\n /**\n * Set the tensor at the index\n * @param elementIndex index of the tensor\n * @param tensor the tensor to be inserted into the list\n */\n setItem(elementIndex: number, tensor: Tensor) {\n if (tensor.dtype !== this.elementDtype) {\n throw new\n Error(`Invalid data types; op elements ${\n tensor.dtype}, but list elements ${this.elementDtype}`);\n }\n \n if (elementIndex < 0 ||\n this.maxNumElements !== -1 && elementIndex >= this.maxNumElements) {\n throw new Error(`Trying to set element ${\n elementIndex} in a list with max ${this.maxNumElements}\n elements.`);\n }\n \n assertShapesMatchAllowUndefinedSize(\n this.elementShape,\n tensor.shape, `TensorList shape mismatch: `);\n keep(tensor);\n this.tensors[elementIndex] = tensor;\n } }\n /**\n * Return selected values in the TensorList as a stacked Tensor. All of\n * selected values must have been\n * written and their shapes must all match.\n * @param indices indices of tensors to gather\n * @param\n * elementDtype output tensor dtype\n * @param elementShape output tensor element shape\n */\n gather(indices:\n number[], elementDtype: DataType, elementShape: number[]):\n Tensor {\n if (elementDtype !==\n this.elementDtype) {\n throw new Error(`Invalid data types; op elements ${\n elementDtype}, but list\n elements ${this.elementDtype}`);\n }\n \n assertShapesMatchAllowUndefinedSize(\n this.elementShape,\n elementShape, `TensorList shape mismatch: `);\n \n // When indices is greater than the size of the list, indices\n // beyond the\n // size of the list are ignored.\n indices = indices.slice(0, this.size());\n const\n outputElementShape =\n inferElementShape(this.elementShape, this.tensors, elementShape);\n if\n (indices.length === 0) {\n return tensor([], [0].concat(outputElementShape));\n }\n \n return tidy(() => {\n const tensors =\n indices.map(i => reshape(this.tensors[i], outputElementShape));\n return stack(tensors,\n 0);\n });\n } }\n /**\n * Return the values in the TensorList as a concatenated Tensor.\n * @param\n * elementDtype output tensor dtype\n * @param elementShape output tensor element shape\n */\n concat(elementDtype: DataType, elementShape: number[]): Tensor {\n if (!elementDtype && elementDtype !==\n this.elementDtype) {\n throw new Error(`TensorList dtype is ${\n this.elementDtype} but concat requested\n dtype ${elementDtype}`);\n }\n \n assertShapesMatchAllowUndefinedSize(\n this.elementShape,\n elementShape, `TensorList shape mismatch: `);\n const outputElementShape =\n inferElementShape(this.elementShape,\n this.tensors, elementShape);\n if (this.size() === 0) {\n return tensor([], [0].concat(outputElementShape));\n }\n \n return tidy(() => {\n const tensors = this.tensors.map(t => reshape(t, outputElementShape));\n return\n concat(tensors, 0);\n });\n } }\n /**\n * Creates a TensorList which, when stacked, has the value of tensor.\n * @param tensor from tensor\n * @param elementShape output tensor element shape\n */\n export function\n fromTensor(\n tensor: Tensor, elementShape: number[], elementDtype: DataType) {\n const dtype =\n tensor.dtype;\n if (tensor.shape.length < 1) {\n throw new Error(`\n `Tensor must be at least a vector, but saw\n shape: ${tensor.shape}`);\n }\n \n if (tensor.dtype !== elementDtype) {\n throw new Error(`Invalid data types; op\n elements ${\n tensor.dtype}, but list elements ${elementDtype}`);\n }\n \n const tensorElementShape =\n tensor.shape.slice(1);\n assertShapesMatchAllowUndefinedSize(\n tensorElementShape,\n elementShape, `TensorList shape mismatch: `);\n const tensorList: Tensor[] = unstack(tensor);\n return new\n TensorList(tensorList, elementShape, dtype);\n } }\n /**\n * Return a TensorList of the given size with empty\n * elements.\n * @param elementShape the shape of the future elements of the list\n * @param elementDtype the\n * desired type of elements in the list\n * @param numElements the number of elements to reserve\n */\n export function\n reserve(\n elementShape: number[], elementDtype: DataType, numElements: number) {\n return new

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TensorList([], elementShape, elementDtype, numElements);\n}\n\n/**\n * Put tensors at specific indices of a
stacked tensor into a TensorList.\n * @param indices list of indices on how to scatter the tensor.\n * @param tensor
input tensor.\n * @param elementShape the shape of the future elements of the list\n * @param numElements the
number of elements to scatter\n * ^\nexport function scatter(\n tensor: Tensor, indices: number[], elementShape:
number[],\n
 numElements?: number): TensorList {\n if (indices.length !== tensor.shape[0]) {\n throw new Error('Expected
len(indices) == tensor.shape[0], but saw: ${\n indices.length} vs. ${tensor.shape[0]}`);\n }\n\n const maxIndex
= Math.max(...indices);\n\n if (numElements != null && numElements !== -1 && maxIndex >= numElements) {\n
 throw new Error(\n `Max index must be < array size (${maxIndex} vs. ${numElements})`);\n }\n\n const list
= new TensorList([], elementShape, tensor.dtype, numElements);\n const tensors = unstack(tensor, 0);\n
 indices.forEach((value, index) => {\n list.setItem(value, tensors[index]);\n });\n return list;\n}\n\n/**\n * Split
the values of a Tensor into a TensorList.\n * @param length the lengths to use when splitting value along\n * its first
dimension.\n * @param tensor the tensor to split.\n * @param elementShape the shape of the future elements of the
list\n * ^\nexport function split(\n tensor: Tensor, length: number[],
 elementShape: number[]) {\n let totalLength = 0;\n const cumulativeLengths = length.map(len => {\n
 totalLength += len;\n return totalLength;\n });\n\n if (totalLength !== tensor.shape[0]) {\n throw new
Error('Expected sum of lengths to be equal to\n tensor.shape[0], but sum of lengths is\n ${totalLength},
and tensor's shape is: ${tensor.shape}`);\n }\n\n const shapeWithoutFirstDim = tensor.shape.slice(1);\n const
outputElementShape =\n mergeElementShape(shapeWithoutFirstDim, elementShape);\n const elementPerRow =
totalLength === 0 ? 0 : tensor.size / totalLength;\n const tensors: Tensor[] = tidy(() => {\n const tensors = [];\n
 tensor = reshape(tensor, [1, totalLength, elementPerRow]);\n for (let i = 0; i < length.length; ++i) {\n const
 previousLength = (i === 0) ? 0 : cumulativeLengths[i - 1];\n const indices = [0, previousLength, 0];\n const
 sizes = [1, length[i], elementPerRow];\n tensors[i] = reshape(\n
 slice(tensor, indices, sizes), outputElementShape as number[]);\n })\n tensor.dispose();\n return tensors;\n
});\n\n const list = new TensorList([], elementShape, tensor.dtype, length.length);\n\n for (let i = 0; i <
 tensors.length; i++) {\n list.setItem(i, tensors[i]);\n }\n return list;\n}\n\n"/**\n * @license\n * Copyright 2018
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may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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=====\\n
*\nimport {DataType, scalar, Tensor} from '@tensorflow/tfjs-core';\nimport {NamedTensorsMap} from
'./../data/types';\nimport {ExecutionContext} from '../..../executor/execution_context';\nimport {TensorArray} from
'./../executor/tensor_array';\nimport {fromTensor, reserve, scatter, split} from '../..../executor/tensor_list';\nimport
{InternalOpAsyncExecutor, Node} from './types';\nimport {cloneTensor, getParamValue, getTensor} from
'./utils';\n\nexport const executeOp: InternalOpAsyncExecutor = async(\n node: Node, tensorMap:
NamedTensorsMap,\n context: ExecutionContext): Promise<Tensor[]> => {\n switch (node.op) {\n case 'If':\n case 'StatelessIf': {\n const thenFunc =\n getParamValue('thenBranch', node, tensorMap, context) as
string;\n const elseFunc =\n getParamValue('elseBranch', node, tensorMap, context) as string;\n const
cond = getParamValue('cond', node, tensorMap, context) as Tensor;\n
 const args = getParamValue('args', node, tensorMap, context) as Tensor[];\n const condValue = await
cond.data();\n if (condValue[0]) {\n return context.functionMap[thenFunc].executeFunctionAsync(\n
 args, context.tensorArrayMap, context.tensorListMap);\n } else {\n return
context.functionMap[elseFunc].executeFunctionAsync(\n
 args, context.tensorArrayMap,
context.tensorListMap);\n }\n }\n case 'While':\n case 'StatelessWhile': {\n const bodyFunc =\n getParamValue('body', node, tensorMap, context) as string;\n const condFunc =\n getParamValue('cond',

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node, tensorMap, context) as string;\n const args = getParamValue('args', node, tensorMap, context) as
Tensor[];\n // Calculate the condition of the loop\n const condResult =\n (await
context.functionMap[condFunc].executeFunctionAsync(\n args, context.tensorArrayMap,
context.tensorListMap));\n const argIds =
args.map(tensor => tensor.id);\n let condValue = await condResult[0].data();\n // Dispose the intermediate
tensors for condition function\n condResult.forEach(tensor => {\n if (!tensor.kept &&
argIds.indexOf(tensor.id) === -1) {\n tensor.dispose();\n }\n });\n let result: Tensor[] = args;\n while (condValue[0]) {\n // Record the previous result for intermediate tensor tracking\n const origResult =
result;\n // Execution the body of the loop\n result = await
context.functionMap[bodyFunc].executeFunctionAsync(\n result, context.tensorArrayMap,
context.tensorListMap);\n const resultIds = result.map(tensor => tensor.id);\n // Dispose the intermediate
tensor for body function that is not global\n // kept, not input/output of the body function\n origResult.forEach(tensor => {\n if (!tensor.kept && argIds.indexOf(tensor.id) === -1 &&\n resultIds.indexOf(tensor.id)
=== -1) {\n tensor.dispose();\n }\n });\n // Recalculate the condition of the loop using the
latest results.\n const condResult =\n (await context.functionMap[condFunc].executeFunctionAsync(\n result, context.tensorArrayMap, context.tensorListMap));\n condValue = await condResult[0].data();\n // Dispose the intermediate tensors for condition function\n condResult.forEach(tensor => {\n if
(!tensor.kept && argIds.indexOf(tensor.id) === -1 &&\n resultIds.indexOf(tensor.id) === -1) {\n tensor.dispose();\n }\n });\n return result;\n }\n case 'LoopCond': {\n const pred =
getParamValue('pred', node, tensorMap, context) as Tensor;\n return [cloneTensor(pred)];\n }\n case 'Switch':
{\n const pred = getParamValue('pred', node, tensorMap, context) as Tensor;\n let data =
getParamValue('data', node,
tensorMap, context) as Tensor;\n if (!data.kept) {\n data = cloneTensor(data);\n }\n // Outputs nodes
:0 => false, :1 => true\n return (await pred.data())[0] ? [undefined, data] : [data, undefined];\n }\n case
'Merge': {\n const inputName = node.inputNames.find(\n name => getTensor(name, tensorMap, context)
!== undefined);\n if (inputName) {\n const data = getTensor(inputName, tensorMap, context);\n return
[cloneTensor(data)];\n }\n return undefined;\n }\n case 'Enter': {\n const frameId =\n getParamValue('frameName', node, tensorMap, context) as string;\n const data = getParamValue('tensor', node,
tensorMap, context) as Tensor;\n context.enterFrame(frameId);\n return [cloneTensor(data)];\n }\n case
'Exit': {\n const data = getParamValue('tensor', node, tensorMap, context) as Tensor;\n context.exitFrame();\n return [cloneTensor(data)];\n }\n case 'NextIteration':
{\n const data = getParamValue('tensor', node, tensorMap, context) as Tensor;\n context.nextIteration();\n return [cloneTensor(data)];\n }\n case 'TensorArrayV3': {\n const size = getParamValue('size', node,
tensorMap, context) as number;\n const dtype =\n getParamValue('dtype', node, tensorMap, context) as
DataType;\n const elementShape =\n getParamValue('elementShape', node, tensorMap, context) as
number[];\n const dynamicSize =\n getParamValue('dynamicSize', node, tensorMap, context) as boolean;\n const clearAfterRead =\n getParamValue('clearAfterRead', node, tensorMap, context) as boolean;\n const
identicalElementShapes =\n getParamValue('identicalElementShapes', node, tensorMap, context) as\n boolean;\n const name = getParamValue('name', node, tensorMap, context) as string;\n const tensorArray =
new TensorArray(\n name, dtype, size, elementShape,
identicalElementShapes, dynamicSize,\n clearAfterRead);\n context.addTensorArray(tensorArray);\n return [tensorArray.idTensor, scalar(1.0)];\n }\n case 'TensorArrayWriteV3': {\n const id =\n getParamValue('tensorArrayId', node, tensorMap, context) as Tensor;\n const index = getParamValue('index',
node, tensorMap, context) as number;\n const writeTensor =\n getParamValue('tensor', node, tensorMap,
context) as Tensor;\n const writeTensorArray = context.getTensorArray(id.id);\n writeTensorArray.write(index, writeTensor);\n return [writeTensorArray.idTensor];\n }\n case
'TensorArrayReadV3': {\n const readId =\n getParamValue('tensorArrayId', node, tensorMap, context) as

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Tensor;\n const readIndex =\n getParamValue('index', node, tensorMap, context) as number;\n const
readTensorArray = context.getTensorArray(readId.id);\n return [readTensorArray.read(readIndex)];\n }\n
 case 'TensorArrayGatherV3': {\n const gatherId =\n getParamValue('tensorArrayId', node, tensorMap,
context) as Tensor;\n const gatherIndices =\n getParamValue('indices', node, tensorMap, context) as
number[];\n const gatherDtype =\n getParamValue('dtype', node, tensorMap, context) as DataType;\n
const gatherTensorArray = context.getTensorArray(gatherId.id);\n return
[gatherTensorArray.gather(gatherIndices, gatherDtype)];\n }\n
 case 'TensorArrayScatterV3': {\n const
scatterId =\n getParamValue('tensorArrayId', node, tensorMap, context) as Tensor;\n const scatterIndices
=\n getParamValue('indices', node, tensorMap, context) as number[];\n const scatterTensor =\n getParamValue('tensor', node, tensorMap, context) as Tensor;\n const scatterTensorArray =
context.getTensorArray(scatterId.id);\n scatterTensorArray.scatter(scatterIndices, scatterTensor);\n return
[scatterTensorArray.idTensor];\n
 }\n
 case 'TensorArrayConcatV3': {\n const concatId =\n getParamValue('tensorArrayId', node,
tensorMap, context) as Tensor;\n const concatTensorArray = context.getTensorArray(concatId.id);\n const
concatDtype =\n getParamValue('dtype', node, tensorMap, context) as DataType;\n return
[concatTensorArray.concat(concatDtype)];\n }\n
 case 'TensorArraySplitV3': {\n const splitId =\n getParamValue('tensorArrayId', node, tensorMap, context) as Tensor;\n const splitTensor =\n getParamValue('tensor', node, tensorMap, context) as Tensor;\n const lengths =\n getParamValue('lengths',
node, tensorMap, context) as number[];\n const splitTensorArray = context.getTensorArray(splitId.id);\n
splitTensorArray.split(lengths, splitTensor);\n return [splitTensorArray.idTensor];\n }\n
 case
'TensorArraySizeV3': {\n const sizeId =\n getParamValue('tensorArrayId', node,
tensorMap, context) as Tensor;\n const sizeTensorArray = context.getTensorArray(sizeId.id);\n return
[scalar(sizeTensorArray.size(), 'int32')];\n }\n
 case 'TensorArrayCloseV3': {\n const closeId =\n getParamValue('tensorArrayId', node, tensorMap, context) as Tensor;\n const closeTensorArray =
context.getTensorArray(closeId.id);\n closeTensorArray.clearAndClose();\n return
[closeTensorArray.idTensor];\n }\n
 case 'TensorListSetItem': {\n const idTensor =\n getParamValue('tensorListId', node, tensorMap, context) as Tensor;\n const index = getParamValue('index', node,
tensorMap, context) as number;\n const writeTensor =\n getParamValue('tensor', node, tensorMap, context)
as Tensor;\n const tensorList = context.getTensorList(idTensor.id);\n tensorList.setItem(index,
writeTensor);\n return [tensorList.idTensor];\n }\n
 case 'TensorListGetItem': {\n const idTensor =\n getParamValue('tensorListId',
node, tensorMap, context) as Tensor;\n const readIndex =\n getParamValue('index', node, tensorMap,
context) as number;\n const elementShape =\n getParamValue('elementShape', node, tensorMap, context)
as number[];\n\n const elementDType =\n getParamValue('elementDType', node, tensorMap, context) as
DataType;\n const tensorList = context.getTensorList(idTensor.id);\n return [tensorList.getItem(readIndex,
elementShape, elementDType)];\n }\n
 case 'TensorListScatterV2':\n case 'TensorListScatter': {\n const
scatterIndices =\n getParamValue('indices', node, tensorMap, context) as number[];\n const scatterTensor
=\n getParamValue('tensor', node, tensorMap, context) as Tensor;\n const elementShape =\n getParamValue('elementShape', node, tensorMap, context) as number[];\n const numElements =\n getParamValue('numElements', node, tensorMap, context) as number;\n
const tensorList =\n scatter(scatterTensor, scatterIndices, elementShape, numElements);\n
context.addTensorList(tensorList);\n return [tensorList.idTensor];\n }\n
 case 'TensorListReserve':\n case
'EmptyTensorList': {\n const elementShape =\n getParamValue('elementShape', node, tensorMap, context)
as number[];\n const elementDtype =\n getParamValue('elementDType', node, tensorMap, context) as
DataType;\n let numElementsParam;\n\n if (node.op === 'TensorListReserve') {\n numElementsParam =
'numElements';\n } else {\n numElementsParam = 'maxNumElements';\n }\n\n const numElements =\n getParamValue(numElementsParam, node, tensorMap, context) as number;\n\n const tensorList =
reserve(elementShape, elementDtype, numElements);\n context.addTensorList(tensorList);\n return

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[tensorList.idTensor];\n }\n case 'TensorListGather': {\n const gatherId =\n getParamValue('tensorListId', node, tensorMap, context) as Tensor;\n const gatherIndices =\n getParamValue('indices', node, tensorMap, context) as number[];\n const elementShape =\n getParamValue('elementShape', node, tensorMap, context) as number[];\n const elementDType =\n getParamValue('elementDType', node, tensorMap, context) as DataType;\n const tensorList =\n context.getTensorList(gatherId.id);\n return [tensorList.gather(gatherIndices, elementDType, elementShape)];\n }\n case 'TensorListStack': {\n const idTensor =\n getParamValue('tensorListId', node, tensorMap,\n context) as Tensor;\n const elementShape =\n getParamValue('elementShape', node, tensorMap, context) as\n number[];\n const elementDType =\n getParamValue('elementDType', node, tensorMap, context) as\n DataType;\n const numElements =\n getParamValue('numElements', node, tensorMap, context) as\n number;\n const\n tensorList = context.getTensorList(idTensor.id);\n return [tensorList.stack(elementShape, elementDType,\n numElements)];\n }\n case 'TensorListFromTensor': {\n const tensor =\n getParamValue('tensor', node,\n tensorMap, context) as Tensor;\n const elementShape =\n getParamValue('elementShape', node, tensorMap,\n context) as number[];\n const elementDType =\n getParamValue('elementDType', node, tensorMap, context)\n as DataType;\n const tensorList = fromTensor(tensor, elementShape, elementDType);\n context.addTensorList(tensorList);\n return [tensorList.idTensor];\n }\n case 'TensorListConcat': {\n const\n concatId =\n getParamValue('tensorListId', node, tensorMap, context) as Tensor;\n const tensorList =\n context.getTensorList(concatId.id);\n const concatDType =\n getParamValue('dtype', node, tensorMap,\n context) as DataType;\n const elementShape =\n getParamValue('elementShape',\n node, tensorMap, context) as number[];\n return [tensorList.concat(concatDType, elementShape)];\n }\n case\n 'TensorListPushBack': {\n const idTensor =\n getParamValue('tensorListId', node, tensorMap, context) as\n Tensor;\n const writeTensor =\n getParamValue('tensor', node, tensorMap, context) as Tensor;\n const\n tensorList = context.getTensorList(idTensor.id);\n tensorList.pushBack(writeTensor);\n return\n [tensorList.idTensor];\n }\n case 'TensorListPopBack': {\n const idTensor =\n getParamValue('tensorListId', node, tensorMap, context) as Tensor;\n const elementShape =\n getParamValue('elementShape', node, tensorMap, context) as number[];\n const elementDType =\n getParamValue('elementDType', node, tensorMap, context) as\n DataType;\n const tensorList =\n context.getTensorList(idTensor.id);\n return [tensorList.popBack(elementShape, elementDType)];\n }\n case\n 'TensorListSplit':\n {\n const splitTensor =\n getParamValue('tensor', node, tensorMap, context) as Tensor;\n const\n elementShape =\n getParamValue('elementShape', node, tensorMap, context) as\n number[];\n const lengths\n =\n getParamValue('lengths', node, tensorMap, context) as number[];\n const tensorList =\n split(splitTensor, lengths, elementShape);\n context.addTensorList(tensorList);\n return\n [tensorList.idTensor];\n }\n default:\n throw TypeError(`Node type ${node.op} is not implemented`);\n }\n}\n\nexport const CATEGORY = 'control';\n\n/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *

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the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

=====
*\n\nimport {Rank, Tensor, Tensor3D, Tensor4D, Tensor5D} from '@tensorflow/tfjs-core';\n// tslint:disable-next-line: no-imports-from-dist\nimport * as tfOps from '@tensorflow/tfjs-core/dist/ops/ops_for_converter';\nimport {NamedTensorsMap} from '../data/types';\nimport {ExecutionContext} from '../executor/execution_context';\nimport {InternalOpExecutor, Node} from '../types';\nimport {getPadding,

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getParamValue} from './utils';\n\nfunction fusedConvAndDepthWiseParams(\n node: Node, tensorMap:
NamedTensorsMap, context: ExecutionContext) {\n const [extraOp, activationFunc] =\n (getParamValue('fusedOps', node, tensorMap, context) as string[]);\n const isBiasAdd
= extraOp === 'biasadd';\n const isPrelu = activationFunc === 'prelu';\n const isBatchNorm = extraOp ===
'fusedbatchnorm';\n const numArgs =\n (getParamValue('numArgs', node, tensorMap, context) as number);\n if (isBiasAdd) {\n if (isPrelu && numArgs !== 2) {\n throw new Error(\n 'FusedConv2d and
DepthwiseConv2d with BiasAdd and Prelu ' +\n 'must have two extra arguments: bias and alpha.');

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as tfOps.fused.Activation,\n preluActivationWeights: preluArg,\n leakyreluAlpha\n });\n}\n case 'Conv2DBackpropInput':\n case 'Conv2dTranspose': {\n const shape = getParamValue(\n 'outputShape', node, tensorMap,\n context) as [number, number, number] |\n [number, number, number, number];\n const stride =\n getParamValue('strides', node, tensorMap,\n context) as number[];\n const pad = getPadding(node, tensorMap, context);\n return\n [tfOps.conv2dTranspose(\n getParamValue('x', node, tensorMap, context) as Tensor3D |\n Tensor4D,\n getParamValue('filter', node, tensorMap, context) as Tensor4D,\n shape, [stride[1],\n stride[2]], pad as 'valid' | 'same');\n }\n case 'DepthwiseConv2dNative':\n case 'DepthwiseConv2d': {\n const stride =\n getParamValue('strides', node, tensorMap, context) as number[];\n const pad = getPadding(node,\n tensorMap, context);\n const dilations =\n getParamValue('dilations', node, tensorMap, context) as\n number[];\n const dataFormat =\n (getParamValue('dataFormat', node, tensorMap, context) as string)\n .toUpperCase();\n return [tfOps.depthwiseConv2d(\n getParamValue('input', node,\n tensorMap, context) as Tensor3D |\n Tensor4D,\n getParamValue('filter', node, tensorMap,\n context) as Tensor4D,\n [stride[1], stride[2]], pad as 'valid' | 'same',\n dataFormat as 'NHWC' | 'NCHW', [dilations[1], dilations[2]]);\n }\n case 'Conv3D': {\n const stride =\n getParamValue('strides', node, tensorMap, context) as number[];\n const pad = getParamValue('pad', node,\n tensorMap, context);\n const dataFormat\n =\n (getParamValue('dataFormat', node, tensorMap, context) as string)\n .toUpperCase();\n const dilations =\n getParamValue('dilations', node, tensorMap, context) as number[];\n return\n [tfOps.conv3d(\n getParamValue('x', node, tensorMap, context) as Tensor4D |\n Tensor<Rank.R5>,\n getParamValue('filter', node, tensorMap, context) as\n Tensor<Rank.R5>,\n [stride[1], stride[2], stride[3]], pad as 'valid' | 'same',\n dataFormat as 'NDHWC' | 'NCDHW',\n [dilations[1], dilations[2], dilations[3]]);\n }\n case 'AvgPool': {\n const stride =\n getParamValue('strides', node, tensorMap, context) as number[];\n const pad = getParamValue('pad', node,\n tensorMap, context);\n const kernelSize =\n getParamValue('kernelSize', node, tensorMap, context) as\n number[];\n return\n [tfOps.avgPool(\n getParamValue('x', node, tensorMap, context) as Tensor3D |\n Tensor4D,\n [kernelSize[1], kernelSize[2]], [stride[1], stride[2]],\n pad as 'valid' | 'same');\n }\n case\n 'MaxPool': {\n const stride =\n getParamValue('strides', node, tensorMap, context) as number[];\n const pad = getParamValue('pad', node, tensorMap, context);\n const kernelSize =\n getParamValue('kernelSize', node, tensorMap, context) as number[];\n return [tfOps.maxPool(\n getParamValue('x', node, tensorMap, context) as Tensor3D |\n Tensor4D,\n [kernelSize[1],\n kernelSize[2]], [stride[1], stride[2]],\n pad as 'valid' | 'same');\n }\n case 'MaxPoolWithArgmax':\n {\n const stride =\n getParamValue('strides', node, tensorMap, context) as number[];\n const pad\n = getParamValue('pad',\n node, tensorMap, context);\n const kernelSize =\n getParamValue('kernelSize', node, tensorMap,\n context) as number[];\n const includeBatchInIndex =\n getParamValue('includeBatchInIndex', node,\n tensorMap, context) as\n boolean;\n const {result, indexes} = tfOps.maxPoolWithArgmax(\n getParamValue('x', node, tensorMap, context) as Tensor4D,\n [kernelSize[1], kernelSize[2]], [stride[1],\n stride[2]],\n pad as 'valid' | 'same', includeBatchInIndex);\n return [result, indexes];\n }\n case\n 'AvgPool3D': {\n const stride =\n getParamValue('strides', node, tensorMap, context) as number[];\n const pad = getParamValue('pad', node, tensorMap, context);\n const kernelSize =\n getParamValue('kernelSize', node, tensorMap, context) as number[];\n return [tfOps.avgPool3d(\n getParamValue('x',\n node, tensorMap, context) as Tensor5D,\n [kernelSize[1], kernelSize[2], kernelSize[3]],\n [stride[1], stride[2], stride[3]], pad as 'valid' | 'same');\n }\n }\n case 'MaxPool3D': {\n const stride =\n getParamValue('strides', node, tensorMap, context) as number[];\n const pad = getParamValue('pad',

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tensorMap, context) as any,\n getParamValue('minval', node, tensorMap, context) as number,\n
getParamValue('maxval', node, tensorMap, context) as number,\n getParamValue('dtype', node, tensorMap,\n
context) as DataType)];\n }\n case 'Range': {\n const start =\n getParamValue('start', node,\n
tensorMap, context) as number;\n const stop =\n getParamValue('stop', node, tensorMap, context) as\n
number;\n const step =\n getParamValue('step', node, tensorMap, context) as number;\n return [tfOps.range(\n start, stop,\n
step,\n getParamValue('dtype', node, tensorMap, context) as 'float32' |\n 'int32')];\n }\n case 'TruncatedNormal': {\n const shape =\n getParamValue('shape', node, tensorMap, context) as\n
number[];\n const mean =\n getParamValue('mean', node, tensorMap, context) as number;\n
const stdDev =\n getParamValue('stdDev', node, tensorMap, context) as number;\n const seed =\n getParamValue('seed', node, tensorMap, context) as number;\n return [tfOps.truncatedNormal(\n shape, mean, stdDev,\n getParamValue('dtype', node, tensorMap, context) as 'float32' |\n 'int32',\n seed)];\n }\n case 'Zeros': {\n return [tfOps.zeros(\n getParamValue('shape', node,\n
tensorMap, context) as number[],\n getParamValue('dtype', node, tensorMap, context) as DataType)];\n
}\n case 'ZerosLike': {\n return [tfOps.zerosLike(\n getParamValue('x', node, tensorMap, context)\n
as Tensor)];\n }\n default:\n throw TypeError(`Node type ${node.op} is not implemented`);\n }\n
};\n\nexport const CATEGORY = 'creation';\n\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights\n
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file\n
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *

http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n
governing\n
permissions and\n * limitations under the License.\n */
\n\n
=====
*\n\nimport {Tensor, Tensor1D, Tensor2D} from '@tensorflow/tfjs-core';\n// tslint:disable-next-line: no-imports-\n
from-dist\nimport * as tfOps from '@tensorflow/tfjs-core/dist/ops/ops_for_converter';\nimport\n
{NamedTensorsMap} from '../data/types';\nimport {ExecutionContext} from\n
'../executor/execution_context';\nimport {InternalOpAsyncExecutor, Node} from '../types';\nimport\n
{getParamValue} from './utils';\n\nfunction nmsParams(\n node: Node, tensorMap: NamedTensorsMap, context:\n
ExecutionContext) {\n const boxes = getParamValue('boxes', node, tensorMap, context) as Tensor;\n const scores\n
= getParamValue('scores', node, tensorMap, context) as Tensor;\n const maxOutputSize =\n getParamValue('maxOutputSize', node, tensorMap, context) as number;\n const iouThreshold =\n getParamValue('iouThreshold', node, tensorMap, context)\n
as number;\n const scoreThreshold =\n getParamValue('scoreThreshold', node, tensorMap, context) as\n
number;\n const softNmsSigma =\n getParamValue('softNmsSigma', node, tensorMap, context) as number;\n\n return {\n boxes,\n scores,\n maxOutputSize,\n iouThreshold,\n scoreThreshold,\n softNmsSigma\n
};\n}\n\nexport const executeOp: InternalOpAsyncExecutor = async(\n node: Node, tensorMap:\n
NamedTensorsMap,\n context: ExecutionContext): Promise<Tensor[]> => {\n switch (node.op) {\n case\n
'NonMaxSuppressionV5': {\n const {\n boxes,\n scores,\n maxOutputSize,\n iouThreshold,\n scoreThreshold,\n softNmsSigma\n } = nmsParams(node, tensorMap, context);\n const result = await\n
tfOps.image.nonMaxSuppressionWithScoreAsync(\n boxes as Tensor2D, scores as Tensor1D, maxOutputSize,\n
iouThreshold,\n scoreThreshold, softNmsSigma);\n return [result.selectedIndices,\n result.selectedScores];\n }\n\n case 'NonMaxSuppressionV4': {\n const {boxes, scores, maxOutputSize, iouThreshold, scoreThreshold}\n
= \n nmsParams(node, tensorMap, context);\n const padToMaxOutputSize =\n getParamValue('padToMaxOutputSize', node, tensorMap, context) as\n boolean;\n const result = await\n
tfOps.image.nonMaxSuppressionPaddedAsync(\n boxes as Tensor2D, scores as Tensor1D, maxOutputSize,\n

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iouThreshold,\n scoreThreshold, padToMaxOutputSize);\n\n return [result.selectedIndices,\n result.validOutputs];\n }\n case 'NonMaxSuppressionV3':\n case 'NonMaxSuppressionV2': {\n const\n {boxes, scores, maxOutputSize, iouThreshold, scoreThreshold} =\n nmsParams(node, tensorMap,\n context);\n\n return [await tfOps.image.nonMaxSuppressionAsync(\n boxes as Tensor2D, scores as\n Tensor1D, maxOutputSize, iouThreshold,\n scoreThreshold)];\n }\n case 'Where': {\n const condition =\n tfOps.cast(\n (getParamValue('condition', node, tensorMap, context) as Tensor),\n 'bool');\n const result = [await\n tfOps.whereAsync(condition)];\n condition.dispose();\n return result;\n }\n case 'ListDiff': {\n return\n tfOps.setdiff1dAsync(\n getParamValue('x', node, tensorMap, context) as Tensor,\n getParamValue('y',\n node, tensorMap, context) as Tensor);\n }\n default:\n throw TypeError(`Node type ${node.op} is not\n implemented`);\n }\n};\n\nexport const CATEGORY = 'dynamic';\n\n"/**\n * @license\n * Copyright 2018 Google\n LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not\n use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *

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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n the specific language governing permissions and\n * limitations under the License.\n *

=====*\n\nimport {Tensor} from '@tensorflow/tfjs-core';\n// tslint:disable-next-line: no-imports-from-dist\nimport * as\n tfOps from '@tensorflow/tfjs-core/dist/ops/ops_for_converter';\nimport {NamedTensorsMap} from\n '../data/types';\nimport {ExecutionContext} from '../executor/execution_context';\nimport {InternalOpExecutor,\n Node} from '../types';\nimport {getParamValue} from './utils';\n\nexport const executeOp: InternalOpExecutor =\n (node: Node, tensorMap: NamedTensorsMap, context: ExecutionContext):\n Tensor[] => {\n switch\n (node.op) {\n case 'TopKV2': {\n const x = getParamValue('x', node, tensorMap, context) as\n Tensor;\n const k = getParamValue('k', node, tensorMap,\n context) as number;\n const sorted =\n getParamValue('sorted', node, tensorMap, context) as\n boolean;\n const result = tfOps.topk(x, k, sorted);\n return [result.values, result.indices];\n }\n case 'Unique': {\n const x = getParamValue('x', node, tensorMap, context) as\n Tensor;\n const\n result = tfOps.unique(x);\n return [result.values, result.indices];\n }\n case 'UniqueV2': {\n const x = getParamValue('x', node, tensorMap, context) as\n Tensor;\n const axis =\n getParamValue('axis', node, tensorMap, context) as number;\n const result = tfOps.unique(x, axis);\n return [result.values, result.indices];\n }\n default:\n throw TypeError(`Node type ${node.op}\n is not implemented`);\n }\n };\n\nexport const CATEGORY = 'evaluation';\n\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a\n copy of the License at\n *

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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n the specific language governing permissions and\n * limitations under the License.\n *

=====*\n\nimport {Tensor} from '@tensorflow/tfjs-core';\n// tslint:disable-next-line: no-imports-from-dist\nimport * as\n tfOps from '@tensorflow/tfjs-core/dist/ops/ops_for_converter';\nimport {NamedTensorsMap} from\n '../data/types';\nimport {ExecutionContext} from '../executor/execution_context';\nimport\n {InternalOpExecutor, Node} from '../types';\nimport {cloneTensor, getParamValue, getTensor} from\n './utils';\n\nexport const executeOp: InternalOpExecutor =\n (node: Node, tensorMap: NamedTensorsMap,\n context: ExecutionContext): Tensor[] => {\n switch (node.op) {\n case 'Const': {\n return\n tensorMap[node.name];\n }\n case 'PlaceholderWithDefault':\n const def =\n getParamValue('default', node, tensorMap, context) as\n Tensor;\n return [getTensor(node.name, tensorMap,\n
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context) || def];\n case 'Placeholder':\n return [getTensor(node.name, tensorMap, context)];\n case\n'Identity':\n case 'StopGradient':\n case 'FakeQuantWithMinMaxVars': { // This op is currently ignored.\n const data = getParamValue('x', node, tensorMap, context) as Tensor;\n return [cloneTensor(data)];\n }\n case 'IdentityN':\n return (getParamValue('x',\nnode, tensorMap, context) as Tensor[])\n .map((t: Tensor) => cloneTensor(t));\n case 'Snapshot':\nconst snapshot =\n (getParamValue('x', node, tensorMap, context) as Tensor);\n return\n[cloneTensor(snapshot)];\n case 'Shape':\n return [tfOps.tensor1d(\n (getParamValue('x', node,\ntensorMap, context) as Tensor).shape,\n 'int32')];\n case 'ShapeN':\n return (getParamValue('x',\nnode, tensorMap, context) as Tensor[])\n .map((t: Tensor) => tfOps.tensor1d(t.shape));\n case 'Size':\n return [tfOps.scalar(\n (getParamValue('x', node, tensorMap, context) as Tensor).size,\n 'int32')];\n case 'Rank':\n return [tfOps.scalar(\n (getParamValue('x', node, tensorMap, context) as\nTensor).rank,\n 'int32')];\n case 'NoOp':\n return [tfOps.scalar(1)];\n case 'Print':\n const input = getParamValue('x', node, tensorMap, context) as Tensor;\n const data =\ngetParamValue('data', node, tensorMap, context) as Tensor[];\n const message =\ngetParamValue('message', node, tensorMap, context) as string;\n const summarize =\ngetParamValue('summarize', node, tensorMap, context) as number;\n console.warn(\n 'The graph has a\n tf.print() operation, ' +\n 'usually used for debugging, which slows down performance.);\n console.log(message);\n for (let i = 0; i < data.length; i++) {\n console.log(Array.prototype.slice.call(data[i].dataSync())\n .slice(0, summarize));\n }\n return [input];\n }\n default:\n throw TypeError(`Node type ${node.op} is not implemented`);\n }\n};\n\nexport const CATEGORY = 'graph';\n\n/*\n * @license\n * Copyright 2020 Google LLC. All Rights\n * Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file\n * except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n *
=====\n
/\nimport {DataType, keep, scalar, stack, Tensor, tidy, unstack, util} from '@tensorflow/tfjs-core';\n\n/\n * Hashtable contains a set of tensors, which can be accessed by key.\n */\nexport class Hashtable {\n readonly\nhandle: Tensor;\n // tslint:disable-next-line: no-any\n private tensorMap: Map<any, Tensor>;\n\n get id() {\n return this.handle.id;\n }\n\n /*\n * Constructor of Hashtable. Creates a hash table.\n * @param\nkeyDType `dtype` of the table keys.\n * @param valueDType `dtype` of the table values.\n */\n constructor(readonly keyDType: DataType, readonly valueDType: DataType) {\n this.handle = scalar(0);\n //\ntslint:disable-next-line: no-any\n this.tensorMap = new Map<any, Tensor>();\n keep(this.handle);\n }\n\n /*\n * Dispose the tensors and handle and clear the hashtable.\n */\n clearAndClose() {\n this.tensorMap.forEach(value => value.dispose());\n this.tensorMap.clear();\n this.handle.dispose();\n }\n\n /*\n * The number of items in the hash table.\n */\n size(): number {\n return this.tensorMap.size;\n }\n\n /*\n * Replaces the contents of the table with the specified keys and values.\n * @param keys Keys to store in\nthe hashtable.\n * @param values Values to store in the hashtable.\n */\n async import(keys: Tensor, values:\nTensor): Promise<Tensor> {\n this.checkKeyAndValueTensor(keys, values);\n // We only store the primitive\nvalues of the keys, this allows lookup\n // to be O(1).\n const $keys = await keys.data();\n // Clear the\nhashtable before inserting new values.\n this.tensorMap.forEach(value => value.dispose());\n this.tensorMap.clear();\n return tidy(() => {\n const $values = unstack(values);\n const keysLength =\n$keys.length;\n const valuesLength = $values.length;\n util.assert(\n keysLength === valuesLength,\n () => `The number of elements doesn't match, keys has ` +\n `${keysLength} elements, the values has\n ${valuesLength} ` +\n `elements.`);\n for (let i = 0; i < keysLength; i++) {\n const key =\n$keys[i];\n const value = $values[i];\n keep(value);\n this.tensorMap.set(key, value);\n }\n })\n }\n}

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return this.handle;\n });\n }\n\n /**\n * Looks up
keys in a hash table, outputs the corresponding values.\n *\n * Performs batch lookups, for every element in the
key tensor, `find`\n * stacks the corresponding value into the return tensor.\n *\n * If an element is not present in
the table, the given `defaultValue` is\n * used.\n *\n * @param keys Keys to look up. Must have the same type
as the keys of the\n * table.\n * @param defaultValue The scalar `defaultValue` is the value output for keys\n
* not present in the table. It must also be of the same type as the\n * table values.\n */\n async find(keys:
Tensor, defaultValue: Tensor): Promise<Tensor> {\n this.checkKeyAndValueTensor(keys, defaultValue);\n\n
const $keys = await keys.data();\n\n return tidy(() => {\n const result: Tensor[] = [];\n\n for (let i = 0; i <
$keys.length; i++) {\n const key = $keys[i];\n const value = this.findWithDefault(key, defaultValue);\n
 result.push(value);\n }\n\n return stack(result);\n });\n }\n\n // tslint:disable-next-line: no-any\n private findWithDefault(key: any,
defaultValue: Tensor): Tensor {\n const result = this.tensorMap.get(key);\n return result != null ? result :
defaultValue;\n }\n\n private checkKeyAndValueTensor(key: Tensor, value: Tensor) {\n if (key.dtype !==
this.keyDType) {\n throw new Error(\n `Expect key dtype ${this.keyDType}, but got ` +\n
`${key.dtype}`);\n }\n\n if (value.dtype !== this.valueDType) {\n throw new Error(\n `Expect value
dtype ${this.valueDType}, but got ` +\n `${value.dtype}`);\n }\n }\n\n"/*\n * @license\n * Copyright
2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n *
you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law
or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n */\n\n
=====\n
*\n\nimport {DataType, Tensor} from '@tensorflow/tfjs-core';\nimport {NamedTensorsMap} from
'../data/types';\nimport {ExecutionContext} from '../executor/execution_context';\nimport {HashTable} from
'../executor/hash_table';\nimport {ResourceManager} from '../executor/resource_manager';\nimport
{InternalOpAsyncExecutor, Node} from './types';\nimport {getParamValue} from './utils';\n\nexport const
executeOp: InternalOpAsyncExecutor = async(\n node: Node, tensorMap: NamedTensorsMap, context:
ExecutionContext,\n resourceManager: ResourceManager): Promise<Tensor[]> => {\n switch (node.op) {\n
case 'HashTable':\n case 'HashTableV2': {\n const keyDType =\n getParamValue('keyDType', node,
tensorMap, context) as DataType;\n const valueDType =\n getParamValue('valueDType', node, tensorMap,
context) as DataType;\n\n const hashTable = new HashTable(keyDType, valueDType);\n
resourceManager.addHashTable(node.name, hashTable);\n return [hashTable.handle];\n }\n case
'LookupTableImport':\n case 'LookupTableImportV2': {\n const handle = getParamValue(\n
'tableHandle', node, tensorMap, context,\n resourceManager) as Tensor;\n const keys =
getParamValue('keys', node, tensorMap, context) as Tensor;\n const values =\n getParamValue('values',
node, tensorMap, context) as Tensor;\n\n const hashTable = resourceManager.getHashTableById(handle.id);\n
return [await hashTable.import(keys, values)];\n }\n case 'LookupTableFind':\n case 'LookupTableFindV2':
{\n const handle = getParamValue(\n 'tableHandle', node, tensorMap, context,\n resourceManager) as Tensor;\n const keys = getParamValue('keys', node, tensorMap, context) as Tensor;\n
const defaultValue =\n getParamValue('defaultValue', node, tensorMap, context) as Tensor;\n\n const
hashTable = resourceManager.getHashTableById(handle.id);\n return [await hashTable.find(keys,
defaultValue)];\n }\n default:\n throw TypeError(`Node type ${node.op} is not implemented`);\n
}\n\n};\n\nexport const CATEGORY = 'hash_table';\n\n"/*\n * @license\n * Copyright 2018 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law
or agreed to in writing,
software\n

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\* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\n\nimport {Tensor, Tensor1D, Tensor2D, Tensor3D, Tensor4D} from '@tensorflow/tfjs-core';\n// tslint:disable-next-line: no-imports-from-dist\nimport * as tfOps from '@tensorflow/tfjs-core/dist/ops/ops_for_converter';\nimport {NamedTensorsMap} from '../data/types';\nimport {ExecutionContext} from '../executor/execution_context';\nimport {InternalOpExecutor, Node} from '../types';\nimport {getParamValue} from './utils';\n\nexport const executeOp: InternalOpExecutor = (node: Node, tensorMap: NamedTensorsMap, context: ExecutionContext): Tensor[] => {\n switch (node.op) {\n case 'ResizeBilinear': {\n const images =\n getParamValue('images', node, tensorMap, context) as Tensor;\n const size =\n getParamValue('size', node, tensorMap, context) as number[];\n const alignCorners =\n getParamValue('alignCorners', node, tensorMap, context) as boolean;\n const halfPixelCenters =\n getParamValue('halfPixelCenters', node, tensorMap, context) as boolean;\n return\ntfOps.image.resizeBilinear(\n images as Tensor3D | Tensor4D, [size[0], size[1]], alignCorners,\n halfPixelCenters);\n }\n case 'ResizeNearestNeighbor': {\n const images =\n getParamValue('images', node, tensorMap, context) as Tensor;\n const size =\n getParamValue('size', node, tensorMap, context) as number[];\n const alignCorners =\n getParamValue('alignCorners', node, tensorMap, context) as boolean;\n const halfPixelCenters =\n getParamValue('halfPixelCenters', node, tensorMap, context) as boolean;\n return\ntfOps.image.resizeNearestNeighbor(\n images as Tensor3D | Tensor4D, [size[0], size[1]], alignCorners,\n halfPixelCenters);\n }\n case 'CropAndResize': {\n const image =\n getParamValue('image', node, tensorMap, context) as Tensor;\n const boxes =\n getParamValue('boxes', node, tensorMap, context) as Tensor;\n const boxInd =\n getParamValue('boxInd', node, tensorMap, context) as Tensor;\n const cropSize =\n getParamValue('cropSize', node, tensorMap, context) as number[];\n const method =\n getParamValue('method', node, tensorMap, context) as string;\n const extrapolationValue =\n getParamValue('extrapolationValue', node, tensorMap, context) as number;\n return\ntfOps.image.cropAndResize(\n image as Tensor4D, boxes as Tensor2D, boxInd as Tensor1D,\n cropSize as [number, number], method as 'bilinear' | 'nearest',\n extrapolationValue);\n }\n }\n default:\n throw TypeError(`Node type ${node.op} is not implemented`);\n }\n};\n\nexport const CATEGORY = 'image';\n\n/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n
```

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=====\n*\n\nimport {Tensor} from '@tensorflow/tfjs-core';\n// tslint:disable-next-line: no-imports-from-dist\nimport * as tfOps from '@tensorflow/tfjs-core/dist/ops/ops_for_converter';\nimport {NamedTensorsMap} from '../data/types';\nimport {ExecutionContext} from '../executor/execution_context';\nimport {InternalOpExecutor, Node} from '../types';\nimport {getParamValue} from './utils';\n\nexport const executeOp: InternalOpExecutor = (node: Node, tensorMap: NamedTensorsMap, context: ExecutionContext): Tensor[] => {\n switch (node.op) {\n case 'Equal': {\n return\ntfOps.equal(\n getParamValue('a', node, tensorMap, context) as Tensor,\n getParamValue('b', node, tensorMap, context) as Tensor);\n }\n case 'NotEqual': {\n return\ntfOps.notEqual(\n getParamValue('a', node, tensorMap, context)\n
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as Tensor,\n getParamValue('b', node, tensorMap, context) as Tensor]);\n }\n case 'Greater': {\n return [tfOps.greater(\n getParamValue('a', node, tensorMap, context) as Tensor,\n getParamValue('b', node, tensorMap, context) as Tensor)];\n }\n case 'GreaterEqual': {\n return [tfOps.greaterEqual(\n getParamValue('a', node, tensorMap, context) as Tensor,\n getParamValue('b', node, tensorMap, context) as Tensor)];\n }\n case 'Less': {\n return [tfOps.less(\n getParamValue('a', node, tensorMap, context) as Tensor,\n getParamValue('b', node, tensorMap, context) as Tensor)];\n }\n case 'LessEqual': {\n return [tfOps.lessEqual(\n getParamValue('a', node, tensorMap, context) as Tensor,\n getParamValue('b', node, tensorMap, context) as Tensor)];\n }\n case 'LogicalAnd':\n {\n return [tfOps.logicalAnd(\n getParamValue('a', node, tensorMap, context) as Tensor,\n getParamValue('b', node, tensorMap, context) as Tensor)];\n }\n case 'LogicalNot': {\n return [tfOps.logicalNot(\n getParamValue('a', node, tensorMap, context) as Tensor)];\n }\n case 'LogicalOr': {\n return [tfOps.logicalOr(\n getParamValue('a', node, tensorMap, context) as Tensor,\n getParamValue('b', node, tensorMap, context) as Tensor)];\n }\n case 'Select':\n case 'SelectV2':\n {\n return [tfOps.where(\n getParamValue('condition', node, tensorMap, context) as Tensor,\n getParamValue('a', node, tensorMap, context) as Tensor,\n getParamValue('b', node, tensorMap, context) as Tensor)];\n }\n default:\n throw TypeError(`Node type ${node.op} is not implemented`);\n }\n };\n\nexport const

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```

=====\n\n*\n\nimport {Tensor, Tensor2D} from '@tensorflow/tfjs-core';\n// tslint:disable-next-line: no-imports-from-dist\nimport * as tfOps from '@tensorflow/tfjs-core/dist/ops/ops_for_converter';\nimport {NamedTensorsMap} from '../data/types';\nimport {ExecutionContext} from '../executor/execution_context';\nimport {InternalOpExecutor, Node} from '../types';\nimport {getParamValue} from './utils';\n\nexport const executeOp: InternalOpExecutor =\n (node: Node, tensorMap: NamedTensorsMap, context: ExecutionContext): Tensor[] => {\n switch (node.op) {\n case 'BatchMatMul':\n case 'BatchMatMulV2':\n case 'MatMul':\n return [tfOps.matMul(\n getParamValue('a', node, tensorMap, context) as Tensor2D,\n getParamValue('b', node, tensorMap, context) as Tensor2D,\n getParamValue('transposeA', node, tensorMap, context) as boolean,\n getParamValue('transposeB', node, tensorMap, context) as boolean)];\n case 'Transpose':\n return [tfOps.transpose(\n getParamValue('x', node, tensorMap, context) as Tensor,\n getParamValue('perm', node, tensorMap, context) as number[])];\n case '_FusedMatMul':\n const [extraOp, activationFunc] =\n (getParamValue('fusedOps', node, tensorMap, context) as string[]);\n const isBiasAdd = extraOp === 'biasadd';\n const isPrelu = activationFunc === 'prelu';\n const numArgs =\n (getParamValue('numArgs', node, tensorMap, context) as number);\n const leakyreluAlpha =\n getParamValue('leakyreluAlpha', node, tensorMap, context) as number;\n if (isBiasAdd) {\n if (isPrelu && numArgs !== 2) {\n throw new Error(\n 'Fused MatMul with BiasAdd and Prelu must have two '+\n 'extra arguments: bias and alpha.');

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node, tensorMap, context) as Tensor[];\n return [tfOps.fused.matmul({\n a: getParamValue('a', node,
tensorMap, context) as Tensor2D,\n b: getParamValue('b', node, tensorMap, context) as Tensor2D,\n transposeA: getParamValue('transposeA', node, tensorMap, context) as\n boolean,\n transposeB:
getParamValue('transposeB', node, tensorMap, context) as\n boolean,\n bias: biasArg,\n activation: activationFunc as tfOps.fused.Activation,\n preluActivationWeights: preluArg,\n leakyreluAlpha\n }]);\n default:\n throw TypeError(`Node type ${node.op} is not
implemented`);\n }\n};\n\nexport const CATEGORY = 'matrices';\n\n/**\n * @license\n * Copyright 2018
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may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless
required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an
\"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {Scalar, Tensor, Tensor3D, Tensor4D} from '@tensorflow/tfjs-core';\n// tslint:disable-next-line: no-
imports-from-dist\nimport * as tfOps from '@tensorflow/tfjs-core/dist/ops/ops_for_converter';\n\nimport
{NamedTensorsMap} from '../data/types';\nimport {ExecutionContext} from
'../executor/execution_context';\nimport {InternalOpExecutor, Node} from '../types';\nimport {getParamValue}
from '../utils';\n\nexport const executeOp: InternalOpExecutor =\n (node: Node, tensorMap:
NamedTensorsMap,\n context: ExecutionContext): Tensor[] => {\n switch (node.op) {\n case
'FusedBatchNorm':\n case 'FusedBatchNormV2': {\n return [tfOps.batchNorm(\n
getParamValue('x', node, tensorMap, context) as Tensor,\n getParamValue('mean', node, tensorMap,
context) as Tensor,\n getParamValue('variance', node, tensorMap, context) as Tensor,\n
getParamValue('offset', node, tensorMap, context) as Tensor,\n getParamValue('scale', node, tensorMap,
context) as Tensor,\n getParamValue('epsilon', node, tensorMap, context) as number)];\n }\n case
'FusedBatchNormV3': {\n return [tfOps.batchNorm(\n getParamValue('x', node, tensorMap, context)
as Tensor,\n getParamValue('mean', node, tensorMap, context) as Tensor,\n
getParamValue('variance', node, tensorMap, context) as Tensor,\n getParamValue('offset',
node, tensorMap, context) as Tensor,\n getParamValue('scale', node, tensorMap, context) as Tensor,\n
getParamValue('epsilon', node, tensorMap, context) as number)];\n }\n case 'LRN': {\n return
[tfOps.localResponseNormalization(\n getParamValue('x', node, tensorMap, context) as Tensor3D |\n
Tensor4D,\n getParamValue('radius', node, tensorMap, context) as number,\n
getParamValue('bias', node, tensorMap, context) as number,\n getParamValue('alpha', node, tensorMap,
context) as number,\n getParamValue('beta', node, tensorMap, context) as number)];\n }\n case
'Softmax': {\n return [tfOps.softmax(\n getParamValue('x', node, tensorMap, context) as Tensor)];\n }\n case 'LogSoftmax': {\n return [tfOps.logSoftmax(\n
getParamValue('x', node, tensorMap, context) as Tensor)];\n }\n case
'SparseToDense': {\n return [tfOps.sparseToDense(\n getParamValue('sparseIndices', node,
tensorMap, context) as\n Tensor,\n getParamValue('outputShape', node, tensorMap, context) as
Tensor,\n getParamValue('sparseValues', node, tensorMap, context) as\n number[],\n getParamValue('defaultValue', node, tensorMap, context) as\n Scalar)];\n }\n default:\n throw TypeError(`Node type ${node.op} is not implemented`);\n }\n };\n\nexport const CATEGORY =
'normalization';\n\n/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless
required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an
\"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
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permissions and\n \* limitations under the License.\n \*

```
=====\n*\n\nimport { Tensor, Tensor1D, Tensor2D } from '@tensorflow/tfjs-core';\n// tslint:disable-next-line: no-imports-from-dist\nimport * as tfOps from '@tensorflow/tfjs-core/dist/ops/ops_for_converter';\n\nimport { NamedTensorsMap } from '../data/types';\nimport { ExecutionContext } from '../executor/execution_context';\nimport { InternalOpExecutor, Node } from '../types';\n\nimport { getParamValue } from './utils';\n\nexport const executeOp: InternalOpExecutor =\n (node: Node, tensorMap: NamedTensorsMap, context: ExecutionContext): Tensor[] => {\n switch (node.op) {\n case 'Max': {\n const axis =\n getParamValue('axis', node, tensorMap, context) as number[];\n const keepDims =\n getParamValue('keepDims', node, tensorMap, context) as boolean;\n return [tfOps.max(\n getParamValue('x', node, tensorMap, context) as Tensor, axis,\n keepDims)];\n }\n case 'Mean': {\n const axis =\n getParamValue('axis', node, tensorMap, context) as number[];\n const keepDims =\n getParamValue('keepDims', node, tensorMap, context) as boolean;\n return [tfOps.mean(\n getParamValue('x', node, tensorMap, context) as Tensor, axis,\n keepDims)];\n }\n case 'Min': {\n const axis =\n getParamValue('axis', node, tensorMap, context) as number[];\n const keepDims =\n getParamValue('keepDims', node, tensorMap, context) as boolean;\n return [tfOps.min(\n getParamValue('x', node, tensorMap, context) as Tensor,\n axis,\n keepDims)];\n }\n case 'Sum': {\n const axis =\n getParamValue('axis', node, tensorMap, context) as number[];\n const keepDims =\n getParamValue('keepDims', node, tensorMap, context) as boolean;\n return [tfOps.sum(\n getParamValue('x', node, tensorMap, context) as Tensor,\n axis,\n keepDims)];\n }\n case 'All': {\n const axis =\n getParamValue('axis', node, tensorMap, context) as number[];\n const keepDims =\n getParamValue('keepDims', node, tensorMap, context) as boolean;\n return [tfOps.all(\n getParamValue('x', node, tensorMap, context) as Tensor,\n axis,\n keepDims)];\n }\n case 'Any': {\n const axis =\n getParamValue('axis', node, tensorMap, context) as number[];\n const keepDims =\n getParamValue('keepDims', node, tensorMap, context) as boolean;\n return [tfOps.any(\n getParamValue('x', node, tensorMap, context) as Tensor,\n axis,\n keepDims)];\n }\n case 'ArgMax': {\n const axis =\n getParamValue('axis', node, tensorMap, context) as number;\n return [tfOps.argMax(\n getParamValue('x', node, tensorMap, context) as Tensor, axis)];\n }\n case 'ArgMin': {\n const axis =\n getParamValue('axis', node, tensorMap, context) as number;\n return [tfOps.argMin(\n getParamValue('x', node, tensorMap, context) as Tensor, axis)];\n }\n case 'Prod': {\n const axis =\n getParamValue('axis', node, tensorMap, context) as number[];\n const keepDims =\n getParamValue('keepDims', node, tensorMap, context) as boolean;\n return [tfOps.prod(\n getParamValue('x', node, tensorMap, context) as Tensor,\n axis,\n keepDims)];\n }\n case 'Cumsum': {\n const axis =\n getParamValue('axis', node, tensorMap, context) as number;\n const exclusive =\n getParamValue('exclusive', node, tensorMap, context) as boolean;\n const reverse =\n getParamValue('reverse', node, tensorMap, context) as boolean;\n return [tfOps.cumsum(\n getParamValue('x', node, tensorMap, context) as Tensor, axis,\n exclusive, reverse)];\n }\n case 'Bincount': {\n const x =\n getParamValue('x', node, tensorMap, context) as Tensor1D;\n const weights =\n getParamValue('weights', node, tensorMap, context) as Tensor1D;\n const size =\n getParamValue('size', node, tensorMap, context) as number;\n return [tfOps.bincount(x, weights, size)];\n }\n case 'DenseBincount': {\n const x =\n getParamValue('x', node, tensorMap, context) as Tensor1D |\n Tensor2D;\n const weights =\n getParamValue('weights', node, tensorMap, context) as Tensor1D |\n Tensor2D;\n const size =\n getParamValue('size', node, tensorMap, context) as number;\n const binaryOutput =\n getParamValue('binaryOutput', node, tensorMap, context) as\n boolean;\n return [tfOps.denseBincount(x, weights, size, binaryOutput)];\n }\n }\n }\n}
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default:\n throw TypeError(`Node type ${node.op} is not implemented`);\n }\n };\n\nexport const
CATEGORY = 'reduction';\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n *
Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

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*\n\nimport {Scalar, Tensor, Tensor1D, tidy, util} from '@tensorflow/tfjs-core';\n// tslint:disable-next-line: no-
imports-from-dist\nimport * as tfOps from '@tensorflow/tfjs-core/dist/ops/ops_for_converter';\n\nimport
{NamedTensorsMap} from '../data/types';\nimport {ExecutionContext} from
'../executor/execution_context';\nimport {InternalOpExecutor, Node} from './types';\n\nimport {getParamValue}
from './utils';\n\nexport const executeOp: InternalOpExecutor =\n (node: Node, tensorMap: NamedTensorsMap,\n context: ExecutionContext): Tensor[] => {\n switch (node.op) {\n case 'ConcatV2':\n case 'Concat': {\n const n = getParamValue('n', node, tensorMap, context) as number;\n const axis =\n getParamValue('axis', node, tensorMap, context) as number;\n let inputs =\n getParamValue('tensors',\n node, tensorMap, context) as Tensor[];\n inputs = inputs.slice(0, n);\n return [tfOps.concat(inputs,\n axis)];\n }\n case 'Gather': {\n const input = getParamValue('x', node, tensorMap, context) as\n Tensor;\n const indices =\n getParamValue('indices', node, tensorMap, context) as Tensor1D;\n return [tfOps.gather(input, tfOps.cast(indices, 'int32'), 0)];\n }\n case 'GatherV2': {\n const axis =\n getParamValue('axis', node, tensorMap, context) as number;\n const batchDims =\n getParamValue('batchDims', node, tensorMap, context) as number;\n const input = getParamValue('x', node,\n tensorMap, context) as Tensor;\n const indices =\n getParamValue('indices', node, tensorMap, context) as Tensor1D;\n return\n [tfOps.gather(\n input, tfOps.cast(indices, 'int32'), axis, batchDims)];\n }\n case 'Reverse': {\n const dims =\n getParamValue('dims', node, tensorMap, context) as boolean[];\n const axis = [];\n for (let i = 0; i < dims.length; i++) {\n if (dims[i]) {\n axis.push(i);\n }\n }\n const\n input = getParamValue('x', node, tensorMap, context) as Tensor;\n return [tfOps.reverse(input, axis)];\n }\n case 'ReverseV2': {\n const axis =\n getParamValue('axis', node, tensorMap, context) as\n number[];\n const input = getParamValue('x', node, tensorMap, context) as Tensor;\n return\n [tfOps.reverse(input, axis)];\n }\n case 'Slice': {\n // tslint:disable-next-line:no-any\n const\n begin = getParamValue('begin', node, tensorMap, context) as any;\n // tslint:disable-next-line:no-any\n const\n size = getParamValue('size', node, tensorMap, context) as any;\n return [tfOps.slice(\n getParamValue('x', node, tensorMap, context) as Tensor, begin,\n size)];\n }\n case 'StridedSlice':\n {\n const begin =\n getParamValue('begin', node, tensorMap, context) as number[];\n const end\n =\n getParamValue('end', node, tensorMap, context) as number[];\n const strides =\n getParamValue('strides', node, tensorMap, context) as number[];\n const beginMask =\n getParamValue('beginMask', node, tensorMap, context) as number;\n const endMask =\n getParamValue('endMask', node, tensorMap, context) as number;\n const ellipsisMask =\n getParamValue('ellipsisMask', node, tensorMap, context) as number;\n const newAxisMask =\n getParamValue('newAxisMask', node, tensorMap, context) as number;\n const shrinkAxisMask =\n getParamValue('shrinkAxisMask', node, tensorMap, context) as\n number;\n const tensor = getParamValue('x', node, tensorMap, context) as Tensor;\n return\n [tfOps.stridedSlice(\n tensor, begin, end, strides, beginMask, endMask, ellipsisMask,\n newAxisMask, shrinkAxisMask)];\n }\n case 'Pack': {\n return tidy(() => {\n const axis =\n getParamValue('axis', node, tensorMap, context) as number;\n const tensors =\n getParamValue('tensors', node, tensorMap, context) as Tensor[];\n // Reshape the tensors to the first tensor's

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=====\n*\n\nimport { Tensor, Tensor4D } from '@tensorflow/tfjs-core';\n// tslint:disable-next-line: no-imports-from-dist\nimport\n\n * as tfOps from '@tensorflow/tfjs-core/dist/ops/ops_for_converter';\nimport { NamedTensorsMap } from\n '../data/types';\nimport { ExecutionContext } from '../executor/execution_context';\nimport { InternalOpExecutor, Node } from '../types';\nimport { getParamValue } from './utils';\n\nexport const executeOp: InternalOpExecutor = (\n node: Node, tensorMap: NamedTensorsMap,\n context: ExecutionContext): Tensor[] => {\n switch\n (node.op) {\n case 'Cast': {\n return [tfOps.cast(\n getParamValue('x', node, tensorMap, context)\n as Tensor,\n getParamValue('dtype', node, tensorMap, context) as 'int32' |\n 'float32' | 'bool')];\n }\n case 'ExpandDims': {\n const axis =\n getParamValue('axis', node, tensorMap, context) as\n number;\n return [tfOps.expandDims(\n getParamValue('x', node, tensorMap, context) as Tensor,\n axis)];\n }\n case 'Squeeze': {\n const axis =\n getParamValue('axis', node, tensorMap, context) as number[];\n return\n [tfOps.squeeze(\n getParamValue('x', node, tensorMap, context) as Tensor, axis)];\n }\n case\n 'Reshape': {\n return [tfOps.reshape(\n getParamValue('x', node, tensorMap, context) as Tensor,\n getParamValue('shape', node, tensorMap, context) as number[])];\n }\n case 'MirrorPad': {\n return\n [tfOps.mirrorPad(\n getParamValue('x', node, tensorMap, context) as Tensor,\n getParamValue('padding', node, tensorMap, context) as\n Array<[number, number]>,\n getParamValue('mode', node, tensorMap, context) as 'reflect' |\n 'symmetric')];\n }\n case\n 'PadV2':\n case 'Pad': {\n return [tfOps.pad(\n getParamValue('x', node, tensorMap, context) as\n Tensor,\n getParamValue('padding',\n node, tensorMap, context) as\n Array<[number, number]>,\n getParamValue('constantValue',\n node, tensorMap, context) as\n number)];\n }\n case 'SpaceToBatchND': {\n const\n blockShape =\n getParamValue('blockShape', node, tensorMap, context) as number[];\n const\n paddings =\n getParamValue('paddings', node, tensorMap, context) as number[][];\n return\n [tfOps.spaceToBatchND(\n getParamValue('x', node, tensorMap, context) as Tensor,\n blockShape,\n paddings)];\n }\n case 'BatchToSpaceND': {\n const blockShape =\n getParamValue('blockShape', node, tensorMap, context) as number[];\n const crops =\n getParamValue('crops', node, tensorMap, context) as number[][];\n return [tfOps.batchToSpaceND(\n getParamValue('x', node, tensorMap, context) as Tensor,\n blockShape,\n crops)];\n }\n case 'DepthToSpace': {\n const blockSize =\n getParamValue('blockSize',\n node, tensorMap, context) as number;\n const dataFormat =\n (getParamValue('dataFormat', node,\n tensorMap, context) as\n string).toUpperCase() as 'NHWC' |\n 'NCHW';\n return\n [tfOps.depthToSpace(\n getParamValue('x', node, tensorMap, context) as Tensor4D,\n blockSize,\n dataFormat)];\n }\n case 'BroadcastTo': {\n return [tfOps.broadcastTo(\n getParamValue('x',\n node, tensorMap, context) as Tensor,\n getParamValue('shape', node, tensorMap, context) as number[])];\n }\n }\n default:\n throw TypeError(`Node type ${node.op} is not implemented`);\n }\n }\n};\n\nexport\nconst CATEGORY = 'transformation';\n\n/**\n * @license\n * Copyright 2018 Google LLC. All Rights
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied. See the License for the specific language governing permissions and limitations under the License.

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*\n\nimport * as tfc from '@tensorflow/tfjs-core';\n\nimport {NamedTensorsMap} from './data/types';\nimport {ExecutionContext} from './executor/execution_context';\nimport {ResourceManager} from './executor/resource_manager';\nimport {NodeValueImpl} from './custom_op/node_value_impl';\nimport {getRegisteredOp} from './custom_op/register';\nimport * as arithmetic from './executors/arithmetic_executor';\nimport * as basicMath from './executors/basic_math_executor';\nimport * as control from './executors/control_executor';\nimport * as convolution from './executors/convolution_executor';\nimport * as creation from './executors/creation_executor';\nimport * as dynamic from './executors/dynamic_executor';\nimport * as evaluation from './executors/evaluation_executor';\nimport * as graph from './executors/graph_executor';\nimport * as hashTable from './executors/hash_table_executor';\nimport * as image from './executors/image_executor';\nimport * as logical from './executors/logical_executor';\nimport * as matrices from './executors/matrices_executor';\nimport * as normalization from './executors/normalization_executor';\nimport * as reduction from './executors/reduction_executor';\nimport * as sliceJoin from './executors/slice_join_executor';\nimport * as spectral from './executors/spectral_executor';\nimport * as transformation from './executors/transformation_executor';\nimport {Node} from './types';\n\n/**\n * Executes the op defined by the node object.\n * @param node\n * @param tensorMap contains tensors for executed nodes and weights\n * @param context contains tensors and information for running the current node.\n * @param resourceManager Optional. Contains global resources of the model.\n */\nexport function executeOp(\n node: Node, tensorMap: NamedTensorsMap, context: ExecutionContext,\n resourceManager?: ResourceManager): tfc.Tensor[] | Promise<tfc.Tensor[]> {\n const value =\n ((node: Node, tensorMap: NamedTensorsMap, context: ExecutionContext) => {\n switch (node.category) {\n case 'arithmetic':\n return tfc.tidy(() => arithmetic.executeOp(node, tensorMap, context));\n case 'basic_math':\n return tfc.tidy(() => basicMath.executeOp(node, tensorMap, context));\n case 'control':\n return control.executeOp(node, tensorMap, context);\n case 'convolution':\n return tfc.tidy(() => convolution.executeOp(node, tensorMap, context));\n case 'creation':\n return tfc.tidy(() => creation.executeOp(node, tensorMap, context));\n case 'dynamic':\n return dynamic.executeOp(node, tensorMap, context);\n case 'evaluation':\n return tfc.tidy(() => evaluation.executeOp(node, tensorMap, context));\n case 'image':\n return tfc.tidy(() => image.executeOp(node, tensorMap, context));\n case 'graph':\n return tfc.tidy(() => graph.executeOp(node, tensorMap, context));\n case 'logical':\n return tfc.tidy(() => logical.executeOp(node, tensorMap, context));\n case 'matrices':\n return tfc.tidy(() => matrices.executeOp(node, tensorMap, context));\n case 'normalization':\n return tfc.tidy(() => normalization.executeOp(node, tensorMap, context));\n case 'reduction':\n return tfc.tidy(() => reduction.executeOp(node, tensorMap, context));\n case 'slice_join':\n return tfc.tidy(() => sliceJoin.executeOp(node, tensorMap, context));\n case 'spectral':\n return tfc.tidy(() => spectral.executeOp(node, tensorMap, context));\n case 'transformation':\n return tfc.tidy(() => transformation.executeOp(node, tensorMap, context));\n case 'hash_table':\n return hashTable.executeOp(node, tensorMap, context, resourceManager);\n case 'custom':\n const opMapper = getRegisteredOp(node.op);\n if (opMapper && opMapper.customExecutor) {\n return opMapper.customExecutor(new NodeValueImpl(node, tensorMap, context));\n } else {\n throw TypeError(`Custom op '${node.op}' is not registered.`);\n }\n default:\n throw TypeError(`Unknown op '${node.op}'. File an issue at https://github.com/tensorflow/tfjs/issues so we can add it`, or register a custom execution with tf.registerOp());\n }\n })(node, tensorMap, context);\n if (tfc.util.isPromise(value)) {\n return (value as Promise<tfc.Tensor>).then((data) => [].concat(data));\n }\n return
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[].concat(value);\n}\n", "/\*\n \* @license\n \* Copyright 2018 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the "License");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \* http://www.apache.org/licenses/LICENSE-2.0\n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an "AS IS" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY

KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

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=====\n*\nimport {Tensor} from '@tensorflow/tfjs-core';\nimport {NamedTensorsMap, TensorArrayMap, TensorListMap} from './data/types';\nimport {TensorArray} from './tensor_array';\nimport {TensorList} from './tensor_list';\nimport {FunctionExecutor} from './types';\nexport interface ExecutionContextInfo {\n id: number;\n // the unique id of the context info\n frameName: string; // The frame name of the loop, this comes from\n // the TensorFlow NodeDef.\n iterationId: number; // The iteration id of the loop\n}\n\n/**\n * ExecutionContext captures the runtime environment of the node. It keeps\n * track of the current frame and iteration for the control flow ops.\n * For example, typical Dynamic RNN model may contain loops, for which\n * TensorFlow will generate graphs with Enter/Exit nodes to control the\n * current execution frame, and NextIteration Nodes for iteration id increment.\n * For model with branch logic, TensorFlow will generate Switch/Merge ops.\n */\nexport class ExecutionContext {\n private rootContext = {id: 0, frameName: "", iterationId: 0};\n private contexts: ExecutionContextInfo[] = [this.rootContext];\n private lastId = 0;\n private _currentContextIds: string[];\n\n constructor(\n readonly weightMap: NamedTensorsMap = {},\n readonly tensorArrayMap: TensorArrayMap = {},\n readonly tensorListMap: TensorListMap = {},\n readonly functionMap: {[key: string]: FunctionExecutor} = {})\n {\n this.generateCurrentContextIds();\n }\n\n private newFrame(id: number, frameName: string) {\n return {id, frameName, iterationId: 0};\n }\n\n /**\n * Set the current context\n * @param contexts: ExecutionContextInfo[] the current path of execution\n * frames\n */\n set currentContext(contexts: ExecutionContextInfo[]) {\n if (this.contexts !== contexts) {\n this.contexts = contexts;\n this.generateCurrentContextIds();\n }\n }\n\n get currentContext(): ExecutionContextInfo {\n return this.contexts;\n }\n\n /**\n * Returns the current context in string format.\n */\n get currentContextId(): string {\n return this._currentContextIds[0];\n }\n\n /**\n * Returns the current context and all parent contexts in string format.\n * This allow access to the nodes in the current and parent frames.\n */\n get currentContextIds(): string[] {\n return this._currentContextIds;\n }\n\n private generateCurrentContextIds() {\n const names = [];\n for (let i = 0; i < this.contexts.length - 1; i++) {\n const contexts = this.contexts.slice(0, this.contexts.length - i);\n names.push(this.contextIdforContexts(contexts));\n }\n names.push("");\n this._currentContextIds = names;\n }\n\n private contextIdforContexts(contexts: ExecutionContextInfo[]) {\n return contexts ?\n contexts\n .map(\n context => (context.id === 0 && context.iterationId === 0) ?\n "" :\n `${context.frameName}-${context.iterationId}`\n)\n .join('/') :\n "";\n }\n\n /**\n * Enter a new frame, a new context is pushed on the current context list.\n * @param frameId new frame id\n */\n enterFrame(frameId: string) {\n if (this.contexts) {\n this.lastId++;\n this.contexts = this.contexts.slice();\n this.contexts.push(this.newFrame(this.lastId, frameId));\n this._currentContextIds.unshift(this.contextIdforContexts(this.contexts));\n }\n }\n\n /**\n * Exit the current frame, the last context is removed from the current\n * context list.\n */\n exitFrame() {\n if (this.contexts && this.contexts.length > 1) {\n this.contexts = this.contexts.slice();\n this.contexts.splice(-1);\n this.currentContextIds.shift();\n } else {\n throw new Error('Cannot exit frame, the context is empty');\n }\n }\n\n /**\n * Enter the next iteration of a loop, the iteration id of last context is\n * increased.\n */\n nextIteration() {\n if (this.contexts && this.contexts.length > 0) {\n this.contexts = this.contexts.slice();\n this.lastId++;\n const context =\n Object.assign({}, this.contexts[this.contexts.length - 1]);\n context.iterationId += 1;\n context.id = this.lastId;\n this.contexts.splice(-1, 1, context);\n this._currentContextIds.splice(\n 0, 1, this.contextIdforContexts(this.contexts));\n } else {\n throw new
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Error('Cannot increase frame iteration, the context is empty');\n }\n }\n\n getWeight(name: string): Tensor[] {\n return this.weightMap[name];\n }\n\n addTensorArray(tensorArray: TensorArray) {\n this.tensorArrayMap[tensorArray.id] = tensorArray;\n }\n\n getTensorArray(id:\n number): TensorArray {\n return this.tensorArrayMap[id];\n }\n\n addTensorList(tensorList: TensorList) {\n this.tensorListMap[tensorList.id] = tensorList;\n }\n\n getTensorList(id: number): TensorList {\n return\n this.tensorListMap[id];\n }\n\n dispose(keepIds: Set<number>) {\n for (const key in this.tensorArrayMap) {\n this.tensorArrayMap[key].clearAndClose(keepIds);\n }\n\n for (const key in this.tensorListMap) {\n this.tensorListMap[key].clearAndClose(keepIds);\n }\n }\n }\n\n"/**\n * @license\n * Copyright 2019 Google\n LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not\n use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n governing permissions and\n * limitations under the License.\n *
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=====\n\n*\n\nimport {NamedTensorMap} from '@tensorflow/tfjs-core';\nimport {NamedTensorsMap} from\n './data/types';\nimport {parseNodeName} from '../operations/executors/utils';\nimport {Graph, Node} from\n './operations/types';\n\nexport interface ExecutionInfo {\n inputs: NamedTensorMap;\n outputs: Node[];\n usedNodes: Set<string>;\n missingInputs: string[];\n dynamicNode: Node;\n syncInputs: string[];\n}\n\n/**\n * Given graph inputs and desired outputs, find the minimal set of nodes\n * to execute in order to compute the outputs.\n * In addition return other useful\n * info such:\n * - Missing inputs needed to compute the output.\n * - Whether the\n subgraph contains dynamic ops (control flow, dynamic shape).\n * - Alternative inputs in order\n to avoid async (dynamic op) execution.\n *\nexport function getExecutionSubgraph(\n inputs:\n NamedTensorMap, outputs: Node[], weightMap: NamedTensorsMap,\n initNodes?: Node[]): ExecutionInfo {\n const usedNodes = new Set<string>();\n const missingInputs: string[] = [];\n let dynamicNode: Node = null;\n let\n syncInputs: string[] = null;\n\n // Start with the outputs, going backwards and find all the nodes that are\n // needed\n to compute those outputs.\n const seen = new Set<string>();\n const inputNodeNames =\n Object.keys(inputs).map(name => parseNodeName(name)[0]);\n\n let initNodeNames: string[] = [];\n if (initNodes\n != null) {\n initNodeNames = initNodes.map(node => parseNodeName(node.name)[0]);\n }\n\n const frontier =\n [...outputs];\n while (frontier.length > 0) {\n const node = frontier.pop();\n if (isControlFlow(node) ||\n isDynamicShape(node) || isHashTable(node)) {\n if (dynamicNode == null) {\n dynamicNode = node;\n syncInputs\n = dynamicNode.children.map(child => child.name)\n .filter(name => usedNodes.has(name));\n }\n }\n usedNodes.add(node.name);\n\n // Weights are dead end since we already have their values.\n if\n (weightMap[node.name] != null) {\n continue;\n }\n\n // This node is a dead end since it's one of the user-\n provided\n inputs.\n if (inputNodeNames.indexOf(node.name) !== -1) {\n continue;\n }\n\n // This node is a\n dead end\n since it\n doesn't\n have any\n inputs.\n if (initNodeNames.indexOf(node.name) !== -1) {\n continue;\n }\n\n if (node.inputs.length === 0) {\n missingInputs.push(node.name);\n continue;\n }\n\n node.inputs.forEach(input => {\n // Don't add to the frontier if it is already there.\n if (seen.has(input.name))\n {\n return;\n }\n seen.add(input.name);\n frontier.push(input);\n });\n }\n\n return {inputs, outputs,\n usedNodes, missingInputs, dynamicNode, syncInputs};\n}\n\n/**\n * Given the execution info, return a list of nodes in topological order that\n * need to be\n executed\n to compute\n the\n output.\n *\nexport function getNodesInTopologicalOrder(\n graph: Graph, weightMap: NamedTensorsMap,\n executionInfo: ExecutionInfo): Node[] {\n const {usedNodes, inputs} = executionInfo;\n const frontier: Node[] =\n [];\n const inputNodes = Object.keys(inputs)\n .map(name => parseNodeName(name)[0])\n .map(name => graph.nodes[name]);\n const initNodes = graph.initNodes;\n\n inputNodes.forEach(input =>\n {\n if (usedNodes.has(input.name)) {\n frontier.push(input);\n }\n });\n graph.weights.forEach(weight =>\n {\n if (usedNodes.has(weight.name)) {\n frontier.push(weight);\n }\n });\n if (initNodes != null) {\n
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initNodes.forEach(node => {\n if (usedNodes.has(node.name)) {\n frontier.push(node);\n }\n});\n\nconst seen = new Set<string>();\nconst orderedNodes:\n Node[] = [];\n while (frontier.length > 0) {\n const node = frontier.pop();\n seen.add(node.name);\n if (!weightMap[node.name]) {\n orderedNodes.push(node);\n }\n node.children.forEach(child => {\n if (!seen.has(child.name) && usedNodes.has(child.name) &&\n child.inputs.every(input => seen.has(input.name))) {\n frontier.push(child);\n }\n });\n }\n return orderedNodes;\n}\n\nconst CONTROL_FLOW_OPS = [\n 'Switch', 'Merge', 'Enter', 'Exit', 'NextIteration', 'StatelessIf',\n 'StatelessWhile', 'if', 'While'];\nconst DYNAMIC_SHAPE_OPS = [\n 'NonMaxSuppressionV2', 'NonMaxSuppressionV3',\n 'NonMaxSuppressionV5', 'Where'];\nconst HASH_TABLE_OPS = [\n 'HashTable', 'HashTableV2', 'LookupTableImport',\n 'LookupTableImportV2', 'LookupTableFind', 'LookupTableFindV2'];\n\nexport function isControlFlow(node: Node) {\n return CONTROL_FLOW_OPS.indexOf(node.op) >= 0;\n}\n\nexport function isDynamicShape(node: Node) {\n return DYNAMIC_SHAPE_OPS.indexOf(node.op) >= 0;\n}\n\nexport function isHashTable(node: Node) {\n return HASH_TABLE_OPS.indexOf(node.op) >= 0;\n}\n\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\nimport {DataType, NamedTensorMap, Tensor, tidy, util} from '@tensorflow/tfjs-core';\nimport {ISignatureDef} from '../data/compiled_api';\nimport {NamedTensorsMap, TensorArrayMap, TensorInfo, TensorListMap} from '../data/types';\nimport {getNodeNameAndIndex, getParamValue, getTensor, getTensorsForCurrentContext, parseNodeName} from '../operations/executors/utis';\nimport {executeOp} from '../operations/operation_executor';\nimport {Graph, Node} from '../operations/types';\nimport {ExecutionContext, ExecutionContextInfo} from './execution_context';\nimport {getExecutionSubgraph, getNodesInTopologicalOrder, isControlFlow} from './model_analysis';\nimport {ResourceManager} from './resource_manager';\nimport {FunctionExecutor} from './types';\n\ninterface NodeWithContexts {\n contexts: ExecutionContextInfo[];\n node: Node;\n}\n\nexport class GraphExecutor implements FunctionExecutor {\n private compiledMap: Map<string, Node[]> = new Map();\n private _weightMap: NamedTensorsMap = {};\n private _weightIds: number[];\n private _signature: ISignatureDef;\n private _inputs: Node[];\n private _outputs: Node[];\n private _initNodes: Node[];\n // Internal init nodes to start initialization.\n private SEPERATOR = ',';\n private _functions: {[key: string]: Graph} = {};\n private _functionExecutorMap: {[key: string]: FunctionExecutor} = {};\n private _resourceManager: ResourceManager;\n\n get weightIds(): number[] {\n return this.parent ? this.parent.weightIds : this._weightIds;\n }\n\n get functionExecutorMap(): {[key: string]: FunctionExecutor} {\n return this.parent ? this.parent.functionExecutorMap : this._functionExecutorMap;\n }\n\n get weightMap(): NamedTensorsMap {\n return this.parent ? this.parent.weightMap : this._weightMap;\n }\n\n set weightMap(weightMap: NamedTensorsMap) {\n const weightIds = Object.keys(weightMap).map(key => weightMap[key].map(tensor => tensor.id));\n this._weightIds = [].concat(...weightIds);\n this._weightMap = weightMap;\n }\n\n /**\n * Set `ResourceManager` shared by executors of a model.\n * @param resourceManager:\n * `ResourceManager` of the `GraphModel`.\n */\n set resourceManager(resourceManager: ResourceManager) {\n this._resourceManager = resourceManager;\n }\n\n get inputs(): TensorInfo[] {\n return this._inputs.map(node => {\n return {\n name: node.name,\n shape: node.attrParams['shape'] ?\n node.attrParams['shape'].value as number[] :\n undefined,\n dtype: node.attrParams['dtype'] ?\n node.attrParams['dtype'].value as DataType :\n undefined;\n };\n });\n }\n\n get outputs(): TensorInfo[] {\n return this._outputs.map(node => {\n return {\n name: node.name,\n shape:

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node.attrParams['shape'] ?\n node.attrParams['shape'].value as number[] :\n undefined,\n dtype:\n node.attrParams['dtype'] ?\n node.attrParams['dtype'].value as DataType :\n undefined\n });\n\n}\n\n get inputNodes(): string[] {\n return this._inputs.map(node\n=> node.signatureKey || node.name);\n }\n\n get outputNodes(): string[] {\n return this._outputs.map((node) =>\n{\n const name = node.signatureKey || node.name;\n return node.defaultOutput ?\n (`${name}:${node.defaultOutput}`): name;\n });\n }\n\n get functions(): {[key: string]: ISignatureDef} {\n return Object.keys(this._functions).reduce((map, key) => {\n map[key] = this._functions[key].signature;\n return map;\n }, {} as {[key: string]: ISignatureDef});\n }\n\n /**\n *\n * @param graph Graph the model or\n * function graph to be executed.\n * @param parent When building function executor you need to set the parent\n * executor. Since the weights and function executor maps are set at parent\n * level, that function executor can\n * access the function maps and weight maps\n * through the parent.\n *\n * constructor(private graph: Graph,\n * private parent?: GraphExecutor) {\n * this._outputs = graph.outputs;\n * this._inputs = graph.inputs;\n * this._initNodes = graph.initNodes;\n * this._signature = graph.signature;\n * this._functions = graph.functions;\n * // create sub-graph executors\n * if (graph.functions != null) {\n * Object.keys(graph.functions).forEach(name =>\n * {\n * this._functionExecutorMap[name] =\n * new GraphExecutor(graph.functions[name], this);\n * });\n * }\n * }\n\n private getCompilationKey(inputs: Node[], outputs: Node[]): string {\n const sortedInputs =\n inputs.map(node => node.name).sort();\n const sortedOutputs = outputs.map(node => node.name).sort();\n return sortedInputs.join(this.SEPERATOR) + '-' +\n sortedOutputs.join(this.SEPERATOR);\n }\n\n /**\n *\n * Compiles the inference graph and returns the minimal set of nodes that are\n * required for execution, in the correct\n * execution order.\n *\n * private compile(inputs: NamedTensorMap, outputs: Node[]): Node[] {\n const\n executionInfo =\n getExecutionSubgraph(inputs, outputs, this.weightMap,\n this._initNodes);\n const {missingInputs, dynamicNode, syncInputs} = executionInfo;\n if (dynamicNode !=\n null) {\n throw new Error(\n `This execution contains the node '${dynamicNode.name}', which has\n `the dynamic op\n `${dynamicNode.op}'. Please use\n `${model.executeAsync()} instead. Alternatively, to\n avoid the\n `${dynamic ops, specify the inputs\n [`${syncInputs}`]);\n }\n\n if (missingInputs.length > 0) {\n const outNames = outputs.map(n => n.name);\n const inNames = Object.keys(inputs);\n throw new Error(\n `Cannot compute the outputs\n [`${outNames}] from the provided inputs\n [`${inNames}`]. Missing the\n following inputs: [`${missingInputs}`]);\n }\n\n return getNodesInTopologicalOrder(\n this.graph,\n this.weightMap, executionInfo);\n }\n\n /**\n *\n * Executes the inference for given input tensors.\n * @param\n * inputs Tensor map for the model inputs, keyed by the input\n * node\n * names.\n * @param outputs Optional. output node name from the Tensorflow model, if\n * no outputs\n * are specified, the default outputs of the model would be used.\n * You can inspect intermediate nodes of the model\n * by adding them to the\n * outputs array.\n *\n * execute(inputs: NamedTensorMap, outputs?: string[]): Tensor[]\n * {\n inputs = this.mapInputs(inputs);\n const names = Object.keys(inputs).sort();\n this.checkInputs(inputs);\n this.checkInputShapeAndType(inputs);\n outputs = this.mapOutputs(outputs);\n this.checkOutputs(outputs);\n const inputNodes =\n names.map(name => this.graph.nodes[parseNodeName(name)[0]]);\n const\n outputNodeNames = outputs.map(name => parseNodeName(name)[0]);\n let outputNodes =\n outputNodeNames.map(name => this.graph.nodes[name]);\n\n // If no outputs are specified, then use the default\n outputs of the model.\n if (outputNodes.length === 0) {\n outputNodes = this._outputs;\n }\n\n const\n compilationKey\n = this.getCompilationKey(inputNodes, outputNodes);\n\n // Do nothing if the compiled graph cache contains the\n input.\n let orderedNodes = this.compiledMap.get(compilationKey);\n if (orderedNodes == null) {\n orderedNodes = this.compile(inputs, outputNodes);\n this.compiledMap.set(compilationKey, orderedNodes);\n }\n\n const tensorArrayMap: TensorArrayMap = {};\n const tensorListMap: TensorListMap = {};\n\n return\n tidy(() => {\n const context = new ExecutionContext(\n this.weightMap, tensorArrayMap, tensorListMap,\n this.functionExecutorMap);\n const tensorsMap: NamedTensorsMap = {...this.weightMap};\n\n Object.keys(inputs).forEach(name => {\n const [nodeName, index] = parseNodeName(name);\n const\n tensors: Tensor[] = [];\n tensors[index] = inputs[name];\n tensorsMap[nodeName] = tensors;\n });\n\n

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const tensorsToKeep = this.getFrozenTensorIds(tensorsMap);\n const intermediateTensorConsumerCount:
 {[key: number]: number} = {};\n for (let i = 0; i < orderedNodes.length; i++) {\n const node =
 orderedNodes[i];\n if (!tensorsMap[node.name]) {\n const tensors =\n executeOp(node,
 tensorsMap, context, this._resourceManager) as\n Tensor[];\n if (util.isPromise(tensors)) {\n
 throw new Error(\n `The execution of the op '${node.op}' returned a promise. ` +\n `Please use
 model.executeAsync() instead.`);\n }\n tensorsMap[node.name] = tensors;\n
 this.checkTensorForDisposal(\n node.name, node, tensorsMap, context, tensorsToKeep,\n
 outputNodeNames, intermediateTensorConsumerCount);\n }\n }\n // dispose the context for the root
 executor\n if (this.parent == null) {\n context.dispose(tensorsToKeep);\n }\n return outputs.map(name
 => getTensor(name, tensorsMap, context));\n });\n
 }\n\n private getFrozenTensorIds(tensorMap: NamedTensorMap): Set<number> {\n const ids =
 [].concat.apply(\n [],\n Object.keys(tensorMap)\n .map(key => tensorMap[key])\n .map(tensors => tensors.map(tensor => tensor.id)));\n return new Set(ids);\n }\n\n private
 checkTensorForDisposal(\n nodeName: string, node: Node, tensorMap: NamedTensorMap,\n context:
 ExecutionContext, tensorsToKeep: Set<number>,\n outputNames: string[],\n
 intermediateTensorConsumerCount: {[key: string]: number}) {\n // Skip output nodes and any control flow nodes,
 since its dependency is\n // tricky to track correctly.\n if (node.category === 'control' ||
 outputNames.indexOf(nodeName) !== -1) {\n return;\n }\n tensorMap[nodeName].forEach(tensor => {\n
 if (tensor != null) {\n intermediateTensorConsumerCount[tensor.id] =\n
 (intermediateTensorConsumerCount[tensor.id] || 0) +\n node.children.length;\n
 }\n });\n node.inputs.forEach(input => {\n // Skip any control flow nodes, since its dependency is tricky
 to track\n // correctly.\n if (input.category !== 'control') {\n const tensors =\n getTensorsForCurrentContenxt(input.name, tensorMap, context);\n if (tensors != null) {\n
 tensors.forEach(tensor => {\n if (tensor && !tensorsToKeep.has(tensor.id)) {\n const count =
 intermediateTensorConsumerCount[tensor.id];\n if (count === 1) {\n tensor.dispose();\n
 delete intermediateTensorConsumerCount[tensor.id];\n } else if (count != null) {\n // only
 intermediate nodes has count set, inputs and weights are\n // not.\n
 intermediateTensorConsumerCount[tensor.id]--;\n }\n });\n });\n });\n });\n }\n\n /**\n * Executes the inference for given input tensors in
 Async\n * fashion.\n * @param inputs Tensor map for the model inputs, keyed by the input node\n * names.\n *
 @param outputs output node name from the Tensorflow model, if no outputs\n * are specified, the default outputs
 of the model would be used. You can\n * inspect intermediate nodes of the model by adding them to the outputs\n
 * array.\n */\n async executeAsync(inputs: NamedTensorMap, outputs?: string[]): Promise<Tensor[]> {\n
 return this._executeAsync(inputs, outputs);\n }\n\n /**\n * Executes the inference for given input tensors in
 Async\n * fashion.\n * @param inputs Tensor map for the model inputs, keyed by the input node\n * names.\n *
 @param outputs Optional. output node name from the Tensorflow model,\n * if no outputs are specified, the
 default outputs of the model would be\n * used. You can inspect intermediate nodes of the model by adding them
 to the\n * outputs array.\n * @param isFunctionExecution Optional. Flag for executing a function.\n
 * @param tensorArrayMap Optional, global TensorArray map by id. Used for\n * function execution.\n *
 @param tensorListMap Optinal global TensorList map by id. Used for\n * function execution.\n */\n private
 async _executeAsync(\n inputs: NamedTensorMap, outputs?: string[], isFunctionExecution = false,\n
 tensorArrayMap: TensorArrayMap = {},\n tensorListMap: TensorListMap = {}): Promise<Tensor[]> {\n if
 (!isFunctionExecution) {\n inputs = this.mapInputs(inputs);\n this.checkInputs(inputs);\n
 this.checkInputShapeAndType(inputs);\n outputs = this.mapOutputs(outputs);\n this.checkOutputs(outputs);\n
 }\n const context = new ExecutionContext(\n this.weightMap, tensorArrayMap, tensorListMap,\n
 this.functionExecutorMap);\n // Graph with control flow op requires runtime evaluation of the execution\n //
 order, while without control flow the execution order is pre-determined\n // in the compile method.\n

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const tensorMap = await this.executeWithControlFlow(\n inputs, context, outputs, isFunctionExecution);\n
const results = outputs.map(name => getTensor(name, tensorMap, context));\n\n // dispose all the intermediate\n
tensors\n const outputIds = results.map(t => t.id);\n const inputIds = Object.keys(inputs).map(name =>\n
inputs[name].id);\n const keepIds =\n new Set<number>([...outputIds, ...inputIds, ...this.weightIds]);\n
Object.keys(tensorMap).forEach(key => {\n const tensorArray = tensorMap[key];\n
tensorArray.forEach(tensor => {\n if (tensor && !tensor.isDisposed && !keepIds.has(tensor.id)) {\n
tensor.dispose();\n }\n });\n });\n // dispose the context for the root executor\n if (this.parent == null)\n
{\n context.dispose(keepIds);\n }\n\n return results;\n }\n\n async executeFunctionAsync(\n inputs:\n
Tensor[], tensorArrayMap: TensorArrayMap,\n tensorListMap: TensorListMap): Promise<Tensor[]>\n
{\n const mappedInputs = inputs.reduce((map, tensor, index) => {\n map[this.inputs[index].name] = tensor;\n
return map;\n }, {} as NamedTensorMap);\n\n return this._executeAsync(\n mappedInputs,\n
this.outputNodes, true, tensorArrayMap, tensorListMap);\n }\n /**\n * When there are control flow nodes in the\n
graph, the graph execution use\n * ExecutionContext to keep track of the frames and loop iterators.\n * @param\n
inputs placeholder tensors for the graph.\n * @param context the execution context object for current execution.\n
*\n * @param outputNames Optional. output node name from the Tensorflow model,\n * if no outputs are specified,\n
the default outputs of the model would be\n * used. You can inspect intermediate nodes of the model by adding\n
them to the\n * outputs array.\n * @param isFunctionExecution Flag for executing a function.\n */\n private\n
async executeWithControlFlow(\n inputs: NamedTensorMap, context: ExecutionContext,\n
outputNames?: string[],\n isFunctionExecution?: boolean): Promise<NamedTensorsMap> {\n const names =\n
Object.keys(inputs);\n const inputNodes =\n names.map(name =>\n
this.graph.nodes[parseNodeName(name)[0]]);\n const outputNodeNames = outputNames.map(name =>\n
parseNodeName(name)[0]);\n let outputNodes = outputNodeNames.map(name => this.graph.nodes[name]);\n\n // If\n
no outputs are specified, then use the default outputs of the model.\n if (outputNodes.length === 0) {\n
outputNodes = this._outputs;\n }\n\n const {usedNodes, missingInputs, dynamicNode, syncInputs} =\n
getExecutionSubgraph(\n inputs, outputNodes, this.weightMap, this._initNodes);\n\n // First nodes to\n
execute include inputNodes, weights, and initNodes.\n const stack: NodeWithContexts[] = [\n ...inputNodes,\n
...this.graph.weights, ...(this._initNodes || [])\n].map(node => {\n return {node, contexts:\n
context.currentContext};\n });\n const tensorsMap:\n
NamedTensorsMap = {...this.weightMap};\n Object.keys(inputs).forEach(name => {\n const [nodeName,\n
index] = parseNodeName(name);\n const tensors: Tensor[] = [];\n tensors[index] = inputs[name];\n
tensorsMap[nodeName] = tensors;\n });\n const intermediateTensorConsumerCount: {[key: number]: number} =\n
{};\n const tensorsToKeep = this.getFrozenTensorIds(tensorsMap);\n const added: {[key: string]: boolean} =\n
{};\n while (stack.length > 0) {\n const promises = this.processStack(\n inputNodes, stack, context,\n
tensorsMap, added, tensorsToKeep,\n outputNodeNames, intermediateTensorConsumerCount, usedNodes);\n
await Promise.all(promises);\n }\n if (dynamicNode == null && !isFunctionExecution) {\n console.warn(\n
`\n
This model execution did not contain any nodes with control flow ` +\n `\n
`or dynamic output shapes. You\n
can use model.execute() instead.`);\n }\n const missingOutputs =\n outputNodes\n
.filter(\n node => !isControlFlow(node) &&\n !getTensor(node.name, tensorsMap,\n
context))\n .map(node => node.name);\n if (missingOutputs.length > 0) {\n let alternativeMsg = `;\n
if (dynamicNode != null) {\n alternativeMsg =\n `Alternatively, to avoid the dynamic ops, use\n
model.execute() ` +\n `and specify the inputs [${syncInputs}];\n }\n throw new Error(\n `Cannot\n
compute the outputs [${missingOutputs}] from the provided ` +\n `inputs [${names}]. Consider providing the\n
following inputs: ` +\n `${missingInputs}. ${alternativeMsg}`);\n }\n return tensorsMap;\n }\n\n private\n
processStack(\n inputNodes: Node[], stack: NodeWithContexts[], context: ExecutionContext,\n tensorMap:\n
NamedTensorsMap, added: {[key: string]: boolean},\n tensorsToKeep: Set<number>, outputNames: string[],\n
intermediateTensorConsumerCount:\n
{[key: number]: number},\n usedNodes: Set<string>)\n {\n const promises: Array<Promise<Tensor[]>> = [];\n
while (stack.length > 0) {\n const item = stack.pop();\n context.currentContext = item.contexts;\n let

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nodeName = "\n // The tensor of the Enter op with isConstant set should be set\n // in the parent scope, so it
will be available as constant for the\n // whole loop.\n if (item.node.op === 'Enter' &&\n
getParamValue('isConstant', item.node, tensorMap, context)) {\n [nodeName] =
getNodeNameAndIndex(item.node.name, context);\n }\n\n // only process nodes that are not in the tensorMap
yet, this include\n // inputNodes and internal initNodes.\n if (tensorMap[item.node.name] == null) {\n
const tensors = \n executeOp(item.node, tensorMap, context, this._resourceManager);\n if (!nodeName)
{\n [nodeName] = getNodeNameAndIndex(item.node.name, context);\n }\n const
currentContext = context.currentContext;\n if (util.isPromise(tensors)) {\n promises.push((tensors as
Promise<Tensor[]>).then(t => {\n tensorMap[nodeName] = t;\n context.currentContext =
currentContext;\n this.checkTensorForDisposal(\n nodeName, item.node, tensorMap, context,
tensorsToKeep,\n outputNames, intermediateTensorConsumerCount);\n this.processChildNodes(\n
item.node, stack, context, tensorMap, added, usedNodes);\n return t;\n }));\n } else {\n
tensorMap[nodeName] = tensors as Tensor[];\n this.checkTensorForDisposal(\n nodeName,
item.node, tensorMap, context, tensorsToKeep,\n outputNames, intermediateTensorConsumerCount);\n
this.processChildNodes(\n item.node, stack, context, tensorMap, added, usedNodes);\n }\n } else {\n
this.processChildNodes(\n item.node,
stack, context, tensorMap, added, usedNodes);\n }\n }\n return promises;\n }\n\n private
processChildNodes(\n node: Node, stack: NodeWithContexts[], context: ExecutionContext,\n tensorMap:
NamedTensorMap, added: {[key: string]: boolean},\n usedNodes: Set<string>) {\n
node.children.forEach((childNode) => {\n const [nodeName,] = getNodeNameAndIndex(childNode.name,
context);\n if (added[nodeName] || !usedNodes.has(childNode.name)) {\n return;\n }\n // Merge op can
be pushed if any of its inputs has value.\n if (childNode.op === 'Merge') {\n if
(childNode.inputNames.some(name => {\n return !!getTensor(name, tensorMap, context);\n }))) {\n
added[nodeName] = true;\n stack.push({ contexts: context.currentContext, node: childNode});\n }\n
} else // Otherwise all inputs must to have value.\n if (childNode.inputNames.every(name => {\n
return
!!getTensor(name, tensorMap, context);\n }))) {\n added[nodeName] = true;\n
stack.push({ contexts: context.currentContext, node: childNode});\n }\n }\n\n /**\n * Releases the
memory used by the weight tensors.\n */\n dispose() {\n Object.keys(this.weightMap)\n .forEach(\n
key => this.weightMap[key].forEach(tensor => tensor.dispose()));\n }\n\n private
checkInputShapeAndType(inputs: NamedTensorMap) {\n Object.keys(inputs).forEach(name => {\n const
input = inputs[name];\n const [nodeName,] = parseNodeName(name);\n const node =
this.graph.nodes[nodeName];\n if (node.attrParams['shape'] && node.attrParams['shape'].value) {\n const
shape = node.attrParams['shape'].value as number[];\n const match = shape.length === input.shape.length &&\n
input.shape.every(\n (dim, index) => shape[index] === -1 || shape[index] === dim);\n
util.assert(\n match,\n
() => `The shape of dict['${node.name}'] provided in ` +\n `model.execute(dict) must be
[${shape}], but was ` +\n `[${input.shape}]);\n }\n if (node.attrParams['dtype'] &&
node.attrParams['dtype'].value) {\n util.assert(\n input.dtype === node.attrParams['dtype'].value as
string,\n
() => `The dtype of dict['${node.name}'] provided in ` +\n `model.execute(dict) must be `
+ \n ` ${node.attrParams['dtype'].value}, but was ${input.dtype}`);\n }\n }\n\n private
mapInputs(inputs: NamedTensorMap) {\n const result: NamedTensorMap = {};\n for (const inputName in
inputs) {\n if (this._signature != null && this._signature.inputs != null &&\n
this._signature.inputs[inputName] != null) {\n const tensor = this._signature.inputs[inputName];\n
result[tensor.name] = inputs[inputName];\n } else {\n result[inputName] = inputs[inputName];\n
}\n }\n return result;\n }\n\n private checkInputs(inputs: NamedTensorMap) {\n const notInGraph =
Object.keys(inputs).filter(name => {\n const [nodeName] = parseNodeName(name);\n return
this.graph.nodes[nodeName] == null;\n });\n if (notInGraph.length > 0) {\n throw new Error(\n `The

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dict provided in model.execute(dict) has `+n `keys: [{notInGraph}] that are not part of graph`);n }n
}n\n private mapOutputs(outputs: string[]) {n return outputs.map(name => {n if (this._signature != null &&
this._signature.outputs != null &&n this._signature.outputs[name] != null) {n const tensor =
this._signature.outputs[name];n return tensor.name;n }n return name;n }, {});n }n\n private
checkOutputs(outputs: string[]): void {n outputs.forEach(name => {n const [normalizedName] =
parseNodeName(name);n if (!this.graph.nodes[normalizedName]) {n throw new
Error(`The output '${name}' is not found in the graph`);n }n });n }n}\n"/**\n * @license\n * Copyright
2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n *
you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\\n
*/\nimport {HashMap, NamedTensorMap} from './data/types';\nimport {HashMap} from
'/hash_table';\n\n/**\n * Contains global resources of a model.\n */\nexport class ResourceManager {n
 constructor(\n readonly hashMapNameToHandle: NamedTensorMap = {},\n readonly hashMap:
HashMap = {}) {}n\n /**\n * Register a `HashMap` in the resource manager.\n * @n * The `HashMap`
can be retrieved by `resourceManager.getHashMapById`,\n * where id is the table handle tensor's id.\n *
@param name Op node name that creates the `HashMap`.\n * @param hashMap The `HashMap` to be added to
resource manager.\n */\n addHashMap(name: string, hashMap: HashMap) {n
 this.hashMapNameToHandle[name] = hashMap.handle;n this.hashMap[hashMap.id] = hashMap;n
 }n\n /**\n * Get the table handle by node name.\n * @param name Op node name that creates the `HashMap`.
This name is also\n * used in the inputs list of lookup and import `HashMap` ops.\n */\n getHashMapHandleByName(name: string) {n return this.hashMapNameToHandle[name];n }n\n /**\n *
Get the actual `HashMap` by its handle tensor's
id.\n * @param id The id of the handle tensor.\n */\n getHashMapById(id: number): HashMap {n return
this.hashMap[id];n }n\n /**\n * Dispose `ResourceManager`, including its hashMap and tensors in
them.\n */\n dispose() {n for (const key in this.hashMap) {n
 this.hashMap[key].clearAndClose();n delete this.hashMap[key];n }n\n for (const name in
this.hashMapNameToHandle) {n this.hashMapNameToHandle[name].dispose();n delete
this.hashMapNameToHandle[name];n }n }n}\n"/**\n * @license\n * Copyright 2018 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS
IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n *
See the License for the specific language governing permissions and\n * limitations under the License.\n *
=====\\n
*/\nimport {InferenceModel, io, ModelPredictConfig, NamedTensorMap, Tensor} from '@tensorflow/tfjs-
core';\nimport * as tensorflow from './data/compiled_api';\nimport {NamedTensorsMap, TensorInfo} from
 './data/types';\nimport {OperationMapper} from './operations/operation_mapper';\nimport {GraphExecutor} from
'/graph_executor';\nimport {ResourceManager} from './resource_manager';\n\nexport const
TFHUB_SEARCH_PARAM = '?tfjs-format=file';\nexport const DEFAULT_MODEL_NAME =
'model.json';\n\n/**\n * A `tf.GraphModel` is a directed, acyclic graph built from a\n * SavedModel GraphDef and
allows inference execution.\n * @n * A `tf.GraphModel` can only be created by loading from a model converted
from\n * a [TensorFlow

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SavedModel](https://www.tensorflow.org/guide/saved_model) using\n * the command line converter tool and
loaded via `tf.loadGraphModel`.\n *\n * @doc {heading: 'Models', subheading: 'Classes'}\n *\nexport class
GraphModel implements InferenceModel {\n private executor: GraphExecutor;\n private version = 'n/a';\n private
handler: io.IOHandler;\n private artifacts: io.ModelArtifacts;\n private initializer: GraphExecutor;\n private
resourceManager: ResourceManager;\n private signature: tensorflow.ISignatureDef;\n\n // Returns the version
information for the tensorflow model GraphDef.\n get modelVersion(): string {\n return this.version;\n }\n\n get
inputNodes(): string[] {\n return this.executor.inputNodes;\n }\n\n get outputNodes(): string[] {\n return
this.executor.outputNodes;\n }\n\n get inputs(): TensorInfo[] {\n return this.executor.inputs;\n }\n\n get
outputs(): TensorInfo[] {\n return this.executor.outputs;\n }\n\n get weights(): NamedTensorsMap
{\n return this.executor.weightMap;\n }\n\n get metadata(): {} {\n return this.artifacts.userDefinedMetadata;\n
}\n\n get modelSignature(): {} {\n return this.signature;\n }\n\n /**\n * @param modelUrl url for the model, or
an `io.IOHandler`.\n * @param weightManifestUrl url for the weight file generated by\n * scripts/convert.py
script.\n * @param requestOptions options for Request, which allows to send credentials\n * and custom
headers.\n * @param onProgress Optional, progress callback function, fired periodically\n * before the load is
completed.\n */\n constructor(\n private modelUrl: string|io.IOHandler,\n private loadOptions:
io.LoadOptions = {}) {\n if (loadOptions == null) {\n this.loadOptions = {};\n }\n this.resourceManager =
new ResourceManager();\n }\n\n private findIOHandler() {\n const path = this.modelUrl;\n if ((path as
io.IOHandler).load != null) {\n // Path is an IO Handler.\n this.handler
= path as io.IOHandler;\n } else if (this.loadOptions.requestInit != null) {\n this.handler =
io.browserHTTPRequest(path as string, this.loadOptions);\n } else {\n const handlers =
io.getLoadHandlers(path as string, this.loadOptions);\n if (handlers.length === 0) {\n // For backward
compatibility: if no load handler can be found,\n // assume it is a relative http path.\n handlers.push(io.browserHTTPRequest(path as string, this.loadOptions));\n } else if (handlers.length > 1) {\n
throw new Error(\n `Found more than one (${handlers.length}) load handlers for ` +\n `URL
`${[path]}`);\n }\n this.handler = handlers[0];\n }\n }\n\n /**\n * Loads the model and weight files,
construct the in memory weight map and\n * compile the inference graph.\n */\n async load(): Promise<boolean>
{\n this.findIOHandler();\n if (this.handler.load == null) {\n throw new Error(\n `Cannot proceed
with model loading because the IOHandler provided ` +\n `does not have the `load` method implemented.`);\n }\n const artifacts = await this.handler.load();\n\n return this.loadSync(artifacts);\n }\n\n /**\n *
Synchronously construct the in memory weight map and\n * compile the inference graph. Also initialize hashtable
if any.\n */\n *\n * @doc {heading: 'Models', subheading: 'Classes', ignoreCI: true}\n *\n loadSync(artifacts:
io.ModelArtifacts) {\n this.artifacts = artifacts;\n const graph = this.artifacts.modelTopology as
tensorflow.IGraphDef;\n\n let signature;\n if (this.artifacts.userDefinedMetadata != null &&\n
this.artifacts.userDefinedMetadata.signature != null) {\n signature = // tslint:disable-next-line:no-any\n
(this.artifacts.userDefinedMetadata as any).signature as\n tensorflow.ISignatureDef;\n } else {\n signature
= this.artifacts.signature;\n }\n this.signature = signature;\n\n this.version = `${graph.versions.producer}.${graph.versions.minConsumer}`;\n const weightMap =\n
io.decodeWeights(this.artifacts.weightData, this.artifacts.weightSpecs);\n this.executor = new GraphExecutor(\n
 OperationMapper.Instance.transformGraph(graph, this.signature);\n this.executor.weightMap =
this.convertTensorMapToTensorsMap(weightMap);\n // Attach a model-level resourceManager to each executor
to share resources,\n // such as `HashTable`.\n this.executor.resourceManager = this.resourceManager;\n\n if
(artifacts.modelInitializer != null &&\n (artifacts.modelInitializer as tensorflow.IGraphDef).node != null) {\n
const initializer =\n OperationMapper.Instance.transformGraph(artifacts.modelInitializer);\n this.initializer
= new GraphExecutor(initializer);\n this.initializer.weightMap = this.executor.weightMap;\n // Attach a
model-level resourceManager to the initializer, the\n // hashTables created from when
executing the initializer will be stored\n // in the resourceManager.\n this.initializer.resourceManager =
this.resourceManager;\n this.initializer.executeAsync({}, []);\n }\n\n return true;\n }\n\n /**\n * Save the
configuration and/or weights of the GraphModel.\n */\n *\n * An `IOHandler` is an object that has a `save` method of

```

the proper signature defined. The `save` method manages the storing or transmission of serialized data ("artifacts") that represent the model's topology and weights onto or via a specific medium, such as file downloads, local storage, IndexedDB in the web browser and HTTP requests to a server. TensorFlow.js provides `IOHandler` implementations for a number of frequently used saving mediums, such as `tf.io.browserDownloads` and `tf.io.browserLocalStorage`. See `tf.io` for more details. This method also allows you to refer to certain types of `IOHandler` as URL-like string shortcuts, such as `'localStorage://'` and `'indexeddb://'`.

**Example 1: Save model's topology and weights to browser [local storage](https://developer.mozilla.org/en-US/docs/Web/API/Window/localStorage) then load it back.**

```

const modelUrl = 'https://storage.googleapis.com/tfjs-models/savedmodel/mobilenet_v2_1.0_224/model.json';
const model = await tf.loadGraphModel(modelUrl);
const zeros = tf.zeros([1, 224, 224, 3]);
model.predict(zeros).print();
const saveResults = await model.save('localStorage://my-model-1');
const loadedModel = await tf.loadGraphModel('localStorage://my-model-1');
console.log('Prediction from loaded model:');
model.predict(zeros).print();

```

**@param handlerOrURL** An instance of `IOHandler` or a URL-like, scheme-based string shortcut for `IOHandler`.

**@param config** Options for saving the model.

**@returns** A `Promise` of `SaveResult`, which summarizes the result of the saving, such as byte sizes of the saved artifacts for the model's topology and weight values.

**@doc** {heading: 'Models', subheading: 'Classes', ignoreCI: true}

```

async save(handlerOrURL: io.IOHandler|string, config?: io.SaveConfig): Promise<io.SaveResult> {
 if (typeof handlerOrURL === 'string') {
 const handlers = io.getSaveHandlers(handlerOrURL);
 if (handlers.length === 0) {
 throw new Error(`Cannot find any save handlers for URL '${handlerOrURL}'`);
 } else if (handlers.length > 1) {
 throw new Error(`Found more than one (${handlers.length}) save handlers for URL '${handlerOrURL}'`);
 }
 handlerOrURL = handlers[0];
 }
 if (handlerOrURL.save == null) {
 throw new Error(`GraphModel.save() cannot proceed because the IOHandler '${handlerOrURL}' provided does not have the 'save' attribute defined.`);
 }
 return handlerOrURL.save(this.artifacts);
}

```

**Execute the inference for the input tensors.**

**@param input** The input tensors, when there is single input for the model, inputs param should be a `tf.Tensor`. For models with multiple inputs, inputs params should be in either `tf.Tensor[]` if the input order is fixed, or otherwise `NamedTensorMap` format.

**@param model** For model with multiple inputs, we recommend you use `NamedTensorMap` as the input type, if you use `tf.Tensor[]`, the order of the array needs to follow the order of `inputNodes` array. @see [GraphModel.inputNodes](#)

**@param outputNodeNames** You can also feed any intermediate nodes using the `NamedTensorMap` as the input type. For example, given the graph `InputNode => Intermediate => OutputNode`, you can execute the subgraph `Intermediate => OutputNode` by calling `model.execute('IntermediateNode': tf.tensor(...))`

This is useful for models that uses `tf.dynamic_rnn`, where the intermediate state needs to be fed manually.

**@param batch** For batch inference execution, the tensors for each input need to be concatenated together. For example with `mobilenet`, the required input shape is `[1, 244, 244, 3]`, which represents the [batch, height, width, channel]. If we are provide a batched data of 100 images, the input tensor should be in the shape of `[100, 244, 244, 3]`.

**@param config** Prediction configuration for specifying the batch size and output node names. Currently the batch size option is ignored for `graph` model.

**@returns** Inference result tensors. The output would be single `tf.Tensor` if model has single output node, otherwise `Tensor[]` or `NamedTensorMap[]` will be returned for model with multiple outputs.

**@doc** {heading: 'Models', subheading: 'Classes'}

```

predict(inputs: Tensor|Tensor[]|NamedTensorMap, config?: ModelPredictConfig): Tensor|Tensor[]|NamedTensorMap {
 return this.execute(inputs, this.outputNodes);
}
private normalizeInputs(inputs: Tensor|Tensor[]|NamedTensorMap): NamedTensorMap {
 if (!(inputs instanceof Tensor) && !Array.isArray(inputs)) {
 // The input is already a NamedTensorMap.
 return inputs;
 }
 inputs = Array.isArray(inputs) ? inputs : [inputs];
 if (inputs.length !== this.inputNodes.length) {
 throw new Error(`Input tensor count mismatch, +

```

```

`the graph model has ${this.inputNodes.length} placeholders, ` +\n `while there are ${inputs.length} input
tensors.`);\n } \n return this.inputNodes.reduce((map, inputName, i) => {\n map[inputName] = (inputs as
Tensor[])[i];\n return map;\n }, {} as NamedTensorMap);\n } \n\n private normalizeOutputs(outputs:
string|string[]): string[] {\n outputs = outputs || this.outputNodes;\n return
!Array.isArray(outputs) ? [outputs] : outputs;\n } \n\n /**\n * Executes inference for the model for given input
tensors.\n * @param inputs tensor, tensor array or tensor map of the inputs for the\n * model, keyed by the input
node names.\n * @param outputs output node name from the Tensorflow model, if no\n * outputs are specified,
the default outputs of the model would be used.\n * You can inspect intermediate nodes of the model by adding
them to the\n * outputs array.\n * \n * @returns A single tensor if provided with a single output or no outputs\n
* are provided and there is only one default output, otherwise return a\n * tensor array. The order of the tensor
array is the same as the outputs\n * if provided, otherwise the order of outputNodes attribute of the model.\n
* \n * @doc {heading: 'Models', subheading: 'Classes'}\n */\n execute(inputs: Tensor|Tensor[]|NamedTensorMap,
outputs?: string|string[]):\n Tensor|Tensor[] {\n inputs = this.normalizeInputs(inputs);\n
 outputs = this.normalizeOutputs(outputs);\n const result = this.executor.execute(inputs, outputs);\n
 return
result.length > 1 ? result : result[0];\n } \n\n /**\n * Executes inference for the model for given input tensors in
async\n * fashion, use this method when your model contains control flow ops.\n * @param inputs tensor, tensor
array or tensor map of the inputs for the\n * model, keyed by the input node names.\n * @param outputs output
node name from the Tensorflow model, if no outputs\n * are specified, the default outputs of the model would be
used. You can\n * inspect intermediate nodes of the model by adding them to the outputs\n * array.\n * \n *
@returns A Promise of single tensor if provided with a single output or\n * no outputs are provided and there is
only one default output, otherwise\n * return a tensor map.\n * \n * @doc {heading: 'Models', subheading:
'Classes'}\n */\n async executeAsync(\n inputs:
Tensor|Tensor[]|NamedTensorMap,\n outputs?: string|string[]): Promise<Tensor|Tensor[]> {\n inputs =
this.normalizeInputs(inputs);\n outputs = this.normalizeOutputs(outputs);\n const result = await
this.executor.executeAsync(inputs, outputs);\n return result.length > 1 ? result : result[0];\n } \n\n private
convertTensorMapToTensorsMap(map: NamedTensorMap): NamedTensorsMap {\n return
Object.keys(map).reduce((newMap: NamedTensorsMap, key) => {\n newMap[key] = [map[key]];\n return
newMap;\n }, {});\n } \n\n /**\n * Releases the memory used by the weight tensors and resourceManager.\n
* \n * @doc {heading: 'Models', subheading: 'Classes'}\n */\n dispose() {\n this.executor.dispose();\n if
(this.initializer) {\n this.initializer.dispose();\n } \n\n this.resourceManager.dispose();\n } \n\n\n /**\n * Load
a graph model given a URL to the model definition.\n * \n * Example of loading MobileNetV2 from a URL and
making a prediction with
a\n * zeros input:\n * \n * ```js\n * const modelUrl =\n * 'https://storage.googleapis.com/tfjs-
models/savedmodel/mobilenet_v2_1.0_224/model.json';\n * const model = await tf.loadGraphModel(modelUrl);\n *
const zeros = tf.zeros([1, 224, 224, 3]);\n * model.predict(zeros).print();\n * ```\n * \n * Example of loading
MobileNetV2 from a TF Hub URL and making a prediction with\n * a zeros input:\n * \n * ```js\n * const modelUrl
=\n * 'https://tfhub.dev/google/imagenet/mobilenet_v2_140_224/classification/2';\n * const model = await
tf.loadGraphModel(modelUrl, {fromTFHub: true});\n * const zeros = tf.zeros([1, 224, 224, 3]);\n *
model.predict(zeros).print();\n * ```\n * \n * @param modelUrl The url or an `io.IOHandler` that loads the model.\n
* \n * @param options Options for the HTTP request, which allows to send credentials\n * and custom headers.\n
* \n * @doc {heading: 'Models', subheading: 'Loading'}\n */\n\n export async function loadGraphModel(\n modelUrl:
string|io.IOHandler,\n options:
io.LoadOptions = {}): Promise<GraphModel> {\n if (modelUrl == null) {\n throw new Error(\n 'modelUrl in
loadGraphModel() cannot be null. Please provide a url ' +\n 'or an IOHandler that loads the model');\n } \n
if (options == null) {\n options = {};\n } \n\n if (options.fromTFHub) {\n if ((modelUrl as io.IOHandler).load ==
null) {\n if (!(modelUrl as string).endsWith('/')) {\n modelUrl = (modelUrl as string) + '/';\n } \n
modelUrl = `${modelUrl}${DEFAULT_MODEL_NAME}${TFHUB_SEARCH_PARAM}`;\n } \n\n const
model = new GraphModel(modelUrl, options);\n await model.load();\n return

```

```

model;\n}\n",null,null,null,null,null,null,null,null,null,null,null,null,null,null,null,null,null,"/**\n * dat-gui
JavaScript Controller Library\n * http://code.google.com/p/dat-gui\n *\n * Copyright 2011 Data Arts Team, Google
Creative Lab\n *\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n *\n * you may not use this file
except
in compliance with the License.\n *\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n\nimport Color from './color/Color';\nimport math from
 './color/math';\nimport interpret from './color/interpret';\n\nimport Controller from './controllers/Controller';\nimport
 BooleanController from './controllers/BooleanController';\nimport OptionController from
 './controllers/OptionController';\nimport StringController from './controllers/StringController';\nimport
 NumberController from './controllers/NumberController';\nimport NumberControllerBox from
 './controllers/NumberControllerBox';\nimport NumberControllerSlider from
 './controllers/NumberControllerSlider';\nimport FunctionController from './controllers/FunctionController';\nimport
 ColorController from './controllers/ColorController';\n\nimport domImport from './dom/dom';\nimport GUIImport
 from './gui/GUI';\n\nexport const color = {\n Color: Color,\n math: math,\n interpret: interpret\n};\n\nexport
 const controllers = {\n Controller: Controller,\n BooleanController: BooleanController,\n OptionController:
 OptionController,\n StringController: StringController,\n NumberController: NumberController,\n
 NumberControllerBox: NumberControllerBox,\n NumberControllerSlider: NumberControllerSlider,\n
 FunctionController: FunctionController,\n ColorController: ColorController\n};\n\nexport const dom = { dom:
 domImport }; \n\nexport const gui = { GUI: GUIImport }; \n\nexport const GUI = GUIImport;\n\nexport default {\n
 color,\n controllers,\n dom,\n gui,\n GUI\n};\n",/**\n * dat-gui JavaScript Controller Library\n *
http://code.google.com/p/dat-gui\n *\n * Copyright 2011 Data Arts Team, Google Creative Lab\n *\n * Licensed
under the Apache License, Version 2.0 (the \"License\");\n *\n * you may not use this file except in compliance with the
License.\n *\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n
*\n\nexport default function(color,
forceCSSHex) {\n const colorFormat = color.__state.conversionName.toString();\n\n const r =
Math.round(color.r);\n const g = Math.round(color.g);\n const b = Math.round(color.b);\n const a = color.a;\n
 const h = Math.round(color.h);\n const s = color.s.toFixed(1);\n const v = color.v.toFixed(1);\n\n if (forceCSSHex
|| (colorFormat === 'THREE_CHAR_HEX') || (colorFormat === 'SIX_CHAR_HEX')) {\n let str =
color.hex.toString(16);\n while (str.length < 6) {\n str = '0' + str;\n }\n return '#' + str;\n } else if
(colorFormat === 'CSS_RGB') {\n return 'rgb(' + r + ',' + g + ',' + b + ')';\n } else if (colorFormat ===
'CSS_RGBA') {\n return 'rgba(' + r + ',' + g + ',' + b + ',' + a + ')';\n } else if (colorFormat === 'HEX') {\n
 return '0x' + color.hex.toString(16);\n } else if (colorFormat === 'RGB_ARRAY') {\n return '[' + r + ',' + g + ',' + b +
']';\n } else if (colorFormat === 'RGBA_ARRAY') {\n return '[' + r + ',' + g + ',' + b + ',' + a +
']';\n } else if (colorFormat === 'RGB_OBJ') {\n return '{r:' + r + ',g:' + g + ',b:' + b + '}';\n } else if (colorFormat
=== 'RGBA_OBJ') {\n return '{r:' + r + ',g:' + g + ',b:' + b + ',a:' + a + '}';\n } else if (colorFormat ===
'HSV_OBJ') {\n return '{h:' + h + ',s:' + s + ',v:' + v + '}';\n } else if (colorFormat === 'HSV_A_OBJ') {\n
 return '{h:' + h + ',s:' + s + ',v:' + v + ',a:' + a + '}';\n }\n\n return 'unknown format';\n}\n",/**\n * dat-gui JavaScript
Controller Library\n * http://code.google.com/p/dat-gui\n *\n * Copyright 2011 Data Arts Team, Google Creative
Lab\n *\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n *\n * you may not use this file except
in compliance with the License.\n *\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n\nconst ARR_EACH = Array.prototype.forEach;\nconst
ARR_SLICE = Array.prototype.slice;\n\n/**\n * Band-aid methods for things that should be a lot easier in
JavaScript.\n * Implementation and structure inspired by underscore.js\n *
http://documentcloud.github.com/underscore/\n *\n\nconst Common = {\n BREAK: {},\n\n extend:
function(target) {\n this.each(ARR_SLICE.call(arguments, 1), function(obj) {\n const keys = this.isObject(obj)
? Object.keys(obj) : [];\n keys.forEach(function(key) {\n if (!this.isUndefined(obj[key])) {\n
 target[key] = obj[key];\n }\n }).bind(this);\n }, this);\n\n return target;\n },\n\n defaults: function(target)
{\n this.each(ARR_SLICE.call(arguments, 1), function(obj) {\n const keys = this.isObject(obj) ?

```





```

space: 'RGB',\n r: original[0],\n g: original[1],\n b: original[2]\n };\n },\n\n write:
function(color) {\n return [color.r, color.g, color.b];\n }\n },\n\n RGBA_ARRAY: {\n read:
function(original) {\n if (original.length !== 4) return false;\n return {\n space: 'RGB',\n r:
original[0],\n g: original[1],\n b: original[2],\n a: original[3]\n };\n },\n\n write:
function(color) {\n return [color.r, color.g, color.b, color.a];\n }\n }\n },\n\n // Objects\n {\n litmus: common.isObject,\n conversions: {\n RGBA_OBJ:
{\n read: function(original) {\n if (common.isNumber(original.r) &&\n common.isNumber(original.g) &&\n common.isNumber(original.b) &&\n common.isNumber(original.a)) {\n return {\n space: 'RGB',\n r: original.r,\n g:
original.g,\n b: original.b,\n a: original.a\n };\n }\n return false;\n },\n\n write: function(color) {\n return {\n r: color.r,\n g: color.g,\n b: color.b,\n a:
color.a\n };\n }\n },\n\n RGB_OBJ: {\n read: function(original) {\n if
(common.isNumber(original.r) &&\n common.isNumber(original.g) &&\n common.isNumber(original.b)) {\n return {\n space: 'RGB',\n r: original.r,\n g:
original.g,\n b: original.b\n };\n }\n return false;\n },\n\n write: function(color) {\n return {\n r: color.r,\n g:
color.g,\n b: color.b\n };\n }\n },\n\n HSVA_OBJ: {\n read: function(original) {\n if
(common.isNumber(original.h) &&\n common.isNumber(original.s) &&\n common.isNumber(original.v) &&\n common.isNumber(original.a)) {\n return {\n space:
'HSV',\n h: original.h,\n s: original.s,\n v: original.v,\n a: original.a\n };\n }\n return false;\n },\n\n write: function(color) {\n return {\n h: color.h,\n s:
color.s,\n v: color.v,\n a: color.a\n };\n }\n },\n\n HSV_OBJ: {\n read:
function(original) {\n if (common.isNumber(original.h) &&\n common.isNumber(original.s)
&&\n common.isNumber(original.v)) {\n return {\n space: 'HSV',\n h: original.h,\n s: original.s,\n v: original.v\n };\n }\n return false;\n },\n\n write:
function(color) {\n return {\n h: color.h,\n s: color.s,\n v: color.v\n };\n }\n }\n }\n }\n }\n }\n }\n\n let result;\n let toReturn;\n const interpret = function() {\n toReturn = false;\n\n const original =
arguments.length > 1 ? common.toArray(arguments) : arguments[0];\n\n common.each(INTERPRETATIONS,
function(family) {\n if (family.litmus(original)) {\n common.each(family.conversions, function(conversion,
conversionName) {\n result = conversion.read(original);\n\n if (toReturn === false && result !== false) {\n toReturn = result;\n result.conversionName = conversionName;\n result.conversion = conversion;\n return common.BREAK;\n }\n });\n }\n });\n\n return common.BREAK;\n }\n });\n\n return
toReturn;\n};\n\nexport default interpret;\n", "/*\n * dat-gui JavaScript Controller Library\n *
http://code.google.com/p/dat-gui\n * Copyright 2011 Data Arts Team, Google Creative Lab\n * Licensed
under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n
*\n\nlet tmpComponent;\nconst ColorMath = {\n hsv_to_rgb: function(h, s, v) {\n const hi = Math.floor(h / 60)
% 6;\n const f = h / 60 - Math.floor(h / 60);\n const p = v * (1.0 - s);\n const q = v * (1.0 - (f * s));\n const t
= v * (1.0 - ((1.0 - f) * s));\n const c = [\n [v, t, p],\n [q, v, p],\n [p, v, t],\n [p, q, v],\n [t, p, v],\n [v, p, q]\n][hi];\n return {\n r: c[0] * 255,\n g: c[1] * 255,\n b: c[2] * 255\n };\n },\n\n rgb_to_hsv: function(r, g, b) {\n const min = Math.min(r, g,
b);\n const max = Math.max(r, g, b);\n const delta = max - min;\n let h;\n let s;\n\n if (max !== 0) {\n s
= delta / max;\n } else {\n return {\n h: NaN,\n s: 0,\n v: 0\n };\n }\n\n if (r === max) {\n h = (g - b) / delta;\n } else if (g === max) {\n h = 2 + (b - r) / delta;\n } else {\n h = 4 + (r - g) / delta;\n }\n\n h /= 6;\n if (h < 0) {\n h += 1;\n }\n\n return {\n h: h * 360,\n s: s,\n v: max / 255\n };\n },\n\n rgb_to_hex: function(r, g, b) {\n let hex = this.hex_with_component(0, 2, r);\n hex =
this.hex_with_component(hex, 1, g);\n hex = this.hex_with_component(hex, 0, b);\n return hex;\n },\n\n component_from_hex: function(hex, componentIndex) {\n return (hex >> (componentIndex * 8)) & 0xFF;\n }\n};

```

```

},\n\n hex_with_component:
function(hex, componentIndex, value) {\n return value << (tmpComponent = componentIndex * 8) | (hex &
~(0xFF << tmpComponent));\n }\n};\n\nexport default ColorMath;\n", "/*\n * dat-gui JavaScript Controller
Library\n * http://code.google.com/p/dat-gui\n * Copyright 2011 Data Arts Team, Google Creative Lab\n *\n *
Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n\nimport interpret from './interpret';\nimport math from
'./math';\nimport colorToString from './toString';\nimport common from './utils/common';\n\nclass Color {\n
constructor() {\n this.__state = interpret.apply(this, arguments);\n\n if (this.__state === false) {\n throw new
Error('Failed to interpret color arguments');\n }\n\n this.__state.a = this.__state.a || 1;\n }\n\n toString() {\n
return colorToString(this);\n
}\n\n toHexString() {\n return colorToString(this, true);\n }\n\n toOriginal() {\n return
this.__state.conversion.write(this);\n }\n\nfunction defineRGBComponent(target, component,
componentHexIndex) {\n Object.defineProperty(target, component, {\n get: function() {\n if
(this.__state.space === 'RGB') {\n return this.__state[component];\n }\n\n Color.recalculateRGB(this,
component, componentHexIndex);\n\n return this.__state[component];\n },\n\n set: function(v) {\n if
(this.__state.space !== 'RGB') {\n Color.recalculateRGB(this, component, componentHexIndex);\n
this.__state.space = 'RGB';\n }\n\n this.__state[component] = v;\n }\n });\n\nfunction
defineHSVComponent(target, component) {\n Object.defineProperty(target, component, {\n get: function() {\n
if (this.__state.space === 'HSV') {\n return this.__state[component];\n }\n\n Color.recalculateHSV(this);\n\n return
this.__state[component];\n },\n\n set: function(v) {\n if (this.__state.space !== 'HSV') {\n
Color.recalculateHSV(this);\n this.__state.space = 'HSV';\n }\n\n this.__state[component] = v;\n }\n
});\n\n\nColor.recalculateRGB = function(color, component, componentHexIndex) {\n if (color.__state.space
=== 'HEX') {\n color.__state[component] = math.component_from_hex(color.__state.hex,
componentHexIndex);\n } else if (color.__state.space === 'HSV') {\n common.extend(color.__state,
math.hsv_to_rgb(color.__state.h, color.__state.s, color.__state.v));\n } else {\n throw new Error('Corrupted color
state');\n }\n};\n\nColor.recalculateHSV = function(color) {\n const result = math.rgb_to_hsv(color.r, color.g,
color.b);\n\n common.extend(color.__state, {\n s: result.s,\n v: result.v\n });\n\n if
(!common.isNaN(result.h)) {\n color.__state.h = result.h;\n } else if (common.isUndefined(color.__state.h)) {\n
color.__state.h
= 0;\n }\n};\n\nColor.COMPONENTS = ['r', 'g', 'b', 'h', 's', 'v', 'hex', 'a'];\n\ndefineRGBComponent(Color.prototype,
'r', 2);\n\ndefineRGBComponent(Color.prototype, 'g', 1);\n\ndefineRGBComponent(Color.prototype, 'b',
0);\n\ndefineHSVComponent(Color.prototype, 'h');\n\ndefineHSVComponent(Color.prototype,
's');\n\ndefineHSVComponent(Color.prototype, 'v');\n\n\nObject.defineProperty(Color.prototype, 'a', {\n get: function()
{\n return this.__state.a;\n },\n\n set: function(v) {\n this.__state.a = v;\n }\n});\n\n\nObject.defineProperty(Color.prototype, 'hex', {\n get: function() {\n if (!this.__state.space !== 'HEX')
{\n this.__state.hex = math.rgb_to_hex(this.r, this.g, this.b);\n }\n\n return this.__state.hex;\n },\n\n set:
function(v) {\n this.__state.space = 'HEX';\n this.__state.hex = v;\n }\n});\n\n\nexport default Color;\n", "/*\n *
dat-gui JavaScript Controller Library\n * http://code.google.com/p/dat-gui\n * Copyright 2011 Data Arts Team,
Google Creative Lab\n *\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n\n**\n * @class An \"abstract\" class that represents a given
property of an object.\n *\n * @param {Object} object The object to be manipulated\n *\n * @param {string} property
The name of the property to be manipulated\n *\n\nclass Controller {\n constructor(object, property) {\n
this.initialValue = object[property];\n\n /**\n * Those who extend this class will put their DOM elements in
here.\n * @type {DOMELEMENT}\n */\n this.domElement = document.createElement('div');\n\n /**\n *
The object to manipulate\n * @type {Object}\n */\n this.object = object;\n\n /**\n * The name of the

```

```

property to manipulate\n * @type {String}\n *^\n this.property = property;\n\n /**\n * The function to be called on change.\n * @type {Function}\n * @ignore\n *^\n this.__onChange =
undefined;\n\n /**\n * The function to be called on finishing change.\n * @type {Function}\n * @ignore\n *^\n this.__onFinishChange = undefined;\n }\n\n /**\n * Specify that a function fire every time someone
changes the value with\n * this Controller.\n *^\n * @param {Function} fnc This function will be called
whenever the value\n * is modified via this Controller.\n * @returns {Controller} this\n *^\n onChange(fnc) {\n
this.__onChange = fnc;\n return this;\n }\n\n /**\n * Specify that a function fire every time someone
\"finishes\" changing\n * the value with this Controller. Useful for values that change\n * incrementally like
numbers or strings.\n *^\n * @param {Function} fnc This function will be called whenever\n * someone
\"finishes\" changing the value via this Controller.\n * @returns {Controller} this\n *^\n
onFinishChange(fnc) {\n this.__onFinishChange = fnc;\n return this;\n }\n\n /**\n * Change the value of
<code>object[property]</code>\n *^\n * @param {Object} newValue The new value of
<code>object[property]</code>\n *^\n setValue(newValue) {\n this.object[this.property] = newValue;\n if
(this.__onChange) {\n this.__onChange.call(this, newValue);\n }\n\n this.updateDisplay();\n return this;\n
}\n\n /**\n * Gets the value of <code>object[property]</code>\n *^\n * @returns {Object} The current value of
<code>object[property]</code>\n *^\n getValue() {\n return this.object[this.property];\n }\n\n /**\n *
Refreshes the visual display of a Controller in order to keep sync\n * with the object's current value.\n * @returns
{Controller} this\n *^\n updateDisplay() {\n return this;\n }\n\n /**\n * @returns {Boolean} true if the value
has deviated from initialValue\n *^\n isModified() {\n return this.initialValue !== this.getValue();\n
}\n}\n\nexport default Controller;\n", /**\n * dat-gui JavaScript Controller Library\n *
http://code.google.com/p/dat-gui\n *^\n * Copyright 2011 Data Arts Team, Google Creative Lab\n *^\n * Licensed
under the Apache License, Version 2.0 (the \"License\");\n *^\n * you may not use this file except in compliance with the
License.\n *^\n * You may obtain a copy of the License at\n *^\n * http://www.apache.org/licenses/LICENSE-2.0\n
*^\n\nimport common from '../utils/common';\n\nconst EVENT_MAP = {\n HTMLEvents: ['change'],\n
MouseEvents: ['click', 'mousemove', 'mousedown', 'mouseup', 'mouseover'],\n KeyboardEvents:
['keydown']\n};\n\nconst EVENT_MAP_INV = {};\n\ncommon.each(EVENT_MAP, function(v, k) {\n
common.each(v, function(e) {\n EVENT_MAP_INV[e] = k;\n });\n});\n\nconst CSS_VALUE_PIXELS =
/(\\d+(\\.\\d+)?px;/\n\nfunction cssValueToPixels(val) {\n if (val === '0' || common.isUndefined(val)) {\n return
0;\n }\n\n const match = val.match(CSS_VALUE_PIXELS);\n\n if (!common.isNull(match))\n {\n return
parseFloat(match[1]);\n }\n\n // TODO ...ems? %?\n\n return 0;\n}\n\n/**\n * @namespace\n *
@member dat.dom\n *^\n\nconst dom = {\n\n /**\n *^\n * @param elem\n * @param selectable\n *^\n
makeSelectable: function(elem, selectable) {\n if (elem === undefined || elem.style === undefined) return;\n\n
elem.onselectstart = selectable ? function() {\n return false;\n } : function() {\n };}\n\n
elem.style.MozUserSelect = selectable ? 'auto' : 'none';\n elem.style.KhtmlUserSelect = selectable ? 'auto' :
'none';\n elem.unselectable = selectable ? 'on' : 'off';\n },\n\n /**\n *^\n * @param elem\n * @param
horizontal\n * @param vert\n *^\n makeFullscreen: function(elem, hor, vert) {\n let vertical = vert;\n let
horizontal = hor;\n\n if (common.isUndefined(horizontal)) {\n horizontal = true;\n }\n\n if
(common.isUndefined(vertical)) {\n vertical = true;\n }\n\n elem.style.position = 'absolute';\n\n
if (horizontal) {\n elem.style.left = 0;\n elem.style.right = 0;\n }\n\n if (vertical) {\n elem.style.top =
0;\n elem.style.bottom = 0;\n }\n },\n\n /**\n *^\n * @param elem\n * @param eventType\n * @param
params\n *^\n fakeEvent: function(elem, eventType, pars, aux) {\n const params = pars || {};\n const
className = EVENT_MAP_INV[eventType];\n if (!className) {\n throw new Error('Event type ' +
eventType + ' not supported.);\n }\n\n const evt = document.createEvent(className);\n switch (className) {\n
case 'MouseEvents':\n {\n const clientX = params.x || params.clientX || 0;\n const clientY =
params.y || params.clientY || 0;\n evt.initMouseEvent(eventType, params.bubbles || false,\n
params.cancelable || true, window, params.clickCount || 1,\n 0, // screen X\n 0, // screen Y\n
clientX, // client X\n clientY, // client

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property) {\n super(object, property);\n\n const _this = this;\n this.__prev = this.getValue();\n\n this.__checkbox = document.createElement('input');\n this.__checkbox.setAttribute('type', 'checkbox');\n\n function onChange() {\n _this.setValue(!_this.__prev);\n }\n\n dom.bind(this.__checkbox, 'change',\n onChange, false);\n\n this.domElement.appendChild(this.__checkbox);\n\n // Match original value\n this.updateDisplay();\n }\n\n setValue(v) {\n const toReturn = super.setValue(v);\n if (this.__onFinishChange)\n {\n this.__onFinishChange.call(this, this.getValue());\n }\n this.__prev = this.getValue();\n return\n toReturn;\n }\n\n updateDisplay() {\n if (this.getValue() === true) {\n this.__checkbox.setAttribute('checked',\n 'checked');\n this.__checkbox.checked = true;\n this.__prev = true;\n } else {\n this.__checkbox.checked\n = false;\n this.__prev = false;\n }\n\n return super.updateDisplay();\n\n }\n}\n\nexport default BooleanController;\n", "/*\n * dat-gui JavaScript Controller Library\n *\n http://code.google.com/p/dat-gui\n *\n * Copyright 2011 Data Arts Team, Google Creative Lab\n *\n * Licensed\n under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the\n License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *\nimport Controller from './Controller';\nimport dom from './dom/dom';\nimport common from\n './utils/common';\n\n/**\n * @class Provides a select input to alter the property of an object, using a\n * list of\n accepted values.\n *\n * @extends dat.controllers.Controller\n *\n * @param {Object} object The object to be\n manipulated\n *\n * @param {string} property The name of the property to be manipulated\n *\n * @param\n {Object|string[]} options A map of labels to acceptable values, or\n * a list of acceptable string values.\n *\n */\n\nclass\n OptionController extends Controller\n {\n\n constructor(object, property, opts) {\n super(object, property);\n\n let options = opts;\n\n const _this =\n this;\n\n /**\n * The drop down menu\n * @ignore\n */\n this.__select =\n document.createElement('select');\n\n if (common.isArray(options)) {\n const map = {};\n\n common.each(options, function(element) {\n map[element] = element;\n });\n options = map;\n }\n\n common.each(options, function(value, key) {\n const opt = document.createElement('option');\n\n opt.innerHTML = key;\n opt.setAttribute('value', value);\n _this.__select.appendChild(opt);\n });\n\n // Acknowledge original value\n this.updateDisplay();\n\n dom.bind(this.__select, 'change', function() {\n const\n desiredValue = this.options[this.selectedIndex].value;\n _this.setValue(desiredValue);\n });\n\n this.domElement.appendChild(this.__select);\n }\n\n setValue(v) {\n const toReturn = super.setValue(v);\n\n if (this.__onFinishChange) {\n this.__onFinishChange.call(this, this.getValue());\n }\n\n return toReturn;\n }\n\n updateDisplay() {\n if (dom.isActive(this.__select)) return this; // prevent number from updating if user is\n trying to manually update\n this.__select.value = this.getValue();\n return super.updateDisplay();\n }\n\n}\n\nexport default OptionController;\n", "/*\n * dat-gui JavaScript Controller Library\n *\n http://code.google.com/p/dat-gui\n *\n * Copyright 2011 Data Arts Team, Google Creative Lab\n *\n * Licensed\n under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the\n License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *\nimport Controller from './Controller';\nimport dom from './dom/dom';\n\n/**\n * @class Provides a text input\n to alter the string property of an object.\n *\n * @extends dat.controllers.Controller\n *\n * @param\n {Object} object The object to be manipulated\n *\n * @param {string} property The name of the property to be\n manipulated\n *\n */\n\nclass\n StringController extends Controller\n {\n\n constructor(object, property) {\n super(object,\n property);\n\n const _this = this;\n\n function onChange() {\n _this.setValue(_this.__input.value);\n }\n\n function onBlur() {\n if (_this.__onFinishChange) {\n _this.__onFinishChange.call(_this,\n _this.getValue());\n }\n }\n\n this.__input = document.createElement('input');\n\n this.__input.setAttribute('type', 'text');\n\n dom.bind(this.__input, 'keyup', onChange);\n dom.bind(this.__input,\n 'change', onChange);\n dom.bind(this.__input, 'blur', onBlur);\n dom.bind(this.__input, 'keydown', function(e)\n {\n if (e.keyCode === 13) {\n this.blur();\n }\n });\n\n this.updateDisplay();\n\n this.domElement.appendChild(this.__input);\n }\n\n updateDisplay() {\n // Stops the caret from moving on\n account of:\n // keyup -> setValue -> updateDisplay\n if (!dom.isActive(this.__input)) {\n this.__input.value\n = this.getValue();\n }\n\n return super.updateDisplay();\n }\n\n}\n\nexport default StringController;\n", "/*\n * dat-

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gui JavaScript Controller Library\n * http://code.google.com/p/dat-gui\n *\n * Copyright 2011 Data Arts Team,
Google Creative Lab\n *\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use
this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n\nimport Controller from './Controller';\nimport common from
 './utils/common';\n\nfunction numDecimals(x) {\n const _x = x.toString();\n if (_x.indexOf('.') > -1) {\n return
_x.length - _x.indexOf('.') - 1;\n }\n return 0;\n}\n\n/**\n * @class Represents a given property of an object that
is a number.\n *\n * @extends dat.controllers.Controller\n *\n * @param {Object} object
The object to be manipulated\n *\n * @param {string} property The name of the property to be manipulated\n *\n
@param {Object} [params] Optional parameters\n *\n * @param {Number} [params.min] Minimum allowed value\n *\n
@param {Number} [params.max] Maximum allowed value\n *\n * @param {Number} [params.step] Increment by
which to change value\n *\n\nclass NumberController extends Controller {\n constructor(object, property, params)
{\n super(object, property);\n\n const _params = params || {};\n\n this.__min = _params.min;\n this.__max =
_params.max;\n this.__step = _params.step;\n\n if (common.isUndefined(this.__step)) {\n if (this.initialValue
=== 0) {\n this.__impliedStep = 1; // What are we, psychics?\n } else {\n // Hey Doug, check this out.\n
this.__impliedStep = Math.pow(10, Math.floor(Math.log(Math.abs(this.initialValue)) / Math.LN10)) / 10;\n }\n }
else {\n this.__impliedStep = this.__step;\n }\n\n this.__precision =
numDecimals(this.__impliedStep);\n\n }\n\n setValue(v) {\n let _v = v;\n\n if (this.__min !== undefined && _v < this.__min) {\n _v =
this.__min;\n } else if (this.__max !== undefined && _v > this.__max) {\n _v = this.__max;\n }\n\n if
(this.__step !== undefined && _v % this.__step !== 0) {\n _v = Math.round(_v / this.__step) * this.__step;\n }\n\n return super.setValue(_v);\n }\n\n /**\n * Specify a minimum value for <code>object[property]</code>.\n
*\n * @param {Number} minValue The minimum value for\n * <code>object[property]</code>\n * @returns
{dat.controllers.NumberController} this\n *\n * ^\n * min(minValue) {\n this.__min = minValue;\n return this;\n }\n\n /**\n * Specify a maximum value for <code>object[property]</code>.\n
*\n * @param {Number}
maxValue The maximum value for\n * <code>object[property]</code>\n * @returns
{dat.controllers.NumberController} this\n *\n * ^\n * max(maxValue) {\n this.__max = maxValue;\n return
this;\n }\n\n /**\n * Specify a step value that dat.controllers.NumberController\n * increments by.\n *\n * @param {Number} stepValue The step value for\n * dat.controllers.NumberController\n * @default if minimum
and maximum specified increment is 1% of the\n * difference otherwise stepValue is 1\n * @returns
{dat.controllers.NumberController} this\n *\n * ^\n * step(stepValue) {\n this.__step = stepValue;\n
this.__impliedStep = stepValue;\n this.__precision = numDecimals(stepValue);\n return this;\n }\n}\n\nexport
default NumberController;\n", /**\n * dat-gui JavaScript Controller Library\n * http://code.google.com/p/dat-gui\n
*\n * Copyright 2011 Data Arts Team, Google Creative Lab\n *\n * Licensed under the Apache License, Version
2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n\nimport NumberController from
 './NumberController';\nimport dom from './dom/dom';\nimport common from './utils/common';\n\nfunction
roundToDecimal(value, decimals) {\n const tenTo = Math.pow(10, decimals);\n return Math.round(value * tenTo)
/ tenTo;\n}\n\n/**\n * @class Represents a given property of an object that is a number and\n * provides an input
element with which to manipulate it.\n *\n * @extends dat.controllers.Controller\n *\n * @extends
dat.controllers.NumberController\n *\n * @param {Object} object The object to be manipulated\n *\n * @param
{string} property The name of the property to be manipulated\n *\n * @param {Object} [params] Optional parameters\n
*\n * @param {Number} [params.min] Minimum allowed value\n *\n * @param {Number} [params.max] Maximum
allowed value\n *\n * @param {Number} [params.step] Increment by which to change value\n *\n\nclass
NumberControllerBox extends NumberController {\n constructor(object, property, params) {\n super(object,
property, params);\n\n this.__truncationSuspended = false;\n\n const _this = this;\n\n /**\n * {Number} Previous mouse y position\n * @ignore\n *\n let prevY;\n\n function onChange() {\n const attempted = parseFloat(_this.__input.value);\n if (!common.isNaN(attempted))
{\n _this.setValue(attempted);\n }\n }\n\n function onFinish() {\n if (_this.__onFinishChange) {\n

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 _this.__onFinishChange.call(_this, _this.getValue());\n }\n }\n\n function onBlur() {\n onFinish();\n }\n\n function onMouseDrag(e) {\n const diff = prevY - e.clientY;\n _this.setValue(_this.getValue() + diff * _this.__impliedStep);\n prevY = e.clientY;\n }\n\n function onMouseUp() {\n dom.unbind(window, 'mousemove', onMouseDrag);\n dom.unbind(window, 'mouseup', onMouseUp);\n onFinish();\n }\n\n function onMouseDown(e) {\n dom.bind(window, 'mousemove', onMouseDrag);\n dom.bind(window, 'mouseup', onMouseUp);\n prevY = e.clientY;\n }\n\n this.__input = document.createElement('input');\n this.__input.setAttribute('type', 'text');\n\n // Makes it so manually specified values are not truncated.\n\n dom.bind(this.__input, 'change', onChange);\n dom.bind(this.__input, 'blur', onBlur);\n dom.bind(this.__input, 'mousedown', onMouseDown);\n dom.bind(this.__input, 'keydown', function(e) {\n // When pressing enter, you can be as precise as you want.\n if (e.keyCode === 13) {\n _this.__truncationSuspended = true;\n this.blur();\n _this.__truncationSuspended = false;\n onFinish();\n }\n });\n\n this.updateDisplay();\n\n this.domElement.appendChild(this.__input);\n\n updateDisplay() {\n this.__input.value = this.__truncationSuspended ? this.getValue() : roundToDecimal(this.getValue(), this.__precision);\n return super.updateDisplay();\n }\n\n export default NumberControllerBox;\n"}\n\n * dat-gui JavaScript Controller Library\n * http://code.google.com/p/dat-gui\n\n * Copyright 2011 Data Arts Team, Google Creative Lab\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n\n import NumberController from './NumberController';\n import dom from './dom/dom';\n\n function map(v, i1, i2, o1, o2) {\n return o1 + (o2 - o1) * ((v - i1) / (i2 - i1));\n}\n\n /**\n * @class Represents a given property of an object that is a number, contains a minimum and maximum, and provides a slider element with which to manipulate it. It should be noted that the slider element is made up of <code><div>></code> tags, not the html5 <code><slider>></code> element.\n * @extends dat.controllers.Controller\n * @extends dat.controllers.NumberController\n * @param {Object} object The object to be manipulated\n * @param {string} property The name of the property to be manipulated\n * @param {Number} minValue Minimum allowed value\n * @param {Number} maxValue Maximum allowed value\n * @param {Number} stepValue Increment by which to change value\n */\n class NumberControllerSlider extends NumberController {\n constructor(object, property, min, max, step) {\n super(object, property, { min: min, max: max, step: step });\n\n const _this = this;\n\n this.__background = document.createElement('div');\n this.__foreground = document.createElement('div');\n\n dom.bind(this.__background, 'mousedown', onMouseDown);\n dom.bind(this.__background, 'touchstart', onTouchStart);\n dom.addClass(this.__background, 'slider');\n dom.addClass(this.__foreground, 'slider-fg');\n\n function onMouseDown(e) {\n document.activeElement.blur();\n dom.bind(window, 'mousemove', onMouseDrag);\n dom.bind(window, 'mouseup', onMouseUp);\n\n onMouseDrag(e);\n }\n\n function onMouseDrag(e) {\n e.preventDefault();\n const bgRect = _this.__background.getBoundingClientRect();\n _this.setValue(\n map(e.clientX, bgRect.left, bgRect.right, _this.__min, _this.__max)\n);\n return false;\n }\n\n function onMouseUp() {\n dom.unbind(window, 'mousemove', onMouseDrag);\n dom.unbind(window, 'mouseup', onMouseUp);\n if (_this.__onFinishChange) {\n _this.__onFinishChange.call(_this, _this.getValue());\n }\n }\n\n function onTouchStart(e) {\n if (e.touches.length !== 1) { return; }\n dom.bind(window, 'touchmove', onTouchMove);\n dom.bind(window, 'touchend', onTouchEnd);\n onTouchMove(e);\n }\n\n function onTouchMove(e) {\n const clientX = e.touches[0].clientX;\n const bgRect = _this.__background.getBoundingClientRect();\n _this.setValue(\n map(clientX, bgRect.left, bgRect.right, _this.__min, _this.__max)\n);\n }\n\n function onTouchEnd() {\n dom.unbind(window, 'touchmove', onTouchMove);\n dom.unbind(window, 'touchend', onTouchEnd);\n if (_this.__onFinishChange) {\n _this.__onFinishChange.call(_this, _this.getValue());\n }\n }\n\n this.updateDisplay();\n this.__background.appendChild(this.__foreground);\n this.domElement.appendChild(this.__background);\n }\n\n updateDisplay() {\n const pct = (this.getValue() -

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this.__min) / (this.__max - this.__min);\n this.__foreground.style.width = pct * 100 + '%';\n return
super.updateDisplay();\n } }\n\nexport default NumberControllerSlider;\n", "/*\n * dat-gui JavaScript Controller
Library\n * http://code.google.com/p/dat-gui\n * \n * Copyright 2011 Data Arts Team, Google Creative Lab\n * \n *
Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n\nimport Controller
from './Controller';\nimport dom from './dom/dom';\n\n/**\n * @class Provides a GUI interface to fire a specified
method, a property of an object.\n * \n * @extends dat.controllers.Controller\n * \n * @param {Object} object The
object to be manipulated\n * @param {string} property The name of the property to be manipulated\n * \n\nclass
FunctionController extends Controller {\n constructor(object, property, text) {\n super(object, property);\n\n const _this = this;\n\n this.__button = document.createElement('div');\n this.__button.innerHTML = text ===
undefined ? 'Fire' : text;\n\n dom.bind(this.__button, 'click', function(e) {\n e.preventDefault();\n _this.fire();\n return false;\n });\n\n dom.addClass(this.__button, 'button');\n\n this.domElement.appendChild(this.__button);\n }\n\n fire() {\n if (this.__onChange) {\n this.__onChange.call(this);\n }\n\n this.getValue().call(this.object);\n if (this.__onFinishChange) {\n this.__onFinishChange.call(this, this.getValue());\n }\n }\n}\n\nexport default FunctionController;\n", "/*\n *
dat-gui JavaScript Controller Library\n * http://code.google.com/p/dat-gui\n * \n * Copyright 2011 Data Arts Team,
Google Creative Lab\n * \n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use
this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n\nimport Controller from './Controller';\nimport dom from
 './dom/dom';\nimport Color from './color/Color';\nimport interpret from './color/interpret';\nimport common from
 './utils/common';\n\n/**\n * @class Represents a given property of an object that is a color.\n * \n * @param {Object}
object\n * @param {string} property\n * \n\nclass ColorController extends Controller {\n constructor(object,
property) {\n super(object, property);\n\n this.__color = new Color(this.getValue());\n this.__temp
= new Color(0);\n\n const _this = this;\n\n this.domElement = document.createElement('div');\n\n dom.makeSelectable(this.domElement, false);\n\n this.__selector = document.createElement('div');\n\n this.__selector.className = 'selector';\n\n this.__saturation_field = document.createElement('div');\n\n this.__saturation_field.className = 'saturation-field';\n\n this.__field_knob = document.createElement('div');\n\n this.__field_knob.className = 'field-knob';\n this.__field_knob_border = '2px solid #fff';\n\n this.__hue_knob =
document.createElement('div');\n this.__hue_knob.className = 'hue-knob';\n\n this.__hue_field =
document.createElement('div');\n this.__hue_field.className = 'hue-field';\n\n this.__input =
document.createElement('input');\n this.__input.type = 'text';\n this.__input_textShadow = '0 1px 1px #000';\n\n dom.bind(this.__input, 'keydown', function(e) {\n if (e.keyCode === 13) { // on enter\n onBlur.call(this);\n }\n });\n\n dom.bind(this.__input, 'blur', onBlur);\n\n dom.bind(this.__selector, 'mousedown', function(/* e */) {\n dom\n .addClass(this, 'drag')\n .bind(window, 'mouseup', function(/* e */) {\n dom.removeClass(_this.__selector, 'drag');\n });\n });\n\n dom.bind(this.__selector, 'touchstart', function(/* e */) {\n dom\n .addClass(this, 'drag')\n .bind(window, 'touchend', function(/* e */) {\n dom.removeClass(_this.__selector, 'drag');\n });\n });\n\n const valueField =
document.createElement('div');\n\n common.extend(this.__selector.style, {\n width: '122px',\n height:
'102px',\n padding: '3px',\n backgroundColor: '#222',\n boxShadow: '0px 1px 3px rgba(0,0,0,0.3)'\n });\n\n common.extend(this.__field_knob.style, {\n position: 'absolute',\n width: '12px',\n height:
'12px',\n border: this.__field_knob_border + (this.__color.v < 0.5 ? '#fff'
: '#000'),\n boxShadow: '0px 1px 3px rgba(0,0,0,0.5)',\n borderRadius: '12px',\n zIndex: 1\n });\n\n common.extend(this.__hue_knob.style, {\n position: 'absolute',\n width: '15px',\n height: '2px',\n borderRight: '4px solid #fff',\n zIndex: 1\n });\n\n common.extend(this.__saturation_field.style, {\n width:
'100px',\n height: '100px',\n border: '1px solid #555',\n marginRight: '3px',\n display: 'inline-block',\n cursor: 'pointer'\n });\n\n common.extend(valueField.style, {\n width: '100%',\n height: '100%',\n background: 'none'\n });\n\n linearGradient(valueField, 'top', 'rgba(0,0,0,0)', '#000');\n\n

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common.extend(this.__hue_field.style, {\n width: '15px',\n height: '100px',\n border: '1px solid #555',\n cursor: 'ns-resize',\n position: 'absolute',\n top: '3px',\n right: '3px'\n });\n\nhueGradient(this.__hue_field);\n\ncommon.extend(this.__input.style,\n {\n outline: 'none',\n width: '120px',\n textAlign: 'center',\n padding: '4px',\n marginBottom: '6px',\n color: '#fff',\n border: 0,\n fontWeight: 'bold',\n textShadow: this.__input_textShadow + 'rgba(0,0,0,0.7)'\n });\n\n dom.bind(this.__saturation_field, 'mousedown', fieldDown);\n dom.bind(this.__saturation_field, 'touchstart', fieldDown);\n dom.bind(this.__field_knob, 'mousedown', fieldDown);\n dom.bind(this.__field_knob, 'touchstart', fieldDown);\n dom.bind(this.__hue_field, 'mousedown', fieldDownH);\n dom.bind(this.__hue_field, 'touchstart', fieldDownH);\n function fieldDown(e) {\n setSV(e);\n dom.bind(window, 'mousemove', setSV);\n dom.bind(window, 'touchmove', setSV);\n dom.bind(window, 'mouseup', fieldUpSV);\n dom.bind(window, 'touchend', fieldUpSV);\n }\n function fieldDownH(e) {\n setH(e);\n dom.bind(window, 'mousemove', setH);\n dom.bind(window, 'touchmove', setH);\n dom.bind(window, 'mouseup', fieldUpH);\n dom.bind(window, 'touchend', fieldUpH);\n }\n function fieldUpSV() {\n dom.unbind(window, 'mousemove', setSV);\n dom.unbind(window, 'touchmove', setSV);\n dom.unbind(window, 'mouseup', fieldUpSV);\n dom.unbind(window, 'touchend', fieldUpSV);\n onFinish();\n }\n function fieldUpH() {\n dom.unbind(window, 'mousemove', setH);\n dom.unbind(window, 'touchmove', setH);\n dom.unbind(window, 'mouseup', fieldUpH);\n dom.unbind(window, 'touchend', fieldUpH);\n onFinish();\n }\n function onBlur() {\n const i = interpret(this.value);\n if (i !== false) {\n __this.__color.__state = i;\n __this.setValue(__this.__color.toOriginal());\n } else {\n this.value = __this.__color.toString();\n }\n }\n function onFinish() {\n if (__this.__onFinishChange) {\n __this.__onFinishChange.call(__this, __this.__color.toOriginal());\n }\n this.__saturation_field.appendChild(valueField);\n this.__selector.appendChild(this.__field_knob);\n this.__selector.appendChild(this.__saturation_field);\n this.__selector.appendChild(this.__hue_field);\n this.__hue_field.appendChild(this.__hue_knob);\n this.domElement.appendChild(this.__input);\n this.domElement.appendChild(this.__selector);\n this.updateDisplay();\n function setSV(e) {\n if (e.type.indexOf('touch') === -1) { e.preventDefault(); }\n const fieldRect = __this.__saturation_field.getBoundingClientRect();\n const { clientX, clientY } = (e.touches && e.touches[0]) || e;\n let s = (clientX - fieldRect.left) / (fieldRect.right - fieldRect.left);\n let v = 1 - (clientY - fieldRect.top) / (fieldRect.bottom - fieldRect.top);\n if (v > 1) {\n v = 1;\n } else if (v < 0) {\n v = 0;\n }\n if (s > 1) {\n s = 1;\n } else\n if (s < 0) {\n s = 0;\n }\n __this.__color.v = v;\n __this.__color.s = s;\n __this.setValue(__this.__color.toOriginal());\n return false;\n }\n function setH(e) {\n if (e.type.indexOf('touch') === -1) { e.preventDefault(); }\n const fieldRect = __this.__hue_field.getBoundingClientRect();\n const { clientY } = (e.touches && e.touches[0]) || e;\n let h = 1 - (clientY - fieldRect.top) / (fieldRect.bottom - fieldRect.top);\n if (h > 1) {\n h = 1;\n } else if (h < 0) {\n h = 0;\n }\n __this.__color.h = h * 360;\n __this.setValue(__this.__color.toOriginal());\n return false;\n }\n updateDisplay() {\n const i = interpret(this.getValue());\n if (i !== false) {\n let mismatch = false;\n // Check for mismatch on the interpreted value.\n common.each(Color.COMPONENTS, function(component) {\n if (!common.isUndefined(i[component]) && !common.isUndefined(this.__color.__state[component]) && i[component] !== this.__color.__state[component]) {\n mismatch = true;\n return {};\n }\n }, this);\n // If nothing diverges, we keep our previous values\n // for statefulness, otherwise we recalculate fresh\n if (mismatch) {\n common.extend(this.__color.__state, i);\n }\n }\n common.extend(this.__temp.__state, this.__color.__state);\n this.__temp.a = 1;\n const flip = (this.__color.v < 0.5 || this.__color.s > 0.5) ? 255 : 0;\n const _flip = 255 - flip;\n common.extend(this.__field_knob.style, {\n marginLeft: 100 * this.__color.s - 7 + 'px',\n marginTop: 100 * (1 - this.__color.v) - 7 + 'px',\n backgroundColor: this.__temp.toHexString(),\n border: this.__field_knob_border + 'rgb(' + flip + ',' + flip + ',' + flip + ')'\n });\n this.__hue_knob.style.marginTop = (1 - this.__color.h / 360) * 100 + 'px';\n this.__temp.s

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= 1;\n this.__temp.v = 1;\n\n linearGradient(this.__saturation_field, 'left', '#fff', this.__temp.toHexString());\n\n this.__input.value = this.__color.toString();\n\n common.extend(this.__input.style, {\n backgroundColor:
this.__color.toHexString(),\n color: 'rgb(' + flip + ',' + flip + ',' + flip + '),\n textShadow:
this.__input_textShadow + 'rgba(' + _flip + ',' + _flip + ',' + _flip + ',.7)\n });\n }\n\nconst vendors = ['-moz-', '-
o-', '-webkit-', '-ms-', ''];\n\nfunction linearGradient(elem, x, a, b) {\n elem.style.background = ";\n
common.each(vendors, function(vendor) {\n elem.style.cssText += 'background: ' + vendor + 'linear-gradient(' + x
+ ', ' + a + ' 0%, ' + b + ' 100%);';\n });\n}\n\nfunction hueGradient(elem) {\n elem.style.background = ";\n
elem.style.cssText += 'background: -moz-linear-gradient(top, #ff0000 0%, #ff00ff 17%, #0000ff 34%, #00ffff 50%,
#00ff00 67%, #ffff00 84%, #ff0000 100%);';\n elem.style.cssText
+= 'background: -webkit-linear-gradient(top, #ff0000 0%,#ff00ff 17%,#0000ff 34%,#00ffff 50%,#00ff00
67%,#ffff00 84%,#ff0000 100%);';\n elem.style.cssText += 'background: -o-linear-gradient(top, #ff0000
0%,#ff00ff 17%,#0000ff 34%,#00ffff 50%,#00ff00 67%,#ffff00 84%,#ff0000 100%);';\n elem.style.cssText +=
'background: -ms-linear-gradient(top, #ff0000 0%,#ff00ff 17%,#0000ff 34%,#00ffff 50%,#00ff00 67%,#ffff00
84%,#ff0000 100%);';\n elem.style.cssText += 'background: linear-gradient(top, #ff0000 0%,#ff00ff 17%,#0000ff
34%,#00ffff 50%,#00ff00 67%,#ffff00 84%,#ff0000 100%);';\n }\n\nexport default ColorController;\n", "/*\n * dat-
gui JavaScript Controller Library\n * http://code.google.com/p/dat-gui\n * \n * Copyright 2011 Data Arts Team,
Google Creative Lab\n * \n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use
this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n
*\n\nconst css = {\n load: function(url, indoc) {\n const doc = indoc || document;\n const link =
doc.createElement('link');\n link.type = 'text/css';\n link.rel = 'stylesheet';\n link.href = url;\n
doc.getElementsByTagName('head')[0].appendChild(link);\n },\n\n inject: function(cssContent, indoc) {\n const
doc = indoc || document;\n const injected = document.createElement('style');\n injected.type = 'text/css';\n
injected.innerHTML = cssContent;\n const head = doc.getElementsByTagName('head')[0];\n try {\n
head.appendChild(injected);\n } catch (e) { // Unable to inject CSS, probably because of a Content Security
Policy\n }\n }\n\nexport default css;\n", "const saveDialogContent = `<div id="dg-save" class="dg
dialogue">\n\n Here's the new load parameter for your <code>GUI</code>'s constructor:\n\n <textarea id="dg-
new-constructor"></textarea>\n\n <div id="dg-save-locally">\n\n <input id="dg-local-storage"
type="checkbox"/> Automatically save\n values to <code>localStorage</code> on exit.\n\n <div id="dg-
local-explain">The values saved to <code>localStorage</code> will\n override those passed to
<code>dat.GUI</code>'s constructor. This makes it\n easier to work incrementally, but
<code>localStorage</code> is fragile,\n and your friends may not see the same values you do.\n\n </div>\n\n </div>\n\n</div>\n\n</div>`; \n\nexport default saveDialogContent;\n", "/*\n * dat-gui JavaScript Controller Library\n *
http://code.google.com/p/dat-gui\n * \n * Copyright 2011 Data Arts Team, Google Creative Lab\n * \n * Licensed
under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n
*\n\nimport OptionController from './OptionController';\nimport NumberControllerBox from
 './NumberControllerBox';\nimport NumberControllerSlider
from './NumberControllerSlider';\nimport StringController from './StringController';\nimport FunctionController
from './FunctionController';\nimport BooleanController from './BooleanController';\nimport common from
 './utils/common';\n\nconst ControllerFactory = function(object, property) {\n const initialValue =
object[property];\n\n // Providing options?\n if (common.isArray(arguments[2]) || common.isObject(arguments[2]))
{\n return new OptionController(object, property, arguments[2]);\n }\n\n // Providing a map?\n if
(common.isNumber(initialValue)) {\n // Has min and max? (slider)\n if (common.isNumber(arguments[2]) &&
common.isNumber(arguments[3])) {\n // has step?\n if (common.isNumber(arguments[4])) {\n return new
NumberControllerSlider(object, property,\n arguments[2], arguments[3], arguments[4]);\n }\n }\n
return new NumberControllerSlider(object, property, arguments[2], arguments[3]);\n }\n\n // number

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box\n if (common.isNumber(arguments[4])) { // has step\n return new NumberControllerBox(object,
property,\n { min: arguments[2], max: arguments[3], step: arguments[4] });\n }\n return new
NumberControllerBox(object, property, { min: arguments[2], max: arguments[3] });\n }\n\n if
(common.isString(initialValue)) {\n return new StringController(object, property);\n }\n\n if
(common.isFunction(initialValue)) {\n return new FunctionController(object, property, ");\n }\n\n if
(common.isBoolean(initialValue)) {\n return new BooleanController(object, property);\n }\n\n return
null;\n};\n\nexport default ControllerFactory;\n", "/*\n * dat-gui JavaScript Controller Library\n *
http://code.google.com/p/dat-gui\n * Copyright 2011 Data Arts Team, Google Creative Lab\n * Licensed
under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the
License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n */\n\nfunction
requestAnimationFrame(callback) {\n setTimeout(callback, 1000 / 60);\n}\n\nexport default
window.requestAnimationFrame ||\n window.webkitRequestAnimationFrame ||\n window.mozRequestAnimationFrame ||\n window.oRequestAnimationFrame ||\n window.msRequestAnimationFrame ||\n requestAnimationFrame;\n", "/*\n * dat-gui JavaScript Controller
Library\n * http://code.google.com/p/dat-gui\n * Copyright 2011 Data Arts Team, Google Creative Lab\n *\n *
Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n */\n\nimport dom from './dom/dom';\nimport common from
'./utils/common';\n\nclass CenteredDiv {\n constructor() {\n this.backgroundElement =
document.createElement('div');\n common.extend(this.backgroundElement.style,
{\n backgroundColor: 'rgba(0,0,0,0.8)',\n top: 0,\n left: 0,\n display: 'none',\n zIndex: '1000',\n
opacity: 0,\n WebkitTransition: 'opacity 0.2s linear',\n transition: 'opacity 0.2s linear'\n });\n\n
dom.makeFullscreen(this.backgroundElement);\n this.backgroundElement.style.position = 'fixed';\n\n
this.domElement = document.createElement('div');\n common.extend(this.domElement.style, {\n position:
'fixed',\n display: 'none',\n zIndex: '1001',\n opacity: 0,\n WebkitTransition: '-webkit-transform 0.2s
ease-out, opacity 0.2s linear',\n transition: 'transform 0.2s ease-out, opacity 0.2s linear'\n });\n\n\n
document.body.appendChild(this.backgroundElement);\n document.body.appendChild(this.domElement);\n\n
const _this = this;\n dom.bind(this.backgroundElement, 'click', function() {\n _this.hide();\n });\n }\n\n
show() {\n const _this = this;\n\n this.backgroundElement.style.display
= 'block';\n\n this.domElement.style.display = 'block';\n this.domElement.style.opacity = 0;\n//
this.domElement.style.top = '52%';\n this.domElement.style.webkitTransform = 'scale(1.1)';\n\n this.layout();\n\n
common.defer(function() {\n _this.backgroundElement.style.opacity = 1;\n _this.domElement.style.opacity =
1;\n _this.domElement.style.webkitTransform = 'scale(1)';\n });\n }\n\n /**\n * Hide centered div\n */\n
hide() {\n const _this = this;\n\n const hide = function() {\n _this.domElement.style.display = 'none';\n
_this.backgroundElement.style.display = 'none';\n dom.unbind(_this.domElement, 'webkitTransitionEnd',
hide);\n dom.unbind(_this.domElement, 'transitionend', hide);\n dom.unbind(_this.domElement,
'oTransitionEnd', hide);\n });\n\n dom.bind(this.domElement, 'webkitTransitionEnd', hide);\n
dom.bind(this.domElement, 'transitionend', hide);\n dom.bind(this.domElement, 'oTransitionEnd',
hide);\n\n this.backgroundElement.style.opacity = 0;\n// this.domElement.style.top = '48%';\n
this.domElement.style.opacity = 0;\n this.domElement.style.webkitTransform = 'scale(1.1)';\n }\n\n layout() {\n
this.domElement.style.left = window.innerWidth / 2 - dom.getWidth(this.domElement) / 2 + 'px';\n
this.domElement.style.top = window.innerHeight / 2 - dom.getHeight(this.domElement) / 2 + 'px';\n }\n\n\nexport
default CenteredDiv;\n", "/*\n * dat-gui JavaScript Controller Library\n * http://code.google.com/p/dat-gui\n *
Copyright 2011 Data Arts Team, Google Creative Lab\n *\n * Licensed under the Apache License, Version 2.0 (the
\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n */\n\nimport css from './utils/css';\nimport
saveDialogueContents from './saveDialogue.html';\nimport ControllerFactory from

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../controllers/ControllerFactory';\nimport
Controller from '../controllers/Controller';\nimport BooleanController from
../controllers/BooleanController';\nimport FunctionController from '../controllers/FunctionController';\nimport
NumberControllerBox from '../controllers/NumberControllerBox';\nimport NumberControllerSlider from
../controllers/NumberControllerSlider';\nimport ColorController from '../controllers/ColorController';\nimport
requestAnimationFrame from '../utils/requestAnimationFrame';\nimport CenteredDiv from
../dom/CenteredDiv';\nimport dom from '../dom/dom';\nimport common from '../utils/common';\n\nimport
styleSheet from './style.scss'; // CSS to embed in build\nncss.inject(styleSheet);\n\n/** @ignore Outer-most
className for GUI's *\nconst CSS_NAMESPACE = 'dg';\n\nconst HIDE_KEY_CODE = 72;\n\n/** @ignore The
only value shared between the JS and SCSS. Use caution. *\nconst CLOSE_BUTTON_HEIGHT = 20;\n\nconst
DEFAULT_DEFAULT_PRESET_NAME = 'Default';\n\nconst SUPPORTS_LOCAL_STORAGE =
(function() {\n try {\n return !!window.localStorage;\n } catch (e) {\n return false;\n }\n})();\n\nlet
SAVE_DIALOGUE;\n\n/** @ignore Have we yet to create an autoPlace GUI? *\nlet autoPlaceVirgin =
true;\n\n/** @ignore Fixed position div that auto place GUI's go inside *\nlet autoPlaceContainer;\n\n/** @ignore
Are we hiding the GUI's ? *\nlet hide = false;\n\n/** @private GUI's which should be hidden *\nconst
hideableGuis = [];\n\n/**\n * @class A lightweight controller library for JavaScript. It allows you to easily\n *
manipulate variables and fire functions on the fly.\n * \n * @typicalname gui\n * \n * @example\n * // Creating a
GUI with options.\n * var gui = new dat.GUI({name: 'My GUI'});\n * \n * @example\n * // Creating a GUI and a
subfolder.\n * var gui = new dat.GUI();\n * var folder1 = gui.addFolder('Flow Field');\n * \n * @param {Object}
[params]\n * @param {String} [params.name] The name of this GUI.\n * @param {Object} [params.load] JSON
object representing the
saved state of\n * this GUI.\n * @param {dat.gui.GUI} [params.parent] The GUI I'm nested in.\n * @param
{Boolean} [params.autoPlace=true]\n * @param {Boolean} [params.hideable=true] If true, GUI is shown/hidden by
<kbd>h</kbd> keypress.\n * @param {Boolean} [params.closed=false] If true, starts closed\n * @param {Boolean}
[params.closeOnTop=false] If true, close/open button shows on top of the GUI\n * \n\nconst GUI = function(pars) {\n
const _this = this;\n\n let params = pars || {};\n\n /**\n * Outermost DOM Element\n * @type {DOMElement}\n
 *\n * this.domElement = document.createElement('div');\n * this.__ul = document.createElement('ul');\n
 * this.domElement.appendChild(this.__ul);\n * dom.addClass(this.domElement, CSS_NAMESPACE);\n\n /**\n *
Nested GUI's by name\n * @ignore\n *\n * this.__folders = {};\n\n * this.__controllers = [];\n\n /**\n *
List of objects I'm remembering for save, only used in top level GUI\n * @ignore\n *\n * this.__rememberedObjects =
[];\n\n /**\n * Maps the index of remembered objects to a map of controllers, only used\n * in top level GUI.\n * \n
 * @private\n * @ignore\n * \n * @example\n * [\n * {\n * propertyName: Controller,\n *
 * anotherPropertyName: Controller\n * },\n * {\n * propertyName: Controller\n * }\n *]\n * \n
 * this.__rememberedObjectIndecesToControllers = [];\n\n * this.__listening = [];\n\n // Default parameters\n *
params = common.defaults(params, {\n * closeOnTop: false,\n * autoPlace: true,\n * width: GUI.DEFAULT_WIDTH\n
 * });\n\n * params = common.defaults(params, {\n * resizable: params.autoPlace,\n * hideable: params.autoPlace\n
 * });\n\n * if (!common.isUndefined(params.load)) {\n * // Explicit preset\n * if (params.preset) {\n
 * params.load.preset = params.preset;\n * }\n * } else {\n * params.load = { preset:
 * DEFAULT_DEFAULT_PRESET_NAME\n * };\n * }\n\n * if (common.isUndefined(params.parent) &&
 * params.hideable) {\n * hideableGuis.push(this);\n * }\n\n // Only root level GUI's are resizable.\n *
params.resizable = common.isUndefined(params.parent) &&
 * params.resizable;\n\n * if (params.autoPlace && common.isUndefined(params.scrollable)) {\n * params.scrollable =
true;\n * }\n\n * params.scrollable = common.isUndefined(params.parent) && params.scrollable === true;\n\n // Not
part of params because I don't want people passing this in via\n * // constructor. Should be a 'remembered' value.\n
 * let useLocalStorage =\n * SUPPORTS_LOCAL_STORAGE &&\n * localStorage.getItem(getLocalStorageHash(this, 'isLocal')) === 'true';\n\n * let saveToLocalStorage;\n * let
 * titleRow;\n\n * Object.defineProperties(this, {\n * /** @lends GUI.prototype *\n * {\n * /**\n * * The parent

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<code>GUI</code>\n * @type dat.gui.GUI\n */\n parent: {\n get: function() {\n return\n params.parent;\n }\n },\n scrollable: {\n get: function() {\n return params.scrollable;\n }\n },\n /**\n * Handles <code>GUI</code>'s element placement for you\n * @type Boolean\n */\n autoPlace: {\n get: function() {\n return params.autoPlace;\n }\n },\n /**\n * Handles\n <code>GUI</code>'s position of open/close button\n * @type Boolean\n */\n closeOnTop: {\n get:\n function() {\n return params.closeOnTop;\n }\n },\n /**\n * The identifier for a set of saved\n values\n * @type String\n */\n preset: {\n get: function() {\n if (_this.parent) {\n return\n _this.getRoot().preset;\n }\n return params.load.preset;\n },\n set: function(v) {\n if\n (_this.parent) {\n _this.getRoot().preset = v;\n } else {\n params.load.preset = v;\n }\n setPresetSelectIndex(this);\n _this.revert();\n }\n },\n /**\n * The width of <code>GUI</code> element\n * @type Number\n */\n width: {\n get: function() {\n return params.width;\n },\n set: function(v) {\n params.width = v;\n setWidth(_this, v);\n }\n },\n /**\n * The name of <code>GUI</code>. Used for folders. i.e\n * a folder's name\n * @type String\n */\n name: {\n get: function() {\n return params.name;\n },\n set:\n function(v) {\n // TODO Check for collisions among sibling folders\n params.name = v;\n if\n (titleRow) {\n titleRow.innerHTML = params.name;\n }\n },\n },\n /**\n * Whether the\n <code>GUI</code> is collapsed or not\n * @type Boolean\n */\n closed: {\n get: function() {\n return params.closed;\n },\n set: function(v) {\n params.closed = v;\n if (params.closed)\n {\n dom.addClass(_this.__ul, GUI.CLASS_CLOSED);\n }\n else {\n dom.removeClass(_this.__ul, GUI.CLASS_CLOSED);\n }\n // For browsers that aren't going to respect\n the CSS transition,\n // Lets just check our height against the window height right off\n // the bat.\n this.onResize();\n if (_this.__closeButton) {\n _this.__closeButton.innerHTML = v ?\n GUI.TEXT_OPEN : GUI.TEXT_CLOSED;\n }\n },\n },\n /**\n * Contains all presets\n * @type Object\n */\n load: {\n get: function() {\n return params.load;\n }\n },\n /**\n * Determines whether or not to use <a\n href="https://developer.mozilla.org/en/DOM/Storage#localStorage">localStorage as the means for\n * <code>remember</code>ing\n * @type Boolean\n */\n useLocalStorage: {\n get: function() {\n return useLocalStorage;\n },\n set: function(bool) {\n if (SUPPORTS_LOCAL_STORAGE) {\n useLocalStorage =\n bool;\n if (bool) {\n dom.bind(window, 'unload', saveToLocalStorage);\n }\n else {\n dom.unbind(window, 'unload', saveToLocalStorage);\n }\n }\n localStorage.setItem(getLocalStorageHash(_this, 'isLocal'), bool);\n }\n },\n // Are we a\n root level GUI?\n if (common.isUndefined(params.parent)) {\n this.closed = params.closed || false;\n }\n dom.addClass(this.domElement, GUI.CLASS_MAIN);\n dom.makeSelectable(this.domElement, false);\n //\n Are we supposed to be loading locally?\n if (SUPPORTS_LOCAL_STORAGE) {\n if (useLocalStorage) {\n _this.useLocalStorage = true;\n const savedGui = localStorage.getItem(getLocalStorageHash(this, 'gui'));\n if (savedGui) {\n params.load = JSON.parse(savedGui);\n }\n }\n this.__closeButton = document.createElement('div');\n this.__closeButton.innerHTML =\n GUI.TEXT_CLOSED;\n dom.addClass(this.__closeButton, GUI.CLASS_CLOSE_BUTTON);\n if\n (params.closeOnTop) {\n dom.addClass(this.__closeButton, GUI.CLASS_CLOSE_TOP);\n }\n this.domElement.insertBefore(this.__closeButton, this.domElement.childNodes[0]);\n } else {\n dom.addClass(this.__closeButton, GUI.CLASS_CLOSE_BOTTOM);\n }\n this.domElement.appendChild(this.__closeButton);\n dom.bind(this.__closeButton, 'click', function() {\n _this.closed = !_this.closed;\n });\n // Oh, you're a nested GUI!\n } else {\n if (params.closed === undefined)\n {\n params.closed = true;\n }\n const titleRowName = document.createTextNode(params.name);\n dom.addClass(titleRowName, 'controller-name');\n titleRow = addRow(_this, titleRowName);\n const\n onClickTitle = function(e) {\n e.preventDefault();\n _this.closed = !_this.closed;\n return

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false;\n
});\n\n
dom.addClass(this.__ul, GUI.CLASS_CLOSED);\n\n
dom.addClass(titleRow, 'title');\n\n
dom.bind(titleRow, 'click', onClickTitle);\n\n
if (!params.closed) {\n
 this.closed = false;\n
} }\n\n
if (params.autoPlace) {\n
 if (common.isUndefined(params.parent)) {\n
 if (autoPlaceVirgin) {\n
 autoPlaceContainer = document.createElement('div');\n
 dom.addClass(autoPlaceContainer, CSS_NAMESPACE);\n
 dom.addClass(autoPlaceContainer, GUI.CLASS_AUTO_PLACE_CONTAINER);\n
 document.body.appendChild(autoPlaceContainer);\n
 autoPlaceVirgin = false;\n
 }\n\n
 // Put it in the dom for you.\n
 autoPlaceContainer.appendChild(this.domElement);\n\n
 // Apply the auto styles\n
 dom.addClass(this.domElement, GUI.CLASS_AUTO_PLACE);\n
 }\n\n\n
 // Make it not elastic.\n
 if (!this.parent) {\n
 setWidth(_this, params.width);\n
 }\n
}\n\n
this.__resizeHandler = function() {\n
 _this.onResizeDebounce();\n
};\n\n
dom.bind(window, 'resize', this.__resizeHandler);\n
dom.bind(this.__ul, 'webkitTransitionEnd', this.__resizeHandler);\n
dom.bind(this.__ul, 'transitionend', this.__resizeHandler);\n
dom.bind(this.__ul, 'oTransitionEnd', this.__resizeHandler);\n
this.onResize();\n\n
if (params.resizable) {\n
 addResizeHandle(this);\n
}\n\n
saveToLocalStorage = function() {\n
 if (SUPPORTS_LOCAL_STORAGE && localStorage.getItem(getLocalStorageHash(_this, 'isLocal')) === 'true') {\n
 localStorage.setItem(getLocalStorageHash(_this, 'gui'), JSON.stringify(_this.getSaveObject()));\n
 }\n
};\n\n
// expose this method publicly\n
this.saveToLocalStorageIfPossible = saveToLocalStorage;\n\n
function resetWidth() {\n
 const root = _this.getRoot();\n
 root.width += 1;\n
 common.defer(function() {\n
 root.width -= 1;\n
 });\n
}\n\n
if (!params.parent) {\n
 resetWidth();\n
}\n\n
}\n\n
GUI.toggleHide = function() {\n
 hide = !hide;\n
 common.each(hideableGuIs, function(gui) {\n
 gui.domElement.style.display = hide ? 'none' : '';\n
 });\n\n
}\n\n
GUI.CLASS_AUTO_PLACE = 'a';\n
GUI.CLASS_AUTO_PLACE_CONTAINER = 'ac';\n
GUI.CLASS_MAIN = 'main';\n
GUI.CLASS_CONTROLLER_ROW = 'cr';\n
GUI.CLASS_TOO_TALL = 'taller-than-window';\n
GUI.CLASS_CLOSED = 'closed';\n
GUI.CLASS_CLOSE_BUTTON = 'close-button';\n
GUI.CLASS_CLOSE_TOP = 'close-top';\n
GUI.CLASS_CLOSE_BOTTOM = 'close-bottom';\n
GUI.CLASS_DRAG = 'drag';\n\n
GUI.DEFAULT_WIDTH = 245;\n
GUI.TEXT_CLOSED = 'Close Controls';\n
GUI.TEXT_OPEN = 'Open Controls';\n\n
GUI._keydownHandler = function(e) {\n
 if (document.activeElement.type !== 'text' && (e.which === HIDE_KEY_CODE || e.keyCode === HIDE_KEY_CODE)) {\n
 GUI.toggleHide();\n
 }\n\n
}\n\n
dom.bind(window, 'keydown', GUI._keydownHandler, false);\n\n
common.extend(\n
 GUI.prototype,\n
 /** @lends GUI.prototype */\n
 {\n\n
 /**\n
 * Adds a new {@link Controller} to the GUI. The type of controller created\n
 * is inferred from the initial value of <code>object[property]</code>.\n
 For\n
 * color properties, see {@link addColor}.\n
 *\n
 * @param {Object} object The object to be manipulated\n
 * @param {String} property The name of the property to be manipulated\n
 * @param {Number} [min] Minimum allowed value\n
 * @param {Number} [max] Maximum allowed value\n
 * @param {Number} [step] Increment by which to change value\n
 * @returns {Controller} The controller that was added to the GUI.\n
 *\n
 * @instance\n
 *\n
 * @example\n
 * // Add a string controller.\n
 * var person = {name: 'Sam'};\n
 * gui.add(person, 'name');\n
 *\n
 * @example\n
 * // Add a number controller slider.\n
 * var person = {age: 45};\n
 * gui.add(person, 'age', 0, 100);\n
 *\n
 * add: function(object, property) {\n
 return add(\n
 this,\n
 object,\n
 property,\n
 {\n
 factoryArgs: Array.prototype.slice.call(arguments, 2)\n
 }\n
);\n
 },\n\n
 /**\n
 * Adds a new color controller to the GUI.\n
 *\n
 * @param object\n
 * @param property\n
 * @returns {Controller} The controller that was added to the GUI.\n
 *\n
 * @instance\n
 *\n
 * @example\n
 * var palette = {\n
 * color1: '#FF0000', // CSS string\n
 * color2: [0, 128, 255], // RGB array\n
 * color3: [0, 128, 255, 0.3], // RGB with alpha\n
 * color4: { h: 350, s: 0.9, v: 0.3 } // Hue, saturation, value\n
 * };\n
 * gui.addColor(palette, 'color1');\n
 * gui.addColor(palette, 'color2');\n
 * gui.addColor(palette, 'color3');\n
 * gui.addColor(palette, 'color4');\n
 *\n
 * addColor: function(object, property) {\n
 return add(\n
 this,\n
 object,\n
 property,\n
 {\n
 color: true\n
 }\n
);\n
 },\n\n
 /**\n
 * Removes the given controller from the GUI.\n
 * @param

```

```

{Controller} controller\n * @instance\n * ^\n remove: function(controller) {\n // TODO listening?\n this.__ul.removeChild(controller.__li);\n\n this.__controllers.splice(this.__controllers.indexOf(controller), 1);\n const _this = this;\n common.defer(function() {\n _this.onResize();\n });\n },\n /**\n * Removes the root GUI from the document and unbinds all event listeners.\n * For subfolders, use `gui.removeFolder(folder)` instead.\n * @instance\n * ^\n destroy: function() {\n if (this.parent) {\n throw new Error(\n 'Only the root GUI should be removed with .destroy(). ' +\n 'For subfolders, use gui.removeFolder(folder) instead.\n);\n }\n\n if (this.autoPlace) {\n autoPlaceContainer.removeChild(this.domElement);\n }\n\n const _this = this;\n common.each(this.__folders, function(subfolder) {\n _this.removeFolder(subfolder);\n });\n\n dom.unbind(window, 'keydown', GUI._keydownHandler, false);\n removeListeners(this);\n },\n /**\n * Creates a new subfolder GUI instance.\n * @param name\n * @returns {dat.gui.GUI} The new folder.\n * @throws {Error} if this GUI already has a folder by the specified\n * name\n * @instance\n * ^\n addFolder: function(name) {\n // We have to prevent collisions on names in order to have a key\n // by which to remember saved values\n if (this.__folders[name] !== undefined) {\n throw new Error('You already have a folder in this GUI by the '\n ' name \'' + name + '\");\n }\n\n const newGuiParams = { name: name, parent: this };\n\n // We need to pass down the autoPlace trait so that we can\n // attach event listeners to open/close folder actions to\n // ensure that a scrollbar appears if the window is too short.\n newGuiParams.autoPlace = this.autoPlace;\n\n // Do we have saved appearance data for this folder?\n if (this.load && // Anything loaded?\n this.load.folders && // Was my parent a dead-end?\n this.load.folders[name]) { // Did daddy remember me?\n // Start me closed if I was closed\n newGuiParams.closed = this.load.folders[name].closed;\n // Pass down the loaded data\n newGuiParams.load = this.load.folders[name];\n }\n\n const gui = new GUI(newGuiParams);\n this.__folders[name] = gui;\n const li = addRow(this, gui.domElement);\n dom.addClass(li, 'folder');\n return gui;\n },\n /**\n * Removes a subfolder GUI instance.\n * @param {dat.gui.GUI} folder The folder to remove.\n * @instance\n * ^\n removeFolder: function(folder) {\n this.__ul.removeChild(folder.domElement.parentElement);\n\n delete this.__folders[folder.name];\n\n // Do we have saved appearance data for this folder?\n if (this.load && // Anything loaded?\n this.load.folders && // Was my parent a dead-end?\n this.load.folders[folder.name]) {\n delete this.load.folders[folder.name];\n }\n\n removeListeners(folder);\n\n const _this = this;\n common.each(folder.__folders, function(subfolder) {\n folder.removeFolder(subfolder);\n });\n\n common.defer(function() {\n _this.onResize();\n });\n },\n /**\n * Opens the GUI.\n * ^\n open: function() {\n this.closed = false;\n },\n /**\n * Closes the GUI.\n * ^\n close: function() {\n this.closed = true;\n },\n /**\n * Hides the GUI.\n * ^\n hide: function() {\n this.domElement.style.display = 'none';\n },\n /**\n * Shows the GUI.\n * ^\n show: function() {\n this.domElement.style.display = '';\n },\n\n onResize: function() {\n // we debounce this function to prevent performance issues when rotating on tablet/mobile\n const root = this.getRoot();\n if (root.scrollable) {\n const top = dom.getOffset(root.__ul).top;\n let h = 0;\n common.each(root.__ul.childNodes, function(node) {\n if (!(root.autoPlace && node === root.__save_row)) {\n h += dom.getHeight(node);\n }\n });\n\n if (window.innerHeight - top - CLOSE_BUTTON_HEIGHT < h) {\n dom.addClass(root.domElement, GUI.CLASS_TOO_TALL);\n root.__ul.style.height = window.innerHeight - top - CLOSE_BUTTON_HEIGHT + 'px';\n } else {\n dom.removeClass(root.domElement, GUI.CLASS_TOO_TALL);\n root.__ul.style.height = 'auto';\n }\n\n if (root.__resize_handle) {\n common.defer(function() {\n root.__resize_handle.style.height = root.__ul.offsetHeight + 'px';\n });\n }\n\n if (root.__closeButton) {\n root.__closeButton.style.width = root.width + 'px';\n }\n },\n onResizeDebounce: common.debounce(function() { this.onResize(); }, 50),\n /**\n * Mark objects for saving. The order of these objects cannot change as

```

```

* the GUI grows. When remembering new objects, append them to the end
* of the list.
*
* @param
{...Object} objects
* @throws {Error} if not called on a top level GUI.
* @instance
* @ignore
*/
remember: function() {
 if (common.isUndefined(SAVE_DIALOGUE)) {
 SAVE_DIALOGUE =
 new CenteredDiv();
 SAVE_DIALOGUE.domElement.innerHTML = saveDialogueContents;
 }
 if (this.parent) {
 throw new Error('You can only call remember on a top level GUI.');
```



```

const nextSibling = controller.__li.nextElementSibling;\n controller.remove();\n\n return add(\n gui,\n controller.object,\n controller.property,\n {\n before: nextSibling,\n factoryArgs:
[common.toArray(arguments)]\n }\n);\n\n if (common.isArray(options) ||
common.isObject(options)) {\n const nextSibling = controller.__li.nextElementSibling;\n controller.remove();\n return add(\n gui,\n controller.object,\n controller.property,\n {\n before: nextSibling,\n factoryArgs: [options]\n }\n);\n }\n\n /**\n * Sets the
name of the
controller.\n * @param {string} name\n * @return {Controller}\n */\n name: function(name) {\n controller.__li.firstChild.firstChild.innerHTML = name;\n return controller;\n },\n\n /**\n * Sets controller to listen for changes on its underlying object.\n * @return {Controller}\n */\n listen:
function() {\n controller.__gui.listen(controller);\n return controller;\n },\n\n /**\n * Removes the
controller from its parent GUI.\n * @return {Controller}\n */\n remove: function() {\n controller.__gui.remove(controller);\n return controller;\n }\n\n });\n\n // All sliders should be accompanied by a
box.\n if (controller instanceof NumberControllerSlider) {\n const box = new
NumberControllerBox(controller.object, controller.property,\n { min: controller.__min, max: controller.__max,
step: controller.__step });\n\n common.each(['updateDisplay', 'onChange', 'onFinishChange', 'step',
'min', 'max'], function(method) {\n const pc = controller[method];\n const pb = box[method];\n controller[method] = box[method] = function() {\n const args = Array.prototype.slice.call(arguments);\n pb.apply(box, args);\n return pc.apply(controller, args);\n };\n });\n\n dom.addClass(li, 'has-slider');\n controller.domElement.insertBefore(box.domElement, controller.domElement.firstChild);\n } else if
(controller instanceof NumberControllerBox) {\n const r = function(returned) {\n // Have we defined both
boundaries?\n if (common.isNumber(controller.__min) && common.isNumber(controller.__max)) {\n //
Well, then lets just replace this with a slider.\n // lets remember if the old controller had a specific name or
was listening\n const oldName = controller.__li.firstChild.firstChild.innerHTML;\n const
wasListening = controller.__gui.__listening.indexOf(controller) > -1;\n controller.remove();\n const newController = add(\n gui,\n controller.object,\n controller.property,\n {\n before: controller.__li.nextElementSibling,\n factoryArgs:
[controller.__min, controller.__max, controller.__step]\n });\n newController.name(oldName);\n if
(wasListening) newController.listen();\n return newController;\n }\n\n return returned;\n };\n\n controller.min = common.compose(r, controller.min);\n controller.max = common.compose(r, controller.max);\n } else if (controller instanceof BooleanController) {\n dom.bind(li, 'click', function() {\n dom.fakeEvent(controller.__checkbox, 'click');\n });\n\n dom.bind(controller.__checkbox, 'click', function(e) {\n e.stopPropagation(); // Prevents double-toggle\n });\n } else if (controller instanceof FunctionController) {\n dom.bind(li, 'click', function() {\n dom.fakeEvent(controller.__button,
'click');\n });\n\n dom.bind(li, 'mouseover', function() {\n dom.addClass(controller.__button, 'hover');\n });\n\n dom.bind(li, 'mouseout', function() {\n dom.removeClass(controller.__button, 'hover');\n });\n } else
if (controller instanceof ColorController) {\n dom.addClass(li, 'color');\n controller.updateDisplay =
common.compose(function(val) {\n li.style.borderColor = controller.__color.toString();\n return val;\n }, controller.updateDisplay);\n controller.updateDisplay();\n }\n\n controller.setValue =
common.compose(function(val) {\n if (gui.getRoot().__preset_select && controller.isModified()) {\n markPresetModified(gui.getRoot(), true);\n }\n return val;\n }, controller.setValue);\n\n function
recallSavedValue(gui, controller) {\n // Find the topmost GUI, that's where remembered objects live.\n const root =
gui.getRoot();\n\n // Does the object we're controlling match anything we've
been told to\n // remember?\n const matchedIndex = root.__rememberedObjects.indexOf(controller.object);\n\n // Why yes, it does!\n if (matchedIndex !== -1) {\n // Let me fetch a map of controllers for th\n common.isObject.\n let controllerMap = root.__rememberedObjectIndecesToControllers[matchedIndex];\n\n // Ohp, I believe this is
the first controller we've created for this\n // object. Lets make the map fresh.\n if (controllerMap ===
undefined) {\n controllerMap = {};\n root.__rememberedObjectIndecesToControllers[matchedIndex] =\n

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controllerMap;\n }\n\n // Keep track of this controller\n controllerMap[controller.property] = controller;\n\n // Okay, now have we saved any values for this controller?\n if (root.load && root.load.remembered) {\n const\n presetMap = root.load.remembered;\n\n // Which preset are we trying to load?\n let preset;\n\n if\n (presetMap[gui.preset]) {\n preset = presetMap[gui.preset];\n }\n else if (presetMap[DEFAULT_DEFAULT_PRESET_NAME]) {\n // Uhh, you can have the default\n instead?\n preset = presetMap[DEFAULT_DEFAULT_PRESET_NAME];\n } else {\n // Nada.\n return;\n }\n\n // Did the loaded object remember thcommon.isObject? && Did we remember this particular\n property?\n if (preset[matchedIndex] && preset[matchedIndex][controller.property] !== undefined) {\n //\n We did remember something for this guy ... \n const value = preset[matchedIndex][controller.property];\n\n // And that's what it is.\n controller.initialValue = value;\n controller.setValue(value);\n }\n }\n\n}\n\nfunction add(gui, object, property, params) {\n if (object[property] === undefined) {\n throw new\n Error('Object "' + object + '" has no property "' + property + '"');\n }\n\n let controller;\n\n if (params.color) {\n controller = new ColorController(object, property);\n } else {\n const factoryArgs = [object,\n property].concat(params.factoryArgs);\n controller = ControllerFactory.apply(gui, factoryArgs);\n }\n\n if\n (params.before instanceof Controller) {\n params.before = params.before.__li;\n }\n\n recallSavedValue(gui,\n controller);\n\n dom.addClass(controller.domElement, 'c');\n\n const name = document.createElement('span');\n dom.addClass(name, 'property-name');\n name.innerHTML = controller.property;\n\n const container =\n document.createElement('div');\n container.appendChild(name);\n\n container.appendChild(controller.domElement);\n\n const li = addRow(gui, container, params.before);\n dom.addClass(li, GUI.CLASS_CONTROLLER_ROW);\n if (controller instanceof ColorController) {\n dom.addClass(li, 'color');\n } else {\n dom.addClass(li, typeof controller.getValue());\n }\n\n augmentController(gui, li, controller);\n\n gui.__controllers.push(controller);\n\n return controller;\n}\n\nfunction\ngetLocalStorageHash(gui, key) {\n // TODO how does this deal with\n multiple GUI's?\n return document.location.href + '.' + key;\n}\n\nfunction addPresetOption(gui, name,\nsetSelected) {\n const opt = document.createElement('option');\n opt.innerHTML = name;\n opt.value = name;\n gui.__preset_select.appendChild(opt);\n if (setSelected) {\n gui.__preset_select.selectedIndex =\n gui.__preset_select.length - 1;\n }\n}\n\nfunction showHideExplain(gui, explain) {\n explain.style.display =\n gui.useLocalStorage ? 'block' : 'none';\n}\n\nfunction addSaveMenu(gui) {\n const div = gui.__save_row =\n document.createElement('li');\n dom.addClass(gui.domElement, 'has-save');\n gui.__ul.insertBefore(div,\n gui.__ul.firstChild);\n dom.addClass(div, 'save-row');\n const gears = document.createElement('span');\n gears.innerHTML = ' ';\n dom.addClass(gears, 'button gears');\n // TODO replace with\n FunctionController\n const button = document.createElement('span');\n button.innerHTML = 'Save';\n dom.addClass(button, 'button');\n dom.addClass(button,\n 'save');\n const button2 = document.createElement('span');\n button2.innerHTML = 'New';\n dom.addClass(button2, 'button');\n dom.addClass(button2, 'save-as');\n const button3 =\n document.createElement('span');\n button3.innerHTML = 'Revert';\n dom.addClass(button3, 'button');\n dom.addClass(button3, 'revert');\n const select = gui.__preset_select = document.createElement('select');\n if\n (gui.load && gui.load.remembered) {\n common.each(gui.load.remembered, function(value, key) {\n addPresetOption(gui, key, key === gui.preset);\n });\n } else {\n addPresetOption(gui,\n DEFAULT_DEFAULT_PRESET_NAME, false);\n }\n\n dom.bind(select, 'change', function() {\n for (let index\n = 0; index < gui.__preset_select.length; index++) {\n gui.__preset_select[index].innerHTML =\n gui.__preset_select[index].value;\n }\n\n gui.preset = this.value;\n });\n\n div.appendChild(select);\n div.appendChild(gears);\n div.appendChild(button);\n div.appendChild(button2);\n div.appendChild(button3);\n\n if (SUPPORTS_LOCAL_STORAGE) {\n const explain =\n document.getElementById('dg-local-explain');\n const localStorageCheckBox = document.getElementById('dg-\n local-storage');\n const saveLocally = document.getElementById('dg-save-locally');\n saveLocally.style.display = 'block';\n if (localStorage.getItem(getLocalStorageHash(gui, 'isLocal')) === 'true')\n {\n localStorageCheckBox.setAttribute('checked', 'checked');\n }\n\n showHideExplain(gui, explain);\n }\n\n //

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TODO: Use a boolean controller, fool!
 dom.bind(localStorageCheckBox, 'change', function() {
 gui.useLocalStorage = !gui.useLocalStorage;
 showHideExplain(gui, explain);
 });
 }
 const
 newConstructorTextArea = document.getElementById('dg-new-constructor');
 dom.bind(newConstructorTextArea, 'keydown', function(e) {
 if (e.metaKey && (e.which === 67 || e.keyCode
 === 67)) {
 SAVE_DIALOGUE.hide();
 }
 });
 dom.bind(gears,
 'click', function() {
 newConstructorTextArea.innerHTML = JSON.stringify(gui.getSaveObject(), undefined,
 2);
 SAVE_DIALOGUE.show();
 newConstructorTextArea.focus();
 newConstructorTextArea.select();
 });
 dom.bind(button, 'click', function() {
 gui.save();
 });
 dom.bind(button2, 'click', function() {
 const presetName = prompt('Enter a new preset name. ');
 if (presetName) {
 gui.saveAs(presetName);
 }
 });
 dom.bind(button3, 'click', function() {
 gui.revert();
 });
 //
 div.appendChild(button2);
 }
 function addResizeHandle(gui) {
 let pmouseX;
 gui.__resize_handle =
 document.createElement('div');
 common.extend(gui.__resize_handle.style, {
 width: '6px',
 marginLeft:
 '-3px',
 height: '200px',
 cursor: 'ew-resize',
 position: 'absolute'
 // border: '1px solid blue'
 });
 function drag(e) {
 e.preventDefault();
 gui.width += pmouseX - e.clientX;
 gui.onResize();
 pmouseX = e.clientX;
 return false;
 }
 function dragStop() {
 dom.removeClass(gui.__closeButton,
 GUI.CLASS_DRAG);
 dom.unbind(window, 'mousemove', drag);
 dom.unbind(window, 'mouseup',
 dragStop);
 }
 function dragStart(e) {
 e.preventDefault();
 pmouseX = e.clientX;
 dom.addClass(gui.__closeButton, GUI.CLASS_DRAG);
 dom.bind(window, 'mousemove', drag);
 dom.bind(window, 'mouseup', dragStop);
 return false;
 }
 dom.bind(gui.__resize_handle, 'mousedown',
 dragStart);
 dom.bind(gui.__closeButton, 'mousedown', dragStart);
 gui.domElement.insertBefore(gui.__resize_handle, gui.domElement.firstChild);
 }
 function
 setWidth(gui, w) {
 gui.domElement.style.width = w + 'px';
 // Auto placed save-rows are position fixed, so we
 have to
 // set the width manually if we want it to bleed to the edge
 if (gui.__save_row && gui.autoPlace) {
 gui.__save_row.style.width = w + 'px';
 }
 if (gui.__closeButton)
 {
 gui.__closeButton.style.width = w + 'px';
 }
 }
 function getCurrentPreset(gui, useInitialValues) {
 const toReturn = {};
 // For each object I'm remembering
 common.each(gui.__rememberedObjects,
 function(val, index) {
 const savedValues = {};
 // The controllers I've made for thcommon.isObject by
 property
 const controllerMap =
 gui.__rememberedObjectIndecesToControllers[index];
 // Remember
 each value for each property
 common.each(controllerMap, function(controller, property) {
 savedValues[property] = useInitialValues ? controller.initialValue : controller.getValue();
 });
 // Save the
 values for thcommon.isObject
 toReturn[index] = savedValues;
 });
 return toReturn;
 }
 function
 setPresetSelectIndex(gui) {
 for (let index = 0; index < gui.__preset_select.length; index++) {
 if
 (gui.__preset_select[index].value === gui.preset) {
 gui.__preset_select.selectedIndex = index;
 }
 }
 }
 function updateDisplays(controllerArray) {
 if (controllerArray.length !== 0) {
 requestAnimationFrame.call(window, function() {
 updateDisplays(controllerArray);
 });
 }
 }
 common.each(controllerArray, function(c) {
 c.updateDisplay();
 });
 }
 export default GUI;
 // stats.js -
 http://github.com/mrdoob/stats.js
 (function(f,e){
 "object"===typeof exports&&"undefined"!=="typeof
 module?module.exports=e):
 "function"===typeof define&&define.amd?define(e):f.Stats=e})(this,function(){
 var
 f=function(){
 function e(a){
 c.appendChild(a.dom);
 return a
 }
 function u(a){
 for(var
 d=0;d<c.children.length;d++)
 c.children[d].style.display=d===a?"block":"none";
 l=a
 }
 var
 l=0,c=document.createElement("div");
 c.style.cssText="position:fixed;top:0;left:0;cursor:pointer;opacity:0.9;z-
 index:10000";
 c.addEventListener("click",function(a){
 a.preventDefault();
 nu(++1%c.children.length)},!1);
 var
 k=(performance||Date).now(),g=k,a=0,r=e(new f.Panel("FPS",\`#\`0ff`,\`#\`002`)),h=e(new
 f.Panel("MS",\`#\`0f0`,\`#\`020`));
 if(self.performance&&self.performance.memory)
 var t=e(new
 f.Panel("MB",\`#\`f08`,\`#\`201`));
 u(0);
 return {
 REVISION:16,dom:c,addPanel:e,showPanel:u,begin:function(){
 k=(performance||Date).now(),end:function(){
 a++;
 var c=(performance||Date).now();
 h.update(c-
 k,200);
 if(c>g+1E3&&(r.update(1E3*a/(c-g),100),g=c,a=0,t))
 {
 var
 d=performance.memory;t.update(d.usedJSHeapSize/1048576,d.jsHeapSizeLimit/1048576)}
 return
 }
 }
 }
 }
 }

```

```

c},update:function(){k=this.end()},domElement:c,setMode:u}};f.Panel=function(e,f,l){var
c=Infinity,k=0,g=Math.round,a=g(window.devicePixelRatio||1),r=80*a,h=48*a,t=3*a,v=2*a,d=3*a,m=15*a,n=74*a
,p=30*a,q=document.createElement("canvas");q.width=r;q.height=h;q.style.cssText="width:80px;height:48px";v
ar b=q.getContext("2d");b.font="bold "+9*a+"px Helvetica,Arial,sans-
serif";b.textBaseline="top";b.fillStyle=l;b.fillRect(0,0,r,h);b.fillStyle=f;b.fillText(e,t,v);nb.fillRect(d,m,n,p);b.fill
Style=l;b.globalAlpha=.9;b.fillRect(d,m,n,p);return{dom:q,update:function(h,w){c=Math.min(c,h);k=Math.max(k,h
);b.fillStyle=l;b.globalAlpha=1;b.fillRect(0,0,r,m);b.fillStyle=f;b.fillText(g(h)+"
"+e+" ("+"g(c)+"+"+"g(k)+"+"),t,v);b.drawImage(q,d+a,m,n-a,p,d,m,n-a,p);b.fillRect(d+n-
a,m,a,p);b.fillStyle=l;b.globalAlpha=.9;b.fillRect(d+n-a,m,a,g((1-h/w)*p))}};return f}};
\n", "/*\n * @license\n
* Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of
the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License
for the specific language governing permissions and\n * limitations under
the License.\n *
=====
\n
*^\\nimport*as tf from"@tensorflow/tfjs-
core";import{util,tidy,div,sub,buffer,Tensor,browser,pad3d,scalar,concat,tensor2d,tensor}from"@tensorflow/tfjs-
core";import{loadGraphModel}from"@tensorflow/tfjs-converter";var
VALID_OUTPUT_STRIDES=[8,16,32];function assertValidOutputStride(e){util.assert("number"===typeof
e,function(){return"outputStride is not a
number"}),util.assert(VALID_OUTPUT_STRIDES.indexOf(e)>=0,function(){return"outputStride of "+e+" is
invalid. It must be either 8, 16, or 32"})}function assertValidResolution(e,t){util.assert("number"===typeof
e,function(){return"resolution is not a number"}),util.assert((e-1)%t===0,function(){return"resolution of "+e+" is
invalid for output stride "+t+"."})}function toFloatIfInt(e){return
tidy(function(){return"int32"===e.dtype&&(e=e.toFloat()),e=div(e,127.5),sub(e,1)})}var
MobileNet=function(){function e(e,t){this.model=e;var
r=this.model.inputs[0].shape;util.assert(-1===r[1]&&-1===r[2],function(){return"Input shape ["+r[1]+"",
"+r[2]+""] must both be -1"}),this.outputStride=t}return e.prototype.predict=function(e){var t=this;return
tidy(function(){var
r=toFloatIfInt(e).expandDims(0),n=t.model.predict(r),o=n[0],i=n[1],s=n[2],a=n[3];return{heatmapScores:i.squeeze(
).sigmoid(),offsets:o.squeeze(),displacementFwd:s.squeeze(),displacementBwd:a.squeeze()}}),e.prototype.dispose
=function(){this.model.dispose(),e()};function half(e){return Math.floor(e/2)}var MaxHeap=function(){function
e(e,t){this.priorityQueue=new Array(e),this.numberOfElements=-1,this.getElementValue=t}return
e.prototype.enqueue=function(e){this.priorityQueue[++this.numberOfElements]=e,this.swim(this.numberOfElemen
ts)},e.prototype.dequeue=function(){var e=this.priorityQueue[0];return this.exchange(0,this.numberOfElements--
),this.sink(0),this.priorityQueue[this.numberOfElements+1]=null,e},e.prototype.empty=function(){return-
1===this.numberOfElements},e.prototype.size=function(){return
this.numberOfElements+1},e.prototype.all=function(){return
this.priorityQueue.slice(0,this.numberOfElements+1)},e.prototype.max=function(){return
this.priorityQueue[0]},e.prototype.swim=function(e){for(;e>0&&this.less(half(e),e);)this.exchange(e,half(e)),e=half
(e)},e.prototype.sink=function(e){for(;2*e<=this.numberOfElements;){var
t=2*e;if(t<this.numberOfElements&&this.less(t,t+1)&&t++,!this.less(e,t))break;this.exchange(e,t),e=t}},e.prototype
.getValueAt=function(e){return this.getElementValue(this.priorityQueue[e])},e.prototype.less=function(e,t){return
this.getValueAt(e)<this.getValueAt(t)},e.prototype.exchange=function(e,t){var
r=this.priorityQueue[e];this.priorityQueue[e]=this.priorityQueue[t],this.priorityQueue[t]=r,e()};function
scoreIsMaximumInLocalWindow(e,t,r,n,o,i){for(var s=i.shape,a=s[0],u=s[1],l=!0,f=Math.max(r-

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o,0),c=Math.min(r+o+1,a),d=f;d<c;++d){for(var p=Math.max(n-
o,0),h=Math.min(n+o+1,u),m=p;m<h;++m)if(i.get(d,m,e)>t){l=!1;break}if(!l)break}return
l}function buildPartWithScoreQueue(e,t,r){for(var n=r.shape,o=n[0],i=n[1],s=n[2],a=new
MaxHeap(o*i*s,function(e){return e.score}),u=0;u<o;++u)for(var l=0;l<i;++l)for(var f=0;f<s;++f){var
c=r.get(u,l,f);c<e||scoreIsMaximumInLocalWindow(f,c,u,l,t,r)&&a.enqueue({score:c,part:{heatmapY:u,heatmapX:l,
id:f}})}return a}var
partNames=["nose","leftEye","rightEye","leftEar","rightEar","leftShoulder","rightShoulder","leftElbow",
"rightElbow","leftWrist","rightWrist","leftHip","rightHip","leftKnee","rightKnee","leftAnkle","rightAn
kle"],NUM_KEYPOINTS=partNames.length,partIds=partNames.reduce(function(e,t,r){return
e[t]=r,e,{}),connectedPartNames=[["leftHip","leftShoulder"],["leftElbow","leftShoulder"],["leftElbow","lef
tWrist"],["leftHip","leftKnee"],["leftKnee","leftAnkle"],["rightHip","rightShoulder"],["rightElbow","right
Shoulder"],["rightElbow","rightWrist"],["rightHip","rightKnee"],["rightKnee","rightAnkle"],["leftShould
er","rightShoulder"],["leftHip","rightHip"]],poseChain=[["nose","leftEye"],["leftEye","leftEar"],["nose",
"rightEye"],["rightEye","rightEar"],["nose","leftShoulder"],["leftShoulder","leftElbow"],["leftElbow","l
eftWrist"],["leftShoulder","leftHip"],["leftHip","leftKnee"],["leftKnee","leftAnkle"],["nose","rightShould
er"],["rightShoulder","rightElbow"],["rightElbow","rightWrist"],["rightShoulder","rightHip"],["rightHip",
"rightKnee"],["rightKnee","rightAnkle"]],connectedPartIndices=connectedPartNames.map(function(e){var
t=e[0],r=e[1];return[partIds[t],partIds[r]]}),partChannels=["left_face","right_face","right_upper_leg_front","rig
ht_lower_leg_back","right_upper_leg_back","left_lower_leg_front","left_upper_leg_front","left_upper_leg_ba
ck","left_lower_leg_back","right_feet","right_lower_leg_front","left_feet","torso_front","torso_back","rig
ht_upper_arm_front","right_upper_arm_back","right_lower_arm_back","left_lower_arm_front","left_upper_ar
m_front","left_upper_arm_back","left_lower_arm_back","right_hand","right_lower_arm_front","left_hand"]);
function
getOffsetPoint(e,t,r,n){return{y:n.get(e,t,r),x:n.get(e,t,r+NUM_KEYPOINTS)}}function getImageCoords(e,t,r){var
n=getOffsetPoint(e.heatmapY,e.heatmapX,e.id,r),o=n.y,i=n.x;return{x:e.heatmapX*t+i,y:e.heatmapY*t+o}}functio
n clamp(e,t,r){return e<t?t:e>r?r:e}function squaredDistance(e,t,r,n){var o=r-e,i=n-t;return o*o+i*i}function
addVectors(e,t){return{x:e.x+t.x,y:e.y+t.y}}var parentChildrenTuples=poseChain.map(function(e){var
t=e[0],r=e[1];return[partIds[t],partIds[r]]}),parentToChildEdges=parentChildrenTuples.map(function(e){return
e[1]}),childToParentEdges=parentChildrenTuples.map(function(e){return e[0]});function
getDisplacement(e,t,r){var n=r.shape[2]/2;return{y:r.get(t.y,t.x,e),x:r.get(t.y,t.x,n+e)}}function
getStridedIndexNearPoint(e,t,r,n){return{y:clamp(Math.round(e.y/t),0,r-1),x:clamp(Math.round(e.x/t),0,n-
1)}}function
traverseToTargetKeypoint(e,t,r,n,o,i,s,a){void 0===a&&(a=2);for(var
u=n.shape,l=u[0],f=u[1],c=getDisplacement(e,getStridedIndexNearPoint(t.position,i,l,f),s),d=addVectors(t.position,c
),p=0;p<a;p++){var
h=getStridedIndexNearPoint(d,i,l,f),m=getOffsetPoint(h.y,h.x,r,o);d=addVectors({x:h.x*i,y:h.y*i},{x:m.x,y:m.y})}
var g=getStridedIndexNearPoint(d,i,l,f),_=n.get(g.y,g.x,r);return{position:d,part:partNames[r],score:_}}function
decodePose(e,t,r,n,o,i){var s=t.shape[2],a=parentToChildEdges.length,u=new
Array(s),l=e.part,f=e.score,c=getImageCoords(l,n,r);u[l.id]={score:f,part:partNames[l.id],position:c};for(var d=a-
1;d>=0;--d){var
p=parentToChildEdges[d],h=childToParentEdges[d];u[p]&&!u[h]&&(u[h]=traverseToTargetKeypoint(d,u[p],h,t,r,n
,i))}for(d=0;d<a;++d){p=childToParentEdges[d],h=parentToChildEdges[d];u[p]&&!u[h]&&(u[h]=traverseToTarge
tKeypoint(d,u[p],h,t,r,n,o))}return u}function withinNmsRadiusOfCorrespondingPoint(e,t,r,n){var o=r.x,i=r.y;return
e.some(function(e){var r=e.keypoints[n].position;return squaredDistance(i,o,r.y,r.x)<=t})}function
getInstanceScore(e,t,r){return r.reduce(function(r,n,o){var i=n.position,s=n.score;return
withinNmsRadiusOfCorrespondingPoint(e,t,i,o)(r+=s),r),0)/r.length}var kLocalMaximumRadius=1;function
decodeMultiplePoses(e,t,r,n,o,i,s,a){void 0===s&&(s=.5),void 0===a&&(a=20);for(var
u=[],l=buildPartWithScoreQueue(s,kLocalMaximumRadius,e),f=a*a;u.length<i&&!l.empty();){var

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c=l.dequeue();if(!withinNmsRadiusOfCorrespondingPoint(u,f.getImageCoords(c.part,o,t),c.part.id)){var
d=decodePose(c,e,t,o,r,n),p=getInstanceScore(u,f,d);u.push({keypoints:d,score:p})}}return u}var
__assign=function(){return(__assign=Object.assign||function(e){for(var t,r=1,n=arguments.length;r<n;r++)for(var o
in t=arguments[r])Object.prototype.hasOwnProperty.call(t,o)&&(e[o]=t[o]);return
e}).apply(this,arguments)};function __awaiter(e,t,r,n){return new(r||(r=Promise))(function(o,i){function
s(e){try{u(n.next(e))}catch(e){i(e)}}function
a(e){try{u(n.throw(e))}catch(e){i(e)}}function u(e){e.done?o(e.value):new
r(function(t){t(e.value)}).then(s,a)}u((n=n.apply(e,t||[])).next())})}function __generator(e,t){var
r,n,o,i,s={label:0,sent:function(){if(1&o[0])throw o[1];return o[1]},trys:[],ops:[]};return
i={next:a(0),throw:a(1),return:a(2)},\function"==typeof Symbol&&(i[Symbol.iterator]=function(){return
this}),i;function a(i){return function(a){return function(i){if(r)throw new TypeError("\Generator is already
executing.\");for(;s;try{if(r=1,n&&(o=2&i[0]?n.return:i[0]?n.throw|((o=n.return)&&o.call(n),0):n.next)&&!o.o.c
all(n,i[1])).done)return o;switch(n=0,o&&(i=[2&i[0],o.value]),i[0]){case 0:case 1:o=i;break;case 4:return
s.label++,{value:i[1],done:!1};case 5:s.label++,n=i[1],i=[0];continue;case
7:i=s.ops.pop(),s.trys.pop();continue;default:if(!(o=(o=s.trys).length>0&&o[o.length-
1])&&(6===i[0]||2===i[0])){s=0;continue}if(3===i[0]&&(!o[i[1]]>o[0]&&i[1]<o[3])){s.label=i[1];break}if(6===i[
0]&&s.label<o[1]){s.label=o[1],o=i;break}if(o&&s.label<o[2]){s.label=o[2],s.ops.push(i);break}o[2]&&s.ops.pop(
),s.trys.pop();continue}i=t.call(e,s)}catch(e){i=[6,e],n=0}finally{r=o=0}if(5&i[0])throw
i[1];return{value:i[0]?i[1]:void 0,done:!0}}(i,a)}}function eitherPointDoesntMeetConfidence(e,t,r){return
e<r||t<r}function getAdjacentKeyPoints(e,t){return connectedPartIndices.reduce(function(r,n){var
o=n[0],i=n[1];return eitherPointDoesntMeetConfidence(e[o].score,e[i].score,t)?r:(r.push([e[o],e[i]]),r),[])}var
NEGATIVE_INFINITY=Number.NEGATIVE_INFINITY,POSITIVE_INFINITY=Number.POSITIVE_INFINITY
;function getBoundingBox(e){return e.reduce(function(e,t){var
r=e.maxX,n=e.maxY,o=e.minX,i=e.minY,s=t.position,a=s.x,u=s.y;return{maxX:Math.max(r,a),maxY:Math.max(n,
u),minX:Math.min(o,a),minY:Math.min(i,u)},{maxX:NEGATIVE_INFINITY,maxY:NEGATIVE_INFINITY,min
X:POSITIVE_INFINITY,minY:POSITIVE_INFINITY}})function getBoundingBoxPoints(e){var
t=getBoundingBox(e),r=t.minX,n=t.minY,o=t.maxX,i=t.maxY;return[{x:r,y:n},{x:o,y:n},{x:o,y:i},{x:r,y:i}]}}functi
on
toTensorBuffer(e,t){return void 0===t&&(t="\float32"),__awaiter(this,void 0,void 0,function(){var r;return
__generator(this,function(n){switch(n.label){case 0:return[4,e.data()];case 1:return
r=n.sent(),[2,buffer(e.shape,t,r)]}})})}function toTensorBuffers3D(e){return __awaiter(this,void 0,void
0,function(){return __generator(this,function(t){return[2,Promise.all(e.map(function(e){return
toTensorBuffer(e,"\float32"))}])}])}function scalePose(e,t,r,n,o){return void 0===n&&(n=0),void
0===o&&(o=0),{score:e.score,keypoints:e.keypoints.map(function(e){var
i=e.score,s=e.part,a=e.position;return{score:i,part:s,position:{x:a.x*r+o,y:a.y*t+n}}})}}function
scalePoses(e,t,r,n,o){return void 0===n&&(n=0),void
0===o&&(o=0),1===r&&1===t&&0===n&&0===o?e:e.map(function(e){return scalePose(e,t,r,n,o)})}function
flipPoseHorizontal(e,t){return{score:e.score,keypoints:e.keypoints.map(function(e){var
r=e.score,n=e.part,o=e.position;return{score:r,part:n,position:{x:t-1-o.x,y:o.y}}})}}function
flipPosesHorizontal(e,t){return t<=0?e:e.map(function(e){return flipPoseHorizontal(e,t)})}function
getInputTensorDimensions(e){return e instanceof Tensor?[e.shape[0],e.shape[1]]:[e.height,e.width]}function
toInputTensor(e){return e instanceof Tensor?e.browser.fromPixels(e)}function padAndResizeTo(e,t){var
r=t[0],n=t[1],o=getInputTensorDimensions(e),i=o[0],s=o[1],a=n/r,u=[0,0,0,0],l=u[0],f=u[1],c=u[2],d=u[3];return
s/i<a?(l=0,f=0,c=Math.round(.5*(a*i-s)),d=Math.round(.5*(a*i-s)):(l=Math.round(.5*(1/a*s-
i)),f=Math.round(.5*(1/a*s-i)),c=0,d=0),{resized:tidy(function(){var
t=toInputTensor(e);return(t=pad3d(t,[[l,f],[c,d],[0,0]])).resizeBilinear([r,n]),padding:{top:l,left:c,right:d,bottom:f}
}})function scaleAndFlipPoses(e,t,r,n,o){var
i=t[0],s=t[1],a=r[0],u=r[1],l=scalePoses(e,(i+n.top+n.bottom)/a,(s+n.left+n.right)/u,-n.top,-n.left);return

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o?flipPosesHorizontal(1,s):1}function mod(e,t){return tidy(function(){var r=e.div(scalar(t,"int32"));return
e.sub(r.mul(scalar(t,"int32")))}function
argmax2d(e){var t=e.shape,r=t[0],n=t[1],o=t[2];return tidy(function(){var
t=e.reshape([r*n,o]).argMax(0),i=t.div(scalar(n,"int32")).expandDims(1),s=mod(t,n).expandDims(1);return
concat([i,s,1])})}function getPointsConfidence(e,t){for(var r=t.shape[0],n=new Float32Array(r),o=0;o<r;o++){var
i=t.get(o,0),s=t.get(o,1);n[o]=e.get(i,s,o)}return n}function
getOffsetPoint$1(e,t,r,n){return {y:n.get(e,t,r),x:n.get(e,t,r+NUM_KEYPOINTS)}}function
getOffsetVectors(e,t){for(var r=[],n=0;n<NUM_KEYPOINTS;n++){var
o=getOffsetPoint$1(e.get(n,0).valueOf(),e.get(n,1).valueOf(),n,t),i=o.x,s=o.y;r.push(s),r.push(i)}return
tensor2d(r,[NUM_KEYPOINTS,2])}function getOffsetPoints(e,t,r){return tidy(function(){var
n=getOffsetVectors(e,r);return e.toTensor().mul(scalar(t,"int32")).toFloat().add(n)}function
decodeSinglePose(e,t,r){return __awaiter(this,void 0,void 0,function(){var n,o,i,s,a,u,l,f,c,d;return
__generator(this,function(p){switch(p.label){case 0:return
n=0,o=argmax2d(e),[4,Promise.all([toTensorBuffer(e),toTensorBuffer(t),toTensorBuffer(o,"int32")]);case
1:return i=p.sent(),s=i[0],a=i[1],u=i[2],[4,toTensorBuffer(l=getOffsetPoints(u,r,a));case 2:return
f=p.sent(),c=Array.from(getPointsConfidence(s,u)),d=c.map(function(e,t){return
n+=e,{position:{y:f.get(t,0),x:f.get(t,1)},part:partNames[t],score:e}),o.dispose(),l.dispose(),[2,{keypoints:d,score:n
/d.length}]}))}}var MOBILENET_BASE_URL="https://storage.googleapis.com/tfjs-
models/savedmodel/posenet/mobilenet/",RESNET50_BASE_URL="https://storage.googleapis.com/tfjs-
models/savedmodel/posenet/resnet50/";function resNet50Checkpoint(e,t){var r="model-stride"+e+"\ cant\n";return
4==t?RESNET50_BASE_URL+"\ cant\n"+r:RESNET50_BASE_URL+"\ cant\n"+r}function
mobileNetCheckpoint(e,t,r){var n={1:"100",.75:"075",.5:"050"},o="model-stride"+e+"\ cant\n";return
4==r?MOBILENET_BASE_URL+"\ cant\n"+n[t]+" cant\n"+o:MOBILENET_BASE_URL+"\ cant\n"+n[t]+" cant\n"+
o}function toFloatIfInt$1(e){return
tidy(function(){cant\n"===e.dtype&&(e=e.toFloat());var t=tensor([-123.15,-115.9,-103.06]);return e.add(t)})}var
ResNet=function(){function e(e,t){this.model=e;var r=this.model.inputs[0].shape;util.assert(-1===r[1]&&-
1===r[2],function(){return"Input shape ["+r[1]+", "+r[2]+"] must both be equal to or -
1"}),this.outputStride=t}return e.prototype.predict=function(e){var t=this;return tidy(function(){var
r=toFloatIfInt$1(e).expandDims(0),n=t.model.predict(r),o=n[0],i=n[1],s=n[2];return {heatmapScores:n[3].squeeze().
sigmoid(),offsets:s.squeeze(),displacementFwd:o.squeeze(),displacementBwd:i.squeeze()})},e.prototype.dispose=f
unction(){this.model.dispose(),e(),MOBILENET_V1_CONFIG={architecture:"MobileNetV1",outputStride:16,
multiplier:.75,inputResolution:257},VALID_ARCHITECTURE=["MobileNetV1","ResNet50"],VALID_STRID
E={MobileNetV1:[8,16,32],ResNet50:[32,16]},VALID_INPUT_RESOLUTION=[161,193,257,289,321,353,385,41
7,449,481,513,801],VALID_MULTIPLIER={MobileNetV1:[.5,.75,1],ResNet50:[1]},VALID_QUANT_BYTES=[1
,2,4];function
validateModelConfig(e){if(null==(e=e||MOBILENET_V1_CONFIG).architecture&&(e.architecture="MobileNetV
1"),VALID_ARCHITECTURE.indexOf(e.architecture)<0)throw new Error("Invalid architecture
"+e.architecture+". Should be one of
"+VALID_ARCHITECTURE);if(null==e.inputResolution&&(e.inputResolution=257),VALID_INPUT_RESOLU
TION.indexOf(e.inputResolution)<0)throw new Error("Invalid inputResolution "+e.inputResolution+". Should be
one of
"+VALID_INPUT_RESOLUTION);if(null==e.outputStride&&(e.outputStride=16),VALID_STRIDE[e.architectur
e].indexOf(e.outputStride)<0)throw new Error("Invalid outputStride "+e.outputStride+". Should be one of
"+VALID_STRIDE[e.architecture]+"] for architectre
"+e.architecture+".");if(null==e.multiplier&&(e.multiplier=1),VALID_MULTIPLIER[e.architecture].indexOf(e.
multiplier)<0)throw new Error("Invalid multiplier "+e.multiplier+". Should be one of
"+VALID_MULTIPLIER[e.architecture]+"] for architectre
"+e.architecture+".");if(null==e.quantBytes&&(e.quantBytes=4),VALID_QUANT_BYTES.indexOf(e.quantByte

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s)<0)throw
 new Error("Invalid quantBytes \""+e.quantBytes+"\ ". Should be one of \"+VALID_QUANT_BYTES+"\ " for
 architectre \""+e.architecture+"\ ".");return e }var
SINGLE_PERSON_INFERENCE_CONFIG={ flipHorizontal:!1 },MULTI_PERSON_INFERENCE_CONFIG={ flip
pHorizontal:!1,maxDetections:5,scoreThreshold:.5,nmsRadius:20 };function validateMultiPersonInputConfig(e){ var
t=e.maxDetections,r=e.scoreThreshold,n=e.nmsRadius;if(t<=0)throw new Error("Invalid maxDetections \""+t+"\ ".
Should be > 0");if(r<0||r>1)throw new Error("Invalid scoreThreshold \""+r+"\ ". Should be in range [0.0,
1.0]);if(n<=0)throw new Error("Invalid nmsRadius \""+n+"\ ".)}var PoseNet=function(){ function
e(e,t){ this.baseModel=e,this.inputResolution=t}return e.prototype.estimateMultiplePoses=function(e,t){return void
0===t&&(t=MULTI_PERSON_INFERENCE_CONFIG),__awaiter(this,void 0,void 0,function(){ var
r,n,o,i,s,a,u,l,f,c,d,p,h,m,g,_,I,E,v,N,y;return
__generator(this,function(T){ switch(T.label){ case 0:return
r=__assign({ },MULTI_PERSON_INFERENCE_CONFIG,t),validateMultiPersonInputConfig(t),n=this.baseModel.
outputStride,o=this.inputResolution,assertValidOutputStride(n),assertValidResolution(this.inputResolution,n),i=getI
nputTensorDimensions(e),s=i[0],a=i[1],u=padAndResizeTo(e,[o,o]),l=u.resized,f=u.padding,c=this.baseModel.predic
t(l),d=c.heatmapScores,p=c.offsets,h=c.displacementFwd,m=c.displacementBwd,[4,toTensorBuffers3D([d,p,h,m])]
);case 1:return
g=T.sent(),_=g[0],I=g[1],E=g[2],v=g[3],[4,decodeMultiplePoses(_,I,E,v,n,r.maxDetections,r.scoreThreshold,r.nmsR
adius)];case 2:return
N=T.sent(),y=scaleAndFlipPoses(N,[s,a],[o,o],f,r.flipHorizontal),d.dispose(),p.dispose(),h.dispose(),m.dispose(),l.di
spose(),[2,y] } } } },e.prototype.estimateSinglePose=function(e,t){return void
0===t&&(t=SINGLE_PERSON_INFERENCE_CONFIG),__awaiter(this,void 0,void 0,function(){ var
r,n,o,i,s,a,u,l,f,c,d,p,h,m,g,_,I,E,v,N,y;return
__generator(this,function(I){ switch(I.label){ case
0:return
r=__assign({ },SINGLE_PERSON_INFERENCE_CONFIG,t),n=this.baseModel.outputStride,o=this.inputResolutio
n,assertValidOutputStride(n),assertValidResolution(o,n),i=getInputTensorDimensions(e),s=i[0],a=i[1],u=padAndRe
sizeTo(e,[o,o]),l=u.resized,f=u.padding,c=this.baseModel.predict(l),d=c.heatmapScores,p=c.offsets,h=c.displacemen
tFwd,m=c.displacementBwd,[4,decodeSinglePose(d,p,n)];case 1:return
g=I.sent(),_=scaleAndFlipPoses([g],[s,a],[o,o],f,r.flipHorizontal),d.dispose(),p.dispose(),h.dispose(),m.dispose(),l.di
spose(),[2,_[0]] } } } },e.prototype.estimatePoses=function(e,t){return __awaiter(this,void 0,void 0,function(){ return
__generator(this,function(r){ switch(r.label){ case 0:return "single-
person"!=t.decodingMethod?[3,2]:[4,this.estimateSinglePose(e,t)];case 1:return[2,[r.sent()]];case
2:return[2,this.estimateMultiplePoses(e,t)] } } } },e.prototype.dispose=function(){ this.baseModel.dispose(),e();fun
ction loadMobileNet(e){return __awaiter(this,void 0,void 0,function(){ var
t,r,n,o,i,s;return __generator(this,function(a){ switch(a.label){ case
0:if(t=e.outputStride,r=e.quantBytes,n=e.multiplier,null===tf)throw new Error("Cannot find TensorFlow.js. If you
are using a <script> tag, please also include @tensorflow/tfjs on the page before using this\n
 model.");return
o=mobileNetCheckpoint(t,n,r),[4,loadGraphModel(e.modelUrl||o)];case 1:return i=a.sent(),s=new
MobileNet(i,t),[2,new PoseNet(s,e.inputResolution)] } } } } }function loadResNet(e){return __awaiter(this,void 0,void
0,function(){ var t,r,n,o,i;return __generator(this,function(s){ switch(s.label){ case
0:if(t=e.outputStride,r=e.quantBytes,null===tf)throw new Error("Cannot find TensorFlow.js. If you are using a
<script> tag, please also include @tensorflow/tfjs on the page before using this\n
 model.");return
n=resNet50Checkpoint(t,r),[4,loadGraphModel(e.modelUrl||n)];case 1:return o=s.sent(),i=new ResNet(o,t),[2,new
PoseNet(i,e.inputResolution)] } } } } }function load(e){return void
0===e&&(e=MOBILENET_V1_CONFIG),__awaiter(this,void
0,void 0,function(){ return
__generator(this,function(t){ return "ResNet50"===e.validateModelConfig(e).architecture?[2,loadResNet(e)]:"M
obileNetV1"===e.architecture?[2,loadMobileNet(e)]:[2,null] } }) }export { decodeMultiplePoses,decodeSinglePose,

```



MobileNet,partChannels,partIds,partNames,poseChain,load,PoseNet,VALID\_INPUT\_RESOLUTION,getAdjacentKeyPoints,getBoundingBox,getBoundingBoxPoints,scalePose};\n","/\*\*\n \* @license\n \* Copyright 2019 Google Inc. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the \"License\");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \* \n \* https://www.apache.org/licenses/LICENSE-2.0\n \* \n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

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=====
*\nimport * as posenet from '@tensorflow-models/posenet';\nimport * as tf from '@tensorflow/tfjs-core';\n\nconst COLOR = 'aqua';\nconst BOUNDING_BOX_COLOR = 'red';\nconst LINE_WIDTH = 2;\n\nexport const TRY_RESNET_BUTTON_NAME = 'tryResNetButton';\nexport const TRY_RESNET_BUTTON_TEXT = '[New] Try ResNet50';\nconst TRY_RESNET_BUTTON_TEXT_CSS = 'width:100%;text-decoration:underline;'\nconst TRY_RESNET_BUTTON_BACKGROUND_CSS = 'background:#e61d5f;'\n\nfunction isAndroid() {\n return /Android/i.test(navigator.userAgent);\n}\n\nfunction isiOS() {\n return /iPhone|iPod|iPad/i.test(navigator.userAgent);\n}\n\nexport function isMobile() {\n return isAndroid() || isiOS();\n}\n\nfunction setDatGuiPropertyCss(propertyText, liCssString, spanCssString = '') {\n var spans = document.getElementsByClassName('property-name');\n for (var i = 0; i < spans.length; i++) {\n var text = spans[i].textContent || spans[i].innerText;\n if (text == propertyText) {\n spans[i].parentNode.parentNode.style = liCssString;\n if (spanCssString !== '') {\n spans[i].style = spanCssString;\n }\n }\n }\n}\n\nexport function updateTryResNetButtonDatGuiCss() {\n setDatGuiPropertyCss(TRY_RESNET_BUTTON_TEXT, TRY_RESNET_BUTTON_BACKGROUND_CSS, TRY_RESNET_BUTTON_TEXT_CSS);\n}\n\n/**\n * Toggles between the loading UI and the main canvas UI.\n */\nexport function toggleLoadingUI(\n showLoadingUI, loadingDivId = 'loading', mainDivId = 'main') {\n if (showLoadingUI) {\n document.getElementById(loadingDivId).style.display = 'block';\n document.getElementById(mainDivId).style.display = 'none';\n } else {\n document.getElementById(loadingDivId).style.display = 'none';\n document.getElementById(mainDivId).style.display = 'block';\n }\n}\n\nexport function drawPoint(ctx, y, x, r, color) {\n ctx.beginPath();\n ctx.arc(x, y, r, 0, 2 * Math.PI);\n ctx.fillStyle = color;\n ctx.fill();\n}\n\n/**\n * Draws a line on a canvas, i.e. a joint.\n */\nexport function drawSegment([ay, ax], [by, bx], color, scale, ctx) {\n ctx.beginPath();\n ctx.moveTo(ax * scale, ay * scale);\n ctx.lineTo(bx * scale, by * scale);\n ctx.lineWidth = LINE_WIDTH;\n ctx.strokeStyle = color;\n ctx.stroke();\n}\n\n/**\n * Draws a pose skeleton by looking up all adjacent keypoints/joints.\n */\nexport function drawSkeleton(keypoints, minConfidence, ctx, scale = 1) {\n const adjacentKeyPoints = posenet.getAdjacentKeyPoints(keypoints, minConfidence);\n function toTuple({y, x}) {\n return [y, x];\n }\n adjacentKeyPoints.forEach((keypoints) => {\n drawSegment(toTuple(keypoints[0].position), toTuple(keypoints[1].position), COLOR, scale, ctx);\n });\n}\n\n/**\n * Draw pose keypoints onto a canvas.\n */\nexport function drawKeypoints(keypoints, minConfidence, ctx, scale = 1) {\n for (let i = 0; i < keypoints.length; i++) {\n const keypoint = keypoints[i];\n if (keypoint.score < minConfidence) {\n continue;\n }\n const {y, x} = keypoint.position;\n drawPoint(ctx, y * scale, x * scale, 3, COLOR);\n }\n}\n\n/**\n * Draw the bounding box of a pose. For example, for a whole person standing\n * in an image, the bounding box will begin at the nose and extend to one of\n * ankles.\n */\nexport function drawBoundingBox(keypoints, ctx) {\n const boundingBox = posenet.getBoundingBox(keypoints);\n ctx.rect(\n boundingBox.minX, boundingBox.minY, boundingBox.maxX - boundingBox.minX,\n boundingBox.maxY - boundingBox.minY);\n ctx.strokeStyle = boundingBoxColor;\n ctx.stroke();\n}\n\n/**\n * Converts an array of pixel data into an ImageData object.\n */\nexport async function renderToCanvas(a, ctx) {\n const [height, width] = a.shape;\n const imageData = new
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ImageData(width, height);\n\n const data = await a.data();\n\n
for (let i = 0; i < height * width; ++i) {\n const j = i * 4;\n const k = i * 3;\n\n imageData.data[j + 0] = data[k
+ 0];\n imageData.data[j + 1] = data[k + 1];\n imageData.data[j + 2] = data[k + 2];\n imageData.data[j + 3] =
255;\n }
\n\n ctx.putImageData(imageData, 0, 0);\n\n\n**\n * Draw an image on a canvas\n *^\nexport function
renderImageToCanvas(image, size, canvas) {\n canvas.width = size[0];\n canvas.height = size[1];\n const ctx =
canvas.getContext('2d');\n\n ctx.drawImage(image, 0, 0);\n}\n\n\n**\n * Draw heatmap values, one of the model
outputs, on to the canvas\n * Read our blog post for a description of PoseNet's heatmap outputs\n *
https://medium.com/tensorflow/real-time-human-pose-estimation-in-the-browser-with-tensorflow-js-
7dd0bc881cd5\n *^\nexport function drawHeatMapValues(heatMapValues, outputStride, canvas) {\n const ctx =
canvas.getContext('2d');\n const radius = 5;\n const scaledValues = heatMapValues.mul(tf.scalar(outputStride,
'int32'));\n\n drawPoints(ctx, scaledValues, radius, COLOR);\n}\n\n\n**\n * Used by the drawHeatMapValues
method to draw heatmap points on to\n * the canvas\n *^\nfunction drawPoints(ctx, points, radius, color) {\n const
data = points.buffer().values;\n\n for (let i = 0; i < data.length; i += 2) {\n const pointY = data[i];\n const pointX
= data[i + 1];\n\n if (pointX !== 0 && pointY !== 0) {\n ctx.beginPath();\n ctx.arc(pointX, pointY, radius,
0, 2 * Math.PI);\n ctx.fillStyle = color;\n ctx.fill();\n }\n }\n}\n\n\n**\n * Draw offset vector values, one of
the model outputs, on to the canvas\n * Read our blog post for a description of PoseNet's offset vector outputs\n *
https://medium.com/tensorflow/real-time-human-pose-estimation-in-the-browser-with-tensorflow-js-
7dd0bc881cd5\n *^\nexport function drawOffsetVectors(\n heatMapValues, offsets, outputStride, scale = 1, ctx)
{\n const offsetPoints =\n posenet.singlePose.getOffsetPoints(heatMapValues,
outputStride, offsets);\n\n const heatmapData = heatMapValues.buffer().values;\n const offsetPointsData =
offsetPoints.buffer().values;\n\n for (let i = 0; i < heatmapData.length; i += 2) {\n const heatmapY =
heatmapData[i] * outputStride;\n const heatmapX = heatmapData[i + 1] * outputStride;\n const offsetPointY =
offsetPointsData[i];\n const offsetPointX = offsetPointsData[i + 1];\n\n drawSegment(\n [heatmapY,
heatmapX], [offsetPointY, offsetPointX], COLOR, scale, ctx);\n }\n}\n\n"/**\n * @license\n * Copyright 2019
Google Inc. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *^\n *
https://www.apache.org/licenses/LICENSE-2.0\n *^\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS
OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions
and\n * limitations under the License.\n *
=====\n *^\n//
color schemes generated using d3-scale-chromatic:\n// https://github.com/d3/d3-scale-chromatic\n\nexport const
rainbow = [\n [110, 64, 170], [143, 61, 178], [178, 60, 178], [210, 62, 167],\n [238, 67, 149], [255, 78, 125], [255,
94, 99], [255, 115, 75],\n [255, 140, 56], [239, 167, 47], [217, 194, 49], [194, 219, 64],\n [175, 240, 91], [135, 245,
87], [96, 247, 96], [64, 243, 115],\n [40, 234, 141], [28, 219, 169], [26, 199, 194], [33, 176, 213],\n [47, 150, 224],
[65, 125, 224], [84, 101, 214], [99, 81, 195]\n];\n\nexport const warm = [\n [110, 64, 170], [106, 72, 183], [100, 81,
196], [92, 91, 206],\n [84, 101, 214], [75, 113, 221], [66, 125, 224], [56, 138, 226],\n [48, 150, 224], [40, 163,
220], [33, 176, 214], [29, 188, 205],\n
[26, 199, 194], [26, 210, 182], [28, 219, 169], [33, 227, 155],\n [41, 234, 141], [51, 240, 128], [64, 243, 116], [79,
246, 105],\n [96, 247, 97], [115, 246, 91], [134, 245, 88], [155, 243, 88]\n];\n\nexport const spectral = [\n [158, 1,
66], [181, 26, 71], [202, 50, 74], [219, 73, 74],\n [232, 94, 73], [242, 117, 75], [248, 142, 83], [251, 167,
96],\n [253, 190, 112], [254, 210, 129], [254, 227, 149], [254, 240, 166],\n [251, 248, 176], [243, 249, 172], [231,
245, 163], [213, 238, 159],\n [190, 229, 160], [164, 218, 163], [137, 207, 165], [110, 192, 168],\n [86, 173, 174],
[70, 150, 179], [67, 127, 180], [77, 103, 173]\n];\n\n"/**\n * @license\n * Copyright 2019 Google Inc. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *^\n *
https://www.apache.org/licenses/LICENSE-2.0\n *^\n * Unless required by applicable

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=====\\n
*\\nimport '@tensorflow/tfjs-backend-webgl';\\nimport * as bodyPix from '@tensorflow-models/body-pix';\\nimport
dat from 'dat.gui';\\nimport Stats from 'stats.js';\\nimport {drawKeypoints, drawSkeleton, toggleLoadingUI,
TRY_RESNET_BUTTON_NAME, TRY_RESNET_BUTTON_TEXT, updateTryResNetButtonDatGuiCss} from
'./demo_util';\\nimport * as partColorScales from './part_color_scales';\\n\\nconst stats = new Stats();\\nconst state =
{\\n video: null,\\n stream: null,\\n net: null,\\n videoConstraints: {},\\n // Triggers the TensorFlow model to reload\\n
changingArchitecture: false,\\n changingMultiplier: false,\\n changingStride:
false,\\n changingResolution: false,\\n changingQuantBytes: false,\\n};\\n\\nfunction isAndroid() {\\n return
/Android/i.test(navigator.userAgent);\\n}\\n\\nfunction isiOS() {\\n return
/iPhone/iPad/iPod/i.test(navigator.userAgent);\\n}\\n\\nfunction isMobile() {\\n return isAndroid() ||
isiOS();\\n}\\n\\nasync function getVideoInputs() {\\n if (!navigator.mediaDevices ||
!navigator.mediaDevices.enumerateDevices) {\\n console.log('enumerateDevices() not supported.');// return [];\\n
}\\n\\n const devices = await navigator.mediaDevices.enumerateDevices();\\n const videoDevices =
devices.filter(device => device.kind === 'videoinput');\\n return videoDevices;\\n}\\n\\nfunction
stopExistingVideoCapture() {\\n if (state.video && state.video.srcObject) {\\n
state.video.srcObject.getTracks().forEach(track => {\\n track.stop();\\n })\\n state.video.srcObject = null;\\n
}\\n}\\n\\nasync function getDeviceIdForLabel(cameraLabel) {\\n const videoInputs = await getVideoInputs();\\n let
(let
 i = 0; i < videoInputs.length; i++) {\\n const videoInput = videoInputs[i];\\n if (videoInput.label ===
cameraLabel) {\\n return videoInput.deviceId;\\n }\\n }\\n return null;\\n}\\n\\n // on mobile, facing mode is the
preferred way to select a camera.\\n // Here we use the camera label to determine if its the environment or\\n // user
facing camera\\n function getFacingMode(cameraLabel) {\\n if (!cameraLabel) {\\n return 'user';\\n }\\n if
(cameraLabel.toLowerCase().includes('back')) {\\n return 'environment';\\n } else {\\n return 'user';\\n
}\\n}\\n \\n \\n async function getConstraints(cameraLabel) {\\n let deviceId;\\n let facingMode;\\n if (cameraLabel) {\\n
deviceId = await getDeviceIdForLabel(cameraLabel);\\n // on mobile, use the facing mode based on the camera.\\n
facingMode = isMobile() ? getFacingMode(cameraLabel) : null;\\n };\\n return {deviceId, facingMode};\\n }\\n}\\n}\\n
* Loads a the camera to be used in the demo\\n *\\n *\\n async function setupCamera(cameraLabel)
{\\n if (!navigator.mediaDevices || !navigator.mediaDevices.getUserMedia) {\\n throw new Error(\\n 'Browser
API navigator.mediaDevices.getUserMedia not available');\\n }\\n \\n const videoElement =
document.getElementById('video');\\n stopExistingVideoCapture();\\n \\n const videoConstraints = await
getConstraints(cameraLabel);\\n const stream = await navigator.mediaDevices.getUserMedia(\\n {audio: false,
video: videoConstraints});\\n videoElement.srcObject = stream;\\n \\n return new Promise((resolve) => {\\n
videoElement.onloadedmetadata = () => {\\n videoElement.width = videoElement.videoWidth;\\n
videoElement.height = videoElement.videoHeight;\\n resolve(videoElement);\\n };\\n });\\n}\\n}\\n \\n \\n async function
loadVideo(cameraLabel) {\\n try {\\n state.video = await setupCamera(cameraLabel);\\n } catch (e) {\\n let info =
document.getElementById('info');\\n info.textContent = 'this browser does not support video capture,' +\\n 'or
this device does
not have a camera';\\n info.style.display = 'block';\\n throw e;\\n }\\n \\n state.video.play();\\n }\\n}\\n \\n \\n const
defaultQuantBytes = 2;\\n \\n const defaultMobileNetMultiplier = isMobile() ? 0.50 : 0.75;\\n \\n const
defaultMobileNetStride = 16;\\n \\n const defaultMobileNetInternalResolution = 'medium';\\n \\n const
defaultResNetMultiplier = 1.0;\\n \\n const defaultResNetStride = 16;\\n \\n const defaultResNetInternalResolution =
'low';\\n \\n const guiState = {\\n algorithm: 'multi-person-instance',\\n estimate: 'partmap',\\n camera: null,\\n
flipHorizontal: true,\\n input: {\\n architecture: 'MobileNetV1',\\n outputStride: 16,\\n internalResolution: 'low',\\n
multiplier: 0.50,\\n quantBytes: 2\\n },\\n multiPersonDecoding: {\\n maxDetections: 5,\\n scoreThreshold:
0.3,\\n nmsRadius: 20,\\n numKeypointForMatching: 17,\\n refineSteps: 10\\n },\\n segmentation: {\\n
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segmentationThreshold: 0.7,\n effect: 'mask',\n maskBackground: true,\n opacity: 0.7,\n
backgroundBlurAmount: 3,\n maskBlurAmount:
0,\n edgeBlurAmount: 3\n },\n partMap: {\n colorScale: 'rainbow',\n effect: 'partMap',\n
segmentationThreshold: 0.5,\n opacity: 0.9,\n blurBodyPartAmount: 3,\n bodyPartEdgeBlurAmount: 3,\n },\n
showFps: !isMobile()\n};\n\nfunction toCameraOptions(cameras) {\n const result = {default: null};\n\n
cameras.forEach(camera => {\n result[camera.label] = camera.label;\n })\n\n return result;\n}\n\n/**\n * Sets up
dat.gui controller on the top-right of the window\n */\nfunction setupGui(cameras) {\n const gui = new
dat.GUI({width: 300});\n\n let architectureController = null;\n guiState[TRY_RESNET_BUTTON_NAME] =
function() {\n architectureController.setValue('ResNet50')\n }; \n gui.add(guiState,
TRY_RESNET_BUTTON_NAME).name(TRY_RESNET_BUTTON_TEXT);\n
updateTryResNetButtonDatGuiCss();\n\n gui.add(guiState, 'camera', toCameraOptions(cameras))\n
.onChange(async function(cameraLabel) {\n state.changingCamera = true;\n\n await
loadVideo(cameraLabel);\n\n
state.changingCamera = false;\n });\n\n gui.add(guiState, 'flipHorizontal');\n\n // There are two algorithms
'person' and 'multi-person-instance'.\n // The 'person' algorithm returns one single segmentation mask (or body\n //
part map) for all people in the image. The 'multi-person-instance'\n // algorithm returns an array of segmentation
mask (or body part map).\n // Each element in the array corresponding to one of the people. In other\n // words,
'multi-person-instance' algorithm does instance-level person\n // segmentation and body part segmentation for every
person in the image.\n const algorithmController =\n gui.add(guiState, 'algorithm', ['person', 'multi-person-
instance']);\n\n // Architecture: there are a few BodyPix models varying in size and\n // accuracy.\n // The input
parameters have the most effect on accuracy and speed of the\n // network\n let input = gui.addFolder('Input');\n\n
// Updates outputStride\n // Output
stride: Internally, this parameter affects the height and width\n // of the layers in the neural network. The lower the
value of the output\n // stride the higher the accuracy but slower the speed, the higher the\n // value the faster the
speed but lower the accuracy.\n let outputStrideController = null;\n function updateGuiOutputStride(outputStride,
outputStrideArray) {\n if (outputStrideController) {\n outputStrideController.remove();\n }\n\n
guiState.input.outputStride = outputStride;\n outputStrideController =\n input.add(guiState.input,
'outputStride', outputStrideArray);\n outputStrideController.onChange(function(outputStride) {\n
state.changingStride = true;\n guiState.input.outputStride = +outputStride;\n });\n }\n\n // Updates internal
resolution\n // Internal resolution: Internally, this parameter affects the height and\n // width of the layers in the
neural network. The higher the value of the\n // internal resolution the
better the accuracy but slower the speed.\n let internalResolutionController = null;\n function
updateGuiInternalResolution(\n internalResolution,\n internalResolutionArray,\n) {\n if
(internalResolutionController) {\n internalResolutionController.remove();\n }\n\n
guiState.input.internalResolution = internalResolution;\n internalResolutionController = input.add(\n
guiState.input, 'internalResolution', internalResolutionArray);\n
internalResolutionController.onChange(function(internalResolution) {\n guiState.input.internalResolution =
internalResolution;\n });\n }\n\n // Updates depth multiplier\n // Multiplier: this parameter affects the number of
feature map channels\n // in the MobileNet. The higher the value, the higher the accuracy but\n // slower the speed,
the lower the value the faster the speed but lower\n // the accuracy.\n let multiplierController = null;\n function
updateGuiMultiplier(multiplier, multiplierArray) {\n
if (multiplierController) {\n multiplierController.remove();\n }\n guiState.input.multiplier = multiplier;\n
multiplierController =\n input.add(guiState.input, 'multiplier', multiplierArray);\n
multiplierController.onChange(function(multiplier) {\n state.changingMultiplier = true;\n\n
guiState.input.multiplier = +multiplier;\n });\n }\n\n // updates quantBytes\n // QuantBytes: this parameter
affects weight quantization in the ResNet50\n // model. The available options are 1 byte, 2 bytes, and 4 bytes. The\n
// higher the value, the larger the model size and thus the longer the\n // loading time, the lower the value, the
shorter the loading time but\n // lower the accuracy.\n let quantBytesController = null;\n function

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updateGuiQuantBytes(quantBytes, quantBytesArray) {\n if (quantBytesController) {\n
quantBytesController.remove();\n }\n guiState.quantBytes = +quantBytes;\n guiState.input.quantBytes =
+quantBytes;\n quantBytesController
=\n input.add(guiState.input, 'quantBytes', quantBytesArray);\n
quantBytesController.onChange(function(quantBytes) {\n state.changingQuantBytes = true;\n
guiState.input.quantBytes = +quantBytes;\n });\n }\n\n function updateGuiInputSection() {\n if
(guiState.input.architecture === 'MobileNetV1') {\n updateGuiInternalResolution(\n
defaultMobileNetInternalResolution,\n ['low', 'medium', 'high', 'full']);\n
updateGuiOutputStride(defaultMobileNetStride, [8, 16]);\n updateGuiMultiplier(defaultMobileNetMultiplier,
[0.50, 0.75, 1.0])\n } else { // guiState.input.architecture === 'ResNet50'\n updateGuiInternalResolution(\n
defaultResNetInternalResolution, ['low', 'medium', 'high', 'full']);\n
updateGuiOutputStride(defaultResNetStride, [32, 16]);\n updateGuiMultiplier(defaultResNetMultiplier, [1.0]);\n
}\n updateGuiQuantBytes(defaultQuantBytes, [1, 2, 4]);\n }\n\n // Architecture:
there are a few PoseNet models varying in size and\n // accuracy. 1.01 is the largest, but will be the slowest. 0.50 is
the\n // fastest, but least accurate.\n architectureController =\n input.add(guiState.input, 'architecture',
['ResNet50', 'MobileNetV1']);\n guiState.architecture = guiState.input.architecture;\n
architectureController.onChange(function(architecture) {\n // if architecture is ResNet50, then show ResNet50
options\n state.changingArchitecture = true;\n guiState.input.architecture = architecture;\n
updateGuiInputSection();\n });\n\n updateGuiInputSection();\n input.open()\n\n const estimateController =\n gui.add(guiState, 'estimate', ['segmentation', 'partmap']);\n\n let segmentation = gui.addFolder('Segmentation');\n
segmentation.add(guiState.segmentation, 'segmentationThreshold', 0.0, 1.0);\n const segmentationEffectController
=\n segmentation.add(guiState.segmentation, 'effect', ['mask', 'bokeh']);\n\n let multiPersonDecoding =
gui.addFolder('MultiPersonDecoding');\n multiPersonDecoding.add(\n guiState.multiPersonDecoding,
'maxDetections', 0, 20, 1);\n multiPersonDecoding.add(\n guiState.multiPersonDecoding, 'scoreThreshold', 0.0,
1.0);\n multiPersonDecoding.add(guiState.multiPersonDecoding, 'nmsRadius', 0, 30, 1);\n
multiPersonDecoding.add(\n guiState.multiPersonDecoding, 'numKeypointForMatching', 1, 17, 1);\n
multiPersonDecoding.add(\n guiState.multiPersonDecoding, 'refineSteps', 1, 10, 1);\n
multiPersonDecoding.open();\n\n algorithmController.onChange(function(value) {\n switch (guiState.algorithm)
{\n case 'single-person':\n multiPersonDecoding.close();\n singlePersonDecoding.open();\n break;\n
case 'multi-person':\n singlePersonDecoding.close();\n multiPersonDecoding.open();\n break;\n }\n
});\n\n let darknessLevel;\n let bokehBlurAmount;\n let edgeBlurAmount;\n let maskBlurAmount;\n let
maskBackground;\n\n segmentationEffectController.onChange(function(effectType)
{\n if (effectType === 'mask') {\n if (bokehBlurAmount) {\n bokehBlurAmount.remove();\n }\n if
(edgeBlurAmount) {\n edgeBlurAmount.remove();\n }\n darknessLevel =\n
segmentation.add(guiState.segmentation, 'opacity', 0.0, 1.0);\n maskBlurAmount =
segmentation.add(guiState.segmentation, 'maskBlurAmount')\n
.min(0)\n
.max(20)\n
.step(1);\n maskBackground =\n segmentation.add(guiState.segmentation,
'maskBackground');\n } else if (effectType === 'bokeh') {\n if (darknessLevel) {\n
darknessLevel.remove();\n }\n if (maskBlurAmount) {\n maskBlurAmount.remove();\n }\n if
(maskBackground) {\n maskBackground.remove();\n }\n bokehBlurAmount = segmentation\n
.add(\n
guiState.segmentation,\n
'backgroundBlurAmount',\n
)\n
.min(1)\n
.max(20)\n
.step(1);\n edgeBlurAmount = segmentation.add(guiState.segmentation,
'edgeBlurAmount')\n
.min(0)\n
.max(20)\n
.step(1);\n }\n });\n\n // manually set the effect so that the options are shown.\n
segmentationEffectController.setValue(guiState.segmentation.effect);\n\n let partMap = gui.addFolder('Part
Map');\n partMap.add(guiState.partMap, 'segmentationThreshold', 0.0, 1.0);\n partMap.add(\n guiState.partMap,
'effect', ['partMap', 'pixelation', 'blurBodyPart']);\n partMap.add(guiState.partMap, 'opacity', 0.0, 1.0);\n

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partMap.add(guiState.partMap, 'colorScale', Object.keys(partColorScales))\n .onChange(colorScale => {\n
setShownPartColorScales(colorScale);\n });\n setShownPartColorScales(guiState.partMap.colorScale);\n
partMap.add(guiState.partMap, 'blurBodyPartAmount').min(1).max(20).step(1);\n partMap.add(guiState.partMap,
'bodyPartEdgeBlurAmount')\n .min(1)\n .max(20)\n .step(1);\n partMap.open();\n\n
estimateController.onChange(function(estimationType) {\n if (estimationType === 'segmentation') {\n
segmentation.open();\n partMap.close();\n document.getElementById('colors').style.display = 'none';\n }
else {\n segmentation.close();\n partMap.open();\n document.getElementById('colors').style.display =
'inline-block';\n }\n });\n\n gui.add(guiState, 'showFps').onChange(showFps => {\n if (showFps) {\n
document.body.appendChild(stats.dom);\n } else {\n document.body.removeChild(stats.dom);\n }\n
})\n})\n\nfunction setShownPartColorScales(colorScale) {\n const colors = document.getElementById('colors');\n
colors.innerHTML = '';\n const partColors = partColorScales[colorScale];\n
 const partNames = bodyPix.PART_CHANNELS;\n\n for (let i = 0; i < partColors.length; i++) {\n const
partColor = partColors[i];\n const child = document.createElement('li');\n child.innerHTML = `\n <div
class='color' style='background-color:rgb(${partColor[0]},${partColor[1]},${partColor[2]})' ></div>\n
${partNames[i]}`;\n colors.appendChild(child);\n }\n}\n\n/**\n * Sets up a frames per second panel on the top-
left of the window\n */\nfunction setupFPS() {\n stats.showPanel(0); // 0: fps, 1: ms, 2: mb, 3+: custom\n
if (guiState.showFps) {\n document.body.appendChild(stats.dom);\n }\n}\n\nasync function estimateSegmentation()
{\n let multiPersonSegmentation = null;\n switch (guiState.algorithm) {\n case 'multi-person-instance':\n
return await state.net.segmentMultiPerson(state.video, {\n internalResolution:\n
guiState.input.internalResolution,\n segmentationThreshold: guiState.segmentation.segmentationThreshold,\n
 maxDetections: guiState.multiPersonDecoding.maxDetections,\n scoreThreshold:\n
guiState.multiPersonDecoding.scoreThreshold,\n nmsRadius: guiState.multiPersonDecoding.nmsRadius,\n
 numKeypointForMatching:\n guiState.multiPersonDecoding.numKeypointForMatching,\n refineSteps:\n
guiState.multiPersonDecoding.refineSteps\n });\n case 'person':\n return await
state.net.segmentPerson(state.video, {\n internalResolution: guiState.input.internalResolution,\n
segmentationThreshold: guiState.segmentation.segmentationThreshold,\n maxDetections:\n
guiState.multiPersonDecoding.maxDetections,\n scoreThreshold:\n
guiState.multiPersonDecoding.scoreThreshold,\n nmsRadius: guiState.multiPersonDecoding.nmsRadius,\n
 });\n default:\n break;\n });\n return multiPersonSegmentation;\n}\n\nasync function
estimatePartSegmentation() {\n switch (guiState.algorithm) {\n case 'multi-person-instance':\n return await
state.net.segmentMultiPersonParts(state.video, {\n internalResolution: guiState.input.internalResolution,\n
segmentationThreshold: guiState.segmentation.segmentationThreshold,\n maxDetections:\n
guiState.multiPersonDecoding.maxDetections,\n scoreThreshold:\n
guiState.multiPersonDecoding.scoreThreshold,\n nmsRadius: guiState.multiPersonDecoding.nmsRadius,\n
 numKeypointForMatching:\n guiState.multiPersonDecoding.numKeypointForMatching,\n refineSteps:\n
guiState.multiPersonDecoding.refineSteps\n });\n case 'person':\n return await
state.net.segmentPersonParts(state.video, {\n internalResolution: guiState.input.internalResolution,\n
segmentationThreshold: guiState.segmentation.segmentationThreshold,\n maxDetections:\n
guiState.multiPersonDecoding.maxDetections,\n scoreThreshold:\n
guiState.multiPersonDecoding.scoreThreshold,\n nmsRadius: guiState.multiPersonDecoding.nmsRadius,\n
 });\n default:\n break;\n });\n return multiPersonPartSegmentation;\n}\n\nfunction
drawPoses(personOrPersonPartSegmentation, flipHorizontally, ctx) {\n if
(Array.isArray(personOrPersonPartSegmentation)) {\n
personOrPersonPartSegmentation.forEach(personSegmentation => {\n let pose = personSegmentation.pose;\n
if (flipHorizontally) {\n pose = bodyPix.flipPoseHorizontal(pose, personSegmentation.width);\n }\n
drawKeypoints(pose.keypoints, 0.1, ctx);\n drawSkeleton(pose.keypoints, 0.1, ctx);\n });\n } else {\n
personOrPersonPartSegmentation.allPoses.forEach(pose => {\n if (flipHorizontally) {\n pose =

```

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bodyPix.flipPoseHorizontal(\n pose, personOrPersonPartSegmentation.width);\n }\n drawKeypoints(pose.keypoints, 0.1, ctx);\n drawSkeleton(pose.keypoints, 0.1, ctx);\n })\n }\n}\n\nasync\nfunction loadBodyPix() {\n toggleLoadingUI(true);\n state.net = await bodyPix.load({\n architecture:\n guiState.input.architecture,\n\n outputStride: guiState.input.outputStride,\n multiplier: guiState.input.multiplier,\n quantBytes:\n guiState.input.quantBytes\n });\n toggleLoadingUI(false);\n}\n\n/**\n * Feeds an image to BodyPix to estimate\n segmentation - this is where the\n * magic happens. This function loops with a requestAnimationFrame method.\n */\nfunction segmentBodyInRealTime() {\n const canvas = document.getElementById('output');\n // since images\n are being fed from a webcam\n\n async function bodySegmentationFrame() {\n // if changing the model or the\n camera, wait a second for it to complete\n // then try again.\n if (state.changingArchitecture ||\n state.changingMultiplier ||\n state.changingCamera || state.changingStride ||\n state.changingQuantBytes)\n {\n console.log('load model...');\n loadBodyPix();\n state.changingArchitecture = false;\n state.changingMultiplier = false;\n state.changingStride = false;\n state.changingQuantBytes\n = false;\n }\n\n // Begin monitoring code for frames per second\n stats.begin();\n\n const flipHorizontally =\n guiState.flipHorizontal;\n\n switch (guiState.estimate) {\n case 'segmentation':\n const\n multiPersonSegmentation = await estimateSegmentation();\n switch (guiState.segmentation.effect) {\n case 'mask':\n const ctx = canvas.getContext('2d');\n const foregroundColor = {r: 255, g: 255, b: 255,\n a: 255};\n const backgroundColor = {r: 0, g: 0, b: 0, a: 255};\n const mask = bodyPix.toMask(\n multiPersonSegmentation, foregroundColor, backgroundColor,\n true);\n bodyPix.drawMask(\n canvas, state.video, mask, guiState.segmentation.opacity,\n guiState.segmentation.maskBlurAmount, flipHorizontally);\n drawPoses(multiPersonSegmentation,\n flipHorizontally, ctx);\n break;\n case 'bokeh':\n bodyPix.drawBokehEffect(\n canvas, state.video, multiPersonSegmentation,\n +guiState.segmentation.backgroundBlurAmount,\n guiState.segmentation.edgeBlurAmount,\n flipHorizontally);\n break;\n }\n break;\n case 'partmap':\n const ctx =\n canvas.getContext('2d');\n const multiPersonPartSegmentation = await estimatePartSegmentation();\n const\n coloredPartImageData = bodyPix.toColoredPartMask(\n multiPersonPartSegmentation,\n partColorScales[guiState.partMap.colorScale]);\n const maskBlurAmount = 0;\n switch\n (guiState.partMap.effect) {\n case 'pixelation':\n const pixelCellWidth = 10.0;\n bodyPix.drawPixelatedMask(\n canvas, state.video, coloredPartImageData,\n guiState.partMap.opacity, maskBlurAmount, flipHorizontally,\n pixelCellWidth);\n break;\n case 'partMap':\n bodyPix.drawMask(\n canvas, state.video, coloredPartImageData, guiState.opacity,\n maskBlurAmount, flipHorizontally);\n break;\n case 'blurBodyPart':\n const blurBodyPartIds =\n [0, 1];\n bodyPix.blurBodyPart(\n canvas, state.video, multiPersonPartSegmentation,\n blurBodyPartIds, guiState.partMap.blurBodyPartAmount,\n guiState.partMap.edgeBlurAmount,\n flipHorizontally);\n drawPoses(multiPersonPartSegmentation, flipHorizontally, ctx);\n break;\n default:\n break;\n }\n break;\n }\n\n // End monitoring code for frames per second\n stats.end();\n\n requestAnimationFrame(bodySegmentationFrame);\n }\n}\n\nbodySegmentationFrame();\n}\n\n/**\n * Kicks off the\n demo.\n */\nexport async function bindPage() {\n // Load the BodyPix model weights with architecture 0.75\n await loadBodyPix();\n document.getElementById('loading').style.display\n = 'none';\n document.getElementById('main').style.display = 'inline-block';\n await\n loadVideo(guiState.camera);\n let cameras = await getVideoInputs();\n setupFPS();\n setupGui(cameras);\n segmentBodyInRealTime();\n}\n\nnavigator.getUserMedia = navigator.getUserMedia ||\n navigator.webkitGetUserMedia || navigator.mozGetUserMedia;\n// kick off the demo\nbindPage();\n}

```

Found in path(s):

\* /opt/cola/permits/1234600288\_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-

pix/demos/dist/demos.ab0c720b.js.map

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## 1.191 hdrhistogram 2.1.12

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\* /opt/cola/permits/1257203437\_1642787675.09/0/hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/PackedConcurrentDoubleHistogram.java

\*

/opt/cola/permits/1257203437\_1642787675.09/0/hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/SynchronizedHistogram.java

\* /opt/cola/permits/1257203437\_1642787675.09/0/hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/packedarray/PackedArraySingleWriterRecorder.java

\* /opt/cola/permits/1257203437\_1642787675.09/0/hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/Histogram.java

\* /opt/cola/permits/1257203437\_1642787675.09/0/hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/LogarithmicIterator.java

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/opt/cola/permits/1257203437\_1642787675.09/0/hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/AtomicHistogram.java  
\* /opt/cola/permits/1257203437\_1642787675.09/0/hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/HistogramIterationValue.java  
\* /opt/cola/permits/1257203437\_1642787675.09/0/hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/Recorder.java  
\* /opt/cola/permits/1257203437\_1642787675.09/0/hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/ConcurrentDoubleHistogram.java  
\* /opt/cola/permits/1257203437\_1642787675.09/0/hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/HistogramLogReader.java  
\* /opt/cola/permits/1257203437\_1642787675.09/0/hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/HistogramLogProcessor.java  
\* /opt/cola/permits/1257203437\_1642787675.09/0/hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/PackedHistogram.java  
\* /opt/cola/permits/1257203437\_1642787675.09/0/hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/SingleWriterDoubleRecorder.java  
\*  
/opt/cola/permits/1257203437\_1642787675.09/0/hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/DoubleRecorder.java  
\* /opt/cola/permits/1257203437\_1642787675.09/0/hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/DoubleHistogramIterationValue.java  
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\* /opt/cola/permits/1257203437\_1642787675.09/0/hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/packedarray/PackedArrayRecorder.java  
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```
package org.HdrHistogram;
```

```
final class Version {
 public static final String version="$VERSION$";
 public static final String build_time="$BUILD_TIMES$";
}
```

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jar/com/zaxxer/hikari/pool/HikariPool.java
* /opt/cola/permits/1257259274_1642793180.98/0/hikaricp-3-4-5-sources-
jar/com/zaxxer/hikari/HikariJNDIFactory.java
* /opt/cola/permits/1257259274_1642793180.98/0/hikaricp-3-4-5-sources-
jar/com/zaxxer/hikari/metrics/dropwizard/CodaHaleMetricsTracker.java
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jar/com/zaxxer/hikari/metrics/MetricsTracker.java
* /opt/cola/permits/1257259274_1642793180.98/0/hikaricp-3-4-5-sources-
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\* /opt/cola/permits/1257259274\_1642793180.98/0/hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/util/PropertyElf.java

```
* /opt/cola/permits/1257259274_1642793180.98/0/hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/util/UtilityElf.java
* /opt/cola/permits/1257259274_1642793180.98/0/hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/pool/ProxyStatement.java
*
/opt/cola/permits/1257259274_1642793180.98/0/hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/pool/ProxyPreparedStatement.java
* /opt/cola/permits/1257259274_1642793180.98/0/hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/HikariDataSource.java
* /opt/cola/permits/1257259274_1642793180.98/0/hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/metrics/prometheus/PrometheusHistogramMetricsTracker.java
* /opt/cola/permits/1257259274_1642793180.98/0/hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/hibernate/HikariConnectionProvider.java
* /opt/cola/permits/1257259274_1642793180.98/0/hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/metrics/prometheus/PrometheusMetricsTracker.java
* /opt/cola/permits/1257259274_1642793180.98/0/hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/hibernate/HikariConfigurationUtil.java
* /opt/cola/permits/1257259274_1642793180.98/0/hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/HikariPoolMXBean.java
* /opt/cola/permits/1257259274_1642793180.98/0/hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/pool/ProxyCallableStatement.java
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/opt/cola/permits/1257259274_1642793180.98/0/hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/metrics/dropwizard/CodahaleMetricsTrackerFactory.java
* /opt/cola/permits/1257259274_1642793180.98/0/hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/HikariConfigMXBean.java
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jar/com/zaxxer/hikari/util/ClockSource.java
* /opt/cola/permits/1257259274_1642793180.98/0/hikaricp-3-4-5-sources-
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jar/com/zaxxer/hikari/metrics/prometheus/HikariCPCollector.java
* /opt/cola/permits/1257259274_1642793180.98/0/hikaricp-3-4-5-sources-
jar/com/zaxxer/hikari/util/ConcurrentBag.java
* /opt/cola/permits/1257259274_1642793180.98/0/hikaricp-3-4-5-sources-
jar/com/zaxxer/hikari/pool/ProxyResultSet.java
*
```



/opt/cola/permits/1257259274\_1642793180.98/0/hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/util/DriverDataSource.java  
\* /opt/cola/permits/1257259274\_1642793180.98/0/hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/util/SuspendResumeLock.java  
\* /opt/cola/permits/1257259274\_1642793180.98/0/hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/util/JavassistProxyFactory.java  
\* /opt/cola/permits/1257259274\_1642793180.98/0/hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/HikariConfig.java  
\* /opt/cola/permits/1257259274\_1642793180.98/0/hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/pool/ProxyConnection.java  
\* /opt/cola/permits/1257259274\_1642793180.98/0/hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/pool/ProxyLeakTaskFactory.java  
\* /opt/cola/permits/1257259274\_1642793180.98/0/hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/pool/ProxyFactory.java  
\* /opt/cola/permits/1257259274\_1642793180.98/0/hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/util/FastList.java  
\*  
/opt/cola/permits/1257259274\_1642793180.98/0/hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/pool/ProxyLeakTask.java  
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jar/com/zaxxer/hikari/metrics/dropwizard/CodahaleHealthChecker.java  
\* /opt/cola/permits/1257259274\_1642793180.98/0/hikaricp-3-4-5-sources-  
jar/com/zaxxer/hikari/pool/PoolEntry.java

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jar/com/zaxxer/hikari/metrics/prometheus/PrometheusHistogramMetricsTrackerFactory.java

## 1.193 statistics 2.1

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\* /opt/cola/permits/1257347829\_1642803596.13/0/spring-retry-1-2-5-release-sources-jar/org/springframework/retry/stats/RetryStatisticsFactory.java  
\* /opt/cola/permits/1257347829\_1642803596.13/0/spring-retry-1-2-5-release-sources-jar/org/springframework/retry/stats/ExponentialAverageRetryStatistics.java  
\* /opt/cola/permits/1257347829\_1642803596.13/0/spring-retry-1-2-5-release-sources-jar/org/springframework/retry/stats/StatisticsListener.java  
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jar/org/springframework/retry/annotation/RetryConfiguration.java  
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jar/org/springframework/classify/util/SimpleMethodInvoker.java  
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jar/org/springframework/retry/interceptor/Retryable.java  
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\* /opt/cola/permits/1257347829\_1642803596.13/0/spring-retry-1-2-5-release-sources-  
jar/org/springframework/retry/backoff/ThreadWaitSleeper.java

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Found in path(s):

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jar/org/springframework/classify/util/MethodInvoker.java  
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Found in path(s):

\* /opt/cola/permits/1257347829\_1642803596.13/0/spring-retry-1-2-5-release-sources-jar/org/springframework/retry/annotation/CircuitBreaker.java

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Found in path(s):

\* /opt/cola/permits/1257347829\_1642803596.13/0/spring-retry-1-2-5-release-sources-jar/org/springframework/retry/interceptor/StatefulRetryOperationsInterceptor.java

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\* /opt/cola/permits/1257347829\_1642803596.13/0/spring-retry-1-2-5-release-sources-jar/org/springframework/retry/RetryListener.java  
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\* /opt/cola/permits/1257347829\_1642803596.13/0/spring-retry-1-2-5-release-sources-jar/org/springframework/retry/policy/AlwaysRetryPolicy.java  
\*  
\* /opt/cola/permits/1257347829\_1642803596.13/0/spring-retry-1-2-5-release-sources-jar/org/springframework/retry/backoff/NoBackOffPolicy.java  
\* /opt/cola/permits/1257347829\_1642803596.13/0/spring-retry-1-2-5-release-sources-jar/org/springframework/retry/ExhaustedRetryException.java  
\* /opt/cola/permits/1257347829\_1642803596.13/0/spring-retry-1-2-5-release-sources-jar/org/springframework/retry/policy/MapRetryContextCache.java  
\* /opt/cola/permits/1257347829\_1642803596.13/0/spring-retry-1-2-5-release-sources-jar/org/springframework/retry/backoff/Sleeper.java  
\* /opt/cola/permits/1257347829\_1642803596.13/0/spring-retry-1-2-5-release-sources-jar/org/springframework/retry/RecoveryCallback.java  
\* /opt/cola/permits/1257347829\_1642803596.13/0/spring-retry-1-2-5-release-sources-jar/org/springframework/retry/policy/RetryCacheCapacityExceededException.java  
\* /opt/cola/permits/1257347829\_1642803596.13/0/spring-retry-1-2-5-release-sources-jar/org/springframework/retry/backoff/BackOffContext.java  
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\* /opt/cola/permits/1257347829\_1642803596.13/0/spring-retry-1-2-5-release-sources-jar/org/springframework/retry/backoff/BackOffPolicy.java  
\* /opt/cola/permits/1257347829\_1642803596.13/0/spring-retry-1-2-5-release-sources-

jar/org/springframework/retry/RetryOperations.java  
\* /opt/cola/permits/1257347829\_1642803596.13/0/spring-retry-1-2-5-release-sources-  
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/opt/cola/permits/1257347829\_1642803596.13/0/spring-retry-1-2-5-release-sources-  
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\* /opt/cola/permits/1257347829\_1642803596.13/0/spring-retry-1-2-5-release-sources-  
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jar/org/springframework/retry/support/RetrySimulator.java  
\* /opt/cola/permits/1257347829\_1642803596.13/0/spring-retry-1-2-5-release-sources-  
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jar/org/springframework/classify/Classifier.java  
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jar/org/springframework/classify/PatternMatcher.java  
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jar/org/springframework/retry/policy/SoftReferenceMapRetryContextCache.java  
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\* /opt/cola/permits/1257347829\_1642803596.13/0/spring-retry-1-2-5-release-sources-  
jar/org/springframework/retry/annotation/Recover.java  
\* /opt/cola/permits/1257347829\_1642803596.13/0/spring-retry-1-2-5-release-sources-  
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- \* /opt/cola/permits/1257347829\_1642803596.13/0/spring-retry-1-2-5-release-sources-jar/org/springframework/classify/BinaryExceptionClassifier.java
  - \* /opt/cola/permits/1257347829\_1642803596.13/0/spring-retry-1-2-5-release-sources-jar/org/springframework/classify/SubclassClassifier.java
  - \* /opt/cola/permits/1257347829\_1642803596.13/0/spring-retry-1-2-5-release-sources-jar/org/springframework/retry/policy/SimpleRetryPolicy.java
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- \* /opt/cola/permits/1257347829\_1642803596.13/0/spring-retry-1-2-5-release-sources-jar/org/springframework/retry/interceptor/FixedKeyGenerator.java
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# 1.195 jctools-core 3.0.0

## 1.195.1 Available under license :

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```
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 </repository>

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</distributionManagement>

<url>https://github.com/JCTools</url>
<inceptionYear>2013</inceptionYear>

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 <url>http://www.apache.org/licenses/LICENSE-2.0.txt</url>
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</license>
</licenses>

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<connection>scm:git:https://github.com/JCTools/JCTools</connection>
<tag>HEAD</tag>
</scm>

<developers>
<developer>
 <url>https://github.com/nitsanw</url>
</developer>
<developer>
 <url>https://github.com/mjpt777</url>
</developer>
<developer>
 <url>https://github.com/RichardWarburton</url>
</developer>
<developer>
 <url>https://github.com/kay</url>
</developer>
<developer>
 <url>https://github.com/franz1981</url>
</developer>
</developers>

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</prerequisites>

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<java.test.version>1.8</java.test.version>

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<maven.compiler.testSource>${java.test.version}</maven.compiler.testSource>
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<junit.version>4.12</junit.version>
<guava-testlib.version>21.0</guava-testlib.version>
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</project>
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in path(s):

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\* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-jar/org/jctools/queues/MessagePassingQueueUtil.java  
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\* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-jar/org/jctools/queues/atomic/MpscAtomicArrayQueue.java  
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\* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-jar/org/jctools/queues/SpSCArrayQueue.java  
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\* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-jar/org/jctools/maps/NonBlockingIdentityHashMap.java  
 \* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-jar/org/jctools/queues/MpscGrowableArrayQueue.java  
 \* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-jar/org/jctools/util/Pow2.java  
 \* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-jar/org/jctools/queues/spec/ConcurrentQueueSpec.java  
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 \* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-jar/org/jctools/util/InternalAPI.java  
 \* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-jar/org/jctools/queues/MpmcUnboundedXaddArrayQueue.java  
 \* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-jar/org/jctools/queues/SpSCLinkedQueue.java  
 \* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-jar/org/jctools/queues/atomic/SpSCChunkedAtomicArrayQueue.java  
 \* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-jar/org/jctools/queues/spec/Ordering.java  
 \* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-jar/org/jctools/queues/spec/Preference.java  
 \* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-jar/org/jctools/maps/AbstractEntry.java  
 \*  
 /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-jar/org/jctools/queues/atomic/MpscGrowableAtomicArrayQueue.java  
 \* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-jar/org/jctools/queues/atomic/BaseMpscLinkedAtomicArrayQueue.java  
 \* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-jar/org/jctools/queues/MpscLinkedQueue.java  
 \* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-jar/org/jctools/queues/package-info.java  
 \* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-jar/org/jctools/util/RangeUtil.java  
 \* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-jar/org/jctools/util/PortableJvmInfo.java  
 \* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-jar/org/jctools/queues/MpscArrayQueue.java  
 \* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-jar/org/jctools/queues/QueueFactory.java  
 \*  
 /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-jar/org/jctools/queues/atomic/MpscChunkedAtomicArrayQueue.java  
 \* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-jar/org/jctools/queues/MpscBlockingConsumerArrayQueue.java  
 \* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-jar/org/jctools/queues/ConcurrentSequencedCircularArrayQueue.java  
 \* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-jar/org/jctools/maps/NonBlockingHashSet.java

\* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-  
 jar/org/jctools/queues/IndexedQueueSizeUtil.java  
 \* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-  
 jar/org/jctools/queues/atomic/LinkedListAtomicNode.java  
 \* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-  
 jar/org/jctools/queues/MpscCompoundQueue.java  
 \* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-  
 jar/org/jctools/queues/MpscUnboundedArrayQueue.java  
 \*  
 /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-  
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 \* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-  
 jar/org/jctools/queues/SupportsIterator.java  
 \* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-  
 jar/org/jctools/queues/atomic/SpvcGrowableAtomicArrayQueue.java  
 \* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-  
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 \* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-  
 jar/org/jctools/queues/atomic/AtomicReferenceArrayQueue.java  
 \* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-  
 jar/org/jctools/queues/atomic/BaseLinkedListAtomicQueue.java  
 \*  
 /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-  
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 \* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-  
 jar/org/jctools/queues/SpvcUnboundedArrayQueue.java  
 \* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-  
 jar/org/jctools/maps/NonBlockingHashMapLong.java  
 \* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-  
 jar/org/jctools/queues/ConcurrentCircularArrayQueue.java  
 \* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-  
 jar/org/jctools/maps/NonBlockingSetInt.java  
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 \*  
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 \* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-  
 jar/org/jctools/maps/NonBlockingHashMap.java  
 \* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-  
 jar/org/jctools/util/UnsafeLongArrayAccess.java  
 \* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-

```
jar/org/jctools/queues/atomic/SpSCLinkedAtomicQueue.java
* /opt/cola/permits/1257637630_1642977964.98/0/jctools-core-3-0-0-sources-
jar/org/jctools/queues/MpscUnboundedXaddArrayQueue.java
* /opt/cola/permits/1257637630_1642977964.98/0/jctools-core-3-0-0-sources-
jar/org/jctools/queues/atomic/MpscUnboundedAtomicArrayQueue.java
* /opt/cola/permits/1257637630_1642977964.98/0/jctools-core-3-0-0-sources-
jar/org/jctools/queues/MessagePassingQueue.java
* /opt/cola/permits/1257637630_1642977964.98/0/jctools-core-3-0-0-sources-
jar/org/jctools/queues/atomic/SequencedAtomicReferenceArrayQueue.java
*
/opt/cola/permits/1257637630_1642977964.98/0/jctools-core-3-0-0-sources-
jar/org/jctools/queues/BaseSpSCLinkedArrayQueue.java
* /opt/cola/permits/1257637630_1642977964.98/0/jctools-core-3-0-0-sources-
jar/org/jctools/queues/LinkedQueueNode.java
* /opt/cola/permits/1257637630_1642977964.98/0/jctools-core-3-0-0-sources-
jar/org/jctools/queues/MpmcArrayQueue.java
* /opt/cola/permits/1257637630_1642977964.98/0/jctools-core-3-0-0-sources-jar/org/jctools/util/UnsafeAccess.java
* /opt/cola/permits/1257637630_1642977964.98/0/jctools-core-3-0-0-sources-
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* /opt/cola/permits/1257637630_1642977964.98/0/jctools-core-3-0-0-sources-
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* /opt/cola/permits/1257637630_1642977964.98/0/jctools-core-3-0-0-sources-
jar/org/jctools/queues/atomic/SpSCUnboundedAtomicArrayQueue.java
* /opt/cola/permits/1257637630_1642977964.98/0/jctools-core-3-0-0-sources-
jar/org/jctools/queues/atomic/AtomicQueueFactory.java
```

## 1.196 jackson-dataformat-yaml 2.11.2

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# Jackson JSON processor

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It was originally written by Tatu Saloranta (tatu.saloranta@iki.fi), and has been in development since 2007.

It is currently developed by a community of developers, as well as supported commercially by FasterXML.com.

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Found in path(s):

```
* /opt/cola/permits/1257860178_1643019491.32/0/jansi-osx-1-8-sources-
jar/org/fusesource/jansi/internal/Kernel32.java
* /opt/cola/permits/1257860178_1643019491.32/0/jansi-osx-1-8-sources-
jar/org/fusesource/jansi/internal/WindowsSupport.java
* /opt/cola/permits/1257860178_1643019491.32/0/jansi-osx-1-8-sources-
jar/org/fusesource/jansi/internal/CLibrary.java
```

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 */
```

Found in path(s):

```
* /opt/cola/permits/1257860186_1643019499.32/0/jansi-native-1-8-sources-
jar/org/fusesource/jansi/internal/WindowsSupport.java
* /opt/cola/permits/1257860186_1643019499.32/0/jansi-native-1-8-sources-
jar/org/fusesource/jansi/internal/CLibrary.java
* /opt/cola/permits/1257860186_1643019499.32/0/jansi-native-1-8-sources-
jar/org/fusesource/jansi/internal/Kernel32.java
```

# 1.200 jakarta-el 3.0.3

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# 1.202 jackson-module-parameter-names

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## 1.206 sequence-generator 5.7.3

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Manifest-Version: 1.0  
Bnd-LastModified: 1563545580901  
Build-Jdk: 1.8.0\_202  
Built-By: jenkins-slave  
Bundle-Description: A set of Java modules for management and monitoring, common to several Terracotta products  
Bundle-License: <http://www.apache.org/licenses/LICENSE-2.0.txt>  
Bundle-ManifestVersion: 2  
Bundle-Name: Terracotta Management :: Sequence Generator  
Bundle-SymbolicName: org.terracotta.management.sequence-generator  
Bundle-Version: 5.7.3  
Created-By: Apache Maven Bundle Plugin  
Export-Package: org.terracotta.management.sequence;version="5.7.3",org.terracotta.management.sequence.perf;version="5.7.3"  
Main-Class: org.terracotta.management.sequence.perf.PerfTest  
Require-Capability: osgi.ee;filter="(&(osgi.ee=JavaSE)(version=1.8))"  
Tool: Bnd-2.4.1.201501161923

Found in path(s):

\* /opt/cola/permits/1258059180\_1643027223.49/0/sequence-generator-5-7-3-jar/META-INF/MANIFEST.MF  
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Found in path(s):

\* /opt/cola/permits/1258059180\_1643027223.49/0/sequence-generator-5-7-3-jar/META-

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Found in path(s):

```
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-
jar/org/terracotta/management/model/message/DefaultManagementCallMessage.java
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-
jar/org/terracotta/management/model/stats/Sample.java
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-
jar/org/terracotta/management/model/call/ContextualCall.java
*
/opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-
jar/org/terracotta/management/model/stats/DelegatingStatistic.java
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-
jar/org/terracotta/management/model/capabilities/descriptors/Descriptor.java
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-
jar/org/terracotta/management/model/stats/Statistic.java
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-
jar/org/terracotta/management/model/capabilities/context/CapabilityContext.java
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-
jar/org/terracotta/management/model/call/Parameter.java
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-
jar/org/terracotta/management/model/capabilities/descriptors/CallDescriptor.java
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-
jar/org/terracotta/management/model/stats/ContextualStatistics.java
*
```

```

/opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-
jar/org/terracotta/management/model/capabilities/descriptors/StatisticDescriptor.java
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-
jar/org/terracotta/management/model/capabilities/DefaultCapability.java
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-
jar/org/terracotta/management/model/context/ContextContainer.java
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-
jar/org/terracotta/management/model/context/Context.java
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-
jar/org/terracotta/management/model/capabilities/Capability.java
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-
jar/org/terracotta/management/model/message/ManagementCallMessage.java
*
/opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-
jar/org/terracotta/management/model/stats/StatisticRegistry.java
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-
jar/org/terracotta/management/model/message/DefaultMessage.java
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-
jar/org/terracotta/management/model/call/ContextualReturn.java
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-
jar/org/terracotta/management/model/message/Message.java
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-
jar/org/terracotta/management/model/cluster/ClientIdentifier.java
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-
jar/org/terracotta/management/model/capabilities/descriptors/Settings.java
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-
jar/org/terracotta/management/model/notification/ContextualNotification.java
*
/opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-
jar/org/terracotta/management/model/context/Contextual.java
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-
jar/org/terracotta/management/model/stats/StatisticType.java
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-
jar/org/terracotta/management/model/stats/DelegatingSample.java

```

## 1.208 offheap-store 2.4.3

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Found in path(s):

- \* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/concurrent/WriteLockedOffHeapHashMapFactory.java
- \* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/AbstractOffHeapClockCache.java
- \*
- /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/concurrent/AbstractConcurrentOffHeapCache.java
- \* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/disk/storage/FileBackedStorageEngine.java
- \* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/eviction/EvictionListeningReadWriteLockedOffHeapClockCache.java
- \* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/concurrent/ConcurrentOffHeapClockCache.java
- \* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/disk/persistent/PersistentReadWriteLockedOffHeapClockCacheFactory.java
- \* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/storage/SplitStorageEngine.java
- \* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/Segment.java
- \*
- /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/storage/OffHeapBufferHalfStorageEngine.java
- \* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/disk/paging/PowerOfTwoFileAllocator.java
- \* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/concurrent/ReadWriteLockedOffHeapHashMapFactory.java
- \* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/storage/PointerSize.java
- \* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/storage/portability/SerializablePortability.java
- \* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/storage/allocator/LongBestFitAllocator.java
- \* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/storage/StorageEngine.java
- \*
- /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/util/PhysicalMemory.java
- \* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-

jar/org/terracotta/offheapstore/buffersource/TimingBufferSource.java  
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jar/org/terracotta/offheapstore/disk/paging/MappedPageSource.java  
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jar/org/terracotta/offheapstore/paging/PhantomReferenceLimitedPageSource.java  
\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
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\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/HashingMap.java  
\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/util/AATreeSet.java  
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jar/org/terracotta/offheapstore/storage/listener/AbstractListenableStorageEngine.java  
\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/util/WeakIdentityHashMap.java  
\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/disk/persistent/PersistentReadWriteLockedOffHeapHashMapFactory.java  
\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/paging/UpfrontAllocatingPageSource.java  
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\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/concurrent/ConcurrentWriteLockedOffHeapHashMap.java  
\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/storage/allocator/PowerOfTwoAllocator.java  
\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
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\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/concurrent/ReadWriteLockedOffHeapClockCacheFactory.java  
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jar/org/terracotta/offheapstore/storage/OffHeapBufferStorageEngine.java  
\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/disk/storage/PersistentIntegerStorageEngine.java  
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/opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/util/FindbugsSuppressWarnings.java  
\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/concurrent/AbstractConcurrentOffHeapMap.java  
\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/set/OffHeapHashSet.java

\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/storage/SerializableStorageEngine.java  
\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/MetadataTuple.java  
\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/storage/PortabilityBasedHalfStorageEngine.java  
\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/storage/StringStorageEngine.java  
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\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/OffHeapHashMap.java  
\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/storage/PortabilityBasedStorageEngine.java  
\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/paging/OffHeapStorageArea.java  
\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/util/ByteBufferUtils.java  
\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/concurrent/ConcurrentOffHeapHashMap.java  
\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/AbstractLockedOffHeapHashMap.java  
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/opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
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\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/disk/persistent/PersistentConcurrentOffHeapClockCache.java  
\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
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\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/eviction/EvictionListeningWriteLockedOffHeapClockCache.java  
\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/disk/persistent/PersistentConcurrentOffHeapHashMap.java  
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jar/org/terracotta/offheapstore/disk/persistent/AbstractPersistentConcurrentOffHeapCache.java  
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INF/maven/org.terracotta/offheap-store/pom.xml  
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jar/org/terracotta/offheapstore/eviction/EvictionListener.java

\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/util/DebuggingUtils.java

\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/storage/allocator/Allocator.java

\*

/opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/storage/BinaryStorageEngine.java

\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/ReadWriteLockedOffHeapHashMap.java

\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/storage/portability/Portability.java

\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/disk/persistent/PersistentPortability.java

\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/pinning/PinnableSegment.java

\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/exceptions/OversizeMappingException.java

\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/WriteLockedOffHeapHashMap.java

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\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/pinning/PinnableCache.java

\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/buffersource/HeapBufferSource.java

\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/buffersource/OffHeapBufferSource.java

\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/paging/Page.java

\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/disk/persistent/Persistent.java

\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/disk/persistent/PersistentStorageEngine.java

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/opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/paging/PageSource.java

\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/storage/listener/RuntimeStorageEngineListener.java

\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/storage/portability/ByteArrayPortability.java

\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/storage/portability/BooleanPortability.java

\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/Metadata.java

\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/WriteLockedOffHeapClockCache.java

\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-

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jar/org/terracotta/offheapstore/disk/paging/MappedPage.java  
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jar/org/terracotta/offheapstore/buffersource/BufferSource.java  
\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/util/NoOpLock.java  
\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/storage/portability/WriteContext.java  
\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/storage/portability/WriteBackPortability.java  
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/opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
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\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/disk/persistent/PersistentReadWriteLockedOffHeapClockCache.java  
\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
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jar/org/terracotta/offheapstore/util/MemoryUnit.java
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* /opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-
jar/org/terracotta/offheapstore/disk/persistent/AbstractPersistentConcurrentOffHeapMap.java
* /opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-
jar/org/terracotta/offheapstore/storage/allocator/Region.java
* /opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-
jar/org/terracotta/offheapstore/concurrent/ConcurrentMapInternals.java
```

## 1.209 nio-stream-storage 1.1.3

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*/
```

Found in path(s):

```
* /opt/cola/permits/1258195506_1643041713.35/0/nio-stream-storage-1-1-3-sources-
jar/org/synchronoss/cloud/nio/stream/storage/StreamStorageFactory.java
* /opt/cola/permits/1258195506_1643041713.35/0/nio-stream-storage-1-1-3-sources-
jar/org/synchronoss/cloud/nio/stream/storage/DeferredFileStreamStorageFactory.java
*
/opt/cola/permits/1258195506_1643041713.35/0/nio-stream-storage-1-1-3-sources-
jar/org/synchronoss/cloud/nio/stream/storage/Disposable.java
* /opt/cola/permits/1258195506_1643041713.35/0/nio-stream-storage-1-1-3-sources-
jar/org/synchronoss/cloud/nio/stream/storage/FileStreamStorage.java
* /opt/cola/permits/1258195506_1643041713.35/0/nio-stream-storage-1-1-3-sources-
jar/org/synchronoss/cloud/nio/stream/storage/StreamStorage.java
* /opt/cola/permits/1258195506_1643041713.35/0/nio-stream-storage-1-1-3-sources-
jar/org/synchronoss/cloud/nio/stream/storage/NameAwarePurgableFileInputStream.java
```

# 1.210 junixsocket-common 2.3.2

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```
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 *
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 */
```

Found in path(s):

```
* /opt/cola/permits/1258507885_1643078430.71/0/junixsocket-common-2-3-2-sources-
jar/org/newsclub/net/unix/AFUNIXSocket.java
* /opt/cola/permits/1258507885_1643078430.71/0/junixsocket-common-2-3-2-sources-
jar/org/newsclub/net/unix/Closeables.java
* /opt/cola/permits/1258507885_1643078430.71/0/junixsocket-common-2-3-2-sources-
jar/org/newsclub/net/unix/SuppressFBWarnings.java
*
/opt/cola/permits/1258507885_1643078430.71/0/junixsocket-common-2-3-2-sources-
jar/org/newsclub/net/unix/NativeUnixSocket.java
* /opt/cola/permits/1258507885_1643078430.71/0/junixsocket-common-2-3-2-sources-
jar/org/newsclub/net/unix/AFUNIXSocketImpl.java
* /opt/cola/permits/1258507885_1643078430.71/0/junixsocket-common-2-3-2-sources-
jar/org/newsclub/net/unix/AFUNIXSocketCapability.java
* /opt/cola/permits/1258507885_1643078430.71/0/junixsocket-common-2-3-2-sources-
jar/org/newsclub/net/unix/AFUNIXSocketFactory.java
* /opt/cola/permits/1258507885_1643078430.71/0/junixsocket-common-2-3-2-sources-
jar/org/newsclub/net/unix/AFUNIXServerSocket.java
* /opt/cola/permits/1258507885_1643078430.71/0/junixsocket-common-2-3-2-sources-
jar/org/newsclub/net/unix/NativeLibraryLoader.java
* /opt/cola/permits/1258507885_1643078430.71/0/junixsocket-common-2-3-2-sources-
jar/org/newsclub/net/unix/AFUNIXSocketAddress.java
*
```



/opt/cola/permits/1258507885\_1643078430.71/0/junixsocket-common-2-3-2-sources-jar/org/newsclub/net/unix/AFUNIXSocketCredentials.java

## 1.211 junixsocket-native-common 2.3.2

### 1.211.1 Available under license :

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```
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 *
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 */
```

Found in path(s):

\* /opt/cola/permits/1258508010\_1643078805.99/0/junixsocket-native-common-2-3-2-sources-jar/org/newsclub/lib/junixsocket/common/NarMetadata.java

## 1.212 webjars-locator-core 0.45

### 1.212.1 Available under license :

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## 1.213 jackson-databind-nullable 0.2.1

### 1.213.1 Available under license :

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## 1.214 jansi 1.18

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 */
```

Found in path(s):

```
* /opt/cola/permits/1260753865_1643213056.2/0/jansi-1-18-sources-jar/org/fusesource/jansi/Ansi.java
* /opt/cola/permits/1260753865_1643213056.2/0/jansi-1-18-sources-jar/org/fusesource/jansi/AnsiConsole.java
* /opt/cola/permits/1260753865_1643213056.2/0/jansi-1-18-sources-
jar/org/fusesource/jansi/AnsiOutputStream.java
*
* /opt/cola/permits/1260753865_1643213056.2/0/jansi-1-18-sources-jar/org/fusesource/jansi/AnsiRenderer.java
* /opt/cola/permits/1260753865_1643213056.2/0/jansi-1-18-sources-
jar/org/fusesource/jansi/WindowsAnsiOutputStream.java
* /opt/cola/permits/1260753865_1643213056.2/0/jansi-1-18-sources-jar/org/fusesource/jansi/AnsiString.java
* /opt/cola/permits/1260753865_1643213056.2/0/jansi-1-18-sources-
jar/org/fusesource/jansi/HtmlAnsiOutputStream.java
* /opt/cola/permits/1260753865_1643213056.2/0/jansi-1-18-sources-jar/org/fusesource/jansi/AnsiMain.java
* /opt/cola/permits/1260753865_1643213056.2/0/jansi-1-18-sources-jar/org/fusesource/jansi/FilterPrintStream.java
* /opt/cola/permits/1260753865_1643213056.2/0/jansi-1-18-sources-jar/org/fusesource/jansi/AnsiRenderWriter.java
* /opt/cola/permits/1260753865_1643213056.2/0/jansi-1-18-sources-jar/org/fusesource/jansi/AnsiPrintStream.java
* /opt/cola/permits/1260753865_1643213056.2/0/jansi-1-18-sources-
jar/org/fusesource/jansi/WindowsAnsiPrintStream.java
```

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Found in path(s):

- \* /opt/cola/permits/1260753865\_1643213056.2/0/jansi-1-18-sources-jar/org/fusesource/jansi/WindowsSupport.java

## 1.215 byte-buddy 1.10.14

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## 1.218 ehcache 3.8.1

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org.ehcache.jsr107.internal.Jsr107CacheConfigurationParser

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- \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/impl/copy/IdentityCopier.java
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- /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/impl/persistence/DefaultLocalPersistenceService.java
- \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/impl/internal/events/FudgingInvocationScopedEventSink.java
- \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/core/spi/store/WrapperStore.java
- \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/impl/serialization/ByteArraySerializer.java
- \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/impl/internal/store/heap/Backend.java
- \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/config/builders/UserManagedCacheConfiguration.java
- \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/impl/config/loaderwriter/writebehind/package-info.java
- \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/xml/service/DefaultSerializerConfigurationParser.java
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- /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/config/builders/CacheManagerBuilder.java
- \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/impl/internal/resilience/RobustLoaderWriterResilienceStrategy.java
- \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/event/EventType.java
- \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/UserManagedCache.java
- \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/impl/internal/classes/ClassInstanceConfiguration.java
- \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/impl/persistence/FileUtils.java
- \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/core/events/CacheEvents.java
- \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/impl/config/persistence/UserManagedPersistenceContext.java

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\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
jar/org/ehcache/impl/internal/sizeof/NoopSizeOfEngine.java  
\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
jar/org/ehcache/core/statistics/LowerCachingTierOperationsOutcome.java  
\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/core/Ehcache.java  
\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
jar/org/ehcache/impl/config/serializer/DefaultSerializerConfiguration.java  
\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
jar/org/ehcache/impl/internal/loaderwriter/writebehind/AbstractWriteBehind.java  
\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
jar/org/ehcache/impl/internal/events/AbstractStoreEventDispatcher.java  
\*

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/opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/core/spi/store/heap/package-info.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/impl/store/HashUtils.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/core/config/store/StoreEventSourceConfiguration.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/xml/provider/DefaultCopyProviderConfigurationParser.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/impl/internal/events/DisabledCacheEventNotificationService.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/config/SizedResourcePool.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/impl/internal/events/StoreEventImpl.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/jsr107/config/Jsr107CacheConfiguration.java
*
/opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/spi/service/ServiceProvider.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/xml/provider/CacheEventDispatcherFactoryConfigurationParser.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/core/events/EventListenerWrapper.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/core/statistics/CachingTierOperationOutcomes.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/xml/DomUtil.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/core/config/store/StoreStatisticsConfiguration.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/core/SpecIterator.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/config/Configuration.java
*
/opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/impl/serialization/IntegerSerializer.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/expiry/package-info.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/core/statistics/SuppliedValueStatistic.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/spi/copy/Copier.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/config/ResourcePools.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/impl/internal/util/Pacer.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/impl/internal/store/disk/OffHeapDiskStore.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/config/EvictionAdvisor.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/core/PersistentUserManagedEhcache.java
*
/opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/Status.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-

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jar/org/ehcache/impl/internal/store/basic/NopStore.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/impl/internal/TimeSourceConfiguration.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/xml/ServiceCreationConfigurationParser.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/impl/config/event/DefaultEventSourceConfiguration.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/PersistentUserManagedCache.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/impl/internal/store/heap/holders/OnHeapKey.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/jsr107/Eh107CompleteConfiguration.java  
 \*  
 /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/spi/service/PluralService.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/config/builders/UserManagedCacheBuilder.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/jsr107/Eh107Configuration.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/config/Builder.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/impl/config/copy/DefaultCopierConfiguration.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/xml/ResourceConfigurationParser.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/core/HumanReadable.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/impl/internal/store/tiering/TieredStoreProviderFactory.java  
 \*  
 /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/xml/BaseConfigParser.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/impl/internal/spi/serialization/DefaultSerializationProvider.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/core/spi/store/heap/LimitExceededException.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/impl/config/store/heap/DefaultSizeOfEngineConfiguration.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/impl/internal/store/offheap/LazyOffHeapValueHolder.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/config/units/MemoryUnit.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/impl/internal/events/FireableStoreEventHolder.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/xml/CacheManagerServiceConfigurationParser.java  
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 /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/impl/internal/loaderwriter/writebehind/BatchingLocalHeapWriteBehindQueue.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/xml/JaxbHelper.java



\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/impl/internal/store/loaderwriter/LocalWriteBehindLoaderWriterStore.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/core/statistics/CacheOperationOutcomes.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/core/util/CollectionUtil.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/core/spi/service/FileBasedPersistenceContext.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/core/statistics/CacheStatistics.java  
 \*  
 /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/core/statistics/Jsr107LatencyMonitor.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/impl/internal/util/ThreadFactoryUtil.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/core/spi/store/ConfigurationChangeSupport.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/config/builders/ResourcePoolsBuilder.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/core/spi/time/package-info.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/xml/exceptions/XmlConfigurationException.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/impl/internal/store/heap/KeyCopyBackend.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/impl/internal/store/disk/factories/EhcachePersistentSegmentFactory.java  
 \*  
 /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/jsr107/internal/WrappedCacheLoaderWriter.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/core/spi/store/tiering/HigherCachingTier.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/core/spi/time/SystemTimeSource.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/core/spi/store/tiering/package-info.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/jsr107/internal/Jsr107ServiceConfigurationParser.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/impl/config/store/heap/DefaultSizeOfEngineProviderConfiguration.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/impl/internal/store/offheap/OffHeapStoreUtils.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/spi/loaderwriter/CacheLoaderWriterConfiguration.java  
 \*  
 /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/spi/copy/CopyProvider.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/core/osgi/OsgiServiceLoader.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/core/spi/store/events/StoreEvent.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/impl/internal/store/loaderwriter/LoaderWriterValueHolder.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/jsr107/config/package-info.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/impl/internal/spi/event/DefaultCacheEventListenerProvider.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/impl/internal/store/heap/OnHeapStoreProviderFactory.java

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/opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/core/spi/service/DiskResourceService.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/jsr107/ConfigurationMerger.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/impl/internal/executor/OutOfBandScheduledExecutor.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/jsr107/Eh107MXBean.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/impl/internal/store/disk/OffHeapDiskStoreProviderFactory.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/impl/config/store/disk/OffHeapDiskStoreConfiguration.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/config/FluentCacheConfigurationBuilder.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/xml/provider/OffHeapDiskStoreProviderConfigurationParser.java

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/opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/CacheManager.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/spi/service/ServiceDependencies.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/core/statistics/OperationObserver.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/impl/internal/store/offheap/EhcacheConcurrentOffHeapClockCache.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/spi/serialization/UnsupportedTypeException.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/jsr107/Eh107ReverseConfiguration.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/impl/internal/store/heap/OnHeapStrategy.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/impl/config/loaderwriter/DefaultCacheLoaderWriterProviderConfiguration.java

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/opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/impl/internal/store/disk/EhcachePersistentConcurrentOffHeapClockCache.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/CachePersistenceException.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/core/config/store/package-info.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/impl/internal/loaderwriter/writebehind/WriteBehindProviderFactory.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/impl/internal/store/offheap/BinaryOffHeapValueHolder.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/xml/service/DefaultCacheEventListenerConfigurationParser.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/impl/internal/loaderwriter/writebehind/operations/DeleteAllOperation.java

\*

/opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/impl/config/loaderwriter/DefaultCacheLoaderWriterConfiguration.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/config/builders/ExpiryPolicyBuilder.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/core/statistics/DelegatingOperationObserver.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/xml/service/DefaultWriteBehindConfigurationParser.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/xml/CoreCacheConfigurationParser.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/impl/config/loaderwriter/package-info.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/impl/internal/resilience/AbstractResilienceStrategy.java

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/opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/core/statistics/StatsUtils.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/config/builders/package-info.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/xml/model/ListenersConfig.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/core/spi/time/TickingTimeSource.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/PersistentCacheManager.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/config/units/package-info.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/spi/loaderwriter/WriteBehindProvider.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/event/CacheEventListener.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/spi/loaderwriter/CacheLoadingException.java

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/opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/xml/service/DefaultCopierConfigurationParser.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-

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 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/impl/config/copy/package-info.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/impl/internal/store/offheap/portability/OffHeapValueHolderPortability.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/core/InternalStatus.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/core/statistics/ChainedOperationObserver.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/impl/internal/sizeof/DefaultSizeOfEngineProvider.java  
 \*  
 /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/impl/internal/store/tiering/CompoundCachingTier.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/core/config/ExpiryUtils.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/core/statistics/ValueStatistic.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/core/events/NullStoreEventDispatcher.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/impl/serialization/TransientStateRepository.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/impl/internal/loaderwriter/writebehind/operations/DeleteOperation.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/impl/internal/persistence/DefaultLocalPersistenceServiceFactory.java  
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 \*  
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 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/spi/loaderwriter/package-info.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/expiry/Expirations.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/impl/internal/persistence/DefaultDiskResourceServiceFactory.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/impl/internal/spi/copy/DefaultCopyProviderFactory.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/impl/events/CacheEventAdapter.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/jsr107/internal/Jsr107CacheConfigurationParser.java  
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 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/spi/resilience/RecoveryStore.java  
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\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/spi/loaderwriter/BulkCacheWritingException.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/core/InternalRuntimeConfiguration.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/impl/internal/store/offheap/AbstractOffHeapStore.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/spi/service/OptionalServiceDependencies.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/jsr107/NullCompletionListener.java

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jar/org/ehcache/impl/internal/classes/commonslang/reflect/MemberUtils.java
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\* /opt/cola/permits/1274024552\_1645166710.08/0/flyway-commandline-7-3-1-sources-jar/org/flywaydb/commandline/FileLog.java  
\* /opt/cola/permits/1274024552\_1645166710.08/0/flyway-commandline-7-3-1-sources-jar/org/flywaydb/commandline/ConsoleLogCreator.java  
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\* /opt/cola/permits/1274024552\_1645166710.08/0/flyway-commandline-7-3-1-sources-jar/org/flywaydb/commandline/ConsoleLog.java  
\* /opt/cola/permits/1274024552\_1645166710.08/0/flyway-commandline-7-3-1-sources-jar/org/flywaydb/commandline/CommandLineArguments.java

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\* /opt/cola/permits/1274024552\_1645166710.08/0/flyway-commandline-7-3-1-sources-jar/META-INF/maven/org.flywaydb/flyway-commandline/pom.xml

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jar/nonapi/io/github/classgraph/fileslice/reader/RandomAccessArrayReader.java  
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jar/nonapi/io/github/classgraph/fileslice/FileSlice.java  
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jar/nonapi/io/github/classgraph/fileslice/reader/RandomAccessByteBufferReader.java  
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jar/nonapi/io/github/classgraph/fileslice/reader/RandomAccessFileReader.java  
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/opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-  
jar/nonapi/io/github/classgraph/fileslice/reader/ClassfileReader.java  
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jar/nonapi/io/github/classgraph/fileslice/ArraySlice.java  
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Found in path(s):

\*/opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-  
jar/nonapi/io/github/classgraph/classloaderhandler/SpringBootRestartClassLoaderHandler.java  
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/\*

\* This file is part of ClassGraph.

\*

\* Author: R. Kempees

\*

\* With contributions from @cpierceworld (#414)

\*

\* Hosted at: <https://github.com/classgraph/classgraph>

\*

\* --

\*

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\*/opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-  
jar/nonapi/io/github/classgraph/classloaderhandler/WebsphereLibertyClassLoaderHandler.java

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```
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 * This file is part of ClassGraph.
 *
 * Author: Harith Elrufaie
 *
 * Hosted at: https://github.com/classgraph/classgraph
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```
*/opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/nonapi/io/github/classgraph/classloaderhandler/FelixClassLoaderHandler.java
```

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/*
 * This file is part of ClassGraph.
 *
 * Author: Sergey Beshpalov
 *
 * Hosted at: https://github.com/classgraph/classgraph
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jar/nonapi/io/github/classgraph/classloaderhandler/WebSphereTraditionalClassLoaderHandler.java  
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\* This file is part of ClassGraph.  
\*  
\* Author: Luke Hutchison  
\*  
\* Hosted at: <https://github.com/classgraph/classgraph>  
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Found in path(s):

\* /opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-jar/nonapi/io/github/classgraph/classpath/ClasspathFinder.java  
\* /opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-jar/nonapi/io/github/classgraph/scanspec/WhiteBlackList.java  
\* /opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-jar/nonapi/io/github/classgraph/utils/LogNode.java  
\* /opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-jar/nonapi/io/github/classgraph/types/Parser.java  
\* /opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-jar/io/github/classgraph/InfoList.java  
\* /opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-jar/io/github/classgraph/FieldInfoList.java  
\*  
/opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-jar/io/github/classgraph/ClassRefTypeSignature.java  
\* /opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-jar/nonapi/io/github/classgraph/fastzipfilereader/PhysicalZipFile.java  
\* /opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-jar/io/github/classgraph/ClassTypeSignature.java  
\* /opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-jar/io/github/classgraph/FieldInfo.java  
\* /opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-jar/io/github/classgraph/ClassGraphClassLoader.java  
\* /opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-jar/nonapi/io/github/classgraph/utils/Join.java  
\* /opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-jar/io/github/classgraph/TypeArgument.java  
\* /opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-jar/io/github/classgraph/ObjectTypedValueWrapper.java  
\*  
/opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-jar/nonapi/io/github/classgraph/recycler/Recycler.java  
\* /opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-



```

jar/nonapi/io/github/classgraph/json/FieldTypeInfo.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/io/github/classgraph/ClasspathElementDir.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/nonapi/io/github/classgraph/json/Id.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/nonapi/io/github/classgraph/json/JSONObject.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/io/github/classgraph/AnnotationParameterValue.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/io/github/classgraph/AnnotationInfo.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/nonapi/io/github/classgraph/Utils/JarUtils.java
*
/opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/nonapi/io/github/classgraph/json/JSONReference.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/nonapi/io/github/classgraph/json/JSONUtils.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/nonapi/io/github/classgraph/json/TypeResolutions.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/io/github/classgraph/ModulePathInfo.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/io/github/classgraph/TypeSignature.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/nonapi/io/github/classgraph/recycler/RecycleOnClose.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/io/github/classgraph/PackageInfoList.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/nonapi/io/github/classgraph/classloaderhandler/FallbackClassLoaderHandler.java
*
/opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/nonapi/io/github/classgraph/fastzipfilereader/LogicalZipFile.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/nonapi/io/github/classgraph/classloaderhandler/ClassLoaderHandlerRegistry.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/nonapi/io/github/classgraph/json/ReferenceEqualityKey.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/io/github/classgraph/GraphvizDotfileGenerator.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-jar/io/github/classgraph/Classfile.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/io/github/classgraph/AnnotationClassRef.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/nonapi/io/github/classgraph/classloaderhandler/PlexusClassWorldsClassRealmClassLoaderHandler.java
*
/opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/io/github/classgraph/MethodParameterInfo.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-

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jar/nonapi/io/github/classgraph/classpath/ClasspathOrder.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/nonapi/io/github/classgraph/json/ParameterizedTypeImpl.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/io/github/classgraph/HierarchicalTypeSignature.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/io/github/classgraph/TypeParameter.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/nonapi/io/github/classgraph/json/ClassFields.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/io/github/classgraph/ClassRefOrTypeVariableSignature.java
*
/opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/io/github/classgraph/ArrayTypeSignature.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/nonapi/io/github/classgraph/classpath/CallStackReader.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/io/github/classgraph/Resource.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/io/github/classgraph/MappableInfoList.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/io/github/classgraph/MethodInfoList.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/nonapi/io/github/classgraph/concurrency/InterruptedException.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/nonapi/io/github/classgraph/json/JSONSerializer.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/nonapi/io/github/classgraph/classpath/SystemJarFinder.java
*
/opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/nonapi/io/github/classgraph/types/TypeUtils.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/io/github/classgraph/ClasspathElementZip.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/nonapi/io/github/classgraph/fastzipfilereader/ZipFileSlice.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/nonapi/io/github/classgraph/Utils/FastPathResolver.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/io/github/classgraph/ModuleRef.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/nonapi/io/github/classgraph/json/JSONDeserializer.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/io/github/classgraph/AnnotationEnumValue.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/io/github/classgraph/AnnotationParameterValueList.java
*
/opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-jar/io/github/classgraph/HasName.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-

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jar/nonapi/io/github/classgraph/classloaderhandler/EquinoxContextFinderClassLoaderHandler.java  
\* /opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-  
jar/nonapi/io/github/classgraph/concurrency/SingletonMap.java  
\* /opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-  
jar/nonapi/io/github/classgraph/classpath/ModuleFinder.java  
\* /opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-  
jar/io/github/classgraph/ClassInfo.java  
\* /opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-  
jar/nonapi/io/github/classgraph/Utils/StringUtils.java  
\* /opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-  
jar/io/github/classgraph/ClassGraphException.java  
\* /opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-  
jar/nonapi/io/github/classgraph/json/JSONParser.java  
\*  
/opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-  
jar/nonapi/io/github/classgraph/Utils/FileUtils.java  
\* /opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-  
jar/io/github/classgraph/ClasspathElementModule.java  
\* /opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-  
jar/nonapi/io/github/classgraph/classloaderhandler/OSGiDefaultClassLoaderHandler.java  
\* /opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-  
jar/nonapi/io/github/classgraph/types/ParseException.java  
\* /opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-  
jar/nonapi/io/github/classgraph/classloaderhandler/JPMSCClassLoaderHandler.java  
\* /opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-  
jar/io/github/classgraph/ScanResult.java  
\* /opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-  
jar/io/github/classgraph/ReferenceTypeSignature.java  
\*  
/opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-  
jar/io/github/classgraph/ModuleReaderProxy.java  
\* /opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-  
jar/io/github/classgraph/ScanResultObject.java  
\* /opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-  
jar/io/github/classgraph/ModuleInfoList.java  
\* /opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-  
jar/io/github/classgraph/TypeVariableSignature.java  
\* /opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-  
jar/nonapi/io/github/classgraph/fastzipfilereader/NestedJarHandler.java  
\* /opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-  
jar/nonapi/io/github/classgraph/json/JSONArray.java  
\* /opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-  
jar/io/github/classgraph/MethodInfo.java  
\* /opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-  
jar/nonapi/io/github/classgraph/classpath/ClassLoaderOrder.java  
\*  
/opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-  
jar/nonapi/io/github/classgraph/classloaderhandler/WeblogicClassLoaderHandler.java

\* /opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-jar/io/github/classgraph/PackageInfo.java  
 \* /opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-jar/io/github/classgraph/Scanner.java  
 \* /opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-jar/io/github/classgraph/AnnotationInfoList.java  
 \* /opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-jar/nonapi/io/github/classgraph/concurrency/WorkQueue.java  
 \* /opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-jar/nonapi/io/github/classgraph/json/ClassFieldCache.java  
 \* /opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-jar/io/github/classgraph/BaseTypeSignature.java  
 \* /opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-jar/io/github/classgraph/PotentiallyUnmodifiableList.java  
 \*  
 /opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-jar/nonapi/io/github/classgraph/recycler/Resettable.java  
 \* /opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-jar/nonapi/io/github/classgraph/classpath/ClassLoaderFinder.java  
 \* /opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-jar/nonapi/io/github/classgraph/Utils/ReflectionUtils.java  
 \* /opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-jar/nonapi/io/github/classgraph/Utils/VersionFinder.java  
 \* /opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-jar/nonapi/io/github/classgraph/classloaderhandler/EquinoxClassLoaderHandler.java  
 \* /opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-jar/io/github/classgraph/MethodTypeSignature.java  
 \* /opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-jar/nonapi/io/github/classgraph/scanspec/ScanSpec.java  
 \* /opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-jar/io/github/classgraph/ClasspathElement.java  
 \*  
 /opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-jar/io/github/classgraph/ArrayClassInfo.java  
 \* /opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-jar/io/github/classgraph/ClassGraph.java  
 \* /opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-jar/nonapi/io/github/classgraph/Utils/CollectionUtils.java  
 \* /opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-jar/nonapi/io/github/classgraph/Utils/URLPathEncoder.java  
 \* /opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-jar/nonapi/io/github/classgraph/classloaderhandler/ClassLoaderHandler.java  
 \* /opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-jar/io/github/classgraph/ClassInfoList.java  
 \* /opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-jar/nonapi/io/github/classgraph/classloaderhandler/ParentLastDelegationOrderTestClassLoaderHandler.java  
 \*  
 /opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-jar/nonapi/io/github/classgraph/fastzipfilereader/FastZipEntry.java

```
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/io/github/classgraph/ModuleInfo.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/nonapi/io/github/classgraph/classloaderhandler/URLClassLoaderHandler.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/nonapi/io/github/classgraph/classloaderhandler/TomcatWebappClassLoaderBaseHandler.java
No license file was found, but licenses were detected in source scan.
```

```
/*
```

```
* This file is part of ClassGraph.
```

```
*
```

```
* Author: Luke Hutchison
```

```
*
```

```
* Hosted at: https://github.com/classgraph/classgraph
```

```
*
```

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* --
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*
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```
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*
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```
* Copyright (c) 2019 Luke Hutchison, with significant contributions from Davy De Durpel
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```
*/
```

```
Found in path(s):
```

```
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/nonapi/io/github/classgraph/classloaderhandler/JBossClassLoaderHandler.java
```

# 1.224 libnetfilter-contrack 1.0.5

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## 1.225 lvm2 2.02.79

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```
* /opt/cola/permits/1316840807_1651048916.85/0/swagger-annotations-1-5-22-sources-2-
jar/io/swagger/annotations/ApiResponse.java
* /opt/cola/permits/1316840807_1651048916.85/0/swagger-annotations-1-5-22-sources-2-
jar/io/swagger/annotations/ApiParam.java
* /opt/cola/permits/1316840807_1651048916.85/0/swagger-annotations-1-5-22-sources-2-
jar/io/swagger/annotations/ExtensionProperty.java
*
/opt/cola/permits/1316840807_1651048916.85/0/swagger-annotations-1-5-22-sources-2-
jar/io/swagger/annotations/AuthorizationScope.java
* /opt/cola/permits/1316840807_1651048916.85/0/swagger-annotations-1-5-22-sources-2-
jar/io/swagger/annotations/ApiOperation.java
* /opt/cola/permits/1316840807_1651048916.85/0/swagger-annotations-1-5-22-sources-2-
jar/io/swagger/annotations/SwaggerDefinition.java
* /opt/cola/permits/1316840807_1651048916.85/0/swagger-annotations-1-5-22-sources-2-
jar/io/swagger/annotations/ApiModelProperty.java
* /opt/cola/permits/1316840807_1651048916.85/0/swagger-annotations-1-5-22-sources-2-
jar/io/swagger/annotations/ApiImplicitParam.java
* /opt/cola/permits/1316840807_1651048916.85/0/swagger-annotations-1-5-22-sources-2-
jar/io/swagger/annotations/ExampleProperty.java
* /opt/cola/permits/1316840807_1651048916.85/0/swagger-annotations-1-5-22-sources-2-
jar/io/swagger/annotations/ApiModel.java
*
```



```
/opt/cola/permits/1316840807_1651048916.85/0/swagger-annotations-1-5-22-sources-2-
jar/io/swagger/annotations/ExternalDocs.java
* /opt/cola/permits/1316840807_1651048916.85/0/swagger-annotations-1-5-22-sources-2-
jar/io/swagger/annotations/Example.java
* /opt/cola/permits/1316840807_1651048916.85/0/swagger-annotations-1-5-22-sources-2-
jar/io/swagger/annotations/Authorization.java
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jar/io/swagger/annotations/Api.java
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jar/io/swagger/annotations/Info.java
* /opt/cola/permits/1316840807_1651048916.85/0/swagger-annotations-1-5-22-sources-2-
jar/io/swagger/annotations/Contact.java
* /opt/cola/permits/1316840807_1651048916.85/0/swagger-annotations-1-5-22-sources-2-
jar/io/swagger/annotations/ApiImplicitParams.java
*
/opt/cola/permits/1316840807_1651048916.85/0/swagger-annotations-1-5-22-sources-2-
jar/io/swagger/annotations/Tag.java
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jar/io/swagger/annotations/Extension.java
* /opt/cola/permits/1316840807_1651048916.85/0/swagger-annotations-1-5-22-sources-2-
jar/io/swagger/annotations/ResponseHeader.java
* /opt/cola/permits/1316840807_1651048916.85/0/swagger-annotations-1-5-22-sources-2-
jar/io/swagger/annotations/ApiResponse.java
```

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(24) - RISC-V Semihosting (riscv-\* targets)

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Julian Seward, [jseward@bzip.org](mailto:jseward@bzip.org)  
bzip2/libbzip2 version 1.0.6 of 6 September 2010

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This is the Debian GNU/Linux prepackaged version of the GNU compiler collection, containing Ada, C, C++, D, Fortran 95, Go, Objective-C, Objective-C++, and Modula-2 compilers, documentation, and support libraries. In addition, Debian provides the gm2 compiler, either in the same source package, or built from a separate same source package.

Packaging is done by the Debian GCC Maintainers

<debian-gcc@lists.debian.org>, with sources obtained from:

ftp://gcc.gnu.org/pub/gcc/releases/ (for full releases)

svn://gcc.gnu.org/svn/gcc/ (for prereleases)

ftp://sourceware.org/pub/newlib/ (for newlib)

git://git.savannah.gnu.org/gm2.git (for Modula-2)

The current gcc-10 source package is taken from the SVN gcc-10-branch.

Changes: See [changelog.Debian.gz](http://changelog.Debian.gz)

Debian splits the GNU Compiler Collection into packages for each language, library, and documentation as follows:

Language	Compiler package	Library package	Documentation
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Ada

	gnat-10	libgnat-10	gnat-10-doc
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BRIG	gccbrig-10	libhsail-rt0	
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C	gcc-10		gcc-10-doc
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C++	g++-10	libstdc++6	libstdc++6-10-doc
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D	gdc-10		
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Fortran 95	gfortran-10	libgfortran5	gfortran-10-doc
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Go	gccgo-10	libgo0	
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Objective C	gobjc-10	libobjc4	
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Objective C++	gobjc++-10		
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Modula-2	gm2-10	libgm2	
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For some language run-time libraries, Debian provides source files, development files, debugging symbols and libraries containing position-

independent code in separate packages:

Language	Sources	Development	Debugging	Position-Independent
C++		libstdc++6-10-dbg	libstdc++6-10-pic	
D	libphobos-10-dev			

Additional packages include:

All languages:

libgcc1,	
libgcc2, libgcc4	GCC intrinsics (platform-dependent)
gcc-10-base	Base files common to all compilers
gcc-10-soft-float	Software floating point (ARM only)
gcc-10-source	The sources with patches

Ada:

libgnat-util10-dev, libgnat-util10 GNAT version library

C:

cpp-10, cpp-10-doc	GNU C Preprocessor
libssp0-dev, libssp0	GCC stack smashing protection library
libquadmath0	Math routines for the __float128 type
fixincludes	Fix non-ANSI header files

C, C++ and Fortran 95:

libgomp1-dev, libgomp1 GCC OpenMP (GOMP) support library  
libitm1-dev, libitm1 GNU Transactional Memory Library

Biarch support: On some 64-bit platforms which can also run 32-bit code, Debian provides additional packages containing 32-bit versions of some libraries. These packages have names beginning with 'lib32' instead of 'lib', for example lib32stdc++6. Similarly, on some 32-bit platforms which can

also run 64-bit code, Debian provides additional packages with names beginning with 'lib64' instead of 'lib'. These packages contain 64-bit versions of the libraries. (At this time, not all platforms and not all libraries support biarch.) The license terms for these lib32 or lib64 packages are identical to the ones for the lib packages.

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ldexpq.c:

- \* Conversion to long double by Ulrich Drepper,
- \* Cygnus Support, drepper@cygnus.com.

cosq\_kernel.c, expq.c, sincos\_table.c, sincosq.c, sincosq\_kernel.c,  
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D:

gdc-10                    GNU D Compiler  
libphobos-10-dev        D standard runtime library

The D source package is made up of the following components.

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- d/\*

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The DMD Compiler implementation of the D programming language:

- d/dmd/\*

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The Phobos standard runtime library:

- d/phobos/\*

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GCC RUNTIME LIBRARY EXCEPTION

Version 3.1, 31 March 2009

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@heading TERMS AND CONDITIONS

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Convey the object code in, or embodied in, a physical product (including a physical distribution medium), accompanied by a written offer,

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@item

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@smallexample

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```
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Version 3, 29 June 2007

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@var{signature of Ty Coon}, 1 April 1990
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Ty Coon, President of Vice
```

```
@end smallexample
```

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-->

<!-- Generate ISC copyright comments from Docbook copyright metadata. -->

```
<xsl:stylesheet version="1.0"
```

```
 xmlns:xsl="http://www.w3.org/1999/XSL/Transform"
```

```
 xmlns:xi="http://www.w3.org/2001/XInclude"
```

```
 xmlns:db="http://docbook.org/ns/docbook">
```

```
 <xsl:template name="isc.copyright.format">
```

```
 <xsl:param name="text"/>
```

```
 <xsl:value-of select="$isc.copyright.leader"/>
```

```
 <xsl:value-of select="normalize-space(substring-before($text, '
'))"/>
```

```
 <xsl:text>
</xsl:text>
```

```
 <xsl:variable name="rest" select="substring-after($text, '
')"/>
```

```
 <xsl:if test="translate($rest, '	 ', '')">
```

```
 <xsl:call-template name="isc.copyright.format">
```

```
 <xsl:with-param name="text" select="$rest"/>
```

```

 </xsl:call-template>
 </xsl:if>
</xsl:template>

<xsl:variable name="isc.copyright.text">
 <xsl:text>
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 </xsl:text>
</xsl:variable>

<xsl:variable name="isc.copyright">
 <xsl:call-template name="isc.copyright.format">
 <xsl:with-param name="text">
 <xsl:for-each select="db:book/db:info/db:copyright | db:refentry/db:docinfo/db:copyright">
 <xsl:text>Copyright (C) </xsl:text>
 <xsl:call-template name="copyright.years">
 <xsl:with-param name="years" select="db:year"/>
 </xsl:call-template>
 <xsl:text> </xsl:text>
 <xsl:value-of select="db:holder"/>
 <xsl:value-of select="$isc.copyright.breakline"/>
 <xsl:text>
</xsl:text>
 </xsl:for-each>
 <xsl:value-of
 select="$isc.copyright.text"/>
 </xsl:with-param>
 </xsl:call-template>
</xsl:variable>
</xsl:stylesheet>

<!--
- Local variables:
- mode: sgml
- End:
-->
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(For example, a function in a library to compute square roots has



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```

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```

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```

```
<signature of Ty Coon>, 1 April 1990
Ty Coon, President of Vice
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## 1.234 iptables 1.8.8

### 1.234.1 Available under license :

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```
/*
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 *
 * IPQ library for userspace.
 *
 * Author: James Morris <jmorris@intercode.com.au>
 *
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 */
```

Found in path(s):

\* /opt/cola/permits/1409587079\_1683835556.5462122/0/iptables-1-1-8-3-1-x86-64-pkg-tar-xz/usr/include/libipq.h

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Found in path(s):

\* /opt/cola/permits/1409587079\_1683835556.5462122/0/iptables-1-1-8-3-1-x86-64-pkg-tar-xz/usr/share/man/man8/arptables-nft-save-8-gz/arptables-nft-save.8

\* /opt/cola/permits/1409587079\_1683835556.5462122/0/iptables-1-1-8-3-1-x86-64-pkg-tar-xz/usr/share/man/man8/iptables-save-8-gz/iptables-save.8

\*

/opt/cola/permits/1409587079\_1683835556.5462122/0/iptables-1-1-8-3-1-x86-64-pkg-tar-xz/usr/share/man/man1/iptables-xml-1-gz/iptables-xml.1

\* /opt/cola/permits/1409587079\_1683835556.5462122/0/iptables-1-1-8-3-1-x86-64-pkg-tar-xz/usr/share/man/man8/iptables-8-gz/iptables.8

\* /opt/cola/permits/1409587079\_1683835556.5462122/0/iptables-1-1-8-3-1-x86-64-pkg-tar-xz/usr/share/man/man8/arptables-nft-restore-8-gz/arptables-nft-restore.8

\* /opt/cola/permits/1409587079\_1683835556.5462122/0/iptables-1-1-8-3-1-x86-64-pkg-tar-xz/usr/share/man/man8/iptables-restore-8-gz/iptables-restore.8

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Found in path(s):

\* /opt/cola/permits/1409587079\_1683835556.5462122/0/iptables-1-1-8-3-1-x86-64-pkg-tar-xz/usr/share/man/man8/eatables-nft-8-gz/eatables-nft.8

\* /opt/cola/permits/1409587079\_1683835556.5462122/0/iptables-1-1-8-3-1-x86-64-pkg-tar-xz/usr/share/man/man8/arptables-nft-8-gz/arptables-nft.8



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```
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```

Found in path(s):

```
* /opt/cola/permits/1409587079_1683835556.5462122/0/iptables-1-1-8-3-1-x86-64-pkg-tar-
xz/usr/share/man/man8/xtables-legacy-8-gz/xtables-legacy.8
```

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```
$FreeBSD: head/etc/pf.os 258865 2013-12-03 04:32:02Z eadler $
$OpenBSD: pf.os,v 1.27 2016/09/03 17:08:57 sthen Exp $
passive OS fingerprinting

#
SYN signatures. Those signatures work for SYN packets only (duh!).
#
(C) Copyright 2000-2003 by Michal Zalewski <lcamtuf@coredump.cx>
(C) Copyright 2003 by Mike Frantzen <frantzen@w4g.org>
#
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#
#
This fingerprint database is adapted from Michal Zalewski's p0f passive
operating system package. The last database sync was from a Nov 3 2003
p0f.fp.
#
#
```

```
Each line in this file specifies a single fingerprint. Please read the
information below carefully before attempting to append any signatures
reported as UNKNOWN to this file to avoid mistakes.
#
We use the following set metrics for fingerprinting:
#
- Window size (WSS) - a highly OS dependent setting used for TCP/IP
performance control (max. amount of data to be sent without ACK).
Some systems use a fixed value for initial packets. On other
systems, it is a multiple of MSS or MTU (MSS+40). In some rare
cases, the value is just arbitrary.
#
NEW SIGNATURE: if p0f reported a special value of 'Snn', the number
appears to be
a multiple of MSS (MSS*nn); a special value of 'Tnn'
means it is a multiple of MTU ((MSS+40)*nn). Unless you notice the
value of nn is not fixed (unlikely), just copy the Snn or Tnn token
literally. If you know this device has a simple stack and a fixed
MTU, you can however multiply S value by MSS, or T value by MSS+40,
and put it instead of Snn or Tnn.
#
If WSS otherwise looks like a fixed value (for example a multiple
of two), or if you can confirm the value is fixed, please quote
it literally. If there's no apparent pattern in WSS chosen, you
should consider wildcarding this value.
#
- Overall packet size - a function of all IP and TCP options and bugs.
#
NEW SIGNATURE: Copy this value literally.
#
- Initial TTL - We check the actual TTL of a received packet. It can't
be higher than the initial TTL, and also shouldn't be dramatically
lower (maximum distance is defined as 40 hops).
#
NEW SIGNATURE: *Never* copy TTL from a p0f-reported
signature literally.
You need to determine the initial TTL. The best way to do it is to
check the documentation for a remote system, or check its settings.
A fairly good method is to simply round the observed TTL up to
32, 64, 128, or 255, but it should be noted that some obscure devices
might not use round TTLs (in particular, some shoddy appliances use
"original" initial TTL settings). If not sure, you can see how many
hops you're away from the remote party with traceroute or mtr.
#
- Don't fragment flag (DF) - some modern OSes set this to implement PMTU
discovery. Others do not bother.
#
NEW SIGNATURE: Copy this value literally.
```

```

#
- Maximum segment size (MSS) - this setting is usually link-dependent. POf
uses it to determine link type of the remote host.
#
NEW SIGNATURE: Always wildcard this value, except for rare cases when
you have an appliance with a fixed value, know the system supports only
a very limited number of
network interface types, or know the system
is using a value it pulled out of nowhere. Specific unique MSS
can be used to tell Google crawlbots from the rest of the population.
#
- Window scaling (WSCALE) - this feature is used to scale WSS.
It extends the size of a TCP/IP window to 32 bits. Some modern
systems implement this feature.
#
NEW SIGNATURE: Observe several signatures. Initial WSCALE is often set
to zero or other low value. There's usually no need to wildcard this
parameter.
#
- Timestamp - some systems that implement timestamps set them to
zero in the initial SYN. This case is detected and handled appropriately.
#
- Selective ACK permitted - a flag set by systems that implement
selective ACK functionality.
#
- The sequence of TCP all options (MSS, window scaling, selective ACK
permitted, timestamp, NOP). Other than the options previously
discussed, pOf also checks for timestamp option (a silly
extension to broadcast your
uptime ;-), NOP options (used for
header padding) and sackOK option (selective ACK feature).
#
NEW SIGNATURE: Copy the sequence literally.
#
To wildcard any value (except for initial TTL or TCP options), replace
it with '*'. You can also use a modulo operator to match any values
that divide by nnn - '%nnn'.
#
Fingerprint entry format:
#
www:ttt:D:ss:OOO...:OS:Version:Subtype:Details
#
wwww - window size (can be *, %nnn, Snn or Tnn). The special values
"S" and "T" which are a multiple of MSS or a multiple of MTU
respectively.
ttt - initial TTL
D - don't fragment bit (0 - not set, 1 - set)
ss - overall SYN packet size

```

```

OOO - option value and order specification (see below)
OS - OS genre (Linux, Solaris, Windows)
Version - OS Version (2.0.27 on x86, etc)
Subtype - OS subtype or patchlevel (SP3, lo0)
details - Generic OS details
#
If OS genre starts with '*', p0f will not show distance,
link type
and timestamp data. It is useful for userland TCP/IP stacks of
network scanners and so on, where many settings are randomized or
bogus.
#
If OS genre starts with @, it denotes an approximate hit for a group
of operating systems (signature reporting still enabled in this case).
Use this feature at the end of this file to catch cases for which
you don't have a precise match, but can tell it's Windows or FreeBSD
or whatnot by looking at, say, flag layout alone.
#
Option block description is a list of comma or space separated
options in the order they appear in the packet:
#
N - NOP option
Wnnn - window scaling option, value nnn (or * or %nnn)
Mnnn - maximum segment size option, value nnn (or * or %nnn)
S - selective ACK OK
T - timestamp
T0 - timestamp with a zero value
#
To denote no TCP options, use a single '!'.
#
Please report any additions to this file, or any inaccuracies or
problems spotted, to the maintainers: lcamtuf@coredump.cx,
#
frantzen@openbsd.org and bugs@openbsd.org with a tcpdump packet
capture of the relevant SYN packet(s)
#
A test and submission page is available at
http://lcamtuf.coredump.cx/p0f-help/
#
#
WARNING WARNING WARNING

#
Do not add a system X as OS Y just because NMAP says so. It is often
the case that X is a NAT firewall. While nmap is talking to the
device itself, p0f is fingerprinting the guy behind the firewall
instead.
#

```

```

When in doubt, use common sense, don't add something that looks like
a completely different system as Linux or FreeBSD or LinkSys router.
Check DNS name, establish a connection to the remote host and look
at SYN+ACK - does it look similar?
#
Some users tweak their TCP/IP settings - enable or disable RFC1323
functionality, enable or disable timestamps or selective ACK,
disable PMTU discovery, change MTU and so on. Always compare a new rule
to other fingerprints for this system, and verify the system
isn't
"customized" before adding it. It is OK to add signature variants
caused by a commonly used software (personal firewalls, security
packages, etc), but it makes no sense to try to add every single
possible /proc/sys/net/ipv4 tweak on Linux or so.
#
KEEP IN MIND: Some packet firewalls configured to normalize outgoing
traffic (OpenBSD pf with "scrub" enabled, for example) will, well,
normalize packets. Signatures will not correspond to the originating
system (and probably not quite to the firewall either).
#
NOTE: Try to keep this file in some reasonable order, from most to
least likely systems. This will speed up operation. Also keep most
generic and broad rules near the end.
#

```

```

#####
Standard OS signatures
#####

```

```

----- AIX -----

```

```

AIX is first because its signatures are close to NetBSD, MacOS X and
Linux 2.0, but it uses a fairly rare MSSes, at least sometimes...
This is a shoddy
hack, though.

```

```

45046:64:0:44:M*: AIX:4.3::AIX 4.3

```

```

16384:64:0:44:M512: AIX:4.3:2-3:AIX 4.3.2 and earlier

```

```

16384:64:0:60:M512,N,W%2,N,N,T: AIX:4.3:3:AIX 4.3.3-5.2

```

```

16384:64:0:60:M512,N,W%2,N,N,T: AIX:5.1-5.2::AIX 4.3.3-5.2

```

```

32768:64:0:60:M512,N,W%2,N,N,T: AIX:4.3:3:AIX 4.3.3-5.2

```

```

32768:64:0:60:M512,N,W%2,N,N,T: AIX:5.1-5.2::AIX 4.3.3-5.2

```

```

65535:64:0:60:M512,N,W%2,N,N,T: AIX:4.3:3:AIX 4.3.3-5.2

```

```

65535:64:0:60:M512,N,W%2,N,N,T: AIX:5.1-5.2::AIX 4.3.3-5.2

```

```

65535:64:0:64:M*,N,W1,N,N,T,N,N,S: AIX:5.3:ML1:AIX 5.3 ML1

```

```

----- Linux -----

```

```
S1:64:0:44:M*:A: Linux:1.2::Linux 1.2.x (XXX quirks support)
512:64:0:44:M*: Linux:2.0:3x:Linux 2.0.3x
16384:64:0:44:M*: Linux:2.0:3x:Linux 2.0.3x

Endian snafu! Nelson says "ha-ha":
2:64:0:44:M*: Linux:2.0:3x:Linux 2.0.3x (MkLinux) on Mac
64:64:0:44:M*: Linux:2.0:3x:Linux 2.0.3x (MkLinux) on Mac

S4:64:1:60:M1360,S,T,N,W0: Linux:google::Linux (Google crawlbot)

S2:64:1:60:M*,S,T,N,W0: Linux:2.4::Linux 2.4 (big boy)
S3:64:1:60:M*,S,T,N,W0: Linux:2.4:.18-21:Linux
2.4.18 and newer
S4:64:1:60:M*,S,T,N,W0: Linux:2.4::Linux 2.4/2.6 <= 2.6.7
S4:64:1:60:M*,S,T,N,W0: Linux:2.6:.1-7:Linux 2.4/2.6 <= 2.6.7

S4:64:1:60:M*,S,T,N,W5: Linux:2.6::Linux 2.6 (newer, 1)
S4:64:1:60:M*,S,T,N,W6: Linux:2.6::Linux 2.6 (newer, 2)
S4:64:1:60:M*,S,T,N,W7: Linux:2.6::Linux 2.6 (newer, 3)
T4:64:1:60:M*,S,T,N,W7: Linux:2.6::Linux 2.6 (newer, 4)

S10:64:1:60:M*,S,T,N,W4: Linux:3.0::Linux 3.0

S3:64:1:60:M*,S,T,N,W1: Linux:2.5::Linux 2.5 (sometimes 2.4)
S4:64:1:60:M*,S,T,N,W1: Linux:2.5-2.6::Linux 2.5/2.6
S3:64:1:60:M*,S,T,N,W2: Linux:2.5::Linux 2.5 (sometimes 2.4)
S4:64:1:60:M*,S,T,N,W2: Linux:2.5::Linux 2.5 (sometimes 2.4)

S20:64:1:60:M*,S,T,N,W0: Linux:2.2:20-25:Linux 2.2.20 and newer
S22:64:1:60:M*,S,T,N,W0: Linux:2.2::Linux 2.2
S11:64:1:60:M*,S,T,N,W0: Linux:2.2::Linux 2.2

Popular cluster config scripts disable timestamps and
selective ACK:
S4:64:1:48:M1460,N,W0: Linux:2.4:cluster:Linux 2.4 in cluster

#
This needs to be investigated. On some systems, WSS
is selected as a multiple of MTU instead of MSS. I got
many submissions for this for many late versions of 2.4:
T4:64:1:60:M1412,S,T,N,W0: Linux:2.4::Linux 2.4 (late, uncommon)

This happens only over loopback, but let's make folks happy:
32767:64:1:60:M16396,S,T,N,W0: Linux:2.4:lo0:Linux 2.4 (local)
S8:64:1:60:M3884,S,T,N,W0: Linux:2.2:lo0:Linux 2.2 (local)
```

```

Opera visitors:
16384:64:1:60:M*,S,T,N,W0: Linux:2.2:Opera:Linux 2.2 (Opera?)
32767:64:1:60:M*,S,T,N,W0: Linux:2.4:Opera:Linux 2.4 (Opera?)

Some fairly common mods:
S4:64:1:52:M*,N,N,S,N,W0: Linux:2.4:ts:Linux 2.4 w/o timestamps
S22:64:1:52:M*,N,N,S,N,W0: Linux:2.2:ts:Linux 2.2 w/o timestamps

----- FreeBSD -----

16384:64:1:44:M*: FreeBSD:2.0-2.2::FreeBSD 2.0-4.2
16384:64:1:44:M*: FreeBSD:3.0-3.5::FreeBSD 2.0-4.2
16384:64:1:44:M*: FreeBSD:4.0-4.2::FreeBSD 2.0-4.2
16384:64:1:60:M*,N,W0,N,N,T: FreeBSD:4.4::FreeBSD 4.4

1024:64:1:60:M*,N,W0,N,N,T: FreeBSD:4.4::FreeBSD
4.4

57344:64:1:44:M*: FreeBSD:4.6-4.8:noRFC1323:FreeBSD 4.6-4.8 (no RFC1323)
57344:64:1:60:M*,N,W0,N,N,T: FreeBSD:4.6-4.9::FreeBSD 4.6-4.9

32768:64:1:60:M*,N,W0,N,N,T: FreeBSD:4.8-4.11::FreeBSD 4.8-5.1 (or MacOS X)
32768:64:1:60:M*,N,W0,N,N,T: FreeBSD:5.0-5.1::FreeBSD 4.8-5.1 (or MacOS X)
65535:64:1:60:M*,N,W0,N,N,T: FreeBSD:4.8-4.11::FreeBSD 4.8-5.2 (or MacOS X)
65535:64:1:60:M*,N,W0,N,N,T: FreeBSD:5.0-5.2::FreeBSD 4.8-5.2 (or MacOS X)
65535:64:1:60:M*,N,W1,N,N,T: FreeBSD:4.7-4.11::FreeBSD 4.7-5.2
65535:64:1:60:M*,N,W1,N,N,T: FreeBSD:5.0-5.2::FreeBSD 4.7-5.2

XXX need quirks support
65535:64:1:60:M*,N,W0,N,N,T:Z:FreeBSD:5.1-5.4::5.1-current (1)
65535:64:1:60:M*,N,W1,N,N,T:Z:FreeBSD:5.1-5.4::5.1-current (2)
65535:64:1:60:M*,N,W2,N,N,T:Z:FreeBSD:5.1-5.4::5.1-current (3)
65535:64:1:44:M*:Z:FreeBSD:5.2::FreeBSD 5.2 (no RFC1323)

16384:64:1:60:M*,N,N,N,N,N,N,T:FreeBSD:4.4:noTS:FreeBSD 4.4 (w/o timestamps)

----- NetBSD -----

16384:64:0:60:M*,N,W0,N,N,T: NetBSD:1.3::NetBSD
1.3
65535:64:0:60:M*,N,W0,N,N,T0: NetBSD:1.6:opera:NetBSD 1.6 (Opera)
16384:64:0:60:M*,N,W0,N,N,T0: NetBSD:1.6::NetBSD 1.6
16384:64:1:60:M*,N,W0,N,N,T0: NetBSD:1.6:df:NetBSD 1.6 (DF)
65535:64:1:60:M*,N,W1,N,N,T0: NetBSD:1.6::NetBSD 1.6W-current (DF)
65535:64:1:60:M*,N,W0,N,N,T0: NetBSD:1.6::NetBSD 1.6X (DF)
32768:64:1:60:M*,N,W0,N,N,T0: NetBSD:1.6:randomization:NetBSD 1.6ZH-current (w/ ip_id randomization)

```

# ----- OpenBSD -----

16384:64:0:60:M\*,N,W0,N,N,T: OpenBSD:2.6::NetBSD 1.3 (or OpenBSD 2.6)  
16384:64:1:64:M\*,N,N,S,N,W0,N,N,T: OpenBSD:3.0-4.8::OpenBSD 3.0-4.8  
16384:64:0:64:M\*,N,N,S,N,W0,N,N,T: OpenBSD:3.0-4.8:no-df:OpenBSD 3.0-4.8 (scrub no-df)  
57344:64:1:64:M\*,N,N,S,N,W0,N,N,T: OpenBSD:3.3-4.0::OpenBSD 3.3-4.0  
57344:64:0:64:M\*,N,N,S,N,W0,N,N,T: OpenBSD:3.3-4.0:no-df:OpenBSD 3.3-4.0 (scrub no-df)  
  
65535:64:1:64:M\*,N,N,S,N,W0,N,N,T: OpenBSD:3.0-4.0:opera:OpenBSD 3.0-4.0 (Opera)  
  
16384:64:1:64:M\*,N,N,S,N,W3,N,N,T: OpenBSD:4.9::OpenBSD  
4.9  
16384:64:0:64:M\*,N,N,S,N,W3,N,N,T: OpenBSD:4.9:no-df:OpenBSD 4.9 (scrub no-df)  
  
16384:64:1:64:M\*,N,N,S,N,W6,N,N,T: OpenBSD:6.1::OpenBSD 6.1  
16384:64:0:64:M\*,N,N,S,N,W6,N,N,T: OpenBSD:6.1:no-df:OpenBSD 6.1 (scrub no-df)

# ----- DragonFly BSD -----

57344:64:1:60:M\*,N,W0,N,N,T: DragonFly:1.0:A:DragonFly 1.0A  
57344:64:0:64:M\*,N,W0,N,N,S,N,N,T: DragonFly:1.2-1.12::DragonFly 1.2-1.12  
5840:64:1:60:M\*,S,T,N,W4: DragonFly:2.0-2.1::DragonFly 2.0-2.1  
57344:64:0:64:M\*,N,W0,N,N,S,N,N,T: DragonFly:2.2-2.3::DragonFly 2.2-2.3  
57344:64:0:64:M\*,N,W5,N,N,S,N,N,T: DragonFly:2.4-2.7::DragonFly 2.4-2.7

# ----- Solaris -----

S17:64:1:64:N,W3,N,N,T0,N,N,S,M\*: Solaris:8:RFC1323:Solaris 8 RFC1323  
S17:64:1:48:N,N,S,M\*: Solaris:8::Solaris 8  
S17:255:1:44:M\*: Solaris:2.5-2.7::Solaris 2.5 to 7  
  
S6:255:1:44:M\*: Solaris:2.6-2.7::Solaris 2.6 to 7  
S23:255:1:44:M\*: Solaris:2.5:1:Solaris 2.5.1  
S34:64:1:48:M\*,N,N,S: Solaris:2.9::Solaris  
9  
S44:255:1:44:M\*: Solaris:2.7::Solaris 7  
  
4096:64:0:44:M1460: SunOS:4.1::SunOS 4.1.x  
  
S34:64:1:52:M\*,N,W0,N,N,S: Solaris:10:beta:Solaris 10 (beta)  
32850:64:1:64:M\*,N,N,T,N,W1,N,N,S: Solaris:10::Solaris 10 1203

# ----- IRIX -----

49152:64:0:44:M\*: IRIX:6.4::IRIX 6.4  
61440:64:0:44:M\*: IRIX:6.2-6.5::IRIX 6.2-6.5  
49152:64:0:52:M\*,N,W2,N,N,S: IRIX:6.5:RFC1323:IRIX 6.5 (RFC1323)  
49152:64:0:52:M\*,N,W3,N,N,S: IRIX:6.5:RFC1323:IRIX 6.5 (RFC1323)



61440:64:0:48:M\*,N,N,S: IRIX:6.5:12-21:IRIX 6.5.12 - 6.5.21

49152:64:0:48:M\*,N,N,S: IRIX:6.5:15-21:IRIX 6.5.15 - 6.5.21

49152:60:0:64:M\*,N,W2,N,N,T,N,N,S: IRIX:6.5:IP27:IRIX 6.5 IP27

# ----- Tru64 -----

32768:64:1:48:M\*,N,W0: Tru64:4.0::Tru64 4.0 (or OS/2 Warp 4)

32768:64:0:48:M\*,N,W0: Tru64:5.0::Tru64 5.0

8192:64:0:44:M1460: Tru64:5.1:noRFC1323:Tru64 6.1 (no RFC1323) (or QNX 6)

61440:64:0:48:M\*,N,W0: Tru64:5.1a:JP4:Tru64 v5.1a JP4 (or OpenVMS  
7.x on Compaq 5.x stack)

# ----- OpenVMS -----

6144:64:1:60:M\*,N,W0,N,N,T: OpenVMS:7.2::OpenVMS 7.2 (Multinet 4.4 stack)

# ----- MacOS -----

# XXX Need EOL tcp opt support

# S2:255:1:48:M\*,W0,E::MacOS:8.6 classic

# XXX some of these use EOL too

16616:255:1:48:M\*,W0: MacOS:7.3-7.6:OTTCP:MacOS 7.3-8.6 (OTTCP)

16616:255:1:48:M\*,W0: MacOS:8.0-8.6:OTTCP:MacOS 7.3-8.6 (OTTCP)

16616:255:1:48:M\*,N,N,N: MacOS:8.1-8.6:OTTCP:MacOS 8.1-8.6 (OTTCP)

32768:255:1:48:M\*,W0,N: MacOS:9.0-9.2::MacOS 9.0-9.2

65535:255:1:48:M\*,N,N,N,N: MacOS:9.1::MacOS 9.1 (OT 2.7.4)

# ----- Windows -----

# Windows TCP/IP stack is a mess. For most recent XP, 2000 and

# even 98, the patchlevel, not the actual OS version, is more

# relevant to the signature. They share the same code, so it would

# seem. Luckily for us, almost all Windows 9x boxes have an

# awkward MSS of 536, which I use to tell one from another

# in most difficult cases.

8192:32:1:44:M\*: Windows:3.11::Windows

3.11 (Tucows)

S44:64:1:64:M\*,N,W0,N,N,T0,N,N,S: Windows:95::Windows 95

8192:128:1:64:M\*,N,W0,N,N,T0,N,N,S: Windows:95:b:Windows 95b

# There were so many tweaking tools and so many stack versions for

# Windows 98 it is no longer possible to tell them from each other

# without some very serious research. Until then, there's an insane  
# number of signatures, for your amusement:

S44:32:1:48:M\*,N,N,S: Windows:98:lowTTL:Windows 98 (low TTL)  
8192:32:1:48:M\*,N,N,S: Windows:98:lowTTL:Windows 98 (low TTL)  
%8192:64:1:48:M536,N,N,S: Windows:98::Windows 98  
%8192:128:1:48:M536,N,N,S: Windows:98::Windows 98  
S4:64:1:48:M\*,N,N,S: Windows:98::Windows 98  
S6:64:1:48:M\*,N,N,S: Windows:98::Windows 98  
S12:64:1:48:M\*,N,N,S: Windows:98::Windows 98  
T30:64:1:64:M1460,N,W0,N,N,T0,N,N,S: Windows:98::Windows 98  
32767:64:1:48:M\*,N,N,S: Windows:98::Windows 98  
37300:64:1:48:M\*,N,N,S: Windows:98::Windows 98  
46080:64:1:52:M\*,N,W3,N,N,S: Windows:98:RFC1323:Windows  
98 (RFC1323)  
65535:64:1:44:M\*: Windows:98:noSack:Windows 98 (no sack)  
S16:128:1:48:M\*,N,N,S: Windows:98::Windows 98  
S16:128:1:64:M\*,N,W0,N,N,T0,N,N,S: Windows:98::Windows 98  
S26:128:1:48:M\*,N,N,S: Windows:98::Windows 98  
T30:128:1:48:M\*,N,N,S: Windows:98::Windows 98  
32767:128:1:52:M\*,N,W0,N,N,S: Windows:98::Windows 98  
60352:128:1:48:M\*,N,N,S: Windows:98::Windows 98  
60352:128:1:64:M\*,N,W2,N,N,T0,N,N,S: Windows:98::Windows 98

# What's with 1414 on NT?

T31:128:1:44:M1414: Windows:NT:4.0:Windows NT 4.0 SP6a  
64512:128:1:44:M1414: Windows:NT:4.0:Windows NT 4.0 SP6a  
8192:128:1:44:M\*: Windows:NT:4.0:Windows NT 4.0 (older)

# Windows XP and 2000. Most of the signatures that were  
# either dubious or non-specific (no service pack data)  
# were deleted and replaced with generics at the end.

65535:128:1:48:M\*,N,N,S: Windows:2000:SP4:Windows 2000 SP4, XP SP1  
65535:128:1:48:M\*,N,N,S: Windows:XP:SP1:Windows 2000 SP4, XP SP1  
%8192:128:1:48:M\*,N,N,S: Windows:2000:SP2+:Windows  
2000 SP2, XP SP1 (seldom 98 4.10.2222)  
%8192:128:1:48:M\*,N,N,S: Windows:XP:SP1:Windows 2000 SP2, XP SP1 (seldom 98 4.10.2222)  
S20:128:1:48:M\*,N,N,S: Windows:2000::Windows 2000/XP SP3  
S20:128:1:48:M\*,N,N,S: Windows:XP:SP3:Windows 2000/XP SP3  
S45:128:1:48:M\*,N,N,S: Windows:2000:SP4:Windows 2000 SP4, XP SP 1  
S45:128:1:48:M\*,N,N,S: Windows:XP:SP1:Windows 2000 SP4, XP SP 1  
40320:128:1:48:M\*,N,N,S: Windows:2000:SP4:Windows 2000 SP4  
  
S6:128:1:48:M\*,N,N,S: Windows:2000:SP2:Windows XP, 2000 SP2+  
S6:128:1:48:M\*,N,N,S: Windows:XP::Windows XP, 2000 SP2+  
S12:128:1:48:M\*,N,N,S: Windows:XP:SP1:Windows XP SP1  
S44:128:1:48:M\*,N,N,S: Windows:2000:SP3:Windows Pro SP1, 2000 SP3

S44:128:1:48:M\*,N,N,S: Windows:XP:SP1:Windows Pro SP1, 2000 SP3  
64512:128:1:48:M\*,N,N,S: Windows:2000:SP3:Windows SP1, 2000 SP3  
64512:128:1:48:M\*,N,N,S: Windows:XP:SP1:Windows SP1, 2000 SP3  
32767:128:1:48:M\*,N,N,S: Windows:2000:SP4:Windows SP1, 2000 SP4  
32767:128:1:48:M\*,N,N,S: Windows:XP:SP1:Windows SP1, 2000  
SP4

8192:128:1:52:M\*,N,W2,N,N,S: Windows:Vista::Windows Vista/7

# Odds, ends, mods:

S52:128:1:48:M1260,N,N,S: Windows:2000:cisco:Windows XP/2000 via Cisco  
S52:128:1:48:M1260,N,N,S: Windows:XP:cisco:Windows XP/2000 via Cisco  
65520:128:1:48:M\*,N,N,S: Windows:XP::Windows XP bare-bone  
16384:128:1:52:M536,N,W0,N,N,S: Windows:2000:ZoneAlarm:Windows 2000 w/ZoneAlarm?  
2048:255:0:40:.: Windows:.NET::Windows .NET Enterprise Server

44620:64:0:48:M\*,N,N,S: Windows:ME::Windows ME no SP (?)  
S6:255:1:48:M536,N,N,S: Windows:95:winsock2:Windows 95 winsock 2  
32768:32:1:52:M1460,N,W0,N,N,S: Windows:2003:AS:Windows 2003 AS

# No need to be more specific, it passes:

# \*:128:1:48:M\*,N,N,S:U:-Windows:XP/2000 while downloading (leak!) XXX quirk

# there is an equiv similar generic sig w/o the quirk

# ----- HP/UX -----

32768:64:1:44:M\*: HP-UX:B.10.20::HP-UX B.10.20  
32768:64:0:48:M\*,W0,N: HP-UX:11.0::HP-UX 11.0  
32768:64:1:48:M\*,W0,N: HP-UX:11.10::HP-UX 11.0  
or 11.11  
32768:64:1:48:M\*,W0,N: HP-UX:11.11::HP-UX 11.0 or 11.11

# Whoa. Hardcore WSS.

0:64:0:48:M\*,W0,N: HP-UX:B.11.00:A:HP-UX B.11.00 A (RFC1323)

# ----- RiscOS -----

# We don't yet support the ?12 TCP option

#16384:64:1:68:M1460,N,W0,N,N,T,N,N,?12: RISCOS:3.70-4.36::RISC OS 3.70-4.36  
12288:32:0:44:M536: RISC OS:3.70:4.10:RISC OS 3.70 inet 4.10

# XXX quirk

# 4096:64:1:56:M1460,N,N,T:T: RISC OS:3.70:freenet:RISC OS 3.70 freenet 2.00

```

----- BSD/OS -----

Once again, power of two WSS is also shared by MacOS X with DF set
8192:64:1:60:M1460,N,W0,N,N,T: BSD/OS:3.1::BSD/OS 3.1-4.3 (or MacOS X 10.2 w/DF)
8192:64:1:60:M1460,N,W0,N,N,T: BSD/OS:4.0-4.3::BSD/OS 3.1-4.3 (or MacOS X 10.2)

----- NewtonOS -----

4096:64:0:44:M1420: NewtonOS:2.1::NewtonOS 2.1

----- NeXTSTEP -----

S4:64:0:44:M1024: NeXTSTEP:3.3::NeXTSTEP 3.3
S8:64:0:44:M512: NeXTSTEP:3.3::NeXTSTEP 3.3

BeOS -----

1024:255:0:48:M*,N,W0: BeOS:5.0-5.1::BeOS 5.0-5.1
12288:255:0:44:M1402: BeOS:5.0::BeOS 5.0.x

----- OS/400 -----

8192:64:1:60:M1440,N,W0,N,N,T: OS/400:VR4::OS/400 VR4/R5
8192:64:1:60:M1440,N,W0,N,N,T: OS/400:VR5::OS/400 VR4/R5
4096:64:1:60:M1440,N,W0,N,N,T: OS/400:V4R5:CF67032:OS/400 V4R5 + CF67032

XXX quirk
28672:64:0:44:M1460:A:OS/390:?

----- ULTRIX -----

16384:64:0:40:.: ULTRIX:4.5::ULTRIX 4.5

----- QNX -----

S16:64:0:44:M512: QNX::QNX demodisk

----- Novell -----

16384:128:1:44:M1460: Novell:NetWare:5.0:Novel Netware 5.0
6144:128:1:44:M1460: Novell:IntranetWare:4.11:Novell IntranetWare 4.11
6144:128:1:44:M1368: Novell:BorderManager::Novell BorderManager ?

6144:128:1:52:M*,W0,N,S,N,N: Novell:Netware:6:Novell Netware 6 SP3

```

```

----- SCO -----
S3:64:1:60:M1460,N,W0,N,N,T: SCO:UnixWare:7.1:SCO
 UnixWare 7.1
S17:64:1:60:M1380,N,W0,N,N,T: SCO:UnixWare:7.1:SCO UnixWare 7.1.3 MP3
S23:64:1:44:M1380: SCO:OpenServer:5.0:SCO OpenServer 5.0

----- DOS -----

2048:255:0:44:M536: DOS:WATTCP:1.05:DOS Arachne via WATTCP/1.05
T2:255:0:44:M984: DOS:WATTCP:1.05Arachne:Arachne via WATTCP/1.05 (eepr)

----- OS/2 -----

S56:64:0:44:M512: OS/2:4::OS/2 4
28672:64:0:44:M1460: OS/2:4::OS/2 Warp 4.0

----- TOPS-20 -----

Another hardcore MSS, one of the ACK leakers hunted down.
XXX QUIRK 0:64:0:44:M1460:A:TOPS-20:version 7
0:64:0:44:M1460: TOPS-20:7::TOPS-20 version 7

----- FreeMiNT -----

S44:255:0:44:M536: FreeMiNT:1:16A:FreeMiNT 1 patch 16A (Atari)

----- AMIGA -----

XXX TCP option 12
S32:64:1:56:M*,N,N,S,N,N,?12::AMIGA:3.9 BB2 with Miami stack

----- Plan9 -----

65535:255:0:48:M1460,W0,N: Plan9:4::Plan9 edition
4

----- AMIGAOS -----

16384:64:1:48:M1560,N,N,S: AMIGAOS:3.9::AMIGAOS 3.9 BB2 MiamiDX

#####
Appliance / embedded / other signatures
#####

----- Firewalls / routers -----

S12:64:1:44:M1460: @Checkpoint::Checkpoint (unknown 1)
S12:64:1:48:N,N,S,M1460: @Checkpoint::Checkpoint (unknown 2)

```

4096:32:0:44:M1460: ExtremeWare:4.x::ExtremeWare 4.x

# XXX TCP option 12

# S32:64:0:68:M512,N,W0,N,N,T,N,N,?12:::Nokia:IPSO w/Checkpoint NG FP3

# S16:64:0:68:M1024,N,W0,N,N,T,N,N,?12:::Nokia:IPSO 3.7 build 026

S4:64:1:60:W0,N,S,T,M1460: FortiNet:FortiGate:50:FortiNet FortiGate 50

8192:64:1:44:M1460: Eagle:::Eagle Secure Gateway

S52:128:1:48:M1260,N,N,N,N: LinkSys:WRV54G::LinkSys WRV54G VPN router

# ----- Switches and other stuff -----

4128:255:0:44:M\*: Cisco::Cisco Catalyst 3500, 7500 etc

S8:255:0:44:M\*: Cisco:12008::Cisco 12008

60352:128:1:64:M1460,N,W2,N,N,T,N,N,S: Alteon:ACEswitch::Alteon  
ACEswitch

64512:128:1:44:M1370: Nortel:Contivity Client::Nortel Conectivity Client

# ----- Caches and whatnots -----

S4:64:1:52:M1460,N,N,S,N,W0: AOL:web cache::AOL web cache

32850:64:1:64:N,W1,N,N,T,N,N,S,M\*: NetApp:5.x::NetApp Data OnTap 5.x

16384:64:1:64:M1460,N,N,S,N,W0,N: NetApp:5.3:1:NetApp 5.3.1

65535:64:0:64:M1460,N,N,S,N,W\*,N,N,T: NetApp:5.3-5.5::NetApp 5.3-5.5

65535:64:0:60:M1460,N,W0,N,N,T: NetApp:CacheFlow::NetApp CacheFlow

8192:64:1:64:M1460,N,N,S,N,W0,N,N,T: NetApp:5.2:1:NetApp NetCache 5.2.1

20480:64:1:64:M1460,N,N,S,N,W0,N,N,T: NetApp:4.1::NetApp NetCache4.1

65535:64:0:60:M1460,N,W0,N,N,T: CacheFlow:4.1::CacheFlow CacheOS 4.1

8192:64:0:60:M1380,N,N,N,N,N,N,T: CacheFlow:1.1::CacheFlow CacheOS 1.1

S4:64:0:48:M1460,N,N,S: Cisco:Content Engine::Cisco Content Engine

27085:128:0:40:: Dell:PowerApp cache::Dell PowerApp (Linux-based)

65535:255:1:48:N,W1,M1460: Inktomi:crawler::Inktomi crawler

S1:255:1:60:M1460,S,T,N,W0: LookSmart:ZyBorg::LookSmart  
ZyBorg

16384:255:0:40:: Proxyblocker::Proxyblocker (what's this?)

65535:255:0:48:M\*,N,N,S: Redline::Redline T|X 2200

32696:128:0:40:M1460: Spirent:Avalanche::Spirent Web Avalanche HTTP benchmarking engine

# ----- Embedded systems -----

S9:255:0:44:M536: PalmOS:Tungsten:C:PalmOS Tungsten C

S5:255:0:44:M536: PalmOS:3::PalmOS 3/4

S5:255:0:44:M536: PalmOS:4::PalmOS 3/4

S4:255:0:44:M536: PalmOS:3:5:PalmOS 3.5

2948:255:0:44:M536: PalmOS:3:5:PalmOS 3.5.3 (Handera)

S29:255:0:44:M536: PalmOS:5::PalmOS 5.0

16384:255:0:44:M1398: PalmOS:5.2:Clie:PalmOS 5.2 (Clie)

S14:255:0:44:M1350: PalmOS:5.2:Treo:PalmOS 5.2.1 (Treo)

S23:64:1:64:N,W1,N,N,T,N,N,S,M1460: SymbianOS:7::SymbianOS 7

8192:255:0:44:M1460: SymbianOS:6048::Symbian OS 6048 (Nokia 7650?)

8192:255:0:44:M536: SymbianOS:9210::Symbian OS (Nokia 9210?)

S22:64:1:56:M1460,T,S: SymbianOS:P800::Symbian OS ? (SE P800?)

S36:64:1:56:M1360,T,S: SymbianOS:6600::Symbian

OS 60xx (Nokia 6600?)

# Perhaps S4?

5840:64:1:60:M1452,S,T,N,W1: Zaurus:3.10::Zaurus 3.10

32768:128:1:64:M1460,N,W0,N,N,T0,N,N,S: PocketPC:2002::PocketPC 2002

S1:255:0:44:M346: Contiki:1.1:rc0:Contiki 1.1-rc0

4096:128:0:44:M1460: Sega:Dreamcast:3.0:Sega Dreamcast Dreamkey 3.0

T5:64:0:44:M536: Sega:Dreamcast:HKT-3020:Sega Dreamcast HKT-3020 (browser disc 51027)

S22:64:1:44:M1460: Sony:PS2::Sony Playstation 2 (SOCOM?)

S12:64:0:44:M1452: AXIS:5600:v5.64:AXIS Printer Server 5600 v5.64

3100:32:1:44:M1460: Windows:CE:2.0:Windows CE 2.0

#####

# Fancy signatures #

#####

1024:64:0:40:: \*NMAP:syn scan:1:NMAP syn scan (1)

2048:64:0:40:: \*NMAP:syn scan:2:NMAP syn scan (2)

3072:64:0:40:: \*NMAP:syn scan:3:NMAP syn scan (3)

4096:64:0:40:: \*NMAP:syn scan:4:NMAP syn scan (4)

# Requires quirks support

```
1024:64:0:40::A:*NMAP:TCP sweep probe (1)
2048:64:0:40::A:*NMAP:TCP sweep probe (2)
3072:64:0:40::A:*NMAP:TCP sweep
probe (3)
4096:64:0:40::A:*NMAP:TCP sweep probe (4)
```

```
1024:64:0:60:W10,N,M265,T: *NMAP:OS:1:NMAP OS detection probe (1)
2048:64:0:60:W10,N,M265,T: *NMAP:OS:2:NMAP OS detection probe (2)
3072:64:0:60:W10,N,M265,T: *NMAP:OS:3:NMAP OS detection probe (3)
4096:64:0:60:W10,N,M265,T: *NMAP:OS:4:NMAP OS detection probe (4)
```

```
32767:64:0:40:: *NAST:::NASTsyn scan
```

```
Requires quirks support
12345:255:0:40::A:-p0f:sendsyn utility
```

```
#####
```

```
Generic signatures - just in case
```

```
#####
```

```
#:64:1:60:M*,N,W*,N,N,T: @FreeBSD:4.0-4.9::FreeBSD 4.x/5.x
```

```
#:64:1:60:M*,N,W*,N,N,T: @FreeBSD:5.0-5.1::FreeBSD 4.x/5.x
```

```
:128:1:52:M,N,W0,N,N,S: @Windows:XP:RFC1323:Windows XP/2000 (RFC1323 no tstamp)
```

```
:128:1:52:M,N,W0,N,N,S: @Windows:2000:RFC1323:Windows XP/2000 (RFC1323 no tstamp)
```

```
:128:1:52:M,N,W*,N,N,S: @Windows:XP:RFC1323:Windows XP/2000 (RFC1323 no tstamp)
```

```
:128:1:52:M,N,W*,N,N,S: @Windows:2000:RFC1323:Windows XP/2000 (RFC1323
```

```
no tstamp)
```

```
:128:1:64:M,N,W0,N,N,T0,N,N,S: @Windows:XP:RFC1323:Windows XP/2000 (RFC1323)
```

```
:128:1:64:M,N,W0,N,N,T0,N,N,S: @Windows:2000:RFC1323:Windows XP/2000 (RFC1323)
```

```
:128:1:64:M,N,W*,N,N,T0,N,N,S: @Windows:XP:RFC1323:Windows XP (RFC1323, w+)
```

```
*:128:1:48:M536,N,N,S: @Windows:98::Windows 98
```

```
:128:1:48:M,N,N,S: @Windows:XP::Windows XP/2000
```

```
:128:1:48:M,N,N,S: @Windows:2000::Windows XP/2000
```

```
Found in path(s):
```

```
* /opt/cola/permits/1409587079_1683835556.5462122/0/iptables-1-1-8-3-1-x86-64-pkg-tar-
xz/usr/share/xtables/pf.os
```

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```
* /opt/cola/permits/1409587079_1683835556.5462122/0/iptables-1-1-8-3-1-x86-64-pkg-tar-
xz/usr/share/man/man8/xtables-nft-8-gz/xtables-nft.8
* /opt/cola/permits/1409587079_1683835556.5462122/0/iptables-1-1-8-3-1-x86-64-pkg-tar-
xz/usr/share/man/man8/xtables-translate-8-gz/xtables-translate.8
```

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Found in path(s):

```
* /opt/cola/permits/1409587079_1683835556.5462122/0/iptables-1-1-8-3-1-x86-64-pkg-tar-
xz/usr/share/man/man3/ipq-set-verdict-3-gz/ipq_set_verdict.3
* /opt/cola/permits/1409587079_1683835556.5462122/0/iptables-1-1-8-3-1-x86-64-pkg-tar-
xz/usr/share/man/man3/ipq-set-mode-3-gz/ipq_set_mode.3
*
/opt/cola/permits/1409587079_1683835556.5462122/0/iptables-1-1-8-3-1-x86-64-pkg-tar-
xz/usr/share/man/man3/ipq-message-type-3-gz/ipq_message_type.3
* /opt/cola/permits/1409587079_1683835556.5462122/0/iptables-1-1-8-3-1-x86-64-pkg-tar-
xz/usr/share/man/man3/ipq-errstr-3-gz/ipq_errstr.3
* /opt/cola/permits/1409587079_1683835556.5462122/0/iptables-1-1-8-3-1-x86-64-pkg-tar-
xz/usr/share/man/man3/libipq-3-gz/libipq.3
* /opt/cola/permits/1409587079_1683835556.5462122/0/iptables-1-1-8-3-1-x86-64-pkg-tar-
xz/usr/share/man/man3/ipq-read-3-gz/ipq_read.3
* /opt/cola/permits/1409587079_1683835556.5462122/0/iptables-1-1-8-3-1-x86-64-pkg-tar-
xz/usr/share/man/man3/ipq-create-handle-3-gz/ipq_create_handle.3
```

## 1.235 cglib 3.3.0

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## 1.236 apr-util 1.6.3

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misc/unix/getopt.c,  
file\_io/unix/mktemp.c, strings/apr\_strings.c:

```
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```

From network\_io/unix/inet\_ntop.c, network\_io/unix/inet\_pton.c:

```
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From dso/aix/dso.c:

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From strings/apr\_strnatcmp.c, include/apr\_strings.h:

strnatcmp.c -- Perform 'natural order' comparisons of strings in C.  
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quirc -- QR-code recognition library

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## 1.239 kmod 30

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# 1.242 coreutils 8.30-3

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# 1.243 systemd 231

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procfs provides functions to retrieve system, kernel and process metrics from the pseudo-filesystem proc.

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LuaFileSystem - File System Library for Lua

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Description

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LuaFileSystem is a Lua library developed to complement the set of functions related to file systems offered by the standard Lua distribution.

LuaFileSystem offers a portable way to access the underlying directory structure and file attributes.

LuaFileSystem is free software and uses the same license as Lua 5.1

## LuaRocks Installation

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luarocks install luafilesystem

## Documentation

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Please check the documentation at [doc/us/](http://doc.us/) for more information.

## History

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### Version 1.5.0 [20/Oct/2009]

- \* added explicit next and close methods to second return value of `lfs.dir` (the directory object), for explicit iteration or explicit closing.
- \* added directory locking via `lfs.lock_dir` function (see the manual).

### Version 1.4.2 [03/Feb/2009]

- \* fixed bug [#13198] `lfs.attributes(filename, 'size')` overflow on files > 2 Gb again (bug report and patch by KUBO Takehiro).
- \* fixed bug [#39794] Compile error on Solaris 10 (bug report and patch by Aaron B).
- \* fixed compilation problems with Borland C.

### Version 1.4.1 [07/May/2008]

- \* documentation review
- \* fixed Windows compilation issues
- \* fixed bug in the Windows tests (patch by Shmuel Zeigerman)
- \* fixed bug [#2185] `lfs.attributes(filename, 'size')` overflow on files > 2 Gb

### Version 1.4.0 [13/Feb/2008]

- \* added function `lfs.setmode` (works only in Windows systems).
- \* `lfs.attributes` raises an error if attribute does not exist

### Version 1.3.0 [26/Oct/2007]

- \* added function `lfs.symlinkattributes` (works only in non Windows systems).

### Version 1.2.1 [08/May/2007]

- \* compatible only with Lua 5.1 (Lua 5.0 support was dropped)

### Version 1.2 [15/Mar/2006]

- \* added optional argument to `lfs.attributes`

\* added  
function lfs.rmdir  
\* bug correction on lfs.dir

Version 1.1 [30/May/2005]

\* added function lfs.touch.

Version 1.0 [21/Jan/2005]

Version 1.0 Beta [10/Nov/2004]

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/\*  
\* wuuid.c

\*  
\* Emulation of libuuid.so API functions based on the native Windows  
\* API. Only those functions actually used by uuid are provided.  
\* Extending this work to a complete emulation of libuuid would be  
\* possible, but of unknown value.  
\*  
\* Implemented by Ross Berteig <Ross@cheshireeng.com>  
\* Released 2007-09-24.  
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--- This dist file is part of LuaDist project  
-- status:

name="uuid"

version="5.1.0.20101118"

desc = "A library for UUID generation"

author = "Luiz Henrique de Figueiredo"

url = "http://www.tecgraf.puc-rio.br/~lhf/ftp/lua/#uuid"

license = "Public domain"

maintainer = "Peter Kapec"

dependencies = {  
 "lua ~> 5.1",  
 Linux = {  
 "uuid-dev >- 2.16"  
 }  
}

Found in path(s):

\* /opt/cola/permits/1547567072\_1675150749.62692/0/tp-uuid-1-051b6bb2c564-zip/dist.info  
No license file was found, but licenses were detected in source scan.

This is a uuid library for Lua 5.1. It generates Universally Unique Identifiers using libuuid, which is part of the e2fsprogs package and is available at <http://e2fsprogs.sourceforge.net/>  
If you're running Linux, libuuid is probably already installed.

To try the library, just edit Makefile to reflect your installation of Lua and possibly of libuuid. Then run make. This will build the library and run a simple test. For detailed installation instructions, see <http://www.tecgraf.puc-rio.br/~lhf/ftp/lua/install.html>

There is no manual but the library is simple and intuitive; see the summary below. Read also test.lua, which shows the library in action.

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Please send comments, suggestions, and bug reports to lhf@tecgraf.puc-rio.br .

-----  
uuid library:  
isvalid(s) new([s]) time(s) version

-----  
Found

in path(s):

\* /opt/cola/permits/1547567072\_1675150749.62692/0/tp-luuid-1-051b6bb2c564-zip/README

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/\*

\* luuid.c

\* uuid interface for Lua 5.1

\* Luiz Henrique de Figueiredo <lhf@tecgraf.puc-rio.br>

\* 18 Nov 2010 19:16:20

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/\*

\* wuuid.h

\*

\* Emulation of libuuid.so API functions based on the native Windows

\* API. Only those functions actually used by luuid are provided.

\* Extending this work to a complete emulation of libuuid would be

\* possible, but of unknown value.

\*

\* Implemented by Ross Berteig <Ross@cheshireeng.com>

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\* /opt/cola/permits/1547567072\_1675150749.62692/0/tp-luuid-1-051b6bb2c564-zip/cmake/luacmake

\* /opt/cola/permits/1547567072\_1675150749.62692/0/tp-luuid-1-051b6bb2c564-zip/cmake/dist.cmake

# 1.248 host-ninja 1.10.0

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# 1.249 syslinux 6.03

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\* This file is part of the lwIP TCP/IP stack.  
\*  
\* Author: Adam Dunkels <adam@sics.se>  
\*  
\*/

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# 1.255 systemd 231

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/**
 * A Base64 encoder/decoder.
 *
 * <p>
 * This class is used to encode and decode data in Base64 format as described in RFC 1521.
 *
 * <p>
 * Project home page: www.
 * source-code.biz/base64coder/java

 * Author: Christian d'Heureuse, Inventec Informatik AG, Zurich, Switzerland

 * Multi-licensed: EPL / LGPL / GPL / AL / BSD.
 */
```

Found in path(s):

\* /opt/cola/permits/1584157893\_1677999786.1262538/0/snakeyaml-2-0-sources-jar/org/yaml/snakeyaml/external/biz/base64Coder/Base64Coder.java

## 1.258 apscheduler 3.10.1

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## 1.259 protobuf 3.6.1.3-2ubuntu5.2

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Gregory Kick <gak@google.com>

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\* Small patch to handle trailing slashes in --proto\_path flag.

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\* Small patch to fix Python CallMethod().

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\* Small optimizations to Python serialization.

Leandro Lucarella <llucax@gmail.com>

\* VI syntax highlighting tweaks.

\* Fix compiler to not make output executable.

Dilip Joseph <dilip.antony.joseph@gmail.com>

\* Heuristic detection of sub-messages when printing unknown fields in text format.

Brian Atkinson <nairb774@gmail.com>

\* Added @Override annotation to generated Java code where appropriate.

Vincent Choiniere <Choiniere.Vincent@hydro.qc.ca>

\* Tru64 support.

Monty Taylor <monty.taylor@gmail.com>

\* Solaris 10 + Sun Studio fixes.

Alek Storm <alek.storm@gmail.com>

\* Slicing support for repeated scalar fields for the Python API.

Oleg Smolsky <oleg.smolsky@gmail.com>

\* MS Visual Studio error format option.

\* Detect unordered\_map in stl\_hash.m4.

Brian Olson <brianolson@google.com>

\* gzip/zlib I/O support.

Michael Poole <mdpoole@troilus.org>

- \* Fixed warnings about generated constructors not explicitly initializing all fields (only present with certain compiler settings).
- \* Added generation of field number constants.

Wink Saville <wink@google.com>

- \* Fixed initialization ordering problem in logging code.

Will Pierce <willp@nuclei.com>

- \* Small patch improving performance of in Python serialization.

Alexandre Vassalotti <alexandre@peadrop.com>

- \* Emacs mode for Protocol Buffers (editors/protobuf-mode.el).

Scott Stafford <scott.stafford@gmail.com>

- \* Added Swap(), SwapElements(), and RemoveLast() to Reflection interface.

Alexander Melnikov <alm@sibmail.ru>

- \* HPUX support.

Oliver Jowett <oliver.jowett@gmail.com>

- \* Detect whether zlib is new enough in configure script.
- \* Fixes for Solaris 10 32/64-bit confusion.

Evan Jones <evanj@mit.edu>

- \* Optimize Java serialization code when writing a small message to a stream.
- \* Optimize Java serialization of strings so that UTF-8 encoding happens only once per string per serialization call.
- \* Clean up some Java warnings.
- \* Fix bug with permanent callbacks that delete themselves when run.

Michael Kucharski <m.kucharski@gmail.com>

- \* Added CodedInputStream.getTotalBytesRead().

Kacper Kowalik <xarthisius.kk@gmail.com>

- \* Fixed m4/acx\_pthread.m4 problem for some Linux distributions.

William Orr <will@worrbase.com>

- \* Fixed detection of sched\_yield on Solaris.
- \* Added atomicops for Solaris

Andrew Paprocki <andrew@ishiboo.com>

- \* Fixed minor IBM x1C compiler build issues
- \* Added atomicops for AIX (POWER)

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## 1.260 springdoc-openapi-ui 1.5.9

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\* /opt/cola/permits/1612572985\_1679608836.6826565/0/springdoc-openapi-ui-1-5-9-sources-jar/org/springdoc/webmvc/ui/SwaggerIndexPageTransformer.java

```
* /opt/cola/permits/1612572985_1679608836.6826565/0/springdoc-openapi-ui-1-5-9-sources-
jar/org/springdoc/webmvc/ui/SwaggerIndexTransformer.java
*
/opt/cola/permits/1612572985_1679608836.6826565/0/springdoc-openapi-ui-1-5-9-sources-
jar/org/springdoc/webmvc/ui/SwaggerWebMvcConfigurer.java
* /opt/cola/permits/1612572985_1679608836.6826565/0/springdoc-openapi-ui-1-5-9-sources-
jar/org/springdoc/webmvc/ui/SwaggerConfig.java
* /opt/cola/permits/1612572985_1679608836.6826565/0/springdoc-openapi-ui-1-5-9-sources-
jar/org/springdoc/webmvc/ui/SwaggerUiHome.java
* /opt/cola/permits/1612572985_1679608836.6826565/0/springdoc-openapi-ui-1-5-9-sources-
jar/org/springdoc/webmvc/ui/SwaggerWelcomeWebMvc.java
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## 1.261 swagger-integration 2.1.9

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## 1.262 springdoc-openapi-common 1.5.9

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jar/org/springdoc/core/customizers/ActuatorOperationCustomizer.java
*
/opt/cola/permits/1612572912_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-
jar/org/springdoc/core/SpringdocBeanFactoryConfigurer.java
* /opt/cola/permits/1612572912_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-
jar/org/springdoc/core/SpringdocActuatorBeanFactoryConfigurer.java
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*
/opt/cola/permits/1612572912_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-
jar/org/springdoc/core/fn/builders/link/Builder.java
* /opt/cola/permits/1612572912_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-
jar/org/springdoc/core/fn/builders/servervariable/Builder.java
* /opt/cola/permits/1612572912_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-
jar/org/springdoc/core/fn/builders/server/Builder.java
* /opt/cola/permits/1612572912_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-
jar/org/springdoc/core/fn/builders/extensionproperty/Builder.java
* /opt/cola/permits/1612572912_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-
jar/org/springdoc/core/fn/builders/securityrequirement/Builder.java
* /opt/cola/permits/1612572912_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-
jar/org/springdoc/core/fn/builders/arraychema/Builder.java
```

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* /opt/cola/permits/1612572912_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-
jar/org/springdoc/core/fn/AbstractSpringdocRouteBuilder.java
*
/opt/cola/permits/1612572912_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-
jar/org/springdoc/core/fn/builders/header/Builder.java
* /opt/cola/permits/1612572912_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-
jar/org/springdoc/core/fn/builders/parameter/Builder.java
* /opt/cola/permits/1612572912_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-
jar/org/springdoc/core/fn/builders/externaldocumentation/Builder.java
* /opt/cola/permits/1612572912_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-
jar/org/springdoc/core/fn/builders/encoding/Builder.java
* /opt/cola/permits/1612572912_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-
jar/org/springdoc/core/fn/builders/discriminatoremapping/Builder.java
* /opt/cola/permits/1612572912_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-
jar/org/springdoc/core/fn/builders/content/Builder.java
* /opt/cola/permits/1612572912_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-
jar/org/springdoc/core/fn/builders/apiresponse/Builder.java
*
/opt/cola/permits/1612572912_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-
jar/org/springdoc/core/fn/builders/schema/Builder.java
* /opt/cola/permits/1612572912_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-
jar/org/springdoc/core/fn/builders/exampleobject/Builder.java
* /opt/cola/permits/1612572912_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-
jar/org/springdoc/core/fn/builders/requestbody/Builder.java
* /opt/cola/permits/1612572912_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-
jar/org/springdoc/core/fn/builders/extension/Builder.java
* /opt/cola/permits/1612572912_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-
jar/org/springdoc/core/fn/builders/operation/Builder.java
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\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/core/converters/models/DefaultPageable.java  
\*  
/opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/core/SecurityService.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/core/Constants.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/api/annotations/ParameterObject.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/core/customizers/ParameterCustomizer.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/core/ParameterInfo.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/core/customizers/OperationCustomizer.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/core/SwaggerUiConfigProperties.java  
\*  
/opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/core/CacheOrGroupedOpenApiCondition.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/core/converters/FileSupportConverter.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/core/converters/models/Pageable.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/core/MultipleOpenApiSupportCondition.java  
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\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/ui/SpringDocUIException.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/core/annotations/RouterOperations.java  
\*  
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\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/api/AbstractOpenApiResource.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/core/converters/models/MonetaryAmount.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/core/GenericParameterService.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/core/converters/ResponseSupportConverter.java



\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/core/converters/models/PageableAsQueryParam.java  
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/opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/core/customizers/OpenApiCustomiser.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/core/converters/AdditionalModelsConverter.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/core/GroupedOpenApi.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/core/fn/RouterOperation.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/core/ReturnTypeParser.java  
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\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/core/SwaggerUiOAuthProperties.java  
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/opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/core/annotations/RouterOperation.java  
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\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/core/OperationService.java  
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/opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/core/converters/ModelConverterRegistrar.java  
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\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/core/PropertyResolverUtils.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/core/SpringDocPropertiesUtils.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/core/fn/AbstractRouterFunctionVisitor.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/core/ActuatorProvider.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/core/RequestBodyInfo.java  
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/opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/core/ControllerAdviceInfo.java  
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\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/core/MethodParameterPojoExtractor.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/core/converters/RequestTypeToIgnoreConverter.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/core/converters/SchemaPropertyDeprecatingConverter.java  
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\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/core/SpringDocAnnotationsUtils.java  
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\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/core/SpringDocConfiguration.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/core/RequestBodyService.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/core/customizers/OpenApiBuilderCustomizer.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/core/MultipleOpenApiGroupsCondition.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/core/DelegatingMethodParameter.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/ui/AbstractSwaggerIndexTransformer.java  
\*  
/opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/ui/AbstractSwaggerWelcome.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/core/SwaggerUiConfigParameters.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/core/converters/ConverterUtils.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/core/customizers/PropertyCustomizer.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/core/converters/PolymorphicModelConverter.java  
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* /opt/cola/permits/1612572912_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-
jar/org/springdoc/api/ErrorMessage.java
```

## 1.263 swagger-models 2.1.9

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* /opt/cola/permits/1612572941_1681848040.6274445/0/swagger-models-2-1-9-sources-1-
jar/io/swagger/v3/oas/models/media/XML.java
* /opt/cola/permits/1612572941_1681848040.6274445/0/swagger-models-2-1-9-sources-1-
jar/io/swagger/v3/oas/models/parameters/Parameter.java
* /opt/cola/permits/1612572941_1681848040.6274445/0/swagger-models-2-1-9-sources-1-
jar/io/swagger/v3/oas/models/media/ArraySchema.java
*
/opt/cola/permits/1612572941_1681848040.6274445/0/swagger-models-2-1-9-sources-1-
jar/io/swagger/v3/oas/models/media/DateSchema.java
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\* /opt/cola/permits/1612572941\_1681848040.6274445/0/swagger-models-2-1-9-sources-1-jar/io/swagger/v3/oas/models/examples/Example.java  
\* /opt/cola/permits/1612572941\_1681848040.6274445/0/swagger-models-2-1-9-sources-1-jar/io/swagger/v3/oas/models/security/OAuthFlows.java  
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\* /opt/cola/permits/1612572941\_1681848040.6274445/0/swagger-models-2-1-9-sources-1-jar/io/swagger/v3/oas/models/media/IntegerSchema.java  
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\* /opt/cola/permits/1612572941\_1681848040.6274445/0/swagger-models-2-1-9-sources-1-jar/io/swagger/v3/oas/models/media/Schema.java  
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\* /opt/cola/permits/1612572941\_1681848040.6274445/0/swagger-models-2-1-9-sources-1-jar/io/swagger/v3/oas/models/media/MapSchema.java  
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/opt/cola/permits/1612572941\_1681848040.6274445/0/swagger-models-2-1-9-sources-1-jar/io/swagger/v3/oas/models/security/SecurityRequirement.java  
\* /opt/cola/permits/1612572941\_1681848040.6274445/0/swagger-models-2-1-9-sources-1-jar/io/swagger/v3/oas/models/media/ObjectSchema.java  
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\* /opt/cola/permits/1612572941\_1681848040.6274445/0/swagger-models-2-1-9-sources-1-

jar/io/swagger/v3/oas/models/PathItem.java  
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jar/io/swagger/v3/oas/models/info/License.java  
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jar/io/swagger/v3/oas/models/tags/Tag.java  
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jar/io/swagger/v3/oas/models/links/LinkParameter.java  
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jar/io/swagger/v3/oas/models/servers/Server.java  
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jar/io/swagger/v3/oas/models/ExternalDocumentation.java  
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/opt/cola/permits/1612572941\_1681848040.6274445/0/swagger-models-2-1-9-sources-1-  
jar/io/swagger/v3/oas/models/security/Scopes.java  
\* /opt/cola/permits/1612572941\_1681848040.6274445/0/swagger-models-2-1-9-sources-1-  
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\* /opt/cola/permits/1612572941\_1681848040.6274445/0/swagger-models-2-1-9-sources-1-  
jar/io/swagger/v3/oas/models/media/ComposedSchema.java  
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jar/io/swagger/v3/oas/models/links/Link.java  
\* /opt/cola/permits/1612572941\_1681848040.6274445/0/swagger-models-2-1-9-sources-1-  
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* /opt/cola/permits/1612572941_1681848040.6274445/0/swagger-models-2-1-9-sources-1-
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* /opt/cola/permits/1612572941_1681848040.6274445/0/swagger-models-2-1-9-sources-1-
jar/io/swagger/v3/oas/models/media/Encoding.java
* /opt/cola/permits/1612572941_1681848040.6274445/0/swagger-models-2-1-9-sources-1-
jar/io/swagger/v3/oas/models/media/StringSchema.java
* /opt/cola/permits/1612572941_1681848040.6274445/0/swagger-models-2-1-9-sources-1-
jar/io/swagger/v3/oas/models/parameters/RequestBody.java
```

## 1.264 springdoc-openapi-webmvc-core 1.5.9

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* /opt/cola/permits/1612572860_1679608931.4898906/0/springdoc-openapi-webmvc-core-1-5-9-sources-
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jar/org/springdoc/webmvc/api/MultipleOpenApiWebMvcResource.java
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*
/opt/cola/permits/1612572860_1679608931.4898906/0/springdoc-openapi-webmvc-core-1-5-9-sources-
jar/org/springdoc/webmvc/core/RequestService.java
* /opt/cola/permits/1612572860_1679608931.4898906/0/springdoc-openapi-webmvc-core-1-5-9-sources-
jar/org/springdoc/webmvc/api/MultipleOpenApiActuatorResource.java
* /opt/cola/permits/1612572860_1679608931.4898906/0/springdoc-openapi-webmvc-core-1-5-9-sources-
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* /opt/cola/permits/1612572860_1679608931.4898906/0/springdoc-openapi-webmvc-core-1-5-9-sources-
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* /opt/cola/permits/1612572860_1679608931.4898906/0/springdoc-openapi-webmvc-core-1-5-9-sources-
jar/org/springdoc/webmvc/core/ActuatorWebMvcProvider.java
* /opt/cola/permits/1612572860_1679608931.4898906/0/springdoc-openapi-webmvc-core-1-5-9-sources-
jar/org/springdoc/webmvc/core/RouterFunctionProvider.java
*
/opt/cola/permits/1612572860_1679608931.4898906/0/springdoc-openapi-webmvc-core-1-5-9-sources-
jar/org/springdoc/webmvc/core/SpringDocWebMvcConfiguration.java
* /opt/cola/permits/1612572860_1679608931.4898906/0/springdoc-openapi-webmvc-core-1-5-9-sources-
jar/org/springdoc/webmvc/api/MultipleOpenApiResource.java
* /opt/cola/permits/1612572860_1679608931.4898906/0/springdoc-openapi-webmvc-core-1-5-9-sources-
jar/org/springdoc/webmvc/api/OpenApiResource.java
```

## 1.265 boost 1.80.0

### 1.265.1 Available under license :

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Julian Seward, [jseward@acm.org](mailto:jseward@acm.org)  
bzip2/libbzip2 version 1.0.8 of 13 July 2019

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///  
[#mpl]

```
MPL Support, <boost/mp11/mpl.hpp>
:toc:
:toc-title:
:idprefix:
```

The header `<boost/mp11/mpl.hpp>`, when included, defines the necessary support infrastructure for `mp_list` and `std::tuple` to be valid link:../../../../libs/mpl[MPL] sequences.

NOTE: `mpl.hpp` is not included by ``.

It's also possible to only enable support for `mp\_list` by including ``, and for `std::tuple` by including ``. This may be required because some libraries, such as Boost.Fusion, contain their own MPL support for `std::tuple`, which conflicts with Mp11's one.

.Converting an existing MPL Sequence into an mp\_list

...

```
using L = mpl::copy<Sequence, mpl::back_inserter<mp11::mp_list<>>>::type;
```

...

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```
<!DOCTYPE html>
```

```
<html>
```

```
<head></head>
```

```
<body>
```

```
<h3>
```

```
 Copyright Test
```

```
</h3>
```

```
<p class="copyright">
```

```
 1963, 1964, 1965 Jane Doe
```

```
</p>
```

```
<p class="copyright">
```

```
 2018 Joe Blow, John Coe
```

```
</p>
```

```
<p class="copyright">
```

```
 1977, 1985 Someone else
```

```
</p>
```

```
</body>
```

```
</html>
```

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```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE article PUBLIC "-//Boost//DTD BoostBook XML V1.0//EN"
"http://www.boost.org/tools/boostbook/dtd/boostbook.dtd">
<article id="copyright_test" last-revision="DEBUG MODE Date: 2000/12/20 12:00:00 $"
xmlns:xi="http://www.w3.org/2001/XInclude">
<title>Copyright Test</title>
<articleinfo>
<copyright>
<year>1963</year> <year>1964</year> <year>1965</year> <holder>Jane Doe</holder>
```

```
</copyright>
<copyright>
 <year>2018</year> <holder>Joe Blow, John Coe</holder>
</copyright>
<copyright>
 <year>1977</year> <year>1985</year> <holder>Someone else</holder>
</copyright>
</articleinfo>
</article>
```

```
=====
Copyright (c) 2007-2011 Barend Gehrels, Amsterdam, the Netherlands.
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## 1.266 micrometer-core 1.5.4

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\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/util/NamedThreadFactory.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/logging/LoggingRegistryConfig.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/push/PushRegistryConfig.java  
\*  
/opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/MultiGauge.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/push/PushMeterRegistry.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/ipc/http/OkHttpSender.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/ipc/http/HttpStatusClass.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/util/JsonUtils.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/ipc/http/URLConnectionSender.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/StrongReferenceGaugeFunction.java  
\*  
/opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/ipc/http/HttpSender.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/ipc/http/ReactorNettySender.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/binder/kafka/KafkaConsumerMetrics.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/logging/LoggingMeterRegistry.java

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jar/io/micrometer/core/util/internal/logging/InternalLogger.java

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\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/binder/httpcomponents/PoolingHttpClientConnectionManagerMetricsBinder.java  
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/opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/distribution/TimeWindowMax.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/dropwizard/DropwizardConfig.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/distribution/TimeWindowPercentileHistogram.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/search/MeterNotFoundException.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/dropwizard/DropwizardFunctionCounter.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/composite/AbstractCompositeMeter.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/dropwizard/package-info.java  
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/opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/binder/jvm/DiskSpaceMetrics.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/composite/CompositeLongTaskTimer.java  
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\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/binder/cache/JCacheMetrics.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/binder/cache/package-info.java  
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\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/distribution/HistogramSnapshot.java  
\*  
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\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/distribution/pause/NoPauseDetector.java  
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\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/internal/TimedExecutor.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/cumulative/CumulativeFunctionTimer.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/MeterRegistry.java

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* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/util/package-info.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/aop/CountedAspect.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/step/StepRegistryConfig.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
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jar/io/micrometer/core/instrument/internal/DefaultGauge.java
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* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/binder/cache/EhCache2Metrics.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
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* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/composite/CompositeDistributionSummary.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/push/package-info.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/distribution/Histogram.java
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/opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
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* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
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* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
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* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/TimeGauge.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
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* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
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/opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/aop/TimedAspect.java

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jar/io/micrometer/core/instrument/Gauge.java
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jar/io/micrometer/core/instrument/dropwizard/DropwizardFunctionTimer.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/binder/jvm/ClassLoaderMetrics.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/binder/cache/GuavaCacheMetrics.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/FunctionTimer.java
*
/opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/step/StepFunctionCounter.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/distribution/ValueAtPercentile.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/binder/cache/HazelcastCacheMetrics.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/cumulative/CumulativeDistributionSummary.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/noop/NoopFunctionTimer.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/binder/jvm/JvmThreadMetrics.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
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/opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/binder/cache/CaffeineCacheMetrics.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/distribution/HistogramGauges.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/composite/CompositeTimer.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/dropwizard/DropwizardRate.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/noop/package-info.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/dropwizard/DropwizardGauge.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/config/MeterRegistryConfig.java
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/opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/binder/hystrix/MicrometerMetricsPublisher.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/composite/CompositeFunctionTimer.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-

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jar/io/micrometer/core/instrument/step/StepMeasurement.java
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jar/io/micrometer/core/instrument/AbstractMeter.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/distribution/pause/ClockDriftPauseDetector.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/Counter.java
*
/opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/lang/NonNull.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/distribution/package-info.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/binder/tomcat/TomcatMetrics.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/lang/NonNullApi.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/FunctionCounter.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/annotation/Counted.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/cumulative/CumulativeFunctionCounter.java
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/opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/distribution/HistogramSupport.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/simple/CountingMode.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/util/TimeUtils.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/lang/Nullable.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/annotation/Timed.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/noop/NoopGauge.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
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* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/binder/db/PostgreSQLDatabaseMetrics.java
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/opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/util/StringUtils.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/binder/BaseUnits.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/distribution/TimeWindowFixedBoundaryHistogram.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/distribution/pause/PauseDetector.java

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\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/annotation/Incubating.java

\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/config/package-info.java

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/opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/distribution/pause/package-info.java

\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/distribution/NoopHistogram.java

\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/step/StepLong.java

\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/search/Search.java

\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/binder/hystrix/MicrometerMetricsPublisherCommand.java

\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/util/IOUtils.java

\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/binder/system/UptimeMetrics.java

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/opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/util/MeterEquivalence.java

\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/binder/jvm/JvmCompilationMetrics.java

\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/Clock.java

\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/step/StepFunctionTimer.java

\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/binder/okhttp3/OkHttpMetricsEventListener.java

\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/DistributionSummary.java

\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/Meter.java

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/opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/config/MissingRequiredConfigurationException.java

\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/noop/NoopFunctionCounter.java

\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/Statistic.java

\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/binder/MeterBinder.java

\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/util/HierarchicalNameMapper.java

\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/internal/package-info.java

\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-



jar/io/micrometer/core/instrument/distribution/PercentileHistogramBuckets.java  
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/opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-  
jar/io/micrometer/core/instrument/config/InvalidConfigurationException.java  
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\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-  
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jar/io/micrometer/core/instrument/binder/jvm/JvmMemoryMetrics.java  
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jar/io/micrometer/core/instrument/binder/system/FileDescriptorMetrics.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-  
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\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-  
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\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-  
jar/io/micrometer/core/instrument/composite/CompositeCounter.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-  
jar/io/micrometer/core/instrument/util/AbstractPartition.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-  
jar/io/micrometer/core/instrument/dropwizard/DropwizardCounter.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-  
jar/io/micrometer/core/instrument/distribution/CountAtBucket.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-  
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/opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-  
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\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-  
jar/io/micrometer/core/instrument/composite/CompositeMeterRegistry.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-  
jar/io/micrometer/core/instrument/cumulative/CumulativeCounter.java  
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jar/io/micrometer/core/instrument/noop/NoopCounter.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-

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jar/io/micrometer/core/instrument/binder/hystrix/MicrometerMetricsPublisherThreadPool.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/step/StepDistributionSummary.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/distribution/DistributionStatisticConfig.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/step/StepMeterRegistry.java
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jar/io/micrometer/core/instrument/internal/DefaultMeter.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
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* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/noop/NoopTimeGauge.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/binder/logging/Log4j2Metrics.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
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* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
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* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/composite/CompositeTimeGauge.java
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jar/io/micrometer/core/instrument/internal/DefaultLongTaskTimer.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/binder/hystrix/HystrixMetricsBinder.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
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* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/noop/NoopLongTaskTimer.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/config/NamingConvention.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/dropwizard/DropwizardMeterRegistry.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
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* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/composite/CompositeMeter.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/util/DoubleFormat.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/config/MeterFilter.java

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\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/step/StepCounter.java  
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\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/MockClock.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/binder/logging/LogbackMetrics.java  
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\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/binder/kafka/KafkaMetrics.java  
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/opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/config/validate/InvalidReason.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/binder/httpcomponents/DefaultUriMapper.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/step/StepTuple2.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-

jar/io/micrometer/core/instrument/distribution/TimeWindowSum.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-  
jar/io/micrometer/core/instrument/binder/db/JooqExecuteListener.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-  
jar/io/micrometer/core/instrument/binder/http/HttpRequestTags.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-  
jar/io/micrometer/core/instrument/config/MeterRegistryConfigValidator.java  
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/opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-  
jar/io/micrometer/core/instrument/binder/cache/HazelcastIMapAdapter.java  
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jar/io/micrometer/core/instrument/binder/jvm/JvmHeapPressureMetrics.java  
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jar/io/micrometer/core/instrument/binder/db/MetricsDSLContext.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-  
jar/io/micrometer/core/instrument/config/validate/DurationValidator.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-  
jar/io/micrometer/core/instrument/binder/jetty/JettyClientTags.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-  
jar/io/micrometer/core/instrument/binder/http/Outcome.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-  
jar/io/micrometer/core/instrument/config/validate/ValidationException.java  
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/opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-  
jar/io/micrometer/core/instrument/binder/jetty/JettyClientTagsProvider.java  
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jar/io/micrometer/core/instrument/config/validate/Validated.java  
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jar/io/micrometer/core/instrument/binder/http/DefaultHttpServletRequestTagsProvider.java  
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jar/io/micrometer/core/instrument/binder/httpcomponents/MicrometerHttpClientInterceptor.java  
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jar/io/micrometer/core/instrument/internal/CumulativeHistogramLongTaskTimer.java  
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jar/io/micrometer/core/instrument/step/StepValue.java  
\*  
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jar/io/micrometer/core/instrument/config/validate/PropertyValidator.java  
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jar/io/micrometer/core/instrument/binder/jetty/JettySslHandshakeMetrics.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-  
jar/io/micrometer/core/instrument/binder/jetty/JettyClientMetrics.java  
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jar/io/micrometer/core/instrument/binder/jpa/HibernateQueryMetrics.java  
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jar/io/micrometer/core/instrument/distribution/FixedBoundaryVictoriaMetricsHistogram.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-  
jar/io/micrometer/core/instrument/binder/http/package-info.java

\*  
/opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/binder/httpcomponents/HttpContextUtils.java  
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\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/util/internal/logging/Slf4JLoggerFactory.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/util/internal/logging/InternalLoggerFactory.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/util/internal/logging/AbstractInternalLogger.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/util/internal/logging/InternalLogLevel.java  
\*  
/opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/util/internal/logging/Slf4JLogger.java  
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* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/binder/mongodb/MongoMetricsConnectionPoolListener.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/internal/TimedCallable.java
*
/opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/internal/TimedScheduledExecutorService.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/binder/jetty/JettyConnectionMetrics.java
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jar/io/micrometer/core/instrument/binder/jetty/JettyServerThreadPoolMetrics.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/internal/TimedRunnable.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/binder/mongodb/MongoMetricsCommandListener.java
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\* /opt/cola/permits/1651261826\_1682398097.451441/0/spring-aspects-5-2-24-release-sources-jar/org/springframework/context/annotation/aspectj/EnableSpringConfigured.java  
\* /opt/cola/permits/1651261826\_1682398097.451441/0/spring-aspects-5-2-24-release-sources-jar/org/springframework/beans/factory/aspectj/ConfigurableObject.java

## 1.268 spring-web 5.2.24.RELEASE

## 1.268.1 Available under license :

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* /opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
jar/org/springframework/web/bind/annotation/RequestMethod.java
* /opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
jar/org/springframework/web/context/request/RequestContextListener.java
*
/opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
jar/org/springframework/web/bind/support/SpringWebConstraintValidatorFactory.java
* /opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
jar/org/springframework/http/client/AbstractClientHttpRequestFactoryWrapper.java
* /opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
jar/org/springframework/web/bind/annotation/SessionAttributes.java
* /opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
jar/org/springframework/http/converter/HttpMessageConversionException.java
* /opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
jar/org/springframework/web/util/HttpSessionMutexListener.java
* /opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
jar/org/springframework/web/server/WebFilter.java
* /opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
jar/org/springframework/web/filter/CommonsRequestLoggingFilter.java
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/opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
jar/org/springframework/web/filter/RequestContextFilter.java
* /opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
jar/org/springframework/http/HttpMessage.java
* /opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
jar/org/springframework/http/converter/HttpMessageNotWritableException.java
* /opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
jar/org/springframework/web/multipart/MultipartResolver.java
```

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* /opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
jar/org/springframework/web/server/WebFilterChain.java
* /opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
jar/org/springframework/web/context/request/DestructionCallbackBindingListener.java
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jar/org/springframework/web/context/support/ServletContextResourceLoader.java
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jar/org/springframework/http/converter/xml/SourceHttpMessageConverter.java
* /opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
jar/org/springframework/web/accept/MediaTypeFileExtensionResolver.java
```

\*  
/opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-jar/org/springframework/http/converter/xml/AbstractJaxb2HttpMessageConverter.java  
\* /opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-jar/org/springframework/web/context/support/GenericWebApplicationContext.java  
\* /opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-jar/org/springframework/http/codec/ResourceHttpMessageWriter.java  
\* /opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-jar/org/springframework/web/context/support/AnnotationConfigWebApplicationContext.java  
\* /opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-jar/org/springframework/web/util/pattern/InternalPathPatternParser.java  
\* /opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-jar/org/springframework/web/util/HtmlCharacterEntityDecoder.java  
\* /opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-jar/org/springframework/web/multipart/support/MultipartResolutionDelegate.java  
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\* /opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-jar/org/springframework/http/codec/support/ServerDefaultCodecsImpl.java  
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\* /opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-jar/org/springframework/web/bind/annotation/RestControllerAdvice.java  
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\* /opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-jar/org/springframework/web/server/handler/WebHandlerDecorator.java  
\*  
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\* /opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-jar/org/springframework/web/filter/reactive/ServerWebExchangeContextFilter.java  
\* /opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-jar/org/springframework/http/server/reactive/AbstractServerHttpRequest.java  
\* /opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-jar/org/springframework/web/cors/UrlBasedCorsConfigurationSource.java  
\* /opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-jar/org/springframework/web/client/UnknownHttpStatusCodeException.java  
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\* /opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-jar/org/springframework/web/context/request/async/DeferredResult.java



\* /opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-jar/org/springframework/web/client/HttpServerErrorException.java  
 \* /opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-jar/org/springframework/web/client/HttpStatusCodeException.java  
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 \* /opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-jar/org/springframework/web/server/session/InMemoryWebSessionStore.java  
 \* /opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-jar/org/springframework/http/HttpStatus.java  
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 \* /opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-jar/org/springframework/http/converter/cbor/MappingJackson2CborHttpMessageConverter.java  
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 \* /opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-jar/org/springframework/web/context/request/ServletRequestAttributes.java  
 \* /opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-jar/org/springframework/web/multipart/commons/CommonsMultipartFile.java  
 \* /opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-jar/org/springframework/web/context/ContextCleanupListener.java  
 \* /opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-jar/org/springframework/http/codec/json/Jackson2SmileEncoder.java  
 \* /opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-

jar/org/springframework/http/client/MultipartBodyBuilder.java  
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jar/org/springframework/web/accept/FixedContentNegotiationStrategy.java  
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jar/org/springframework/http/codec/FormHttpMessageReader.java  
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jar/org/springframework/http/converter/protobuf/ProtobufHttpMessageConverter.java  
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jar/org/springframework/http/converter/xml/Jaxb2RootElementHttpMessageConverter.java  
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\* /opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-  
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jar/org/springframework/web/util/HtmlUtils.java  
\* /opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-  
jar/org/springframework/web/bind/annotation/ControllerAdvice.java  
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jar/org/springframework/http/codec/xml/XmlEventDecoder.java  
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jar/org/springframework/web/client/RestOperations.java  
\* /opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-  
jar/org/springframework/web/client/RestOperationsExtensions.kt  
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/opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-  
jar/org/springframework/http/codec/protobuf/ProtobufDecoder.java  
\* /opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-  
jar/org/springframework/http/converter/feed/AbstractWireFeedHttpMessageConverter.java  
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jar/org/springframework/http/server/ServerHttpRequest.java  
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```
* /opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
jar/org/springframework/web/filter/ServletContextRequestLoggingFilter.java
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* limitations under the License.
*/
/**
* Return the web session for the current request. Always guaranteed to
* return an instance either matching to the session id requested by the
* client, or with a new session id either because the client did not
* specify one or because the underlying session had expired. Use of this
* method
does not automatically create a session. See {@link WebSession}
* for more details.
*/
```

Found in path(s):

```
* /opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
jar/org/springframework/web/server/ServerWebExchange.java
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* /opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
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\* /opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-jar/org/springframework/web/method/support/HandlerMethodArgumentResolver.java  
\* /opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-jar/org/springframework/http/server/ServerHttpAsyncRequestControl.java

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\* /opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-  
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 jar/org/springframework/web/filter/HttpPutFormContentFilter.java  
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jar/org/springframework/web/util/OpaqueUriComponents.java
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jar/org/springframework/http/server/reactive/ContextPathCompositeHandler.java
No license file was found, but licenses were detected in source scan.
```

```
This file maps Internet media types to unique file extension(s).
Although created for httpd, this file is used by many software systems
and has been placed in the public domain for unlimited redistribution.
#
The table below contains both registered and (common) unregistered types.
A type that has no unique extension can be ignored -- they are listed
here to guide configurations toward known types and to make it easier to
identify "new" types. File extensions are also commonly used to indicate
content languages and encodings, so choose them carefully.
#
Internet media types should be registered as described in RFC 4288.
The registry is at <https://www.iana.org/assignments/media-types/>.
#
This file was retrieved from
https://svn.apache.org/viewvc/httpd/httpd/trunk/docs/conf/mime.types?revision=1752884&view=co
#
MIME type (lowercased) Extensions
=====
#
application/1d-interleaved-parityfec
application/3gpdash-qoe-report+xml
application/3gpp-ims+xml
application/a2l
application/activemessage
application/alto-costmap+json
application/alto-costmapfilter+json
application/alto-directory+json
application/alto-endpointcost+json
application/alto-endpointcostparams+json
application/alto-endpointprop+json
application/alto-endpointpropparams+json
application/alto-error+json
application/alto-networkmap+json
application/alto-networkmapfilter+json
application/aml
application/andrew-inset ez
application/applefile
application/applixware aw
application/atf
application/atfx
application/atom+xml atom
```

application/atomcat+xml atomcat  
# application/atomdeleted+xml  
# application/atomicmail  
application/atomsvc+xml atomsvc  
# application/atxml  
# application/auth-policy+xml  
# application/bacnet-xdd+zip  
# application/batch-smtp  
# application/beep+xml  
# application/calendar+json  
# application/calendar+xml  
#  
application/call-completion  
# application/cals-1840  
# application/cbor  
# application/ccmp+xml  
application/ccxml+xml ccxml  
# application/cdfx+xml  
application/cdmi-capability cdmia  
application/cdmi-container cdmic  
application/cdmi-domain cdmid  
application/cdmi-object cdmio  
application/cdmi-queue cdmiq  
# application/cdni  
# application/cea  
# application/cea-2018+xml  
# application/cellml+xml  
# application/cfw  
# application/cms  
# application/cnrx+xml  
# application/coap-group+json  
# application/commonground  
# application/conference-info+xml  
# application/cpl+xml  
# application/csrattrs  
# application/csta+xml  
# application/cstadata+xml  
# application/csvm+json  
application/cu-seeme cu  
# application/cybercash  
# application/dash+xml  
# application/dashdelta  
application/davmount+xml davmount  
# application/dca-rft  
# application/dcd  
# application/dec-dx  
# application/dialog-info+xml  
# application/dicom



# application/dii  
# application/dit  
# application/dns  
application/docbook+xml dbk  
#  
application/dskpp+xml  
application/dssc+der dssc  
application/dssc+xml xdssc  
# application/dvcs  
application/ecmascript ecma  
# application/edi-consent  
# application/edi-x12  
# application/edifact  
# application/efi  
# application/emergencycalldata.comment+xml  
# application/emergencycalldata.deviceinfo+xml  
# application/emergencycalldata.providerinfo+xml  
# application/emergencycalldata.serviceinfo+xml  
# application/emergencycalldata.subscriberinfo+xml  
application/emma+xml emma  
# application/emotionml+xml  
# application/encaprtp  
# application/epp+xml  
application/epub+zip epub  
# application/eshop  
# application/example  
application/exi exi  
# application/fastinfoset  
# application/fastsoap  
# application/fdt+xml  
# application/fits  
# application/font-sfnt  
application/font-tdpfr pfr  
application/font-woff woff  
# application/framework-attributes+xml  
# application/geo+json  
application/gml+xml gml  
application/gpx+xml gpx  
application/gxf gxf  
# application/gzip  
#  
application/h224  
# application/held+xml  
# application/http  
application/hyperstudio stk  
# application/ibe-key-request+xml  
# application/ibe-pkg-reply+xml  
# application/ibe-pp-data

# application/iges  
# application/im-iscomposing+xml  
# application/index  
# application/index.cmd  
# application/index.obj  
# application/index.response  
# application/index.vnd  
application/inkml+xml ink inkml  
# application/iotp  
application/ipfix ipfix  
# application/ipp  
# application/isup  
# application/its+xml  
application/java-archive jar  
application/java-serialized-object ser  
application/java-vm class  
application/javascript js  
# application/jose  
# application/jose+json  
# application/jrd+json  
application/json json  
# application/json-patch+json  
# application/json-seq  
application/jsonml+json jsonml  
# application/jwk+json  
# application/jwk-set+json  
# application/jwt  
# application/kpml-request+xml  
# application/kpml-response+xml  
# application/ld+json  
# application/lgr+xml  
# application/link-format  
#  
application/load-control+xml  
application/lost+xml lostxml  
# application/lostsync+xml  
# application/lxf  
application/mac-binhex40 hqx  
application/mac-compactpro cpt  
# application/macwriteii  
application/mads+xml mads  
application/marc mrc  
application/marcxml+xml mrcx  
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# application/mathml-presentation+xml  
# application/mbms-associated-procedure-description+xml

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application/media-policy-dataset+xml
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application/metalink4+xml meta4
application/mets+xml mets
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application/mods+xml mods
application/moss-keys
application/moss-signature
application/mosskey-data
application/mosskey-request
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application/mp4 mp4s
application/mpeg4-generic
application/mpeg4-iod
application/mpeg4-iod-xmt
application/mrb-consumer+xml
application/mrb-publish+xml
application/msc-ivr+xml
application/msc-mixer+xml
application/msword doc dot
application/mxf mxf
application/nasdata
application/news-checkgroups
application/news-groupinfo
application/news-transmission
application/nlsml+xml
application/nss
application/ocsp-request
application/ocsp-response
application/octet-stream bin dms lrf mar so dist distz pkg bpk dump elc deploy
application/oda oda
application/odx
```

application/oebps-package+xml opf  
application/ogg ogx  
application/omdoc+xml omdoc  
application/onenote onetoc  
onetoc2 onetmp onepkg  
application/oxps oxps  
# application/p2p-overlay+xml  
# application/parityfec  
application/patch-ops-error+xml xer  
application/pdf pdf  
# application/pdx  
application/pgp-encrypted pgp  
# application/pgp-keys  
application/pgp-signature asc sig  
application/pics-rules prf  
# application/pidf+xml  
# application/pidf-diff+xml  
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# application/pkcs12  
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application/pkcs7-signature p7s  
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application/pkix-attr-cert ac  
application/pkix-cert cer  
application/pkix-crl crl  
application/pkix-pkipath pkipath  
application/pkixcmp pki  
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application/rpki-roa roa  
# application/rpki-updown  
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application/rss+xml rss  
application/rtf rtf  
# application/rtploopback  
# application/rtx  
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# application/samlmetadata+xml  
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# application/scaip+xml  
# application/scim+json  
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application/scvp-vp-request spq  
application/scvp-vp-response spp  
application/sdp sdp  
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# application/sep-exi  
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# application/set-registration  
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# application/sgml-open-catalog  
application/shf+xml shf  
# application/sieve  
# application/simple-filter+xml  
# application/simple-message-summary  
# application/simplesymbolcontainer  
# application/slate  
# application/smil  
application/smil+xml smi smil  
# application/smpite336m  
# application/soap+fastinfoset

# application/soap+xml  
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application/sparql-results+xml srx  
# application/spirits-event+xml  
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# application/tamp-status-response  
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# application/tamp-update-confirm  
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# application/ttml+xml  
# application/tve-trigger  
# application/ulpfec  
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# application/vnd.3lightssoftware.imagescal  
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application/vnd.audiograph aep  
# application/vnd.autopackage  
# application/vnd.avistar+xml  
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# application/vnd.balsamiq.bmpr  
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# application/vnd.collection.next+json  
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# application/vnd.commerce-battelle  
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application/vnd.contact.cmsg cdbcmg  
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application/vnd.crick.clicker.palette clkp  
application/vnd.crick.clicker.template clkt  
application/vnd.crick.clicker.wordbank clkw  
application/vnd.criticaltools.wbs+xml wbs  
application/vnd.ctc-posml pml  
# application/vnd.ctct.ws+xml



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application/vnd.cups-pdf
application/vnd.cups-postscript
application/vnd.cups-ppd ppd
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application/vnd.cups-raw
application/vnd.curl
application/vnd.curl.car car
application/vnd.curl.pcurl pcurl
application/vnd.cyan.dean.root+xml
application/vnd.cybank
application/vnd.dart dart
application/vnd.data-vision.rdz rdz
application/vnd.debian.binary-package
application/vnd.dece.data uvf uvvf
 uvd uvvd
application/vnd.dece.ttml+xml uvt uvvt
application/vnd.dece.unspecified uvx uvvx
application/vnd.dece.zip uvz uvvz
application/vnd.denovo.fcselayout-link fe_launch
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application/vnd.document+json
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application/vnd.dolby.mobile.1
application/vnd.dolby.mobile.2
application/vnd.doremir.scorecloud-binary-document
application/vnd.dpgraph dpg
application/vnd.dreamfactory dfac
application/vnd.drive+json
application/vnd.ds-keypoint kpxx
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application/vnd.etsi.iptvdiscovery+xml
application/vnd.etsi.iptvprofile+xml
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```

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application/vnd.etsi.simserv+xml
application/vnd.etsi.timestamp-token
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application/vnd.ezpix-package ez3
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application/vnd.fints
application/vnd.firemonkeys.cloudcell
application/vnd.flographit gph
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application/vnd.fujitsu.oasys2 oa2
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application/vnd.geocube+xml
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application/vnd.geospace g3w
```

```
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icm
application/vnd.ieee.1905
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application/vnd.immervision-ivu ivu  
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# application/vnd.iptc.g2.packageitem+xml  
# application/vnd.iptc.g2.planningitem+xml  
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ktr  
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application/vnd.ms-htmlhelp chm  
application/vnd.ms-ims ims  
application/vnd.ms-lrm lrm  
# application/vnd.ms-office.activex+xml  
application/vnd.ms-officetheme thmx  
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application/vnd.ms-opentype  
# application/vnd.ms-package.obfuscated-opentype  
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# application/vnd.oipf.userprofile+xml  
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application/vnd.oma.bcast.notification+xml
application/vnd.oma.bcast.provisioningtrigger
application/vnd.oma.bcast.sgboot
application/vnd.oma.bcast.sgdd+xml
application/vnd.oma.bcast.sgdu
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```



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application/watcherinfo+xml
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application/whoispp-response
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application/wita
application/wordperfect5.1
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application/x-authorware-seg aas
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application/x-bittorrent torrent
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```

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application/x-csh csh
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application/x-dtbncx+xml ncx
application/x-dtbook+xml dtb
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application/x-freearc arc
application/x-futuresplash spl
application/x-gca-compressed gca
application/x-glulx ulx
application/x-gnumeric gnumeric
application/x-gramps-xml gramps
application/x-gtar gtar
application/x-gzip
application/x-hdf hdf
application/x-install-instructions install
application/x-iso9660-image iso
application/x-java-jnlp-file jnlp
application/x-latex latex
application/x-lzh-compressed lzh lha
application/x-mie mie
```

application/x-mobipocket-ebook prc  
mobi  
application/x-ms-application application  
application/x-ms-shortcut lnk  
application/x-ms-wmd wmd  
application/x-ms-wmz wmz  
application/x-ms-xbap xbap  
application/x-msaccess mdb  
application/x-msbinder obd  
application/x-mscardfile crd  
application/x-msclip clp  
application/x-msdownload exe dll com bat msi  
application/x-msmediaview mvb m13 m14  
application/x-msmetafile wmf wmz emf emz  
application/x-msmoney mny  
application/x-mspublisher pub  
application/x-msschedule scd  
application/x-msterminal trm  
application/x-mswrite wri  
application/x-netcdf nc cdf  
application/x-nzb nzb  
application/x-pkcs12 p12 pfx  
application/x-pkcs7-certificates p7b spc  
application/x-pkcs7-certreqresp p7r  
application/x-rar-compressed rar  
application/x-research-info-systems ris  
application/x-sh sh  
application/x-shar shar  
application/x-shockwave-flash swf  
application/x-silverlight-app xap  
application/x-sql sql  
application/x-stuffit sit  
application/x-stuffitx sitx  
application/x-subrip srt  
application/x-sv4cpio sv4cpio  
application/x-sv4crc sv4crc  
application/x-t3vm-image t3  
application/x-tads gam  
application/x-tar tar  
application/x-tcl tcl  
application/x-tex tex  
application/x-tex-tfm tfm  
application/x-texinfo texinfo  
texi  
application/x-tgif obj  
application/x-ustar ustar  
application/x-wais-source src  
# application/x-www-form-urlencoded

application/x-x509-ca-cert der crt  
application/x-xfig fig  
application/x-xliff+xml xlf  
application/x-xpinstall xpi  
application/x-xz xz  
application/x-zmachine z1 z2 z3 z4 z5 z6 z7 z8  
# application/x400-bp  
# application/xacml+xml  
application/xaml+xml xaml  
# application/xcap-att+xml  
# application/xcap-caps+xml  
application/xcap-diff+xml xdf  
# application/xcap-el+xml  
# application/xcap-error+xml  
# application/xcap-ns+xml  
# application/xcon-conference-info+xml  
# application/xcon-conference-info-diff+xml  
application/xenc+xml xenc  
application/xhtml+xml xhtml  
xht  
# application/xhtml-voice+xml  
application/xml xml xsl  
application/xml-dtd dtd  
# application/xml-external-parsed-entity  
# application/xml-patch+xml  
# application/xmpp+xml  
application/xop+xml xop  
application/xproc+xml xpl  
application/xslt+xml xslt  
application/xspf+xml xspf  
application/xv+xml mxml xhvm xvm xvm  
application/yang yang  
application/yin+xml yin  
application/zip zip  
# application/zlib  
# audio/1d-interleaved-parityfec  
# audio/32kadpcm  
# audio/3gpp  
# audio/3gpp2  
# audio/ac3  
audio/adpcm adp  
# audio/amr  
# audio/amr-wb  
# audio/amr-wb+  
# audio/aptx  
# audio/asc  
# audio/atrac-advanced-lossless  
# audio/atrac-x

# audio/atrac3  
audio/basic au snd  
# audio/bv16  
# audio/bv32  
# audio/clearmode  
# audio/cn  
# audio/dat12  
# audio/dls  
# audio/dsr-es201108  
# audio/dsr-es202050  
# audio/dsr-es202211  
# audio/dsr-es202212  
# audio/dv  
# audio/dvi4  
# audio/eac3  
# audio/encaprtsp  
# audio/evrc  
# audio/evrc-qcp  
# audio/evrc0  
# audio/evrc1  
#  
audio/evrcb  
# audio/evrcb0  
# audio/evrcb1  
# audio/evrcnw  
# audio/evrcnw0  
# audio/evrcnw1  
# audio/evrcwb  
# audio/evrcwb0  
# audio/evrcwb1  
# audio/evs  
# audio/example  
# audio/fwdred  
# audio/g711-0  
# audio/g719  
# audio/g722  
# audio/g7221  
# audio/g723  
# audio/g726-16  
# audio/g726-24  
# audio/g726-32  
# audio/g726-40  
# audio/g728  
# audio/g729  
# audio/g7291  
# audio/g729d  
# audio/g729e  
# audio/gsm

# audio/gsm-efr  
# audio/gsm-hr-08  
# audio/ilbc  
# audio/ip-mr\_v2.5  
# audio/isac  
# audio/116  
# audio/120  
# audio/124  
# audio/18  
# audio/lpc  
audio/midi mid midi kar rmi  
# audio/mobile-xmf  
audio/mp4 m4a mp4a  
# audio/mp4a-latm  
# audio/mpa  
# audio/mpa-robust  
audio/mpeg mpga mp2 mp2a mp3 m2a m3a  
# audio/mpeg4-generic  
# audio/musepack  
audio/ogg oga ogg spx  
# audio/opus  
# audio/parityfec  
# audio/pcma  
# audio/pcma-wb  
# audio/pcmu  
# audio/pcmu-wb  
# audio/prs.sid  
# audio/qcelp  
# audio/raptorfec  
# audio/red  
# audio/rtp-enc-aescm128  
# audio/rtp-midi  
# audio/rtploopback  
# audio/rtx  
audio/s3m s3m  
audio/silk sil  
#  
audio/smv  
# audio/smv-qcp  
# audio/smv0  
# audio/sp-midi  
# audio/speex  
# audio/t140c  
# audio/t38  
# audio/telephone-event  
# audio/tone  
# audio/uemclip  
# audio/ulpfec

```
audio/vdvi
audio/vmr-wb
audio/vnd.3gpp.iufp
audio/vnd.4sb
audio/vnd.audiokoz
audio/vnd.celp
audio/vnd.cisco.nse
audio/vnd.cmles.radio-events
audio/vnd.cns.anp1
audio/vnd.cns.infl
audio/vnd.dece.audio uva uvva
audio/vnd.digital-winds eol
audio/vnd.dlna.adts
audio/vnd.dolby.heaac.1
audio/vnd.dolby.heaac.2
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audio/vnd.dolby.mps
audio/vnd.dolby.pl2
audio/vnd.dolby.pl2x
audio/vnd.dolby.pl2z
audio/vnd.dolby.pulse.1
audio/vnd.dra dra
audio/vnd.dts dts
audio/vnd.dts.hd dtshd
audio/vnd.dvb.file
audio/vnd.everad.plj
audio/vnd.hns.audio
audio/vnd.lucent.voice lvp
audio/vnd.ms-playready.media.pya pya
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audio/vnd.nuera.ecelp7470 ecelp7470
audio/vnd.nuera.ecelp9600 ecelp9600
#
audio/vnd.octel.sbc
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audio/vnd.rip rip
audio/vnd.sealedmedia.softseal.mpeg
audio/vnd.vmx.cvsd
audio/vorbis
audio/vorbis-config
audio/webm weba
audio/x-aac aac
audio/x-aiff aif aiff aifc
audio/x-caf caf
audio/x-flac flac
```

audio/x-matroska mka  
audio/x-mpegurl m3u  
audio/x-ms-wax wax  
audio/x-ms-wma wma  
audio/x-pn-realaudio ram ra  
audio/x-pn-realaudio-plugin rmp  
# audio/x-tta  
audio/x-wav wav  
audio/xm xm  
chemical/x-cdx cdx  
chemical/x-cif cif  
chemical/x-cmdf cmdf  
chemical/x-cml cml  
chemical/x-csml csml  
# chemical/x-pdb  
chemical/x-xyz xyz  
image/bmp bmp  
image/cgm cgm  
# image/dicom-rl  
# image/emf  
# image/example  
# image/fits  
image/g3fax g3  
image/gif gif  
image/ief ief  
# image/jls  
# image/jp2  
image/jpeg jpeg jpg jpe  
# image/jpm  
# image/jpx  
image/ktx ktx  
# image/naplps  
image/png png  
image/prs.btif btif  
#  
image/prs.pti  
# image/pwg-raster  
image/sgi sgi  
image/svg+xml svg svgz  
# image/t38  
image/tiff tiff tif  
# image/tiff-fx  
image/vnd.adobe.photoshop psd  
# image/vnd.airzip.accelerator.azv  
# image/vnd.cns.inf2  
image/vnd.dece.graphic uvi uvvi uvg uvvg  
image/vnd.djvu djvu djv  
image/vnd.dvb.subtitle sub



image/vnd.dwg dwg  
image/vnd.dxf dxf  
image/vnd.fastbidsheet fbs  
image/vnd.fpx fpx  
image/vnd.fst fst  
image/vnd.fujixerox.edmics-mmr mmr  
image/vnd.fujixerox.edmics-rlc rlc  
# image/vnd.globalgraphics.pgb  
# image/vnd.microsoft.icon  
# image/vnd.mix  
# image/vnd.mozilla.apng  
image/vnd.ms-modi mdi  
image/vnd.ms-photo wdp  
image/vnd.net-fpx npx  
# image/vnd.radiance  
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# image/vnd.sealedmedia.softseal.jpg  
# image/vnd.svf  
# image/vnd.tencent.tap  
# image/vnd.valve.source.texture  
image/vnd.wap.wbmp wbmp  
image/vnd.xiff xif  
# image/vnd.zbrush.pcx  
image/webp webp  
# image/wmf  
image/x-3ds 3ds  
image/x-cmu-raster ras  
image/x-cmx cmx  
image/x-freehand fh  
fhc fh4 fh5 fh7  
image/x-icon ico  
image/x-mrsid-image sid  
image/x-pcx pcx  
image/x-pict pic pct  
image/x-portable-anymap pnm  
image/x-portable-bitmap pbm  
image/x-portable-graymap pgm  
image/x-portable-pixmap ppm  
image/x-rgb rgb  
image/x-tga tga  
image/x-xbitmap xbm  
image/x-xpixmap xpm  
image/x-xwindowdump xwd  
# message/cpim  
# message/delivery-status  
# message/disposition-notification  
# message/example

```
message/external-body
message/feedback-report
message/global
message/global-delivery-status
message/global-disposition-notification
message/global-headers
message/http
message/imdn+xml
message/news
message/partial
message/rfc822 eml mime
message/s-http
message/sip
message/sipfrag
message/tracking-status
message/vnd.si.simp
message/vnd.wfa.wsc
model/example
model/gltf+json
model/iges igs iges
model/mesh msh mesh silo
model/vnd.collada+xml dae
model/vnd.dwf dwf
#
 model/vnd.flatland.3dml
model/vnd.gdl gdl
model/vnd.gs-gdl
model/vnd.gs.gdl
model/vnd.gtw gtw
model/vnd.moml+xml
model/vnd.mts mts
model/vnd.opengex
model/vnd.parasolid.transmit.binary
model/vnd.parasolid.transmit.text
model/vnd.rosette.annotated-data-model
model/vnd.valve.source.compiled-map
model/vnd.vtu vtu
model/vrml wrl vrml
model/x3d+binary x3db x3dbz
model/x3d+fastinfoset
model/x3d+vrml x3dv x3dvz
model/x3d+xml x3d x3dz
model/x3d-vrml
multipart/alternative
multipart/appledouble
multipart/byteranges
multipart/digest
multipart/encrypted
```

# multipart/example  
# multipart/form-data  
# multipart/header-set  
# multipart/mixed  
# multipart/parallel  
# multipart/related  
# multipart/report  
# multipart/signed  
# multipart/voice-message  
# multipart/x-mixed-replace  
# text/1d-interleaved-parityfec  
text/cache-manifest appcache  
text/calendar ics ifb  
text/css css  
text/csv csv  
# text/csv-schema  
#  
text/directory  
# text/dns  
# text/ecmascript  
# text/encaprtf  
# text/enriched  
# text/example  
# text/fwdred  
# text/grammar-ref-list  
text/html html htm  
# text/javascript  
# text/jcr-cnd  
# text/markdown  
# text/mizar  
text/n3 n3  
# text/parameters  
# text/parityfec  
text/plain txt text conf def list log in  
# text/provenance-notation  
# text/prs.fallenstein.rst  
text/prs.lines.tag dsc  
# text/prs.prop.logic  
# text/raptorfec  
# text/red  
# text/rfc822-headers  
text/richtext rtx  
# text/rtf  
# text/rtp-enc-aescm128  
# text/rtploopback  
# text/rtx  
text/sgml sgml sgm  
# text/t140

text/tab-separated-values tsv  
text/troff t tr roff man me ms  
text/turtle ttl  
# text/ulpfec  
text/uri-list uri uris urls  
text/vcard vcard  
# text/vnd.a  
# text/vnd.abc  
text/vnd.curl curl  
text/vnd.curl.dcurl dcurl  
text/vnd.curl.mcurl mcurl  
text/vnd.curl.scurl scurl  
# text/vnd.debian.copyright  
# text/vnd.dmclientscript  
text/vnd.dvb.subtitle sub  
# text/vnd.esmertec.theme-descriptor  
text/vnd.fly fly  
text/vnd.fmi.flexstor flx  
text/vnd.graphviz gv  
text/vnd.in3d.3dml 3dml  
text/vnd.in3d.spot spot  
#  
text/vnd.iptc.newsml  
# text/vnd.iptc.nitf  
# text/vnd.latex-z  
# text/vnd.motorola.reflex  
# text/vnd.ms-mediapackage  
# text/vnd.net2phone.commcenter.command  
# text/vnd.radisys.msml-basic-layout  
# text/vnd.si.uricatalogue  
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# text/vnd.trolltech.linguist  
# text/vnd.wap.si  
# text/vnd.wap.sl  
text/vnd.wap.wml wml  
text/vnd.wap.wmlscript wmls  
text/x-asm s asm  
text/x-c c cc cxx cpp h hh dic  
text/x-fortran f for f77 f90  
text/x-java-source java  
text/x-nfo nfo  
text/x-opml opml  
text/x-pascal p pas  
text/x-setext etx  
text/x-sfv sfv  
text/x-uencode uu  
text/x-vcalendar vcs  
text/x-vcard vcf

```
text/xml
text/xml-external-parsed-entity
video/1d-interleaved-parityfec
video/3gpp 3gp
video/3gpp-tt
video/3gpp2 3g2
video/bmpeg
video/bt656
video/celb
video/dv
video/encaprtsp
#
video/example
video/h261 h261
video/h263 h263
video/h263-1998
video/h263-2000
video/h264 h264
video/h264-rcdo
video/h264-svc
video/h265
video/iso.segment
video/jpeg jpgv
video/jpeg2000
video/jpm jpm jpgm
video/mj2 mj2 mjp2
video/mp1s
video/mp2p
video/mp2t
video/mp4 mp4 mp4v mpg4
video/mp4v-es
video/mpeg mpeg mpg mpe m1v m2v
video/mpeg4-generic
video/mpv
video/nv
video/ogg ogv
video/parityfec
video/pointer
video/quicktime qt mov
video/raptorfec
video/raw
video/rtp-enc-aescm128
video/rtploopback
video/rtx
video/smpte292m
video/ulpfec
video/vcl
video/vnd.cctv
```

video/vnd.dece.hd uvh uvvh  
video/vnd.dece.mobile uvm uvvm  
# video/vnd.dece.mp4  
video/vnd.dece.pd uvp uvvp  
video/vnd.dece.sd uvs uvvs  
video/vnd.dece.video uvv uvvv  
# video/vnd.directv.mpeg  
# video/vnd.directv.mpeg-tts  
# video/vnd.dlna.mpeg-tts  
video/vnd.dvb.file dvb  
video/vnd.fvt fvt  
# video/vnd.hns.video  
# video/vnd.iptvforum.1dparityfec-1010  
#  
video/vnd.iptvforum.1dparityfec-2005  
# video/vnd.iptvforum.2dparityfec-1010  
# video/vnd.iptvforum.2dparityfec-2005  
# video/vnd.iptvforum.ttsavc  
# video/vnd.iptvforum.ttsmpeg2  
# video/vnd.motorola.video  
# video/vnd.motorola.videop  
video/vnd.mpegurl mxu m4u  
video/vnd.ms-playready.media.pyv pyv  
# video/vnd.nokia.interleaved-multimedia  
# video/vnd.nokia.videovoip  
# video/vnd.objectvideo  
# video/vnd.radgamettools.bink  
# video/vnd.radgamettools.smacker  
# video/vnd.sealed.mpeg1  
# video/vnd.sealed.mpeg4  
# video/vnd.sealed.swf  
# video/vnd.sealedmedia.softseal.mov  
video/vnd.uvu.mp4 uvu uvvu  
video/vnd.vivo viv  
# video/vp8  
video/webm webm  
video/x-f4v f4v  
video/x-fli fli  
video/x-flv flv  
video/x-m4v m4v  
video/x-matroska mkv mk3d mks  
video/x-mng mng  
video/x-ms-asf asf asx  
video/x-ms-vob vob  
video/x-ms-wm wm  
video/x-ms-wmv wmv  
video/x-ms-wmx wmx  
video/x-ms-wvx wvx

video/x-msvideo avi  
video/x-sgi-movie movie  
video/x-smv smv  
x-conference/x-cooltalk ice

#### Found

in path(s):

\* /opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-jar/org/springframework/http/mime.types

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\* /opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-jar/org/springframework/web/bind/annotation/Mapping.java

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\* /opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-jar/org/springframework/web/multipart/MultipartHttpServletRequest.java  
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\*/

Found in path(s):

\* /opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-jar/org/springframework/http/ResponseCookie.java  
\* /opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-jar/org/springframework/http/converter/json/JsonbHttpMessageConverter.java  
\*  
/opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-jar/org/springframework/web/accept/ServletPathExtensionContentNegotiationStrategy.java  
\* /opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-jar/org/springframework/remoting/httpinvoker/AbstractHttpInvokerRequestExecutor.java  
\* /opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-jar/org/springframework/http/converter/json/GsonHttpMessageConverter.java  
\* /opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-jar/org/springframework/web/server/session/DefaultWebSessionManager.java  
\* /opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-jar/org/springframework/http/codec/json/AbstractJackson2Encoder.java  
\* /opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-jar/org/springframework/web/util/UriTemplate.java  
\* /opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-jar/org/springframework/web/cors/CorsUtils.java  
\*  
/opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-jar/org/springframework/http/MediaType.java  
\* /opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-jar/org/springframework/http/server/reactive/ServerHttpRequest.java  
\* /opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-jar/org/springframework/http/codec/CodecConfigurer.java



\* /opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-jar/org/springframework/web/server/MediaTypeNotSupportedStatusException.java  
 \* /opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-jar/org/springframework/http/codec/json/Jackson2Tokenizer.java  
 \* /opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-jar/org/springframework/web/bind/annotation/RequestMapping.java  
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## 1.269 spring-expression 5.2.24.RELEASE

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\* /opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/MethodFilter.java

\*

/opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/EvaluationException.java

\* /opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/spel/standard/TokenKind.java

\* /opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/ConstructorResolver.java

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\* /opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/ExpressionInvocationTargetException.java  
\*  
/opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/MethodResolver.java  
\* /opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/MethodExecutor.java  
\* /opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/ConstructorExecutor.java  
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- \* /opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/common/ExpressionUtils.java
- \*

- /opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/spel/SpelParseException.java
- \* /opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/ParseException.java
- \* /opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/OperatorOverloader.java
- \* /opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/Expression.java
- \* /opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/spel/standard/Token.java
- \* /opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/spel/support/ReflectiveConstructorExecutor.java
- \* /opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/TypeConverter.java
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- /opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/AccessException.java
- \* /opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/ParserContext.java
- \* /opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/spel/SpelParserConfiguration.java
- \* /opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/spel/support/StandardTypeLocator.java

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- \* /opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/BeanResolver.java
- \*

/opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/spel/ast/BeanReference.java

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- \* /opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/spel/ast/Selection.java
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/opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/spel/ast/ValueRef.java

- \* /opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/spel/ast/QualifiedIdentifier.java
- \* /opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/spel/ast/OpInc.java
- \* /opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/spel/ast/OperatorBetween.java
- \* /opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/spel/ast/NullLiteral.java

\* /opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/spel/ast/OperatorPower.java

\* /opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/spel/ast/RealLiteral.java

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/opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/spel/ast/FunctionReference.java

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\* /opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/spel/ast/IntLiteral.java

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/opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/spel/ast/OpLT.java

\* /opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/PropertyAccessor.java

\* /opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/spel/ast/OpAnd.java

\* /opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/spel/ast/OpDivide.java

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\* /opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/spel/ast/OperatorNot.java

\* /opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/spel/ast/OpNE.java

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/opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/spel/support/ReflectiveConstructorResolver.java

\* /opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/spel/ast/Elvis.java

\* /opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/spel/ast/OpDec.java

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\* /opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/spel/ast/TypeReference.java

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\* /opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/spel/ast/InlineMap.java  
\* /opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/spel/ast/TypeCode.java  
\* /opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/spel/standard/Tokenizer.java  
\* /opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/spel/ast/OpOr.java  
\* /opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/spel/ast/FloatLiteral.java  
\* /opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/spel/ast/Literal.java  
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/opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/spel/support/StandardTypeComparator.java  
\* /opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/spel/ast/OperatorInstanceof.java  
\* /opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/spel/ast/OpModulus.java  
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\* /opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/spel/ast/Operator.java  
\* /opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/spel/ast/OpLE.java  
\* /opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/spel/ast/BooleanLiteral.java

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\* /opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/EvaluationContext.java

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\* /opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/spel/SpelNode.java

\* /opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/spel/support/StandardTypeConverter.java

\* /opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/TypedValue.java

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\* /opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/ExpressionException.java

\* /opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/common/CompositeStringExpression.java

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/opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/spel/support/DataBindingPropertyAccessor.java

\* /opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/Operation.java

\* /opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/spel/CodeFlow.java

\* /opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/spel/support/BooleanTypedValue.java

# 1.270 spring-jdbc 5.2.24.RELEASE

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*/
/**
* Strategy interface for translating between { @link SQLException SQLExceptions }
* and Spring's data access strategy-agnostic { @link DataAccessException }
* hierarchy.
*
* <p>Implementations can be generic (for example, using
* { @link java.sql.SQLException#getSQLState() SQLState } codes for JDBC) or
* wholly
* proprietary (for example, using Oracle error codes) for greater precision.
*
* @author Rod Johnson
* @author Juergen Hoeller
* @see org.springframework.dao.DataAccessException
*/
```

Found in path(s):

```
* /opt/cola/permits/1651261891_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-
jar/org/springframework/jdbc/support/SQLExceptionTranslator.java
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\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/support/xml/SqlXmlValue.java

\*

/opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/support/incrementer/DB2SequenceMaxValueIncrementer.java  
\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/core/DisposableSqlTypeValue.java

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\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/support/SQLExceptionSubclassTranslator.java

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```

*/
/**
 * Implement this interface when parameters need to be customized based
 * on the connection. We might need to do this to make use of proprietary
 * features, available only with a specific Connection type.
 *
 * @author Rod Johnson
 * @author Thomas Risberg
 * @see CallableStatementCreatorFactory#newCallableStatementCreator(ParameterMapper)
 * @see org.springframework.jdbc.object.StoredProcedure#execute(ParameterMapper)
 */
/**
 * Create a Map of input parameters, keyed by name.
 * @param con a JDBC connection. This is useful (and the purpose of this interface)
 * if we need to do something RDBMS-specific with a proprietary Connection
 * implementation class. This class conceals such proprietary details. However,
 * it is best to avoid using such proprietary RDBMS features if possible.
 * @return a Map of input parameters, keyed by name (never {@code null})
 * @throws SQLException if an SQLException is encountered setting
 * parameter values (that is, there's no need to catch SQLException)
 */

```

Found in path(s):

```

* /opt/cola/permits/1651261891_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-
jar/org/springframework/jdbc/core/ParameterMapper.java

```

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Found in path(s):

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* /opt/cola/permits/1651261891_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-
jar/org/springframework/jdbc/core/namedparam/MapSqlParameterSourceExtensions.kt

```

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Found in path(s):

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* /opt/cola/permits/1651261891_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-
jar/org/springframework/jdbc/core/RowMapperResultSetExtractor.java
* /opt/cola/permits/1651261891_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-
jar/org/springframework/jdbc/support/incrementer/H2SequenceMaxValueIncrementer.java
*
/opt/cola/permits/1651261891_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-
jar/org/springframework/jdbc/object/SqlCall.java
* /opt/cola/permits/1651261891_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-
jar/org/springframework/jdbc/support/AbstractFallbackSQLExceptionTranslator.java
* /opt/cola/permits/1651261891_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-
jar/org/springframework/jdbc/datasource/AbstractDataSource.java
* /opt/cola/permits/1651261891_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-
jar/org/springframework/jdbc/LobRetrievalFailureException.java
* /opt/cola/permits/1651261891_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-
jar/org/springframework/jdbc/core/namedparam/NamedParameterBatchUpdateUtils.java
* /opt/cola/permits/1651261891_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-
jar/org/springframework/jdbc/datasource/embedded/H2EmbeddedDatabaseConfigurer.java
* /opt/cola/permits/1651261891_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-
jar/org/springframework/jdbc/datasource/lookup/MapDataSourceLookup.java
*
/opt/cola/permits/1651261891_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-
jar/org/springframework/jdbc/core/ResultSetSupportingSqlParameter.java
* /opt/cola/permits/1651261891_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-
jar/org/springframework/jdbc/datasource/UserCredentialsDataSourceAdapter.java
* /opt/cola/permits/1651261891_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-
jar/org/springframework/jdbc/datasource/lookup/IsolationLevelDataSourceRouter.java
* /opt/cola/permits/1651261891_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-
jar/org/springframework/jdbc/core/StatementCallback.java
* /opt/cola/permits/1651261891_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-
jar/org/springframework/jdbc/core/PreparedStatementCreator.java
* /opt/cola/permits/1651261891_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-
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jar/org/springframework/jdbc/datasource/embedded/EmbeddedDatabaseType.java  
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\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-  
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\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-  
jar/org/springframework/jdbc/support/JdbcAccessor.java  
\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-  
jar/org/springframework/jdbc/core/metadata/HanaCallMetaDataProvider.java  
\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-  
jar/org/springframework/jdbc/support/CustomSQLExceptionTranslatorRegistrar.java  
\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-  
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\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-  
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jar/org/springframework/jdbc/BadSqlGrammarException.java  
\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-  
jar/org/springframework/jdbc/object/SqlQuery.java  
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jar/org/springframework/jdbc/CannotGetJdbcConnectionException.java  
\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-  
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\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-  
jar/org/springframework/jdbc/InvalidResultSetAccessException.java  
\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-  
jar/org/springframework/jdbc/object/StoredProcedure.java  
\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-  
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jar/org/springframework/jdbc/support/DatabaseStartupValidator.java  
 \* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-  
 jar/org/springframework/jdbc/core/SqlReturnUpdateCount.java  
 \* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-  
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 jar/org/springframework/jdbc/core/SqlInOutParameter.java  
 \* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-  
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jar/org/springframework/jdbc/core/SqlOutParameter.java  
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jar/org/springframework/jdbc/support/xml/SqlXmlHandler.java  
\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-  
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\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-  
jar/org/springframework/jdbc/datasource/IsolationLevelDataSourceAdapter.java  
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jar/org/springframework/jdbc/core/CallableStatementCallback.java  
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jar/org/springframework/jdbc/core/support/JdbcBeanDefinitionReader.java  
\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-  
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jar/org/springframework/jdbc/support/incrementer/MySQLMaxValueIncrementer.java  
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jar/org/springframework/jdbc/object/MappingSqlQuery.java  
\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-  
jar/org/springframework/jdbc/datasource/embedded/EmbeddedDatabaseConfigurerFactory.java  
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jar/org/springframework/jdbc/core/ResultSetExtractor.java

\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/support/incrementer/PostgreSQLSequenceMaxValueIncrementer.java

\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/core/RowCountCallbackHandler.java

\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/core/PreparedStatementCallback.java

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/opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/object/BatchSqlUpdate.java

\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/JdbcUpdateAffectedIncorrectNumberOfRowsException.java

\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/core/RowMapper.java

\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/core/CallableStatementCreator.java

\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/core/metadata/DerbyTableMetaDataProvider.java

\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/datasource/embedded/EmbeddedDatabaseFactory.java

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\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-



jar/org/springframework/jdbc/datasource/embedded/OutputStreamFactory.java

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jar/org/springframework/jdbc/object/SqlUpdate.java

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jar/org/springframework/jdbc/core/ColumnMapRowMapper.java

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* /opt/cola/permits/1651261891_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-
jar/org/springframework/jdbc/datasource/init/ScriptStatementFailedException.java
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*/
/**
* Close this LobCreator session and free its temporarily created BLOBs and CLOBs.
* Will not need to do anything if using PreparedStatement's standard methods,
* but might be necessary to free database resources if using proprietary means.
* <p>NOTE</p>: Needs to be invoked after the involved
PreparedStatements have
* been executed or the affected O/R mapping sessions have been flushed.
* Otherwise, the database resources for the temporary BLOBs might stay allocated.
*/
```

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/opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/datasource/init/ScriptException.java  
\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/datasource/init/UncategorizedScriptException.java  
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\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/support/KeyHolder.java  
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\* The classes in this package make JDBC easier to use and

\* reduce the likelihood of common errors. In particular, they:

\* <ul>

\* <li>Simplify error handling, avoiding the need for try/catch/finally

- \* blocks in application code.
- \* <li>Present exceptions to application code in a generic hierarchy of
- \* unchecked exceptions, enabling applications to catch data access
- \* exceptions without being dependent on JDBC, and to ignore fatal
- \* exceptions there is no value in catching.
- \* <li>Allow the implementation of error handling to be modified
- \* to target different RDBMSes without introducing proprietary
- \* dependencies into application code.
- \* </ul>
- \* <p>This package and related packages are discussed in Chapter 9 of
- \* <a href="https://www.amazon.com/exec/obidos/tg/detail/-/0764543857/">Expert One-On-One J2EE Design and Development</a>
- \* by Rod Johnson (Wrox, 2002).
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jar/org/springframework/jdbc/core/namedparam/ParsedSql.java  
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jar/org/springframework/jdbc/datasource/DataSourceTransactionManager.java  
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jar/org/springframework/jdbc/core/simple/AbstractJdbcCall.java  
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\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/datasource/init/ScriptUtils.java  
\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/core/metadata/TableMetaDataProviderFactory.java  
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\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/core/namedparam/NamedParameterJdbcOperations.java  
\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/core/BeanPropertyRowMapper.java  
\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/core/metadata/GenericTableMetaDataProvider.java  
\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/core/metadata/TableMetaDataContext.java  
\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/core/JdbcOperations.java  
\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/core/namedparam/NamedParameterUtils.java  
\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/core/metadata/GenericCallMetaDataProvider.java  
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  - \* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/core/support/AbstractLobCreatingPreparedStatementCallback.java
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- \* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/datasource/init/DataSourceInitializer.java
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- \*/opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/core/simple/SimpleJdbcInsert.java
- \* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/core/metadata/OracleCallMetaDataProvider.java
- \* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/datasource/ConnectionProxy.java
- \* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/core/metadata/PostgresCallMetaDataProvider.java
- \* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/datasource/DelegatingDataSource.java
- \* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/datasource/init/ScriptParseException.java
- \* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/config/InitializeDatabaseBeanDefinitionParser.java
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/opt/cola/permits/1651261891_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-
jar/org/springframework/jdbc/support/lob/PassThroughBlob.java
* /opt/cola/permits/1651261891_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-
jar/org/springframework/jdbc/datasource/AbstractDriverBasedDataSource.java
* /opt/cola/permits/1651261891_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-
jar/org/springframework/jdbc/core/support/SqlLobValue.java
* /opt/cola/permits/1651261891_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-
jar/org/springframework/jdbc/support/lob/PassThroughClob.java
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jar/org/springframework/jdbc/core/ParameterDisposer.java
* /opt/cola/permits/1651261891_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-
jar/org/springframework/jdbc/core/metadata/SqlServerCallMetaDataProvider.java
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* /opt/cola/permits/1651261891_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-
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* /opt/cola/permits/1651261891_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-
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* /opt/cola/permits/1651261891_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-
jar/org/springframework/jdbc/config/EmbeddedDatabaseBeanDefinitionParser.java

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\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/NoHandlerFoundException.java

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/opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/view/document/AbstractXlsxView.java

\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/view/document/AbstractXlsxStreamingView.java

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\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/view/groovy/GroovyMarkupConfig.java

\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/tags/ArgumentAware.java

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\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/view/AbstractUrlBasedView.java  
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/opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/config/annotation/ResourceHandlerRegistration.java  
\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/handler/HandlerInterceptorAdapter.java  
\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/mvc/method/annotation/ServletWebArgumentResolverAdapter.java  
\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/view/tiles3/TilesView.java  
\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/config/annotation/RedirectViewControllerRegistration.java  
\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/config/annotation/ViewControllerRegistration.java  
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/opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/mvc/method/annotation/AsyncTaskMethodReturnValueHandler.java  
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\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/view/groovy/GroovyMarkupView.java  
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\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/handler/SimpleServletPostProcessor.java  
\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/i18n/AbstractLocaleContextResolver.java  
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/opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/handler/UserRoleAuthorizationInterceptor.java

\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/mvc/method/annotation/CallableMethodReturnValueHandler.java

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jar/org/springframework/web/servlet/resource/HttpResource.java  
\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-  
jar/org/springframework/web/servlet/view/tiles3/TilesConfigurer.java  
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* /opt/cola/permits/1651261818_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-
jar/org/springframework/web/servlet/handler/HandlerMappingIntrospector.java
* /opt/cola/permits/1651261818_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-
jar/org/springframework/web/servlet/config/FreeMarkerConfigurerBeanDefinitionParser.java
*
/opt/cola/permits/1651261818_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-
jar/org/springframework/web/servlet/i18n/AcceptHeaderLocaleResolver.java
* /opt/cola/permits/1651261818_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-
jar/org/springframework/web/servlet/mvc/method/annotation/RequestBodyAdvice.java
* /opt/cola/permits/1651261818_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-
jar/org/springframework/web/servlet/mvc/method/annotation/RequestMappingHandlerMapping.java
* /opt/cola/permits/1651261818_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-
jar/org/springframework/web/servlet/function/RequestPredicate.java
* /opt/cola/permits/1651261818_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-
jar/org/springframework/web/servlet/mvc/method/annotation/ReactiveTypeHandler.java
* /opt/cola/permits/1651261818_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-
jar/org/springframework/web/servlet/handler/AbstractHandlerExceptionResolver.java
*
/opt/cola/permits/1651261818_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-
jar/org/springframework/web/servlet/resource/ResourceUrlProvider.java
* /opt/cola/permits/1651261818_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-
jar/org/springframework/web/servlet/handler/MatchableHandlerMapping.java
* /opt/cola/permits/1651261818_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-
jar/org/springframework/web/servlet/mvc/support/DefaultHandlerExceptionResolver.java
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\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/handler/AbstractHandlerMethodMapping.java  
\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/function/PathResourceLookupFunction.java  
\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/mvc/method/annotation/MvcUriComponentsBuilder.java  
\*

/opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/mvc/method/RequestMappingInfoHandlerMapping.java  
\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/mvc/method/annotation/RequestBodyAdviceAdapter.java  
\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/FrameworkServlet.java  
\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/function/support/RouterFunctionMapping.java

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- \* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/theme/ThemeChangeInterceptor.java
- \*

/opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/tags/form/HiddenInputTag.java

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- \* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/resource/CssLinkResourceTransformer.java
- \*

/opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/function/DefaultRenderingResponseBuilder.java

- \* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/function/ToStringVisitor.java
- \* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/mvc/WebContentInterceptor.java
- \* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/function/RenderingResponse.java
- \* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/mvc/ServletWrappingController.java

\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/DispatcherServlet.java

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/opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/view/DefaultRequestToViewNameTranslator.java

\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/mvc/condition/AbstractRequestCondition.java

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\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/i18n/LocaleChangeInterceptor.java

\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/resource/VersionResourceResolver.java

\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/handler/AbstractUrlHandlerMapping.java

\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/config/annotation/DelegatingWebMvcConfiguration.java

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/opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/mvc/method/annotation/DeferredResultMethodReturnValueHandler.java

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\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/HandlerInterceptor.java

\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/view/script/ScriptTemplateView.java

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\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/handler/BeanNameUrlHandlerMapping.java

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\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/function/support/HandlerFunctionAdapter.java

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\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/mvc/method/annotation/ViewNameMethodReturnValueHandler.java  
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 \* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/mvc/method/annotation/ServletInvocableHandlerMethod.java  
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 \* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/resource/CachingResourceResolver.java  
 \* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/view/script/ScriptTemplateConfig.java  
 \* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/mvc/method/RequestMappingInfoHandlerMethodMappingNamingStrategy.java  
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 \* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/config/MvcNamespaceUtils.java  
 \* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/handler/HandlerExceptionResolverComposite.java  
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 /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/function/ServerRequestExtensions.kt  
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 \* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/mvc/method/annotation/StreamingResponseBodyReturnValueHandler.java  
 \* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/view/script/ScriptTemplateConfigurer.java  
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 \* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/handler/SimpleUrlHandlerMapping.java  
 \* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/mvc/method/annotation/PathVariableMethodArgumentResolver.java  
 \* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/function/EntityResponse.java  
 \* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/function/RouterFunction.java  
 \* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/resource/EncodedResourceResolver.java  
 \* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/function/ResourceHandlerFunction.java

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\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/mvc/method/annotation/ViewMethodReturnValueHandler.java  
\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/resource/CachingResourceTransformer.java  
\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/config/annotation/InterceptorRegistration.java  
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\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/config/MvcNamespaceHandler.java  
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/opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/view/ViewResolverComposite.java  
\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/mvc/Controller.java  
\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/mvc/method/annotation/StreamingResponseBody.java  
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\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/config/InterceptorsBeanDefinitionParser.java  
\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/mvc/condition/RequestCondition.java  
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\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/view/AbstractTemplateView.java  
\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/handler/RequestMatchResult.java  
\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/config/DefaultServletHandlerBeanDefinitionParser.java  
\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/config/annotation/WebMvcConfigurerAdapter.java

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\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/tags/form/AbstractCheckedElementTag.java

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\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/tags/form/FormTag.java

\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/view/freemarker/FreeMarkerConfigurer.java

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\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/config/ScriptTemplateConfigurerBeanDefinitionParser.java

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\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/mvc/condition/CompositeRequestCondition.java

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\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/resource/DefaultResourceResolverChain.java

\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/view/feed/AbstractFeedView.java

\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/view/document/AbstractPdfView.java

\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/mvc/AbstractController.java

\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/resource/ContentVersionStrategy.java

\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/theme/CookieThemeResolver.java

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\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/HandlerMapping.java  
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jar/org/springframework/web/servlet/config/annotation/UrlBasedViewResolverRegistration.java
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jar/org/springframework/web/servlet/mvc/method/annotation/ServletCookieValueMethodArgumentResolver.java  
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jar/org/springframework/web/servlet/mvc/UrlFilenameViewController.java  
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jar/org/springframework/web/servlet/config/ResourcesBeanDefinitionParser.java  
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\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-  
jar/org/springframework/web/servlet/function/ServerRequest.java  
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jar/org/springframework/web/servlet/config/annotation/CorsRegistration.java  
\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-  
jar/org/springframework/web/servlet/mvc/annotation/ResponseStatusExceptionHandler.java  
\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-  
jar/org/springframework/web/servlet/mvc/method/annotation/ResponseBodyEmitterReturnValueHandler.java  
\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-  
jar/org/springframework/web/servlet/mvc/condition/AbstractMediaTypeExpression.java  
\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-  
jar/org/springframework/web/servlet/support/ServletUriComponentsBuilder.java  
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/opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-  
jar/org/springframework/web/servlet/config/AnnotationDrivenBeanDefinitionParser.java  
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/\*\*

\* A contract for inspecting and potentially modifying request data values such

\* as URL query parameters or form field values before they are rendered by a

\* view or before a redirect.

\*

\* <p>Implementations may use this contract for example as part of a solution

\* to provide data integrity, confidentiality,

protection against cross-site

\* request forgery (CSRF), and others or for other tasks such as automatically

\* adding a hidden field to all forms and URLs.

\*

\* <p>View technologies that support this contract can obtain an instance to

\* delegate to via { @link RequestContext#getRequestDataValueProcessor() }.

\*

\* @author Rossen Stoyanchev

\* @since 3.1

\*/

Found in path(s):

\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/support/RequestDataValueProcessor.java

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- \* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/mvc/condition/MediaTypeExpression.java
- \*
- /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/SmartView.java
- \* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/tags/form/OptionWriter.java
- \* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/handler/AbstractDetectingUrlHandlerMapping.java
- \* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/tags/form/TagIdGenerator.java
- \* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/view/tiles3/AbstractSpringPreparerFactory.java
- \* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/tags/form/RadioButtonTag.java
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- \* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/mvc/AbstractUrlViewController.java
- \* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/mvc/support/RedirectAttributes.java
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- \*



/opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/view/tiles3/SpringBeanPreparerFactory.java

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\* XSLT-driven View that allows for response context to be rendered as the

\* result of an XSLT transformation.

\*

\* <p>The XSLT Source object is supplied as a parameter in the model and then

\* { @link #locateSource detected } during response rendering. Users can either specify

\* a specific entry in the

model via the { @link #setSourceKey sourceKey } property or

\* have Spring locate the Source object. This class also provides basic conversion

\* of objects into Source implementations. See { @link #getSourceTypes() here }

\* for more details.

\*

\* <p>All model parameters are passed to the XSLT Transformer as parameters.

\* In addition the user can configure { @link #setOutputProperties output properties }

\* to be passed to the Transformer.

\*

\* @author Rob Harrop

\* @author Juergen Hoeller

\* @since 2.0

\*/

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\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/view/xslt/XsltView.java

## 1.272 spring-tx 5.2.24.RELEASE

## 1.272.1 Available under license :

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jar/org/springframework/jca/cci/core/RecordCreator.java
* /opt/cola/permits/1651261844_1682321444.8156874/0/spring-tx-5-2-24-release-sources-
jar/org/springframework/dao/support/PersistenceExceptionTranslator.java
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jar/org/springframework/transaction/support/SmartTransactionObject.java
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\* /opt/cola/permits/1651261844\_1682321444.8156874/0/spring-tx-5-2-24-release-sources-jar/org/springframework/transaction/reactive/TransactionSynchronizationManager.java  
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\* /opt/cola/permits/1651261844\_1682321444.8156874/0/spring-tx-5-2-24-release-sources-jar/org/springframework/transaction/annotation/AbstractTransactionManagementConfiguration.java  
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\* /opt/cola/permits/1651261844\_1682321444.8156874/0/spring-tx-5-2-24-release-sources-  
jar/org/springframework/transaction/TransactionSuspensionNotSupportedException.java  
\* /opt/cola/permits/1651261844\_1682321444.8156874/0/spring-tx-5-2-24-release-sources-  
jar/org/springframework/dao/DataIntegrityViolationException.java  
\* /opt/cola/permits/1651261844\_1682321444.8156874/0/spring-tx-5-2-24-release-sources-  
jar/org/springframework/transaction/support/DelegatingTransactionDefinition.java  
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/opt/cola/permits/1651261844\_1682321444.8156874/0/spring-tx-5-2-24-release-sources-  
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\* /opt/cola/permits/1651261844\_1682321444.8156874/0/spring-tx-5-2-24-release-sources-  
jar/org/springframework/transaction/jta/UserTransactionAdapter.java  
\* /opt/cola/permits/1651261844\_1682321444.8156874/0/spring-tx-5-2-24-release-sources-  
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\* /opt/cola/permits/1651261844\_1682321444.8156874/0/spring-tx-5-2-24-release-sources-  
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\* /opt/cola/permits/1651261844\_1682321444.8156874/0/spring-tx-5-2-24-release-sources-  
jar/org/springframework/transaction/jta/TransactionFactory.java

\* /opt/cola/permits/1651261844\_1682321444.8156874/0/spring-tx-5-2-24-release-sources-jar/org/springframework/transaction/support/ResourceTransactionManager.java  
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\* /opt/cola/permits/1651261844\_1682321444.8156874/0/spring-tx-5-2-24-release-sources-jar/org/springframework/transaction/IllegalTransactionStateException.java  
\* /opt/cola/permits/1651261844\_1682321444.8156874/0/spring-tx-5-2-24-release-sources-jar/org/springframework/transaction/TransactionException.java

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\* /opt/cola/permits/1651261844\_1682321444.8156874/0/spring-tx-5-2-24-release-sources-jar/org/springframework/transaction/support/CallbackPreferringPlatformTransactionManager.java

\* /opt/cola/permits/1651261844\_1682321444.8156874/0/spring-tx-5-2-24-release-sources-jar/org/springframework/transaction/support/TransactionCallbackWithoutResult.java

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/opt/cola/permits/1651261844\_1682321444.8156874/0/spring-tx-5-2-24-release-sources-jar/org/springframework/dao/NonTransientDataAccessResourceException.java

\* /opt/cola/permits/1651261844\_1682321444.8156874/0/spring-tx-5-2-24-release-sources-jar/org/springframework/jca/support/SimpleBootstrapContext.java

\* /opt/cola/permits/1651261844\_1682321444.8156874/0/spring-tx-5-2-24-release-sources-jar/org/springframework/dao/DataAccessException.java

\* /opt/cola/permits/1651261844\_1682321444.8156874/0/spring-tx-5-2-24-release-sources-jar/org/springframework/jca/support/ResourceAdapterFactoryBean.java

\* /opt/cola/permits/1651261844\_1682321444.8156874/0/spring-tx-5-2-24-release-sources-jar/org/springframework/dao/NonTransientDataAccessException.java

\* /opt/cola/permits/1651261844\_1682321444.8156874/0/spring-tx-5-2-24-release-sources-jar/org/springframework/jca/cci/core/CciOperations.java

\* /opt/cola/permits/1651261844\_1682321444.8156874/0/spring-tx-5-2-24-release-sources-jar/org/springframework/dao/ConcurrencyFailureException.java

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/opt/cola/permits/1651261844_1682321444.8156874/0/spring-tx-5-2-24-release-sources-
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* /opt/cola/permits/1651261844_1682321444.8156874/0/spring-tx-5-2-24-release-sources-
jar/org/springframework/dao/TransientDataAccessException.java
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/opt/cola/permits/1651261844_1682321444.8156874/0/spring-tx-5-2-24-release-sources-
jar/org/springframework/dao/UncategorizedDataAccessException.java
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jar/org/springframework/dao/annotation/PersistenceExceptionTranslationPostProcessor.java
* /opt/cola/permits/1651261844_1682321444.8156874/0/spring-tx-5-2-24-release-sources-
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jar/org/springframework/transaction/annotation/Transactional.java
* /opt/cola/permits/1651261844_1682321444.8156874/0/spring-tx-5-2-24-release-sources-
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jar/org/springframework/transaction/jta/WebSphereUowTransactionManager.java
* /opt/cola/permits/1651261844_1682321444.8156874/0/spring-tx-5-2-24-release-sources-
jar/org/springframework/transaction/reactive/AbstractReactiveTransactionManager.java
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* /opt/cola/permits/1651261844_1682321444.8156874/0/spring-tx-5-2-24-release-sources-
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* /opt/cola/permits/1651261844_1682321444.8156874/0/spring-tx-5-2-24-release-sources-
jar/org/springframework/transaction/config/TxAdviceBeanDefinitionParser.java
* /opt/cola/permits/1651261844_1682321444.8156874/0/spring-tx-5-2-24-release-sources-
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* /opt/cola/permits/1651261844_1682321444.8156874/0/spring-tx-5-2-24-release-sources-
jar/org/springframework/transaction/support/SimpleTransactionScope.java
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jar/org/springframework/transaction/reactive/TransactionalOperator.java
* /opt/cola/permits/1651261844_1682321444.8156874/0/spring-tx-5-2-24-release-sources-
jar/org/springframework/transaction/PlatformTransactionManager.java
* /opt/cola/permits/1651261844_1682321444.8156874/0/spring-tx-5-2-24-release-sources-
jar/org/springframework/transaction/annotation/ProxyTransactionManagementConfiguration.java
* /opt/cola/permits/1651261844_1682321444.8156874/0/spring-tx-5-2-24-release-sources-
jar/org/springframework/transaction/annotation/EnableTransactionManagement.java
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\* /opt/cola/permits/1651261844\_1682321444.8156874/0/spring-tx-5-2-24-release-sources-jar/org/springframework/jca/cci/object/MappingCommAreaOperation.java  
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\* /opt/cola/permits/1651261844\_1682321444.8156874/0/spring-tx-5-2-24-release-sources-jar/org/springframework/transaction/config/JtaTransactionManagerBeanDefinitionParser.java  
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\* /opt/cola/permits/1651261834\_1682321546.5973234/0/spring-beans-5-2-24-release-sources-jar/org/springframework/beans/factory/groovy/GroovyBeanDefinitionReader.java  
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jar/org/springframework/beans/factory/serviceloader/ServiceFactoryBean.java

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- \* /opt/cola/permits/1651261834\_1682321546.5973234/0/spring-beans-5-2-24-release-sources-jar/org/springframework/beans/factory/config/BeanDefinitionCustomizer.java
- \* /opt/cola/permits/1651261834\_1682321546.5973234/0/spring-beans-5-2-24-release-sources-jar/org/springframework/beans/propertyeditors/ReaderEditor.java
- \* /opt/cola/permits/1651261834\_1682321546.5973234/0/spring-beans-5-2-24-release-sources-jar/org/springframework/beans/factory/support/ImplicitlyAppearedSingletonException.java
- \* /opt/cola/permits/1651261834\_1682321546.5973234/0/spring-beans-5-2-24-release-sources-jar/org/springframework/beans/propertyeditors/URLEditor.java
- \* /opt/cola/permits/1651261834\_1682321546.5973234/0/spring-beans-5-2-24-release-sources-jar/org/springframework/beans/factory/serviceloader/ServiceListFactoryBean.java
- \* /opt/cola/permits/1651261834\_1682321546.5973234/0/spring-beans-5-2-24-release-sources-jar/org/springframework/beans/factory/config/SmartInstantiationAwareBeanPostProcessor.java
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- \* /opt/cola/permits/1651261834\_1682321546.5973234/0/spring-beans-5-2-24-release-sources-jar/org/springframework/beans/factory/NamedBean.java
- \* /opt/cola/permits/1651261834\_1682321546.5973234/0/spring-beans-5-2-24-release-sources-jar/org/springframework/beans/NullValueInNestedPathException.java
- \* /opt/cola/permits/1651261834\_1682321546.5973234/0/spring-beans-5-2-24-release-sources-jar/org/springframework/beans/factory/BeanInitializationException.java
- \* /opt/cola/permits/1651261834\_1682321546.5973234/0/spring-beans-5-2-24-release-sources-jar/org/springframework/beans/factory/BeanNameAware.java
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- /opt/cola/permits/1651261834\_1682321546.5973234/0/spring-beans-5-2-24-release-sources-jar/org/springframework/beans/support/ResourceEditorRegistrar.java
- \* /opt/cola/permits/1651261834\_1682321546.5973234/0/spring-beans-5-2-24-release-sources-jar/org/springframework/beans/factory/config/Scope.java
- \* /opt/cola/permits/1651261834\_1682321546.5973234/0/spring-beans-5-2-24-release-sources-

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\* /opt/cola/permits/1651261834\_1682321546.5973234/0/spring-beans-5-2-24-release-sources-jar/org/springframework/beans/factory/ListableBeanFactory.java  
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/opt/cola/permits/1651261834\_1682321546.5973234/0/spring-beans-5-2-24-release-sources-jar/org/springframework/beans/factory/support/ReplaceOverride.java  
\* /opt/cola/permits/1651261834\_1682321546.5973234/0/spring-beans-5-2-24-release-sources-jar/org/springframework/beans/factory/config/YamlProcessor.java  
\* /opt/cola/permits/1651261834\_1682321546.5973234/0/spring-beans-5-2-24-release-sources-jar/org/springframework/beans/factory/annotation/InjectionMetadata.java  
\* /opt/cola/permits/1651261834\_1682321546.5973234/0/spring-beans-5-2-24-release-sources-jar/org/springframework/beans/factory/support/DefaultSingletonBeanRegistry.java  
\* /opt/cola/permits/1651261834\_1682321546.5973234/0/spring-beans-5-2-24-release-sources-jar/org/springframework/beans/factory/parsing/BeanEntry.java  
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jar/org/springframework/beans/ExtendedBeanInfoFactory.java
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jar/org/springframework/beans/BeanInfoFactory.java
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\* /opt/cola/permits/1651261858\_1682321586.8808553/0/spring-aop-5-2-24-release-sources-jar/org/springframework/aop/aspectj/AspectJAfterAdvice.java  
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/opt/cola/permits/1651261858\_1682321586.8808553/0/spring-aop-5-2-24-release-sources-jar/org/springframework/aop/TargetClassAware.java

\* /opt/cola/permits/1651261858\_1682321586.8808553/0/spring-aop-5-2-24-release-sources-jar/org/springframework/aop/ProxyMethodInvocation.java

\* /opt/cola/permits/1651261858\_1682321586.8808553/0/spring-aop-5-2-24-release-sources-jar/org/springframework/aop/aspectj/annotation/PrototypeAspectInstanceFactory.java

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\* /opt/cola/permits/1651261858\_1682321586.8808553/0/spring-aop-5-2-24-release-sources-jar/org/springframework/aop/aspectj/SingletonAspectInstanceFactory.java  
\* /opt/cola/permits/1651261858\_1682321586.8808553/0/spring-aop-5-2-24-release-sources-jar/org/springframework/aop/aspectj/AspectJMethodBeforeAdvice.java  
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\* /opt/cola/permits/1651261858\_1682321586.8808553/0/spring-aop-5-2-24-release-sources-jar/org/springframework/aop/support/DefaultIntroductionAdvisor.java

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/opt/cola/permits/1651261858\_1682321586.8808553/0/spring-aop-5-2-24-release-sources-jar/org/springframework/aop/framework/autoproxy/AbstractAutoProxyCreator.java

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jar/org/springframework/aop/AfterAdvice.java  
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jar/org/springframework/aop/framework/AdvisedSupportListener.java  
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jar/org/springframework/aop/IntroductionInterceptor.java  
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jar/org/springframework/aop/RawTargetAccess.java  
\* /opt/cola/permits/1651261858\_1682321586.8808553/0/spring-aop-5-2-24-release-sources-  
jar/org/springframework/aop/BeforeAdvice.java  
\* /opt/cola/permits/1651261858\_1682321586.8808553/0/spring-aop-5-2-24-release-sources-  
jar/org/springframework/aop/framework/InterceptorAndDynamicMethodMatcher.java  
\* /opt/cola/permits/1651261858\_1682321586.8808553/0/spring-aop-5-2-24-release-sources-  
jar/org/springframework/aop/framework/AopInfrastructureBean.java  
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jar/org/springframework/aop/SpringProxy.java

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jar/org/springframework/aop/framework/autoproxy/target/QuickTargetSourceCreator.java  
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jar/org/aopalliance/intercept/MethodInterceptor.java
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* /opt/cola/permits/1651261858_1682321586.8808553/0/spring-aop-5-2-24-release-sources-
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* /opt/cola/permits/1651261858_1682321586.8808553/0/spring-aop-5-2-24-release-sources-
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* /opt/cola/permits/1651261858_1682321586.8808553/0/spring-aop-5-2-24-release-sources-
jar/org/springframework/aop/framework/ProxyCreatorSupport.java
* /opt/cola/permits/1651261858_1682321586.8808553/0/spring-aop-5-2-24-release-sources-
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* /opt/cola/permits/1651261858_1682321586.8808553/0/spring-aop-5-2-24-release-sources-
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* /opt/cola/permits/1651261858_1682321586.8808553/0/spring-aop-5-2-24-release-sources-
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jar/org/springframework/aop/aspectj/annotation/BeanFactoryAspectInstanceFactory.java
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 jar/org/springframework/aop/aspectj/AspectJPointcutAdvisor.java



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\* /opt/cola/permits/1651261858\_1682321586.8808553/0/spring-aop-5-2-24-release-sources-jar/org/springframework/aop/framework/autoprox/target/LazyInitTargetSourceCreator.java  
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/opt/cola/permits/1651261858\_1682321586.8808553/0/spring-aop-5-2-24-release-sources-jar/org/springframework/aop/support/NameMatchMethodPointcutAdvisor.java  
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- \* /opt/cola/permits/1651261858\_1682321586.8808553/0/spring-aop-5-2-24-release-sources-jar/org/springframework/aop/support/ExpressionPointcut.java
- \* /opt/cola/permits/1651261858\_1682321586.8808553/0/spring-aop-5-2-24-release-sources-jar/org/springframework/aop/aspectj/AspectInstanceFactory.java
- \* /opt/cola/permits/1651261858\_1682321586.8808553/0/spring-aop-5-2-24-release-sources-jar/org/springframework/aop/framework/autoproxy/BeanNameAutoProxyCreator.java
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- \* /opt/cola/permits/1651261858\_1682321586.8808553/0/spring-aop-5-2-24-release-sources-jar/org/springframework/aop/support/AbstractGenericPointcutAdvisor.java
- \* /opt/cola/permits/1651261858\_1682321586.8808553/0/spring-aop-5-2-24-release-sources-jar/org/springframework/aop/support/DelegatingIntroductionInterceptor.java
- \* /opt/cola/permits/1651261858\_1682321586.8808553/0/spring-aop-5-2-24-release-sources-jar/org/springframework/aop/config/AbstractInterceptorDrivenBeanDefinitionDecorator.java
- \* /opt/cola/permits/1651261858\_1682321586.8808553/0/spring-aop-5-2-24-release-sources-jar/org/springframework/aop/interceptor/JamonPerformanceMonitorInterceptor.java
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- /opt/cola/permits/1651261858\_1682321586.8808553/0/spring-aop-5-2-24-release-sources-jar/org/springframework/aop/support/AbstractBeanFactoryPointcutAdvisor.java
- \* /opt/cola/permits/1651261858\_1682321586.8808553/0/spring-aop-5-2-24-release-sources-jar/org/springframework/aop/interceptor/SimpleTraceInterceptor.java
- \* /opt/cola/permits/1651261858\_1682321586.8808553/0/spring-aop-5-2-24-release-sources-jar/org/springframework/aop/support/DefaultPointcutAdvisor.java

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\* /opt/cola/permits/1651261858\_1682321586.8808553/0/spring-aop-5-2-24-release-sources-jar/org/springframework/aop/interceptor/AbstractTraceInterceptor.java  
\* /opt/cola/permits/1651261858\_1682321586.8808553/0/spring-aop-5-2-24-release-sources-jar/org/springframework/aop/config/MethodLocatingFactoryBean.java  
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jar/org/aopalliance/intercept/MethodInvocation.java  
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jar/org/springframework/aop/aspectj/AspectJAfterReturningAdvice.java  
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jar/org/springframework/aop/support/RootClassFilter.java

\* /opt/cola/permits/1651261858\_1682321586.8808553/0/spring-aop-5-2-24-release-sources-jar/org/springframework/aop/aspectj/AbstractAspectJAdvice.java  
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\* /opt/cola/permits/1651261858\_1682321586.8808553/0/spring-aop-5-2-24-release-sources-jar/org/springframework/aop/support/Pointcuts.java  
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/opt/cola/permits/1651261858\_1682321586.8808553/0/spring-aop-5-2-24-release-sources-jar/org/springframework/aop/framework/AdvisedSupport.java  
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- \* /opt/cola/permits/1651261858\_1682321586.8808553/0/spring-aop-5-2-24-release-sources-jar/org/springframework/aop/Pointcut.java
- \*
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- \* /opt/cola/permits/1651261858\_1682321586.8808553/0/spring-aop-5-2-24-release-sources-jar/org/springframework/aop/aspectj/AspectJAopUtils.java
- \* /opt/cola/permits/1651261858\_1682321586.8808553/0/spring-aop-5-2-24-release-sources-jar/org/springframework/aop/AopInvocationException.java
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- \* /opt/cola/permits/1651261858\_1682321586.8808553/0/spring-aop-5-2-24-release-sources-jar/org/springframework/aop/target/dynamic/Refreshable.java
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- \* /opt/cola/permits/1651261858\_1682321586.8808553/0/spring-aop-5-2-24-release-sources-

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* /opt/cola/permits/1651261858_1682321586.8808553/0/spring-aop-5-2-24-release-sources-
jar/org/springframework/aop/IntroductionAdvisor.java
* /opt/cola/permits/1651261858_1682321586.8808553/0/spring-aop-5-2-24-release-sources-
jar/org/springframework/aop/scope/ScopedObject.java

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```
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The hypothetical commands

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```
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```

```
<signature of Ty Coon>, 1 April 1989
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\* /opt/cola/permits/1681297276\_1684484022.2676213/0/servlet-api-4-0-0-sources-6-jar/META-INF/maven/org.xipki/servlet-api/pom.xml

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\* /opt/cola/permits/1681297276\_1684484022.2676213/0/servlet-api-4-0-0-sources-6-jar/org/xipki/http/servlet/ServletURI.java

\* /opt/cola/permits/1681297276\_1684484022.2676213/0/servlet-api-4-0-0-sources-6-jar/org/xipki/http/servlet/ServletURIPool.java

\*

/opt/cola/permits/1681297276\_1684484022.2676213/0/servlet-api-4-0-0-sources-6-jar/org/xipki/http/servlet/HttpServlet.java

\* /opt/cola/permits/1681297276\_1684484022.2676213/0/servlet-api-4-0-0-sources-6-jar/org/xipki/http/servlet/AbstractHttpServlet.java

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\* /opt/cola/permits/1681297276\_1684484022.2676213/0/servlet-api-4-0-0-sources-6-jar/org/xipki/http/servlet/SimpleLruCache.java

```
* /opt/cola/permits/1681297276_1684484022.2676213/0/servlet-api-4-0-0-sources-6-
jar/org/xipki/http/servlet/package-info.java
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# 1.278 flyway-spring5-test 6.4.0

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```
* /opt/cola/permits/1705980508_1686041451.9314718/0/flyway-spring5-test-6-4-0-sources-1-
jar/context/dataSourceSingleContext.xml
* /opt/cola/permits/1705980508_1686041451.9314718/0/flyway-spring5-test-6-4-0-sources-1-
jar/context/flywayPropertiesContext.xml
* /opt/cola/permits/1705980508_1686041451.9314718/0/flyway-spring5-test-6-4-0-sources-1-
jar/context/secondFlywayContainerContext.xml
*
/opt/cola/permits/1705980508_1686041451.9314718/0/flyway-spring5-test-6-4-0-sources-1-
jar/context/simple_applicationContext.xml
* /opt/cola/permits/1705980508_1686041451.9314718/0/flyway-spring5-test-6-4-0-sources-1-
jar/context/flywaySingleContext.xml
* /opt/cola/permits/1705980508_1686041451.9314718/0/flyway-spring5-test-6-4-0-sources-1-
jar/context/flywayContainerContext.xml
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\* /opt/cola/permits/1705980508\_1686041451.9314718/0/flyway-spring5-test-6-4-0-sources-1-jar/org/flywaydb/test/ExecutionListenerHelper.java

\*

/opt/cola/permits/1705980508\_1686041451.9314718/0/flyway-spring5-test-6-4-0-sources-1-jar/org/flywaydb/test/junit/FlywayTestExecutionListener.java

\* /opt/cola/permits/1705980508\_1686041451.9314718/0/flyway-spring5-test-6-4-0-sources-1-jar/org/flywaydb/test/junit5/annotation/FlywayTestExtension.java

\* /opt/cola/permits/1705980508\_1686041451.9314718/0/flyway-spring5-test-6-4-0-sources-1-jar/org/flywaydb/test/FlywayHelperFactory.java

\* /opt/cola/permits/1705980508\_1686041451.9314718/0/flyway-spring5-test-6-4-0-sources-1-jar/org/flywaydb/test/junit5/annotation/package-info.java

\* /opt/cola/permits/1705980508\_1686041451.9314718/0/flyway-spring5-test-6-4-0-sources-1-jar/org/flywaydb/test/junit/package-info.java

\* /opt/cola/permits/1705980508\_1686041451.9314718/0/flyway-spring5-test-6-4-0-sources-1-jar/org/flywaydb/test/junit5/FlywayTestExtension.java

\* /opt/cola/permits/1705980508\_1686041451.9314718/0/flyway-spring5-test-6-4-0-sources-1-jar/org/flywaydb/test/junit/FlywayHelperFactory.java

\*

/opt/cola/permits/1705980508\_1686041451.9314718/0/flyway-spring5-test-6-4-0-sources-1-jar/org/flywaydb/test/package-info.java



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```
* /opt/cola/permits/1705980500_1686096448.7662416/0/flyway-test-6-4-0-sources-1-
jar/org/flywaydb/test/annotation/FlywayTests.java
* /opt/cola/permits/1705980500_1686096448.7662416/0/flyway-test-6-4-0-sources-1-
jar/org/flywaydb/test/annotation/package-info.java
* /opt/cola/permits/1705980500_1686096448.7662416/0/flyway-test-6-4-0-sources-1-
jar/org/flywaydb/test/annotation/FlywayTest.java
```

# 1.280 loguru 0.7.0

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## 1.283 spring-context-support

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# 1.288 spring-boot-starter 2.3.3.RELEASE

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# 1.289 Ivm2 1.02.132

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## 1.290 spring-security-config 5.4.11

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## 1.291 spring-security 5.4.11

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# 1.292 libnss-nis 3.2

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/\*

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From strings/apr\_strnatcmp.c,  
include/apr\_strings.h:

strnatcmp.c -- Perform 'natural order' comparisons of strings in C.  
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From  
strings/apr\_snprintf.c:

- \*
- \* cvt - IEEE floating point formatting routines.
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-----  
fontconfig/fc-case/CaseFolding.txt

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-----  
fontconfig/src/fcatomic.h

/\*

\* Mutex operations. Originally copied from HarfBuzz.

\*

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-----  
fontconfig/src/fcfoundry.h

/\*

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-----  
fontconfig/src/fcmd5.h

```
/*
 * This code implements the MD5 message-digest algorithm.
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 * written by Colin Plumb in 1993, no copyright is claimed.
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 *
 * Equivalent code is available from RSA Data Security, Inc.
 * This code has been tested against that, and is equivalent,
 * except that you don't need to include two pages of legalese
 * with every copy.
 *
 * To compute the message digest of a chunk of bytes, declare an
 * MD5Context structure, pass it to MD5Init, call MD5Update
 * as
 * needed on buffers full of bytes, and then call MD5Final, which
 * will fill a supplied 16-byte array with the digest.
 */
```

-----  
fontconfig/src/fcmutex.h

```
/*
 * Atomic int and pointer operations. Originally copied from HarfBuzz.
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-----  
fontconfig/src/ftglue.[ch]

/\* ftglue.c: Glue code for compiling the OpenType code from  
\* FreeType 1 using only the public API of FreeType 2  
\*

\* By David Turner, The FreeType Project (www.freetype.org)  
\*

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\*

\* =====

\* the OpenType

parser codes was originally written as an extension to

\* FreeType 1.x. As such, its source code was embedded within the library,

\* and used many internal FreeType functions to deal with memory and

\* stream i/o.  
\*

\* When it was 'salvaged' for Pango and Qt, the code was "ported" to FreeType 2,

\* which basically means that some macro tricks were performed in order to

\* directly access FT2 \_internal\_ functions.  
\*

\* these functions were never part of FT2 public API, and \_did\_ change between

\* various releases. This created chaos for many users: when they upgraded the

\* FreeType library on their system, they couldn't run Gnome anymore since

\* Pango refused to link.  
\*

\* Very fortunately, it's possible to completely avoid this problem because

\* the FT\_StreamRec and FT\_MemoryRec structure types, which describe how

\* memory and stream implementations interface with the rest of the font

\* library, have always been part of the public API, and never changed.  
\*

\* What we do

thus is re-implement, within the OpenType parser, the few

\* functions that depend on them. This only adds one or two kilobytes of

\* code, and ensures that the parser can work with \_any\_ version

\* of FreeType installed on your system. How sweet... !  
\*

\* Note that we assume that Pango doesn't use any other internal functions

\* from FreeType. It used to in old versions, but this should no longer

\* be the case. (crossing my fingers).

\*  
\* - David Turner  
\* - The FreeType Project (www.freetype.org)  
\*  
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```
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```

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```
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```

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```
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```
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```

```
<signature of Ty Coon>, 1 April 1989
```

```
Ty Coon, President of Vice
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- \* Focusing on what is best for the community
- \* Showing empathy towards other community members

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.. \_contrib:

```
=====
click-contrib
=====
```

As the number of users of Click grows, more and more major feature requests are made. To users it may seem reasonable to include those features with Click;

however, many of them are experimental or aren't practical to support generically. Maintainers have to choose what is reasonable to maintain in Click core.

The click-contrib\_ GitHub organization exists as a place to collect third-party packages that extend Click's features. It is also meant to ease the effort of searching for such extensions.

Please note that the quality and stability of those packages may be different than Click itself. While published under a common organization, they are still separate from Click and the Pallets maintainers.

.. \_click-contrib: <https://github.com/click-contrib/>

Found in path(s):

\* /opt/cola/permits/1768276572\_1692297746.6031988/0/pallets-click-8-1-7-0-g874ca2b-tar-gz/pallets-click-006ae84/docs/contrib.rst

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## 1.306 libatomic-ops 7.2

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This code is derived from section 17.1 of Applied Cryptography, second edition, which describes a stream cipher allegedly compatible with RSA Labs "RC4" cipher (the actual description of which is a trade secret). The same algorithm is used as a stream cipher called "arcfour" in Tatu Ylonen's ssh package.

Here the stream cipher has been modified always to include the time when initializing the state. That makes it impossible to regenerate the same random sequence twice, so this can't be used for encryption, but will generate good random numbers.

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This code implements the MD5 message-digest algorithm. The algorithm is due to Ron Rivest. This code was written by Colin Plumb in 1993, no copyright is claimed. This code is in the public domain; do with it what you wish.

Equivalent code is available from RSA Data Security, Inc. This code has been tested against that, and is equivalent, except that you don't need to include two pages of legalese with every copy.

To compute the message digest of a chunk of bytes, declare an MD5Context structure, pass it to MD5Init, call MD5Update as needed on buffers full of bytes, and then call MD5Final, which

will fill a supplied 16-byte array with the digest.

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## 1.308 libpcap 1.8.0

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## 1.309 Ivm2 2.02.187

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@C{[(------)]}

@manual{

@sect1{ @title{Introduction}}

Lua is a powerful, efficient, lightweight, embeddable scripting language.

It supports procedural programming,  
 object-oriented programming, functional programming,  
 data-driven programming, and data description.

Lua combines simple procedural syntax with powerful data description  
 constructs based on associative arrays and extensible semantics.

Lua is dynamically typed,  
 runs by interpreting bytecode with a register-based  
 virtual machine,  
 and has automatic memory management with  
 a generational garbage collection,  
 making it ideal for configuration, scripting,  
 and rapid prototyping.

Lua is implemented as a library, written in @emphx{clean C},  
 the common subset of @N{standard C} and C++.

The Lua distribution includes a host program called @id{lua},  
 which uses the Lua library to offer  
 a complete,  
 standalone Lua interpreter,  
 for interactive or batch use.

Lua is intended to be used both as a powerful, lightweight,  
 embeddable scripting language for any program that needs one,  
 and as a powerful but lightweight and efficient stand-alone language.

As an extension language, Lua has no notion of a `@Q{main}` program: it works `@emph{embedded}` in a host client, called the `@emph{embedding program}` or simply the `@emphx{host}`. (Frequently, this host is the stand-alone `@id{lua}` program.) The host program can invoke functions to execute a piece of Lua code, can write and read Lua variables, and can register `@N{C functions}` to be called by Lua code. Through the use of `@N{C functions}`, Lua can be augmented to cope with a wide range of different domains, thus creating customized programming languages sharing a syntactical framework.

Lua is free software, and is provided as usual with no guarantees, as stated in its license. The implementation described in this manual is available at Lua's official web site, `@id{www.lua.org}`.

Like any other reference manual, this document is dry in places. For a discussion of the decisions behind the design of Lua, see the technical papers available at Lua's web site. For a detailed introduction to programming in Lua, see Roberto's book, `@emphx{Programming in Lua}`.

}

`@C{-----}`  
`@sect1{basic| @title{Basic Concepts}`

`@simplesect{`

This section describes the basic concepts of the language.

}

`@sect2{TypesSec| @title{Values and Types}`

Lua is a dynamically typed language. This means that variables do not have types; only values do. There are no type definitions in the language. All values carry their own type.

All values in Lua are first-class values. This means that all values can be stored in variables,



passed as arguments to other functions, and returned as results.

There are eight @x{basic types} in Lua:

@def{nil}, @def{boolean}, @def{number},  
@def{string},  
@def{function}, @def{userdata},  
@def{thread}, and @def{table}.

The type @emph{nil} has one single value, @nil,  
whose main property is to be different from any other value;  
it often represents the absence of a useful value.

The type @emph{boolean} has two values, @false and @true.

Both @nil and @false make a condition false;  
they are collectively called @def{false values}.

Any other value makes a condition true.

Despite its name,

@false is frequently used as an alternative to @nil,  
with the key difference that @false behaves  
like a regular value in a table,  
while a @nil in a table represents an absent key.

The type @emph{number} represents both  
integer numbers and real (floating-point) numbers,  
using two @x{subtypes}: @def{integer} and @def{float}.

Standard Lua uses 64-bit integers and double-precision (64-bit) floats,  
but you can also compile Lua so that it  
uses 32-bit integers and/or single-precision (32-bit) floats.

The option with 32 bits for both integers and floats  
is particularly

attractive

for small machines and embedded systems.

(See macro @id{LUA\_32BITS} in file @id{luaconf.h}.)

Unless stated otherwise,

any overflow when manipulating integer values @def{wrap around},  
according to the usual rules of two-complement arithmetic.

(In other words,

the actual result is the unique representable integer  
that is equal modulo @M{2@sp{n}} to the mathematical result,  
where @M{n} is the number of bits of the integer type.)

Lua has explicit rules about when each subtype is used,

but it also converts between them automatically as needed @see{coercion}.

Therefore,

the programmer may choose to mostly ignore the difference  
between integers and floats

or to assume complete control over the representation of each number.

The type @emph{string} represents immutable sequences of bytes.

@index{eight-bit clean}

Lua is 8-bit clean:

strings can contain any 8-bit value,  
including @x{embedded zeros} (@Char{\0}).

Lua is also encoding-agnostic;  
it makes no assumptions about the contents  
of a string.

The length of any string in Lua must fit in a Lua integer.

Lua can call (and manipulate) functions written in Lua and  
functions written in C @see{functioncall}.

Both are represented by the type @emph{function}.

The type @emph{userdata} is provided to allow arbitrary @N{C data} to  
be stored in Lua variables.

A userdata value represents a block of raw memory.

There are two kinds of userdata:

@emphx{full userdata},

which is an object with a block of memory managed by Lua,

and @emphx{light userdata},

which is simply a @N{C pointer} value.

Userdata has no predefined operations in Lua,  
except assignment and identity test.

By using @emph{metatables},

the programmer can define operations for full userdata values

@see{metatable}.

Userdata values cannot be created or modified in Lua,  
only through the @N{C API}.

This guarantees the integrity of data owned by  
the host program and @N{C libraries}.

The type @def{thread} represents independent threads of execution  
and it is used to

implement coroutines @see{coroutine}.

Lua threads are not related to operating-system threads.

Lua supports coroutines on all systems,  
even those that do not support threads natively.

The type @emph{table} implements @x{associative arrays},  
that is, @x{arrays} that can have as indices not only numbers,  
but any Lua value except @nil and @x{NaN}.

(@emphx{Not a Number} is a special floating-point value  
used by the @x{IEEE 754} standard to represent  
undefined numerical results, such as @T{0/0}.)

Tables can be @emph{heterogeneous};

that is, they can contain values of all types (except @nil).

Any key associated to the value @nil is not considered part of the table.

Conversely, any key that is not part of a table has

an associated value `@nil`.

Tables are the sole data-structuring mechanism in Lua; they can be used to represent ordinary arrays, lists, symbol tables, sets, records, graphs, trees, etc. To represent `@x{records}`, Lua uses the field name as an index. The language supports this representation by providing `@id{a.name}` as syntactic sugar for `@T{a["name"]}`. There are several convenient ways to create tables in Lua `@see{tableconstructor}`.

Like indices, the values of table fields can be of any type. In particular, because functions are first-class values, table fields can contain functions. Thus tables can also carry `@emph{methods}` `@see{func-def}`.

The indexing of tables follows the definition of raw equality in the language. The expressions `@T{a[i]}` and `@T{a[j]}` denote the same table element if and only if `@id{i}` and `@id{j}` are raw equal (that is, equal without metamethods). In particular, floats with integral values are equal to their respective integers (e.g., `@T{1.0 == 1}`). To avoid ambiguities, any float used as a key that is equal to an integer is converted to that integer. For instance, if you write `@T{a[2.0] = true}`, the actual key inserted into the table will be the integer `@T{2}`.

Tables, functions, threads, and (full) userdata values are `@emph{objects}`: variables do not actually `@emph{contain}` these values, only `@emph{references}` to them. Assignment, parameter passing, and function returns always manipulate references to such values; these operations do not imply any kind of copy.

The library function `@Lid{type}` returns a string describing the type of a given value `@seeF{type}`.

}

## @sect2{globalenv| @title{Environments and the Global Environment}}

As we will discuss further in @refsec{variables} and @refsec{assignment}, any reference to a free name

(that is, a name not bound to any declaration) @id{var}

is syntactically translated to @T{\_ENV.var}.

Moreover, every chunk is compiled in the scope of an external local variable named @id{\_ENV} @see{chunks}, so @id{\_ENV} itself is never a free name in a chunk.

Despite the existence of this external @id{\_ENV} variable and the translation of free names,

@id{\_ENV} is a completely regular name.

In particular,

you can define new variables and parameters with that name.

Each reference to a free

name uses the @id{\_ENV} that is

visible at that point in the program,

following the usual visibility rules of Lua @see{visibility}.

Any table used as the value of @id{\_ENV} is called an @def{environment}.

Lua keeps a distinguished environment called the @def{global environment}.

This value is kept at a special index in the C registry @see{registry}.

In Lua, the global variable @Lid{\_G} is initialized with this same value.

(@Lid{\_G} is never used internally,

so changing its value will affect only your own code.)

When Lua loads a chunk,

the default value for its @id{\_ENV} variable

is the global environment @seeF{load}.

Therefore, by default,

free names in Lua code refer to entries in the global environment

and, therefore, they are also called @def{global variables}.

Moreover, all standard libraries are loaded in the global environment

and some functions there operate on that environment.

You can use @Lid{load} (or @Lid{loadfile})

to load a chunk with a different environment.

(In C,

you have to load the chunk and then change the value

of its first upvalue; see @See{lua\_setupvalue}.)

}

## @sect2{error| @title{Error Handling}}

Several operations in Lua can @emph{raise} an error.

An error interrupts the normal flow of the program,

which can continue by `@emph{catching}` the error.

Lua code can explicitly raise an error by calling the `@Lid{error}` function.

(This function never returns.)

To catch errors in Lua,

you can do a `@def{protected call}`,

using `@Lid{pcall}` (or `@Lid{xpcall}`).

The function `@Lid{pcall}` calls a given function in `@def{protected mode}`.

Any error while running the function stops its execution,

and control returns immediately to `@id{pcall}`,

which returns a status code.

Because Lua is an embedded extension language,

Lua code starts running by a call

from `@N{C code}` in the host program.

(When you use Lua standalone,

the `@id{lua}` application is the host program.)

Usually, this call is protected;

so, when an otherwise unprotected error occurs during  
the compilation

or execution of a Lua chunk,

control returns to the host,

which can take appropriate measures,

such as printing an error message.

Whenever there is an error,

an `@def{error object}`

is propagated with information about the error.

Lua itself only generates errors whose error object is a string,

but programs may generate errors with

any value as the error object.

It is up to the Lua program or its host to handle such error objects.

For historical reasons,

an error object is often called an `@def{error message}`,

even though it does not have to be a string.

When you use `@Lid{xpcall}` (or `@Lid{lua_pcall}`, in C)

you may give a `@def{message handler}`

to be called in case of errors.

This function is called with the original error object

and returns a new error object.

It is called before the error unwinds the stack,

so that it can gather more information about the error,

for instance by inspecting the stack and creating a stack traceback.

This message handler is still protected by the

protected call;  
so, an error inside the message handler  
will call the message handler again.  
If this loop goes on for too long,  
Lua breaks it and returns an appropriate message.  
The message handler is called only for regular runtime errors.  
It is not called for memory-allocation errors  
nor for errors while running finalizers or other message handlers.

Lua also offers a system of `@emph{warnings}` `@seeF{warn}`.  
Unlike errors, warnings do not interfere  
in any way with program execution.  
They typically only generate a message to the user,  
although this behavior can be adapted from C `@seeC{lua_setwarnf}`.

}

`@sect2{metatable| @title{Metatables and Metamethods}`

Every value in Lua can have a `@emph{metatable}`.  
This `@def{metatable}` is an ordinary Lua table  
that defines the behavior of the original value  
under certain events.  
You can change several aspects of the behavior  
of a value by setting specific fields in its metatable.  
For instance, when a non-numeric value is the operand of an addition,  
Lua  
checks for a function in the field `@idx{__add}` of the value's metatable.  
If it finds one,  
Lua calls this function to perform the addition.

The key for each event in a metatable is a string  
with the event name prefixed by two underscores;  
the corresponding value is called a `@def{metavalue}`.  
For most events, the metavalue must be a function,  
which is then called a `@def{metamethod}`.  
In the previous example, the key is the string `@St{__add}`  
and the metamethod is the function that performs the addition.  
Unless stated otherwise,  
a metamethod may in fact be any `@x{callable value}`,  
which is either a function or a value with a `@idx{__call}` metamethod.

You can query the metatable of any value  
using the `@Lid{getmetatable}` function.  
Lua queries metamethods in metatables using a raw access `@seeF{rawget}`.

You can replace the metatable of tables  
using the `@Lid{setmetatable}` function.

You cannot change the metatable of other types from Lua code, except by using the `@link{debuglib|debug library}`.

## Tables

and full userdata have individual metatables, although multiple tables and userdata can share their metatables. Values of all other types share one single metatable per type; that is, there is one single metatable for all numbers, one for all strings, etc. By default, a value has no metatable, but the string library sets a metatable for the string type `@see{strlib}`.

A detailed list of operations controlled by metatables is given next. Each event is identified by its corresponding key. By convention, all metatable keys used by Lua are composed by two underscores followed by lowercase Latin letters.

`@description{`

`@item{ @idx{__add}|`  
the addition (`@T{+}`) operation.  
If any operand for an addition is not a number, Lua will try to call a metamethod. It starts by checking the first operand (even if it is a number); if that operand does not define a metamethod for `@idx{__add}`, then Lua will check the second operand. If Lua can find a metamethod, it calls the metamethod with the two operands as arguments, and the result of the call (adjusted to one value) is the result of the operation. Otherwise, if no metamethod is found, Lua raises an error.  
`}`

`@item{ @idx{__sub}|`  
the subtraction (`@T{-}`) operation.  
Behavior similar to the addition operation.  
`}`

`@item{ @idx{__mul}|`  
the multiplication (`@T{*}`) operation.  
Behavior similar to the addition operation.  
`}`

`@item{ @idx{__div}|`  
the division (`@T{/}`) operation.

Behavior similar to the addition operation.

}

@item{ @idx{\_\_mod}|

the modulo ( $@T\{\%\}$ ) operation.

Behavior similar to the addition operation.

}

@item{ @idx{\_\_pow}|

the exponentiation ( $@T\{\wedge\}$ ) operation.

Behavior similar to the addition operation.

}

@item{ @idx{\_\_unm}|

the negation (unary  $@T\{-\}$ ) operation.

Behavior similar to the addition operation.

}

@item{ @idx{\_\_idiv}|

the floor division ( $@T\{/\}$ ) operation.

Behavior similar to the addition operation.

}

@item{ @idx{\_\_band}|

the bitwise AND ( $@T\{\&\}$ ) operation.

Behavior similar to the addition operation,

except that Lua will

try a metamethod

if any operand is neither an integer

nor a float coercible to an integer @see{coercion}.

}

@item{ @idx{\_\_bor}|

the bitwise OR ( $@T\{\|\}$ ) operation.

Behavior similar to the bitwise AND operation.

}

@item{ @idx{\_\_bxor}|

the bitwise exclusive OR (binary  $@T\{\sim\}$ ) operation.

Behavior similar to the bitwise AND operation.

}

@item{ @idx{\_\_bnot}|

the bitwise NOT (unary  $@T\{\sim\}$ ) operation.

Behavior similar to the bitwise AND operation.

}

@item{ @idx{\_\_shl}|



the bitwise left shift (`@T{<<}`) operation.  
Behavior similar to the bitwise AND operation.  
}

@item{ @idx{\_\_shr}|  
the bitwise right shift (`@T{>>}`) operation.  
Behavior similar to the bitwise AND operation.  
}

@item{ @idx{\_\_concat}|  
the concatenation (`@T{..}`) operation.  
Behavior similar to the addition operation,  
except that Lua will try a metamethod  
if any operand is neither a string nor a number  
(which is always coercible to a string).  
}

@item{ @idx{\_\_len}|  
the length (`@T{#}`) operation.  
If the object is not a string,  
Lua will try its  
metamethod.  
If there is a metamethod,  
Lua calls it with the object as argument,  
and the result of the call  
(always adjusted to one value)  
is the result of the operation.  
If there is no metamethod but the object is a table,  
then Lua uses the table length operation @see{len-op}.  
Otherwise, Lua raises an error.  
}

@item{ @idx{\_\_eq}|  
the equal (`@T{==}`) operation.  
Behavior similar to the addition operation,  
except that Lua will try a metamethod only when the values  
being compared are either both tables or both full userdata  
and they are not primitively equal.  
The result of the call is always converted to a boolean.  
}

@item{ @idx{\_\_lt}|  
the less than (`@T{<}`) operation.  
Behavior similar to the addition operation,  
except that Lua will try a metamethod only when the values  
being compared are neither both numbers nor both strings.  
Moreover, the result of the call is always converted to a boolean.  
}

@item{ @idx{\_\_le}|  
the less equal (@T{<=}) operation.  
Behavior similar to the less than operation.  
}

@item{ @idx{\_\_index}|  
The  
indexing access operation @T{table[key]}.  
This event happens when @id{table} is not a table or  
when @id{key} is not present in @id{table}.  
The metavalues are looked up in the metatable of @id{table}.

The metavalues for this event can be either a function, a table,  
or any value with an @idx{\_\_index} metavalues.  
If it is a function,  
it is called with @id{table} and @id{key} as arguments,  
and the result of the call  
(adjusted to one value)  
is the result of the operation.  
Otherwise,  
the final result is the result of indexing this metavalues with @id{key}.  
This indexing is regular, not raw,  
and therefore can trigger another @idx{\_\_index} metavalues.  
}

@item{ @idx{\_\_newindex}|  
The indexing assignment @T{table[key] = value}.  
Like the index event,  
this event happens when @id{table} is not a table or  
when @id{key} is not present in @id{table}.  
The metavalues are looked up in the metatable of @id{table}.

Like with indexing,  
the metavalues for this event can be either a function,  
a table,  
or any value with an @idx{\_\_newindex} metavalues.  
If it is a function,  
it is called with @id{table}, @id{key}, and @id{value} as arguments.  
Otherwise,  
Lua repeats the indexing assignment over this metavalues  
with the same key and value.  
This assignment is regular, not raw,  
and therefore can trigger another @idx{\_\_newindex} metavalues.

Whenever a @idx{\_\_newindex} metavalues is invoked,  
Lua does not perform the primitive assignment.  
If needed,

the metamethod itself can call `@Lid{rawset}`

to do the assignment.

}

`@item{ @idx{__call}|`

The call operation `@T{func(args)}`.

This event happens when Lua tries to call a non-function value (that is, `@id{func}` is not a function).

The metamethod is looked up in `@id{func}`.

If present,

the metamethod is called with `@id{func}` as its first argument, followed by the arguments of the original call (`@id{args}`).

All results of the call

are the results of the operation.

This is the only metamethod that allows multiple results.

}

}

In addition to

the previous list,

the interpreter also respects the following keys in metatables:

`@idx{__gc}` `@see{finalizers}`,

`@idx{__close}` `@see{to-be-closed}`,

`@idx{__mode}` `@see{weak-table}`,

and `@idx{__name}`.

(The entry `@idx{__name}`,

when it contains a string,

may be used by `@Lid{tostring}` and in error messages.)

For the unary operators (negation, length, and bitwise NOT),

the metamethod is computed and called with a dummy second operand, equal to the first one.

This extra operand is only to simplify Lua's internals

(by making these operators behave like a binary operation)

and may be removed in future versions.

For most uses this extra operand is irrelevant.

Because metatables are regular tables,

they can contain arbitrary fields,

not only the event names defined above.

Some functions in the standard library

(e.g., `@Lid{tostring}`)

use other fields in metatables for their own purposes.

It is a good practice to add all needed metamethods to a table

before setting it as a metatable of some object.

In

particular, the `@idx{__gc}` metamethod works only when this order is followed `@see{finalizers}`.

It is also a good practice to set the metatable of an object right after its creation.

```
}
```

```
@sect2{GC| @title{Garbage Collection}
```

```
@simplesect{
```

Lua performs automatic memory management.

This means that

you do not have to worry about allocating memory for new objects or freeing it when the objects are no longer needed.

Lua manages memory automatically by running

a `@def{garbage collector}` to collect all `@emph{dead}` objects.

All memory used by Lua is subject to automatic management:

strings, tables, userdata, functions, threads, internal structures, etc.

An object is considered `@def{dead}`

as soon as the collector can be sure the object

will not be accessed again in the normal execution of the program.

(`@Q{Normal execution}` here excludes finalizers,

which can resurrect dead objects `@see{finalizers}`,

and excludes also operations using the debug library.)

Note that the time when the collector can

be sure that an object

is dead may not coincide with the programmer's expectations.

The only guarantees are that Lua will not collect an object

that may still be accessed in the normal execution of the program,

and it will eventually collect an object

that is inaccessible from Lua.

(Here,

`@emph{inaccessible from Lua}` means that neither a variable nor another live object refer to the object.)

Because Lua has no knowledge about `@N{C code}`,

it never collects objects accessible through the registry `@see{registry}`,

which includes the global environment `@see{globalenv}`.

The garbage collector (GC) in Lua can work in two modes:

incremental and generational.

The default GC mode with the default parameters

are adequate for most uses.

However, programs that waste a large proportion of their time

allocating and freeing memory can benefit from other settings.

Keep in mind that the GC behavior is non-portable both across platforms and across different Lua releases; therefore, optimal settings are also non-portable.

You can change the GC mode and parameters by calling `@Lid{lua_gc} @N{in C}` or `@Lid{collectgarbage}` in Lua.

You can also use these functions to control the collector directly (e.g., to stop and restart it).

}

@sect3{incmode| @title{Incremental Garbage Collection}}

In incremental mode, each GC cycle performs a mark-and-sweep collection in small steps interleaved with the program's execution.

In this mode,

the collector uses three numbers to control its garbage-collection cycles:

the `@def{garbage-collector pause}`,  
the `@def{garbage-collector step multiplier}`,  
and the `@def{garbage-collector step size}`.

The garbage-collector pause

controls how long the collector waits before starting a new cycle.

The collector starts a new cycle when the use of memory hits `@M{n%}` of the use after the previous collection.

Larger values make the collector less aggressive.

Values equal to or less than 100 mean the collector will not wait to start a new cycle.

A value of 200 means that

the collector waits for the total memory in use to double before starting a new cycle.

The default value is 200; the maximum value is 1000.

The garbage-collector step multiplier

controls the speed of the collector relative to memory allocation,

that is,

how many elements it marks or sweeps for each kilobyte of memory allocated.

Larger values make the collector more aggressive but also increase the size of each incremental step.

You should not use values less than 100,

because they make the collector too slow and can result in the collector never finishing a cycle.

The default value is 100; the maximum value is 1000.

The garbage-collector step size controls the size of each incremental step, specifically how many bytes the interpreter allocates before performing a step.

This parameter is logarithmic:

A value of  $M\{n\}$  means the interpreter will allocate  $M\{2^{sp}\{n\}\}$  bytes between steps and perform equivalent work during the step.

A large value (e.g., 60) makes the collector a stop-the-world (non-incremental) collector.

The default value is 13, which means steps of approximately  $N\{8\}$  Kbytes.

}

@sect3{genmode| @title{Generational Garbage Collection}}

In generational mode, the collector does frequent **minor** collections, which traverses only objects recently created. If after a minor collection the use of memory is still above a limit, the collector does a stop-the-world **major** collection, which traverses all objects.

The generational mode uses two parameters: the **minor multiplier** and the **major multiplier**.

The minor multiplier controls the frequency of minor collections. For a minor multiplier  $M\{x\}$ , a new minor collection will be done when memory grows  $M\{x\}\%$  larger than the memory in use after the previous major collection.

For instance, for a multiplier of 20, the collector will do a minor collection when the use of memory gets 20% larger than the use after the previous major collection. The default value is 20; the maximum value is 200.

The major multiplier controls the frequency of major collections. For a major multiplier  $M\{x\}$ , a new major collection will be done when memory grows  $M\{x\}\%$  larger than the memory in use after the previous major collection.

For instance, for a multiplier of 100, the collector will do a major collection when the use of memory gets larger than twice the use after the previous collection. The default value is 100; the maximum value is 1000.

}

@sect3{finalizers| @title{Garbage-Collection Metamethods}

You can set garbage-collector metamethods for tables and, using the @N{C API}, for full userdata @see{metatable}.

These metamethods, called @def{finalizers}, are called when the garbage collector detects that the corresponding table or userdata is dead.

Finalizers allow you to coordinate Lua's garbage collection with external resource management such as closing files, network or database connections, or freeing your own memory.

For an object (table or userdata) to be finalized when collected, you

must @emph{mark} it for finalization.

@index{mark (for finalization)}

You mark an object for finalization when you set its metatable and the metatable has a @idx{\_\_gc} metamethod.

Note that if you set a metatable without a @idx{\_\_gc} field and later create that field in the metatable, the object will not be marked for finalization.

When a marked object becomes dead, it is not collected immediately by the garbage collector.

Instead, Lua puts it in a list.

After the collection,

Lua goes through that list.

For each object in the list,

it checks the object's @idx{\_\_gc} metamethod:

If it is present,

Lua calls it with the object as its single argument.

At the end of each garbage-collection cycle,

the finalizers are called in

the reverse order that the objects were marked for finalization, among those collected in that cycle;

that is, the first finalizer to be called is the one associated with the object marked last in the program.

The execution of each finalizer may occur at any point during

the execution of the regular code.

Because the object being collected must still be used by the finalizer, that object (and other objects accessible only through it)

must be @emph{resurrected} by Lua. @index{resurrection}

Usually, this resurrection is transient,  
and the object memory is freed in the next garbage-collection cycle.  
However, if the finalizer stores the object in some global place  
(e.g., a global variable),  
then the resurrection is permanent.  
Moreover, if the finalizer marks a finalizing object for finalization again,  
its finalizer will be called again in the next cycle where the  
object is dead.  
In any case,  
the object memory is freed only in a GC cycle where  
the object is dead and not marked for finalization.

When you close a state @seeF{lua\_close},  
Lua calls the finalizers of all objects marked for finalization,  
following the reverse order that they were marked.  
If any finalizer marks objects for collection during that phase,  
these marks have no effect.

#### Finalizers

cannot yield nor run the garbage collector.  
Because they can run in unpredictable times,  
it is good practice to restrict each finalizer  
to the minimum necessary to properly release  
its associated resource.

Any error while running a finalizer generates a warning;  
the error is not propagated.

}

@sect3{weak-table| @title{Weak Tables}

A @def{weak table} is a table whose elements are  
@def{weak references}.  
A weak reference is ignored by the garbage collector.  
In other words,  
if the only references to an object are weak references,  
then the garbage collector will collect that object.

A weak table can have weak keys, weak values, or both.  
A table with weak values allows the collection of its values,  
but prevents the collection of its keys.  
A table with both weak keys and weak values allows the collection of  
both keys and values.  
In any case, if either the key or the value is collected,  
the whole pair is removed from the table.  
The weakness of a table is controlled by the  
@idx{\_\_mode}



field of its metatable.

This metavalue, if present, must be one of the following strings:

@St{k}, for a table with weak keys;

@St{v}, for a table with weak values;

or @St{kv}, for a table with both weak keys and values.

A table with weak keys and strong values

is also called an @def{ephemeron table}.

In an ephemeron table,

a value is considered reachable only if its key is reachable.

In particular,

if the only reference to a key comes through its value,

the pair is removed.

Any change in the weakness of a table may take effect only

at the next collect cycle.

In particular, if you change the weakness to a stronger mode,

Lua may still collect some items from that table

before the change takes effect.

Only objects that have an explicit construction

are removed from weak tables.

Values, such as numbers and @x{light @N{C functions}},

are not subject to garbage collection,

and therefore are not removed from weak tables

(unless their associated values are collected).

Although strings

are subject to garbage collection,

they do not have an explicit construction and

their equality is by value;

they behave more like values than like objects.

Therefore, they are not removed from weak tables.

Resurrected objects

(that is, objects being finalized

and objects accessible only through objects being finalized)

have a special behavior in weak tables.

They are removed from weak values before running their finalizers,

but are removed from weak keys only in the next collection

after running their finalizers, when such objects are actually freed.

This behavior allows the finalizer to access properties

associated with the object through weak tables.

If a weak table is among the resurrected objects in a collection cycle,

it may not be properly cleared until the next cycle.

}

}

@sect2{coroutine| @title{Coroutines}

Lua supports coroutines,  
also called @emph{collaborative multithreading}.  
A coroutine in Lua represents an independent thread of execution.  
Unlike threads in multithread  
systems, however,  
a coroutine only suspends its execution by explicitly calling  
a yield function.

You create a coroutine by calling @Lid{coroutine.create}.  
Its sole argument is a function  
that is the main function of the coroutine.  
The @id{create} function only creates a new coroutine and  
returns a handle to it (an object of type @emph{thread});  
it does not start the coroutine.

You execute a coroutine by calling @Lid{coroutine.resume}.  
When you first call @Lid{coroutine.resume},  
passing as its first argument  
a thread returned by @Lid{coroutine.create},  
the coroutine starts its execution by  
calling its main function.  
Extra arguments passed to @Lid{coroutine.resume} are passed  
as arguments to that function.  
After the coroutine starts running,  
it runs until it terminates or @emph{yields}.

A coroutine can terminate its execution in two ways:  
normally, when its main function returns  
(explicitly or implicitly, after the last instruction);  
and abnormally, if there is an unprotected  
error.

In case of normal termination,  
@Lid{coroutine.resume} returns @true,  
plus any values returned by the coroutine main function.  
In case of errors, @Lid{coroutine.resume} returns @false  
plus the error object.  
In this case, the coroutine does not unwind its stack,  
so that it is possible to inspect it after the error  
with the debug API.

A coroutine yields by calling @Lid{coroutine.yield}.  
When a coroutine yields,  
the corresponding @Lid{coroutine.resume} returns immediately,  
even if the yield happens inside nested function calls

(that is, not in the main function, but in a function directly or indirectly called by the main function). In the case of a `yield`, `@Lid{coroutine.resume}` also returns `@true`, plus any values passed to `@Lid{coroutine.yield}`. The next time you resume the same coroutine, it continues its execution from the point where it yielded, with the call to `@Lid{coroutine.yield}` returning any extra arguments passed to `@Lid{coroutine.resume}`.

Like `@Lid{coroutine.create}`, the `@Lid{coroutine.wrap}` function also creates a coroutine, but instead of returning the coroutine itself, it returns a function that, when called, resumes the coroutine. Any arguments passed to this function go as extra arguments to `@Lid{coroutine.resume}`. `@Lid{coroutine.wrap}` returns all the values returned by `@Lid{coroutine.resume}`, except the first one (the boolean error code). Unlike `@Lid{coroutine.resume}`, the function created by `@Lid{coroutine.wrap}` propagates any error to the caller. In this case, the function also closes the coroutine `@seeF{coroutine.close}`.

As an example of how coroutines work, consider the following code:

```
@verbatim{
function foo (a)
 print("foo", a)
 return coroutine.yield(2*a)
end

co = coroutine.create(function (a,b)
 print("co-body", a, b)
 local r = foo(a+1)
 print("co-body", r)
 local r, s = coroutine.yield(a+b, a-b)
 print("co-body", r, s)
 return b, "end"
end)

print("main", coroutine.resume(co, 1, 10))
print("main", coroutine.resume(co,
 "r"))
print("main", coroutine.resume(co, "x", "y"))
print("main", coroutine.resume(co, "x", "y"))
}
```

When you run it, it produces the following output:

```

@verbatim{
co-body 1 10
foo 2
main true 4
co-body r
main true 11 -9
co-body x y
main true 10 end
main false cannot resume dead coroutine
}

```

You can also create and manipulate coroutines through the C API:  
see functions @Lid{lua\_newthread}, @Lid{lua\_resume},  
and @Lid{lua\_yield}.

```

}

```

```

}

```

```

@C{-----}
@sect1{language| @title{The Language}

```

```

@simplesect{

```

This section describes the lexis, the syntax, and the semantics of Lua.  
In other words,  
this section describes  
which tokens are valid,  
how they can be combined,  
and what their combinations mean.

Language constructs will be explained using the usual extended BNF notation,  
in which

@N{ @bnfrep{ @rep{a} } means 0 or more @rep{a}'s, and

@N{ @bnfopt{ @rep{a} } means } an

optional @rep{a}.

Non-terminals are shown like @bnfNter{non-terminal},

keywords are shown like @rw{kword},

and other terminal symbols are shown like @bnfter{=}.

The complete syntax of Lua can be found in @refsec{BNF}  
at the end of this manual.

```

}

```

```

@sect2{lexical| @title{Lexical Conventions}

```

Lua is a @x{free-form} language.

It ignores spaces and comments between lexical elements (`@x{tokens}`), except as delimiters between two tokens.

In source code,

Lua recognizes as spaces the standard ASCII whitespace characters space, form feed, newline, carriage return, horizontal tab, and vertical tab.

`@def{Names}`

(also called `@def{identifiers}`)

in Lua can be any string of Latin letters,

Arabic-Indic digits, and underscores,

not beginning with a digit and

not being a reserved word.

Identifiers are used to name variables, table fields, and labels.

The following `@def{keywords}` are reserved and cannot be used as names:

`@index{reserved words}`

`@verbatim{`

and break do else elseif

end

false for function goto if in

local nil not or repeat return

then true until while

}

Lua is a case-sensitive language:

`@id{and}` is a reserved word, but `@id{And}` and `@id{AND}` are two different, valid names.

As a convention,

programs should avoid creating

names that start with an underscore followed by

one or more uppercase letters (such as `@Lid{_VERSION}`).

The following strings denote other `@x{tokens}`:

`@verbatim{`

+ - \* / % ^ #

& ~ | << >> //

== ~= <= >= < > =

( ) { } [ ] ::

; : , . .. ...

}

A `@def{short literal string}`

can be delimited by matching single or double quotes,

and can contain the following C-like escape sequences:

`@Char{\a}` (bell),

`@Char{\b}` (backspace),

@Char{\f} (form feed),  
@Char{\n} (newline),  
@Char{\r} (carriage return),  
@Char{\t} (horizontal tab),  
@Char{\v} (vertical tab),  
@Char{\\} (backslash),  
@Char{\"}  
(quotation mark [double quote]),  
and @Char{\'} (apostrophe [single quote]).

A backslash followed by a line break  
results in a newline in the string.

The escape sequence @Char{\z} skips the following span  
of whitespace characters,  
including line breaks;  
it is particularly useful to break and indent a long literal string  
into multiple lines without adding the newlines and spaces  
into the string contents.

A short literal string cannot contain unescaped line breaks  
nor escapes not forming a valid escape sequence.

We can specify any byte in a short literal string,  
including @x{embedded zeros},  
by its numeric value.

This can be done  
with the escape sequence @T{\x@rep{XX}},  
where @rep{XX} is a sequence of exactly two hexadecimal digits,  
or with the escape sequence @T{\@rep{ddd}},  
where @rep{ddd} is a sequence of up to three decimal digits.  
(Note that if a decimal escape sequence is to be followed by a digit,  
it must be expressed using exactly three digits.)

The @x{UTF-8} encoding  
of a @x{Unicode} character  
can be inserted in a literal string with  
the escape sequence @T{\u{@rep{XXX}}}  
(with mandatory enclosing braces),  
where @rep{XXX} is a sequence of one or more hexadecimal digits  
representing the character code point.  
This code point can be any value less than @M{2@sp{31}}.  
(Lua uses the original UTF-8 specification here,  
which is not restricted to valid Unicode code points.)

Literal strings can also be defined using a long format  
enclosed by @def{long brackets}.

We define an @def{opening long bracket of level @rep{n}} as an opening  
square bracket followed by @rep{n} equal signs followed by another  
opening square bracket.

So, an opening long bracket of @N{level 0} is written as @T{[[], @C{]]}

an opening long bracket of @N{level 1} is written as @T{[=[, @C{]]}

and so on.

A @emph{closing long bracket} is defined similarly;

for instance,

a closing long bracket of @N{level 4} is written as @C{[[[] @T{]====]}.

A @def{long literal} starts with an opening long bracket

of any level and

ends at the first closing long bracket of the same level.

It can contain any text except a closing bracket of the same level.

Literals in this bracketed form can run for several lines,

do not interpret any escape sequences,

and ignore long brackets of any other level.

Any kind of end-of-line sequence

(carriage return, newline, carriage return followed by newline,

or newline followed by carriage return)

is converted to a simple newline.

When the opening long bracket is immediately followed by a newline,

the newline is not included in the string.

As an example, in a system using ASCII

(in which @Char{a} is coded @N{as 97},

newline is coded @N{as 10}, and @Char{1} is coded @N{as 49}),

the five literal strings below denote the same string:

```
@verbatim{
a = 'alo\n123"'
a = "alo\n123\""
a = "\97lo\10\04923"
a = [[alo
123"]]
a = [==[
alo
123"]]==]
}
```

Any byte in a literal string not

explicitly affected by the previous rules represents itself.

However, Lua opens files for

parsing in text mode,

and the system's file functions may have problems with

some control characters.

So, it is safer to represent

binary data as a quoted literal with

explicit escape sequences for the non-text characters.

A @def{numeric constant} (or @def{numeral})

can be written with an optional fractional part

and an optional decimal exponent,

marked by a letter @Char{e} or @Char{E}.

Lua also accepts `@x{hexadecimal constants}`, which start with `@T{0x}` or `@T{0X}`. Hexadecimal constants also accept an optional fractional part plus an optional binary exponent, marked by a letter `@Char{p}` or `@Char{P}` and written in decimal. (For instance, `@T{0x1.fp10}` denotes 1984, which is `@M{0x1f / 16}` multiplied by `@M{2@sp{10}}`.)

A numeric constant with a radix point or an exponent denotes a float; otherwise, if its value fits in an integer or it is a hexadecimal constant, it denotes an integer; otherwise (that is, a decimal integer numeral that overflows), it denotes a float.

Hexadecimal numerals with neither a radix point nor an exponent always denote an integer value; if the value overflows, it `@emph{wraps around}` to fit into a valid integer.

Examples of valid integer constants are

```
@verbatim{
3 345 0xff 0xBEBADA
}
```

Examples of valid float constants are

```
@verbatim{
3.0 3.1416 314.16e-2 0.31416E1 34e1
0x0.1E 0xA23p-4 0X1.921FB54442D18P+1
}
```

A `@def{comment}` starts with a double hyphen (`@T{--}`) anywhere outside a string. If the text immediately after `@T{--}` is not an opening long bracket, the comment is a `@def{short comment}`, which runs until the end of the line. Otherwise, it is a `@def{long comment}`, which runs until the corresponding closing long bracket.

```
}
```

```
@sect2{variables| @title{Variables}}
```

Variables are places that store values. There are three kinds of variables in Lua: global variables, local variables, and table fields.

A single name can denote a global variable or a local variable



(or a function's formal parameter,

which is a particular kind of

local variable):

```
@Produc{
@producname{var}@producbody{@bnfNter{Name}}
}
```

@bnfNter{Name} denotes identifiers @see{lexical}.

Any variable name is assumed to be global unless explicitly declared

as a local @see{localvar}.

@x{Local variables} are @emph{lexically scoped}:

local variables can be freely accessed by functions

defined inside their scope @see{visibility}.

Before the first assignment to a variable, its value is @nil.

Square brackets are used to index a table:

```
@Produc{
@producname{var}@producbody{prefixexp @bnfter{[] exp @bnfter{[]}}
}
```

The meaning of accesses to table fields can be changed via metatables

@see{metatable}.

The syntax @id{var.Name} is just syntactic sugar for

```
@T{var["Name"]};
```

```
@Produc{
@producname{var}@producbody{prefixexp @bnfter{.} @bnfNter{Name}}
}
```

An access to a global variable @id{x}

is equivalent to @id{\_ENV.x}.

Due to the way that chunks are compiled,

the variable @id{\_ENV} itself is never global @see{globalenv}.

```
}
```

```
@sect2{stats| @title{Statements}}
```

```
@simplesect{
```

Lua

supports an almost conventional set of @x{statements},

similar to those in other conventional languages.

This set includes

blocks, assignments, control structures, function calls,

and variable declarations.

```
}
```

```
@sect3{ @title{Blocks}}
```

A `@x{block}` is a list of statements,  
which are executed sequentially:

```
@Produc{
@producname{block}@producbody{ @bnfrep{stat} }
}
```

Lua has `@def{empty statements}`  
that allow you to separate statements with semicolons,  
start a block with a semicolon  
or write two semicolons in sequence:

```
@Produc{
@producname{stat}@producbody{ @bnfter{;} }
}
```

Both function calls and assignments  
can start with an open parenthesis.  
This possibility leads to an ambiguity in Lua's grammar.  
Consider the following fragment:

```
@verbatim{
a = b + c
(print or io.write)('done')
}
```

The grammar could see this fragment in two ways:

```
@verbatim{
a = b + c(print or io.write)('done')
```

```
a = b + c; (print or io.write)('done')
}
```

The current parser always sees such constructions  
in the first way,  
interpreting  
the open parenthesis  
as the start of the arguments to a call.

To avoid this ambiguity,  
it is a good practice to always precede with a semicolon  
statements that start with a parenthesis:

```
@verbatim{
;(print or io.write)('done')
}
```

A block can be explicitly delimited to produce a single statement:

```
@Produc{
@producname{stat}@producbody{ @Rw{do} block @Rw{end} }
}
```

Explicit blocks are useful  
to control the scope of variable declarations.

Explicit blocks are also sometimes used to add a `@Rw{return}` statement in the middle of another block `@see{control}`.

```
}
```

```
@sect3{chunks| @title{Chunks}}
```

The unit of compilation of Lua is called a `@def{chunk}`.

Syntactically,

a chunk is simply a block:

```
@Produc{
@producname{chunk}@producbody{block}
}
```

Lua handles a chunk as the body of an anonymous function with a variable number of arguments

`@see{func-def}`.

As such, chunks can define local variables, receive arguments, and return values.

Moreover, such anonymous function is compiled as in the scope of

an external local variable called `@id{_ENV}` `@see{globalenv}`.

The resulting function always has `@id{_ENV}` as its only external variable, even if it does not use that variable.

A chunk can be stored in a file or in a string inside the host program.

To execute a chunk,

Lua first `@emph{loads}` it,

precompiling the chunk's code into instructions for a virtual machine,

and then Lua executes the compiled code

with an interpreter for the virtual machine.

Chunks can also be precompiled into binary form;

see the program `@idx{luac}` and the function `@Lid{string.dump}` for details.

Programs in source and compiled forms are interchangeable;

Lua automatically detects the file type and acts accordingly `@seeF{load}`.

```
}
```

```
@sect3{assignment| @title{Assignment}}
```

Lua allows `@x{multiple assignments}`.

Therefore, the syntax for assignment

defines a list of variables on the left side

and a list of expressions on the right side.

The elements in both lists are separated by commas:

```
@Produc{
```

```

@producname{stat}@producbody{varlist
 @bnfter{=} explist}
@producname{varlist}@producbody{var @bnfrep{@bnfter{,} var}}
@producname{explist}@producbody{exp @bnfrep{@bnfter{,} exp}}
}

```

Expressions are discussed in @See{expressions}.

Before the assignment,  
the list of values is @emph{adjusted} to the length of  
the list of variables @see{multires}.

If a variable is both assigned and read  
inside a multiple assignment,  
Lua ensures that all reads get the value of the variable  
before the assignment.

Thus the code

```

@verbatim{
i = 3
i, a[i] = i+1, 20
}

```

sets @T{a[3]} to 20, without affecting @T{a[4]}  
because the @id{i} in @T{a[i]} is evaluated (to 3)  
before it is @N{assigned 4}.

Similarly, the line

```

@verbatim{
x, y = y, x
}

```

exchanges the values of @id{x} and @id{y},  
and

```

@verbatim{
x, y, z = y, z, x
}

```

cyclically permutes the values of @id{x}, @id{y}, and @id{z}.

Note that this guarantee covers only accesses  
syntactically inside the assignment statement.

If a function or a metamethod called during the assignment  
changes  
the value of a variable,  
Lua gives no guarantees about the order of that access.

An assignment to a global name @T{x = val}  
is equivalent to the assignment  
@T{\_ENV.x = val} @see{globalenv}.

The meaning of assignments to table fields and  
global variables (which are actually table fields, too)  
can be changed via metatables @see{metatable}.

```
}
```

```
@sect3{control| @title{Control Structures}
```

The control structures

@Rw{if}, @Rw{while}, and @Rw{repeat} have the usual meaning and familiar syntax:

```
@index{ while-do statement }
```

```
@index{ repeat-until statement }
```

```
@index{ if-then-else statement }
```

```
@Produc{
```

```
@producname{stat} @producbody{ @Rw{while} exp @Rw{do} block @Rw{end} }
```

```
@producname{stat} @producbody{ @Rw{repeat} block @Rw{until} exp }
```

```
@producname{stat} @producbody{ @Rw{if} exp @Rw{then} block
```

```
 @bnfrep{ @Rw{elseif} exp @Rw{then} block }
```

```
 @bnfoft{ @Rw{else} block } @Rw{end} }
```

```
}
```

Lua also has a @Rw{for} statement, in two flavors @see{for}.

The @x{condition expression} of a control structure can return any value.

Both

@false and @nil test false.

All values different from @nil and @false test true.

In particular, the number 0 and the empty string also test true.

In the @Rw{repeat} @En@Rw{until} loop, the inner block does not end at the @Rw{until} keyword, but only after the condition.

So, the condition can refer to local variables declared inside the loop block.

The @Rw{goto} statement transfers the program control to a label.

For syntactical reasons,

labels in Lua are considered statements too:

```
@index{ goto statement }
```

```
@index{ label }
```

```
@Produc{
```

```
@producname{stat} @producbody{ @Rw{goto} Name }
```

```
@producname{stat} @producbody{ label }
```

```
@producname{label} @producbody{ @bnfter{::} Name @bnfter{::} }
```

```
}
```

A label is visible in the entire block where it is defined, except inside nested functions.

A goto may jump to any visible label as long as it does not enter into the scope of a local variable.

A label should not be declared

where a label with the same name is visible,  
even if this other label has been declared in an  
enclosing block.

The `@Rw{break}` statement terminates the execution of a  
`@Rw{while}`, `@Rw{repeat}`, or `@Rw{for}` loop,  
skipping to the next statement after the loop:

```
@index{break statement}
@Produc{
@producname{stat}@producbody{@Rw{break}}
}
```

A `@Rw{break}` ends the innermost enclosing loop.

The `@Rw{return}` statement is used to return values  
from a function or a chunk  
(which is handled as an anonymous function).

```
@index{return statement}
Functions can return more than one value,
so the syntax for the @Rw{return} statement is
@Produc{
@producname{stat}@producbody{@Rw{return} @bnfoft{explist} @bnfter{;}}
}
```

The `@Rw{return}` statement can only be written  
as the last statement of a block.

If it is necessary to `@Rw{return}` in the middle of a block,  
then an explicit inner block can be used,  
as in the idiom `@T{do return end}`,  
because now `@Rw{return}` is the last statement in its (inner) block.

```
}
```

```
@sect3{for| @title{For Statement}
```

```
@index{for statement}
```

The `@Rw{for}` statement has two forms:

one

numerical and one generic.

```
@sect4{@title{The numerical @Rw{for} loop}
```

The numerical `@Rw{for}` loop repeats a block of code while a  
control variable goes through an arithmetic progression.

It has the following syntax:

```
@Produc{
@producname{stat}@producbody{@Rw{for} @bnfNter{Name} @bnfter{=}
exp @bnfter{,} exp @bnfoft{@bnfter{,} exp} @Rw{do} block @Rw{end}}
}
```

The given identifier (`@bnfNter{Name}`) defines the control variable, which is a new variable local to the loop body (`@emph{block}`).

The loop starts by evaluating once the three control expressions. Their values are called respectively the `@emph{initial value}`, the `@emph{limit}`, and the `@emph{step}`. If the step is absent, it defaults `@N{to 1}`.

If both the initial value and the step are integers, the loop is done with integers; note that the limit may not be an integer. Otherwise, the three values are converted to floats and the loop is done with floats. Beware of floating-point accuracy in this case.

After that initialization, the loop body is repeated with the value of the control variable going through an arithmetic progression, starting at the initial value, with a common difference given by the step. A negative step makes a decreasing sequence; a step equal to zero raises an error. The loop continues while the value is less than or equal to the limit (greater than or equal to for a negative step). If the initial value is already greater than the limit (or less than, if the step is negative), the body is not executed.

For integer loops, the control variable never wraps around; instead, the loop ends in case of an overflow.

You should not change the value of the control variable during the loop.

If you need its value after the loop, assign it to another variable before exiting the loop.

}

@sect4{@title{The generic @Rw{for} loop}

The generic `@Rw{for}` statement works over functions, called `@def{iterators}`.

On each iteration, the iterator function is called to produce a new value, stopping when this new

value is @nil.

The generic @Rw{for} loop has the following syntax:

```
@Produc{
@producname{stat}@producbody{@Rw{for} namelist @Rw{in} explist
 @Rw{do} block @Rw{end}}
@producname{namelist}@producbody{@bnfNter{Name} @bnfrep{@bnfter{,} @bnfNter{Name}}}
}
```

A @Rw{for} statement like

```
@verbatim{
for @rep{var_1}, @Cdots, @rep{var_n} in @rep{explist} do @rep{body} end
}
```

works as follows.

The names @rep{var\_i} declare loop variables local to the loop body.

The first of these variables is the @emph{control variable}.

The loop starts by evaluating @rep{explist}

to produce four values:

an @emph{iterator function},

a @emph{state},

an initial value for the control variable,

and a @emph{closing value}.

Then, at each iteration,

Lua calls the iterator function with two arguments:

the state and the control variable.

The results from this call are then assigned to the loop variables,

following the rules of multiple assignments @see{assignment}.

If the control variable becomes @nil,

the

loop terminates.

Otherwise, the body is executed and the loop goes

to the next iteration.

The closing value behaves like a

to-be-closed variable @see{to-be-closed},

which can be used to release resources when the loop ends.

Otherwise, it does not interfere with the loop.

You should not change the value of the control variable

during the loop.

```
}
```

```
}
```

@sect3{funcstat| @title{Function Calls as Statements}}

To allow possible side-effects,



function calls can be executed as statements:

```
@Produc{
@producname{stat}@producbody{functioncall}
}
```

In this case, all returned values are thrown away.

Function calls are explained in @See{functioncall}.

```
}
```

```
@sect3{localvar| @title{Local Declarations}
```

@x{Local variables} can be declared anywhere inside a block.

The declaration can include an initialization:

```
@Produc{
@producname{stat}@producbody{@Rw{local} attnamelist @bnfopt{@bnfter{=} explist}}
@producname{attnamelist}@producbody{
@bnfNter{Name} attrib @bnfrep{@bnfter{,} @bnfNter{Name} attrib}}
}
```

If

present, an initial assignment has the same semantics of a multiple assignment @see{assignment}.

Otherwise, all variables are initialized with @nil.

Each variable name may be postfixed by an attribute

(a name between angle brackets):

```
@Produc{
@producname{attrib}@producbody{@bnfopt{@bnfter{<} @bnfNter{Name} @bnfter{>}}
}
```

There are two possible attributes:

@id{const}, which declares a @x{constant variable},

that is, a variable that cannot be assigned to

after its initialization;

and @id{close}, which declares a to-be-closed variable @see{to-be-closed}.

A list of variables can contain at most one to-be-closed variable.

A chunk is also a block @see{chunks},

and so local variables can be declared in a chunk outside any explicit block.

The visibility rules for local variables are explained in @See{visibility}.

```
}
```

```
@sect3{to-be-closed| @title{To-be-closed Variables}
```

A to-be-closed variable behaves like a constant local variable, except that its value is @emph{closed} whenever the variable goes

out of scope, including normal block termination,

exiting its block by @Rw{break}/@Rw{goto}/@Rw{return},

or exiting by an error.

Here, to `@emph{close}` a value means to call its `@idx{__close}` metamethod.

When calling the metamethod, the value itself is passed as the first argument and the error object that caused the exit (if any) is passed as a second argument; if there was no error, the second argument is `@nil`.

The value assigned to a to-be-closed variable must have a `@idx{__close}` metamethod or be a false value. (`@nil` and `@false` are ignored as to-be-closed values.)

If several to-be-closed variables go out of scope at the same event, they are closed in the reverse order that they were declared.

If there is any error while running a closing method, that error is handled like an error in the regular code where the variable was defined. After an error, the other pending closing methods will still be called.

If a coroutine yields and is never resumed again, some variables may never go out of scope, and therefore they will never be closed. (These variables are the ones created inside the coroutine and in scope at the point where the coroutine yielded.) Similarly, if a coroutine ends with an error, it does not unwind its stack, so it does not close any variable. In both cases, you can either use finalizers or call `@Lid{coroutine.close}` to close the variables. However, if the coroutine was created through `@Lid{coroutine.wrap}`, then its corresponding function will close the coroutine in case of errors.

}

}

`@sect2{expressions| @title{Expressions}}`

`@simplesect{`

The basic expressions in Lua are the following:

```
@Produc{
@producname{exp}@producbody{prefixexp}
@producname{exp}@producbody{@Rw{nil} @Or @Rw{false} @Or @Rw{true}}
@producname{exp}@producbody{@bnfNter{Numeral}}
@producname{exp}@producbody{@bnfNter{LiteralString}}
@producname{exp}@producbody{functiondef}
@producname{exp}@producbody{tableconstructor}
@producname{exp}@producbody{@bnfter{...}}
@producname{exp}@producbody{exp
binop exp}
@producname{exp}@producbody{unop exp}
@producname{prefixexp}@producbody{var @Or functioncall @Or
@bnfter{() exp @bnfter{}}}}
}
```

Numerals and literal strings are explained in @See{lexical};

variables are explained in @See{variables};

function definitions are explained in @See{func-def};

function calls are explained in @See{functioncall};

table constructors are explained in @See{tableconstructor}.

Vararg expressions,

denoted by three dots (@Char{...}), can only be used when

directly inside a variadic function;

they are explained in @See{func-def}.

Binary operators comprise arithmetic operators @see{arith},

bitwise operators @see{bitwise},

relational operators @see{rel-ops}, logical operators @see{logic},

and the concatenation operator @see{concat}.

Unary operators comprise the unary minus @see{arith},

the unary bitwise NOT @see{bitwise},

the unary logical @Rw{not} @see{logic},

and the unary @def{length operator} @see{len-op}.

```
}
```

```
@sect3{arith|
```

```
@title{Arithmetic Operators}
```

Lua supports the following @x{arithmetic operators}:

```
@description{
```

```
@item{@T{+}|addition}
```

```
@item{@T{-}|subtraction}
```

```
@item{@T{*}|multiplication}
```

```

@item{ @T{/}|float division}
@item{ @T{//}|floor division}
@item{ @T{%}|modulo}
@item{ @T^|exponentiation}
@item{ @T{-}|unary minus}
}

```

With the exception of exponentiation and float division, the arithmetic operators work as follows: If both operands are integers, the operation is performed over integers and the result is an integer. Otherwise, if both operands are numbers, then they are converted to floats, the operation is performed following the machine's rules for floating-point arithmetic (usually the @x{IEEE 754} standard), and the result is a float. (The string library coerces strings to numbers in arithmetic operations; see @See{coercion} for details.)

Exponentiation and float division (@T{/}) always convert their operands to floats and the result is always a float. Exponentiation uses the @ANSI{pow}, so that it works for non-integer exponents too.

Floor division (@T{//}) is a division that rounds the quotient towards minus infinity, resulting in the floor of the division of its operands.

Modulo is defined as the remainder of a division that rounds the quotient towards minus infinity (floor division).

In case of overflows in integer arithmetic, all operations @emphx{wrap around}.

```

}
```

```

@sect3{bitwise| @title{Bitwise Operators}
Lua supports the following @x{bitwise operators}:
@description{
@item{ @T{&}|bitwise AND}
@item{ @T{ @VerBar}|bitwise OR}
@item{ @T{~}|bitwise exclusive OR}
@item{ @T{>>}|right shift}
@item{ @T{<<}|left shift}
@item{ @T{~}|unary bitwise NOT}
}

```

All bitwise operations convert its operands to integers  
@see{coercion},  
operate on all bits of those integers,  
and result in an integer.

Both right and left shifts fill the vacant bits with zeros.  
Negative displacements shift to the other direction;  
displacements with absolute values equal to or higher than  
the  
number of bits in an integer  
result in zero (as all bits are shifted out).

}

@sect3{coercion| @title{Coercions and Conversions}  
Lua provides some automatic conversions between some  
types and representations at run time.  
Bitwise operators always convert float operands to integers.  
Exponentiation and float division  
always convert integer operands to floats.  
All other arithmetic operations applied to mixed numbers  
(integers and floats) convert the integer operand to a float.  
The C API also converts both integers to floats and  
floats to integers, as needed.  
Moreover, string concatenation accepts numbers as arguments,  
besides strings.

In a conversion from integer to float,  
if the integer value has an exact representation as a float,  
that is the result.  
Otherwise,  
the conversion gets the nearest higher or  
the nearest lower representable value.  
This kind of conversion never fails.

The conversion from float to integer  
checks whether the float has an exact representation as an integer  
(that  
is, the float has an integral value and  
it is in the range of integer representation).  
If it does, that representation is the result.  
Otherwise, the conversion fails.

Several places in Lua coerce strings to numbers when necessary.  
In particular,  
the string library sets metamethods that try to coerce  
strings to numbers in all arithmetic operations.

If the conversion fails,  
the library calls the metamethod of the other operand  
(if present) or it raises an error.  
Note that bitwise operators do not do this coercion.

It is always a good practice not to rely on the  
implicit coercions from strings to numbers,  
as they are not always applied;  
in particular, `@T{"1"==1}` is false and `@T{"1"<1}` raises an error  
[@see{rel-ops}](#).  
These coercions exist mainly for compatibility and may be removed  
in future versions of the language.

A string is converted to an integer or a float  
following its syntax and the rules of the Lua lexer.  
The string may have also leading and trailing whitespaces and a sign.  
All  
conversions from strings to numbers  
accept both a dot and the current locale mark  
as the radix character.  
(The Lua lexer, however, accepts only a dot.)  
If the string is not a valid numeral,  
the conversion fails.  
If necessary, the result of this first step is then converted  
to a specific number subtype following the previous rules  
for conversions between floats and integers.

The conversion from numbers to strings uses a  
non-specified human-readable format.  
To convert numbers to strings in any specific way,  
use the function `@Lid{string.format}`.

}

[@sect3{rel-ops| @title{Relational Operators}](#)  
Lua supports the following `@x{relational operators}`:  
[@description{](#)  
[@item{ @T{==}|equality }](#)  
[@item{ @T{~=}|inequality }](#)  
[@item{ @T{<}|less than }](#)  
[@item{ @T{>}|greater than }](#)  
[@item{ @T{<=}|less or equal }](#)  
[@item{ @T{>=}|greater or equal }](#)  
[}](#)

These operators always result in `@false` or `@true`.

Equality (`@T{==}`) first compares the type of its operands.  
If the types are different, then the result is `@false`.

Otherwise,  
the values of the operands are compared.  
Strings are equal if they have the same byte content.  
Numbers are equal if they denote the same mathematical value.

Tables, userdata, and threads  
are compared by reference:  
two objects are considered equal only if they are the same object.  
Every time you create a new object  
(a table, a userdata, or a thread),  
this new object is different from any previously existing object.  
A function is always equal to itself.  
Functions with any detectable difference  
(different behavior, different definition) are always different.  
Functions created at different times but with no detectable differences  
may be classified as equal or not  
(depending on internal caching details).

You can change the way that Lua compares tables and userdata  
by using the `@idx{__eq}` metamethod `@see{metatable}`.

Equality comparisons do not convert strings to numbers  
or vice versa.  
Thus, `@T{"0"}==0` evaluates to `@false`,  
and `@T{t[0]}` and `@T{t["0"]}` denote different  
entries in a table.

The  
operator `@T{~=}` is exactly the negation of equality (`@T{==}`).

The order operators work as follows.  
If both arguments are numbers,  
then they are compared according to their mathematical values,  
regardless of their subtypes.  
Otherwise, if both arguments are strings,  
then their values are compared according to the current locale.  
Otherwise, Lua tries to call the `@idx{__lt}` or the `@idx{__le}`  
metamethod `@see{metatable}`.  
A comparison `@T{a > b}` is translated to `@T{b < a}`  
and `@T{a >= b}` is translated to `@T{b <= a}`.

Following the `@x{IEEE 754}` standard,  
the special value `@x{NaN}` is considered neither less than,  
nor equal to, nor greater than any value, including itself.

}

`@sect3{logic| @title{Logical Operators}}`

The `@x{logical operators}` in Lua are `@Rw{and}`, `@Rw{or}`, and `@Rw{not}`. Like the control structures `@see{control}`, all logical operators consider both `@false` and `@nil` as false and anything else as true.

The negation operator `@Rw{not}` always returns `@false` or `@true`.

The conjunction

operator `@Rw{and}` returns its first argument if this value is `@false` or `@nil`; otherwise, `@Rw{and}` returns its second argument.

The disjunction operator `@Rw{or}` returns its first argument if this value is different from `@nil` and `@false`; otherwise, `@Rw{or}` returns its second argument.

Both `@Rw{and}` and `@Rw{or}` use `@x{short-circuit evaluation}`; that is, the second operand is evaluated only if necessary.

Here are some examples:

```
@verbatim{
10 or 20 --> 10
10 or error() --> 10
nil or "a" --> "a"
nil and 10 --> nil
false and error() --> false
false and nil --> false
false or nil --> nil
10 and 20 --> 20
}

}
```

`@sect3{concat| @title{Concatenation}`

The string `@x{concatenation}` operator in Lua is denoted by two dots (`@Char{..}`).

If both operands are strings or numbers, then the numbers are converted to strings in a non-specified format `@see{coercion}`.

Otherwise, the `@idx{__concat}` metamethod is called `@see{metatable}`.

```
}
```

`@sect3{len-op|`

`@title{The Length Operator}`

The length operator is denoted by the unary prefix operator `@T{#}`.

The length of a string is its number of bytes.

(That is the usual meaning of string length when each



character is one byte.)

The length operator applied on a table  
returns a `@x{border}` in that table.

A `@def{border}` in a table `@id{t}` is any non-negative integer  
that satisfies the following condition:

```
@verbatim{
(border == 0 or t[border] ~= nil) and
(t[border + 1] == nil or border == math.maxinteger)
}
```

In words,

a border is any positive integer index present in the table  
that is followed by an absent index,

plus two limit cases:

zero, when index 1 is absent;

and the maximum value for an integer, when that index is present.

Note that keys that are not positive integers  
do not interfere with borders.

A table with exactly one border is called a `@def{sequence}`.

For instance, the table `@T{{10, 20, 30, 40, 50}}` is a sequence,  
as it has only one border (5).

The table `@T{{10, 20, 30, nil, 50}}` has  
two borders (3 and 5),

and therefore it is not a sequence.

(The `@nil` at index 4 is called a `@emphx{hole}`.)

The table `@T{{nil, 20, 30, nil, nil, 60, nil}}`  
has three borders (0, 3, and 6),

so it is not a sequence, too.

The table `@T{{}}` is a sequence with border 0.

When `@id{t}` is a sequence,

`@T{#t}` returns its only border,

which corresponds to the intuitive notion of the length of the sequence.

When `@id{t}` is not a sequence,

`@T{#t}` can return any of its borders.

(The exact one depends on details of  
the internal representation of the table,

which in turn can depend on how the table was populated and  
the memory addresses of its non-numeric keys.)

The computation of the length of a table

has a guaranteed worst time of `@M{O(log n)}`,

where `@M{n}` is the largest integer key in the table.

A program can modify the behavior of the length operator for

any value but strings through the `@idx{__len}` metamethod `@see{metatable}`.

}

@sect3{prec| @title{Precedence}

@x{Operator precedence} in Lua follows

the table below,

from lower to higher priority:

@verbatim{

or

and

< > <= >= ~= ==

|

~

&

<< >>

..

+ -

\* / // %

unary operators (not # - ~)

^

}

As usual,

you can use parentheses to change the precedences of an expression.

The concatenation (@Char{..}) and exponentiation (@Char{^})

operators are right associative.

All other binary operators are left associative.

}

@sect3{tableconstructor| @title{Table Constructors}

Table @x{constructors} are expressions that create tables.

Every time a constructor is evaluated, a new table is created.

A constructor can be used to create an empty table

or to create a table and initialize some of its fields.

The general syntax for constructors is

@Produc{

@producname{tableconstructor}@prodocbody{@bnfter{@Open} @bnfopt{fieldlist} @bnfter{@Close}}

@producname{fieldlist}@prodocbody{field @bnfrep{fieldsep field} @bnfopt{fieldsep}}

@producname{field}@prodocbody{@bnfter{[] exp @bnfter{]} @bnfter{=} exp @Or

@bnfNter{Name} @bnfter{=} exp @Or exp}

@producname{fieldsep}@prodocbody{@bnfter{,} @Or @bnfter{;}}

}

Each field of the form @T{[exp1] = exp2} adds to the new table an entry with key @id{exp1} and value @id{exp2}.

A field of the form @T{name = exp} is equivalent to

@T{["name"] = exp}.

Fields of the form @id{exp} are equivalent to

@T{[i] = exp}, where @id{i} are consecutive integers starting with 1;

fields in the other formats do not affect this counting.

For example,

```
@verbatim{
a = { [f(1)] = g; "x", "y"; x = 1, f(x), [30] = 23; 45 }
}
```

is equivalent to

```
@verbatim{
do
local t = {}
t[f(1)] = g
t[1] = "x" -- 1st exp
t[2] = "y" -- 2nd exp
t.x = 1 -- t["x"] = 1
t[3] = f(x) -- 3rd exp
t[30] = 23
t[4] = 45 -- 4th exp
a = t
end
}
```

The order of the assignments in a constructor is undefined.

(This order would be relevant only when there are repeated keys.)

If the last field in the list has the form @id{exp}

and the expression

is a multires expression,

then all values returned by this expression enter the list consecutively

@see{multires}.

The field list can have an optional trailing separator,

as a convenience for machine-generated code.

```
}
```

```
@sect3{functioncall| @title{Function Calls}
```

A @x{function call} in Lua has the following syntax:

```
@Produc{
@producname{functioncall}@producbody{prefixexp args}
}
```

In a function call,

first @bnfNter{prefixexp} and @bnfNter{args} are evaluated.

If the value of @bnfNter{prefixexp} has type @emph{function},

then this function is called

with the given arguments.

Otherwise, if present,

the @bnfNter{prefixexp} @idx{\_\_call} metamethod is called:

its first argument is the value of `@bnfNter{prefixexp}`, followed by the original call arguments `@see{metatable}`.

The form

```
@Produc{
@producname{functioncall}@produciblebody{prefixexp @bnfter{:} @bnfNter{Name} args}
}
```

can be used to emulate methods.

A call `@T{v:name(@rep{args})}`

is syntactic sugar for `@T{v.name(v,@rep{args})}`,

except that `@id{v}`

is evaluated only once.

Arguments have the following syntax:

```
@Produc{
@producname{args}@produciblebody{ @bnfter{(} @bnfopt{explist} @bnfter{)}}
@producname{args}@produciblebody{tableconstructor}
@producname{args}@produciblebody{ @bnfNter{LiteralString} }
}
```

All argument expressions are evaluated before the call.

A call of the form `@T{f{@rep{fields}}}` is

syntactic sugar for `@T{f({@rep{fields}})}`;

that is, the argument list is a single new table.

A call of the form `@T{f'@rep{string}'}`

(or `@T{f"@rep{string}"}` or `@T{f[[@rep{string}]}`)

is syntactic sugar for `@T{f('@rep{string}')`;

that is, the argument list is a single literal string.

A call of the form `@T{return @rep{functioncall}}` not in the scope of a to-be-closed variable is called a `@def{tail call}`.

Lua implements `@def{proper tail calls}`

(or `@def{proper tail recursion}`):

In a tail call,

the called function reuses the stack entry of the calling function.

Therefore, there is no limit on the number of nested tail calls that a program can execute.

However,

a tail call erases any debug information about the calling function.

Note that a tail call only happens with a particular syntax,

where the `@Rw{return}` has one single function call as argument, and it is outside the scope of any to-be-closed variable.

This syntax makes the calling function return exactly

the returns of the called function,

without any intervening action.

So, none of the following examples are tail calls:

```
@verbatim{
```

```

return (f(x)) -- results adjusted to 1
return 2 * f(x) -- result multiplied by 2
return x, f(x) -- additional results
f(x); return -- results discarded
return x or f(x) -- results adjusted to 1
}

}

```

```
@sect3{func-def| @title{Function Definitions}}
```

The syntax for function definition is

```

@Produce{
@producname{functiondef} @producbody{ @Rw{function} funcbody }
@producname{funcbody} @producbody{ @bnfter{() @bnfopt{parlist} @bnfter{}} block @Rw{end}}
}

```

The following syntactic sugar simplifies function definitions:

```

@Produce{
@producname{stat} @producbody{ @Rw{function}
funcname funcbody }
@producname{stat} @producbody{ @Rw{local} @Rw{function} @bnfNter{Name} funcbody }
@producname{funcname} @producbody{ @bnfNter{Name} @bnfrep{ @bnfter{.} @bnfNter{Name} } }
@bnfopt{ @bnfter{:} @bnfNter{Name} } }
}

```

The statement

```

@verbatim{
function f () @rep{body} end
}

```

translates to

```

@verbatim{
f = function () @rep{body} end
}

```

The statement

```

@verbatim{
function t.a.b.c.f () @rep{body} end
}

```

translates to

```

@verbatim{
t.a.b.c.f = function () @rep{body} end
}

```

The statement

```

@verbatim{
local function f () @rep{body} end
}

```

translates to

```

@verbatim{
local f; f = function () @rep{body} end
}

```

```
}
not to
@verbatim{
local f = function () @rep{body} end
}
```

(This only makes a difference when the body of the function contains references to @id{f}.)

A function definition is an executable expression, whose value has type @emph{function}. When Lua precompiles a chunk, all its function bodies are precompiled too, but they are not created yet. Then, whenever Lua executes the function definition, the function is @emph{instantiated} (or @emph{closed}). This function instance, or @emph{closure}, is the final value of the expression.

Parameters act as local variables that are initialized with the argument values:

```
@Produc{
@producname{parlist}@probody{namelist @bnfopt{ @bnfter{,} @bnfter{...} } @Or
@bnfter{...}
}
```

When a Lua function is called, it adjusts its list of @x{arguments} to the length of its list of parameters @see{multires}, unless the function is a @def{variadic function}, which is indicated by three dots (@Char{...}) at the end of its parameter list.

A variadic function does not adjust its argument list; instead, it collects all extra arguments and supplies them to the function through a @def{vararg expression}, which is also written as three dots.

The value of this expression is a list of all actual extra arguments, similar to a function with multiple results @see{multires}.

As an example, consider the following definitions:

```
@verbatim{
function
f(a, b) end
function g(a, b, ...) end
function r() return 1,2,3 end
}
```

Then, we have the following mapping from arguments to parameters and to the vararg expression:

```
@verbatim{
CALL PARAMETERS
```

```
f(3) a=3, b=nil
f(3, 4) a=3, b=4
f(3, 4, 5) a=3, b=4
f(r(), 10) a=1, b=10
f(r()) a=1, b=2
```

```
g(3) a=3, b=nil, ... --> (nothing)
g(3, 4) a=3, b=4, ... --> (nothing)
g(3, 4, 5, 8) a=3, b=4, ... --> 5 8
g(5, r()) a=5, b=1, ... --> 2 3
}
```

Results are returned using the `@Rw{return}` statement `@see{control}`.  
If control reaches the end of a function  
without encountering a `@Rw{return}` statement,  
then the function returns with no results.

`@index{multiple return}`  
There is a system-dependent limit on the number of values  
that a function may return.  
This limit is guaranteed to be greater than 1000.

The `@emphx{colon}` syntax  
is used to emulate `@def{methods}`,  
adding an implicit extra parameter `@idx{self}` to  
the function.

Thus, the statement

```
@verbatim{
function t.a.b.c:f (@rep{params}) @rep{body} end
}
```

is syntactic sugar for

```
@verbatim{
t.a.b.c.f = function (self, @rep{params}) @rep{body} end
}
```

```
}
```

`@sect3{multires| @title{Lists of expressions, multiple results,  
and adjustment}`

Both function calls and `vararg` expressions can result in multiple values.  
These expressions are called `@def{multires expressions}`.

When a `multires` expression is used as the last element  
of a list of expressions,

all results from the expression are added to the list of values produced by the list of expressions.

Note that a single expression in a place that expects a list of expressions is the last expression in that (singleton) list.

These are the places where Lua expects a list of expressions:

@description{

@item{A @rw{return} statement,  
for instance @T{return e1, e2, e3} @see{control}.}

@item{A table constructor,  
for instance @T{{e1, e2, e3}} @see{tableconstructor}.}

@item{The arguments of a function call,  
for  
instance @T{foo(e1, e2, e3)} @see{functioncall}.}

@item{A multiple assignment,  
for instance @T{a, b, c = e1, e2, e3} @see{assignment}.}

@item{A local declaration,  
for instance @T{local a, b, c = e1, e2, e3} @see{localvar}.}

@item{The initial values in a generic @rw{for} loop,  
for instance @T{for k in e1, e2, e3 do ... end} @see{for}.}

}

In the last four cases,  
the list of values from the list of expressions  
must be @emph{adjusted} to a specific length:  
the number of parameters in a call to a non-variadic function  
@see{func-def},  
the number of variables in a multiple assignment or  
a local declaration,  
and exactly four values for a generic @rw{for} loop.

The @def{adjustment} follows these rules:

If there are more values than needed,  
the extra values are thrown away;  
if there are fewer values than needed,  
the list is extended with @nil's.

When the list of expressions ends with a multi-res expression,  
all results from that expression enter the list of values  
before the adjustment.

When



a multi-res expression is used  
in a list of expressions without being the last element,  
or in a place where the syntax expects a single expression,  
Lua adjusts the result list of that expression to one element.  
As a particular case,  
the syntax expects a single expression inside a parenthesized expression;  
therefore, adding parentheses around a multi-res expression  
forces it to produce exactly one result.

We seldom need to use a vararg expression in a place  
where the syntax expects a single expression.  
(Usually it is simpler to add a regular parameter before  
the variadic part and use that parameter.)  
When there is such a need,  
we recommend assigning the vararg expression  
to a single variable and using that variable  
in its place.

Here are some examples of uses of multi-res expressions.

In all cases, when the construction needs

@Q{the n-th result} and there is no such result,  
it uses a @nil.

@verbatim{

```
print(x, f()) -- prints x and all results from f().
```

```
print(x, (f())) -- prints
```

```
 x and the first result from f().
```

```
print(f(), x) -- prints the first result from f() and x.
```

```
print(1 + f()) -- prints 1 added to the first result from f().
```

```
local x = ... -- x gets the first vararg argument.
```

```
x,y = ... -- x gets the first vararg argument,
 -- y gets the second vararg argument.
```

```
x,y,z = w, f() -- x gets w, y gets the first result from f(),
 -- z gets the second result from f().
```

```
x,y,z = f() -- x gets the first result from f(),
 -- y gets the second result from f(),
 -- z gets the third result from f().
```

```
x,y,z = f(), g() -- x gets the first result from f(),
 -- y gets the first result from g(),
 -- z gets the second result from g().
```

```
x,y,z = (f()) -- x gets the first result from f(), y and z get nil.
```

```
return f() -- returns all results from f().
```

```
return x, ... -- returns x and all received vararg arguments.
```

```
return x,y,f()
 -- returns x, y, and all results from f().
```

```
{f()} -- creates a list with all results from f().
```

```
{...} -- creates a list with all vararg arguments.
```

```
{f(), 5} -- creates a list with the first result from f() and 5.
```

```
}
```

```
}
```

```
}
```

```
@sect2{visibility| @title{Visibility Rules}
```

```
@index{ visibility }
```

Lua is a lexically scoped language.

The scope of a local variable begins at the first statement after its declaration and lasts until the last non-void statement of the innermost block that includes the declaration.

(@emph{Void statements} are labels and empty statements.)

Consider the following example:

```
@verbatim{
x = 10 -- global variable
do -- new block
 local x = x -- new 'x', with value 10
 print(x) --> 10
 x = x+1
do -- another block
 local x = x+1 -- another 'x'
 print(x) --> 12
end
print(x) --> 11
end
print(x) --> 10 (the global one)
}
```

Notice

that, in a declaration like @T{local x = x}, the new @id{x} being declared is not in scope yet, and so the second @id{x} refers to the outside variable.

Because of the @x{lexical scoping} rules, local variables can be freely accessed by functions defined inside their scope.

A local variable used by an inner function is called an @def{upvalue} (or @emphx{external local variable}, or simply @emphx{external variable}) inside the inner function.

Notice that each execution of a @Rw{local} statement defines new local variables.

Consider the following example:

```
@verbatim{
a = { }
local x = 20
for i = 1, 10 do
```

```

local y = 0
a[i] = function () y = y + 1; return x + y end
end
}

```

The loop creates ten closures

(that is, ten instances of the anonymous function).

Each of these closures uses a different `@id{y}` variable, while all of them share the same `@id{x}`.

```

}

```

```

}

```

```

@C{-----}

```

```

@sect1{API| @title{The Application Program Interface}

```

```

@simplesect{

```

```

@index{C
API}

```

This section describes the `@N{C API}` for Lua, that is, the set of `@N{C functions}` available to the host program to communicate with Lua.

All API functions and related types and constants are declared in the header file `@defid{lua.h}`.

Even when we use the term `@Q{function}`, any facility in the API may be provided as a macro instead. Except where stated otherwise, all such macros use each of their arguments exactly once (except for the first argument, which is always a Lua state), and so do not generate any hidden side-effects.

As in most `@N{C libraries}`, the Lua API functions do not check their arguments for validity or consistency. However, you can change this behavior by compiling Lua with the macro `@defid{LUA_USE_APICHECK}` defined.

The Lua library is fully reentrant:

it has no global variables.

It keeps all information it needs in a dynamic structure, called the `@def{Lua state}`.

Each Lua state has one or more threads, which correspond to independent,

cooperative lines of execution.

The type `@Lid{lua_State}` (despite its name) refers to a thread. (Indirectly, through the thread, it also refers to the Lua state associated to the thread.)

A pointer to a thread must be passed as the first argument to every function in the library, except to `@Lid{lua_newstate}`, which creates a Lua state from scratch and returns a pointer to the `@emph{main thread}` in the new state.

}

@sect2{ @title{The Stack}

@simplesect{

Lua uses a `@emph{virtual stack}` to pass values to and from C. Each element in this stack represents a Lua value (`@nil`, number, string, etc.). Functions in the API can access this stack through the Lua state parameter that they receive.

Whenever Lua calls C, the called function gets a new stack, which is independent of previous stacks and of stacks of `@N{C functions}` that are still active. This stack initially contains any arguments to the `@N{C function}` and it is where the `@N{C function}` can store temporary Lua values and must push its results to be returned to the caller `@seeC{lua_CFunction}`.

For convenience, most query operations in the API do not follow a strict stack discipline. Instead, they can refer to any element in the stack by using an `@emph{index}:@index{index (API stack)}`. A positive index represents an absolute stack position, starting `@N{at 1}` as the bottom of the stack; a negative index represents an offset relative to the top of the stack. More specifically, if the stack has `@rep{n}` elements, then `@N{index 1}` represents the first element (that is, the element that was pushed onto the stack first) and `@N{index @rep{n}}` represents the last element; `@N{index @num{-1}}` also represents the last element (that is, the element at `@N{the top}`) and `index @M{-n}` represents the first element.

}

@sect3{stacksize| @title{Stack Size}

When you interact with the Lua API,  
you are responsible for ensuring consistency.

In particular,

@emph{you are responsible for controlling stack overflow}.

When you call any

API function,

you must ensure the stack has enough room to accommodate the results.

There is one exception to the above rule:

When you call a Lua function

without a fixed number of results @seeF{lua\_call},

Lua ensures that the stack has enough space for all results.

However, it does not ensure any extra space.

So, before pushing anything on the stack after such a call

you should use @Lid{lua\_checkstack}.

Whenever Lua calls C,

it ensures that the stack has space for

at least @defid{LUA\_MINSTACK} extra elements;

that is, you can safely push up to @id{LUA\_MINSTACK} values into it.

@id{LUA\_MINSTACK} is defined as 20,

so that usually you do not have to worry about stack space

unless your code has loops pushing elements onto the stack.

Whenever necessary,

you can use the function @Lid{lua\_checkstack}

to ensure that the stack has enough space for pushing new elements.

}

@sect3{@title{Valid and Acceptable Indices}

Any function in the API that receives stack indices

works only with @emphx{valid

indices} or @emphx{acceptable indices}.

A @def{valid index} is an index that refers to a  
position that stores a modifiable Lua value.

It comprises stack indices @N{between 1} and the stack top

(@T{1 @leq abs(index) @leq top})

@index{stack index}

plus @def{pseudo-indices},

which represent some positions that are accessible to @N{C code}

but that are not in the stack.

Pseudo-indices are used to access the registry @see{registry}

and the upvalues of a `@N{C function}` `@see{c-closure}`.

Functions that do not need a specific mutable position, but only a value (e.g., query functions), can be called with acceptable indices.

An `@def{acceptable index}` can be any valid index, but it also can be any positive index after the stack top within the space allocated for the stack, that is, indices up to the stack size.

(Note that 0 is never an acceptable index.)

Indices to upvalues `@see{c-closure}` greater than the real number of upvalues in the current `@N{C function}` are also acceptable (but invalid).

Except

when noted otherwise,

functions in the API work with acceptable indices.

Acceptable indices serve to avoid extra tests against the stack top when querying the stack.

For instance, a `@N{C function}` can query its third argument without the need to check whether there is a third argument, that is, without the need to check whether 3 is a valid index.

For functions that can be called with acceptable indices, any non-valid index is treated as if it contains a value of a virtual type `@defid{LUA_TNONE}`, which behaves like a nil value.

}

`@sect3{constchar|@title{Pointers to strings}`

Several functions in the API return pointers (`@T{const char*}`) to Lua strings in the stack.

(See `@Lid{lua_pushfstring}`, `@Lid{lua_pushlstring}`, `@Lid{lua_pushstring}`, and `@Lid{lua_tolstring}`.

See also `@Lid{luaL_checklstring}`, `@Lid{luaL_checkstring}`, and `@Lid{luaL_tolstring}` in the auxiliary library.)

In general,

Lua's garbage collection can free or move internal memory and then invalidate pointers to internal strings.

To allow a safe use of these pointers, the API guarantees that any pointer to a string in a stack index is valid while the string value at that index is not removed from the stack.

(It can be moved to another index, though.)

When the index is a pseudo-index (referring to an upvalue), the pointer is valid while the corresponding call is active and

the corresponding upvalue is not modified.

Some functions in the debug interface also return pointers to strings, namely `@Lid{lua_getlocal}`, `@Lid{lua_getupvalue}`, `@Lid{lua_setlocal}`, and `@Lid{lua_setupvalue}`. For these functions, the pointer is guaranteed to be valid while the caller function is active and the given closure (if one was given) is in the stack.

Except for these guarantees, the garbage collector is free to invalidate any pointer to internal strings.

}

}

@sect2{c-closure| @title{C Closures}

When a `@N{C function}` is created, it is possible to associate some values with it, thus creating a `@def{ @N{C closure} }` `@seeC{lua_pushcclosure}`; these values are called `@def{upvalues}` and are accessible to the function whenever it is called.

Whenever a `@N{C function}` is called, its upvalues are located at specific pseudo-indices. These pseudo-indices are produced by the macro `@Lid{lua_upvalueindex}`. The first upvalue associated with a function is at index `@T{lua_upvalueindex(1)}`, and so on. Any access to `@T{lua_upvalueindex(@rep{n})}`, where `@rep{n}` is greater than the number of upvalues of the current function (but not greater than 256, which is one plus the maximum number of upvalues in a closure), produces an acceptable but invalid index.

A `@N{C closure}` can also change the values of its corresponding upvalues.

}

@sect2{registry| @title{Registry}

Lua provides a `@def{registry}`,  
a predefined table that can be used by any `@N{C code}` to  
store whatever Lua values it needs to store.  
The registry table is always accessible at pseudo-index  
`@defid{LUA_REGISTRYINDEX}`.  
Any `@N{C library}` can store data into  
this table,  
but it must take care to choose keys  
that are different from those used  
by other libraries, to avoid collisions.  
Typically, you should use as key a string containing your library name,  
or a light userdata with the address of a `@N{C object}` in your code,  
or any Lua object created by your code.  
As with variable names,  
string keys starting with an underscore followed by  
uppercase letters are reserved for Lua.

The integer keys in the registry are used  
by the reference mechanism `@seeC{luaL_ref}`  
and by some predefined values.  
Therefore, integer keys in the registry  
must not be used for other purposes.

When you create a new Lua state,  
its registry comes with some predefined values.  
These predefined values are indexed with integer keys  
defined as constants in `@id{lua.h}`.  
The following constants are defined:  
`@description{`  
`@item{ @defid{LUA_RIDX_MAINTHREAD}|` At this index the registry has  
the main thread of the state.  
(The main thread is the one created together with the state.)  
`}`

`@item{ @defid{LUA_RIDX_GLOBALS}|`  
At this index the registry has  
the `@x{global environment}`.  
`}`  
`}`  
  
`}`

`@sect2{C-error|@title{Error Handling in C}`

`@simplesect{`

Internally, Lua uses the C `@id{longjmp}` facility to handle errors.  
(Lua will use exceptions if you compile it as C++;



search for @id{LUA\_THROW} in the source code for details.)

When Lua faces any error,  
such as a @x{memory allocation error} or a type error,  
it @emph{raises} an error;  
that is, it does a long jump.  
A @emphx{protected environment} uses @id{setjmp}  
to set a recovery point;  
any error jumps to the most recent active recovery point.

Inside a @N{C function} you can raise an error explicitly  
by calling @Lid{lua\_error}.

Most functions in the API can raise an error,  
for instance due to a @x{memory allocation error}.  
The documentation for each function indicates whether  
it can raise errors.

If an error happens outside any protected environment,  
Lua calls a @def{panic function} (see @Lid{lua\_atpanic})  
and then calls @T{abort},  
thus  
exiting the host application.  
Your panic function can avoid this exit by  
never returning  
(e.g., doing a long jump to your own recovery point outside Lua).

The panic function,  
as its name implies,  
is a mechanism of last resort.  
Programs should avoid it.  
As a general rule,  
when a @N{C function} is called by Lua with a Lua state,  
it can do whatever it wants on that Lua state,  
as it should be already protected.  
However,  
when C code operates on other Lua states  
(e.g., a Lua-state argument to the function,  
a Lua state stored in the registry, or  
the result of @Lid{lua\_newthread}),  
it should use them only in API calls that cannot raise errors.

The panic function runs as if it were a @x{message handler} @see{error};  
in particular, the error object is on the top of the stack.  
However, there is no guarantee about stack space.  
To push anything on the stack,  
the panic function must first check the available space @see{stacksize}.

}

@sect3{statuscodes|@title{Status Codes}

Several functions

that report errors in the API use the following status codes to indicate different kinds of errors or other conditions:

@description{

@item{ @defid{LUA\_OK} (0)| no errors. }

@item{ @defid{LUA\_ERRRUN}| a runtime error. }

@item{ @defid{LUA\_ERRMEM}|

@x{memory allocation error}.

For such errors, Lua does not call the @x{message handler}.

}

@item{ @defid{LUA\_ERRERR}| error while running the @x{message handler}. }

@item{ @defid{LUA\_ERRSYNTAX}| syntax error during precompilation. }

@item{ @defid{LUA\_YIELD}| the thread (coroutine) yields. }

@item{ @defid{LUA\_ERRFILE}| a file-related error;

e.g., it cannot open or read the file. }

}

These constants are defined in the header file @id{lua.h}.

}

}

@sect2{continuations|@title{Handling Yields in C}

Internally, Lua uses the C @id{longjmp} facility to yield a coroutine.

Therefore, if a @N{C function} @id{foo} calls an API function

and this API function yields

(directly or indirectly by calling another function that yields),

Lua cannot return to

@id{foo} any more,

because the @id{longjmp} removes its frame from the @N{C stack}.

To avoid this kind of problem,

Lua raises an error whenever it tries to yield across an API call,

except for three functions:

@Lid{lua\_yieldk}, @Lid{lua\_callk}, and @Lid{lua\_pcallk}.

All those functions receive a @def{continuation function}  
(as a parameter named @id{k}) to continue execution after a yield.

We need to set some terminology to explain continuations.

We have a @N{C function} called from Lua which we will call  
the @emph{original function}.

This original function then calls one of those three functions in the C API,  
which we will call the @emph{callee function},  
that then yields the current thread.

This can happen when the callee function is @Lid{lua\_yieldk},  
or when the callee function is either @Lid{lua\_callk} or @Lid{lua\_pcallk}  
and the function called by them yields.

Suppose the running thread yields while executing the callee function.

After the thread resumes,  
it eventually will finish  
running the callee function.

However,

the callee function cannot return to the original function,  
because its frame in the @N{C stack} was destroyed by the yield.

Instead, Lua calls a @def{continuation function},  
which was given as an argument to the callee function.

As the name implies,  
the continuation function should continue the task  
of the original function.

As an illustration, consider the following function:

```
@verbatim{
int original_function (lua_State *L) {
... /* code 1 */
status = lua_pcall(L, n, m, h); /* calls Lua */
... /* code 2 */
}
}
```

Now we want to allow

the Lua code being run by @Lid{lua\_pcall} to yield.

First, we can rewrite our function like here:

```
@verbatim{
int k (lua_State *L, int status, lua_KContext ctx) {
... /* code 2 */
}
}
```

```
int original_function (lua_State *L) {
... /* code 1 */
return k(L, lua_pcall(L, n, m, h), ctx);
}
}
```

In the above code,

the new function `@id{k}` is a  
`@emph{continuation function}` (with type `@Lid{lua_KFunction}`),  
which  
should do all the work that the original function  
was doing after calling `@Lid{lua_pcall}`.

Now, we must inform Lua that it must call `@id{k}` if the Lua code  
being executed by `@Lid{lua_pcall}` gets interrupted in some way  
(errors or yielding),

so we rewrite the code as here,

replacing `@Lid{lua_pcall}` by `@Lid{lua_pcallk}`:

`@verbatim{`

```
int original_function (lua_State *L) {
 ... /* code 1 */
 return k(L, lua_pcallk(L, n, m, h, ctx2, k), ctx1);
}
}
```

Note the external, explicit call to the continuation:

Lua will call the continuation only if needed, that is,  
in case of errors or resuming after a yield.

If the called function returns normally without ever yielding,

`@Lid{lua_pcallk}` (and `@Lid{lua_callk}`) will also return normally.

(Of course, instead of calling the continuation in that case,

you can do the equivalent work directly inside the original function.)

Besides the Lua state,

the continuation function has two other parameters:

the final status of the call and the context value

(`@id{ctx}`) that

was passed originally to `@Lid{lua_pcallk}`.

Lua does not use this context value;

it only passes this value from the original function to the  
continuation function.

For `@Lid{lua_pcallk}`,

the status is the same value that would be returned by `@Lid{lua_pcallk}`,

except that it is `@Lid{LUA_YIELD}` when being executed after a yield  
(instead of `@Lid{LUA_OK}`).

For `@Lid{lua_yieldk}` and `@Lid{lua_callk}`,

the status is always `@Lid{LUA_YIELD}` when Lua calls the continuation.

(For these two functions,

Lua will not call the continuation in case of errors,

because they do not handle errors.)

Similarly, when using `@Lid{lua_callk}`,

you should call the continuation function

with `@Lid{LUA_OK}` as the status.

(For `@Lid{lua_yieldk}`, there is not much point in calling

directly the continuation function,

because `@Lid{lua_yieldk}` usually does not return.)

Lua treats the continuation function as if it were the original function. The continuation function receives the same Lua stack from the original function, in the same state it would be if the callee function had returned. (For instance, after a `@Lid{lua_callk}` the function and its arguments are removed from the stack and replaced by the results from the call.) It also has the same upvalues. Whatever it returns is handled by Lua as if it were the return of the original function.

}

@sect2{ @title{Functions and Types}

Here we list all functions and types from the @N{C API} in alphabetical order.

Each function has an indicator like this:

@apii{o,p,x}

The first field, @T{o},

is how many elements the function pops from the stack.

The second field, @T{p},

is how many elements the function pushes onto the stack.

(Any function always pushes its results after popping its arguments.)

A field in the form @T{x|y} means the function can push (or pop)

@T{x} or @T{y} elements,

depending on the situation;

an interrogation mark @Char{?} means that

we cannot know how many elements the function pops/pushes by looking only at its arguments.

(For

instance, they may depend on what is in the stack.)

The third field, @T{x},

tells whether the function may raise errors:

@Char{-} means the function never raises any error;

@Char{m} means the function may raise only out-of-memory errors;

@Char{v} means the function may raise the errors explained in the text;

@Char{e} means the function can run arbitrary Lua code,

either directly or through metamethods,

and therefore may raise any errors.

@APIEntry{int lua\_absindex (lua\_State \*L, int idx);|

@apii{0,0,-}

Converts the @x{acceptable index} @id{idx}

into an equivalent `@x{absolute index}`  
(that is, one that does not depend on the stack size).

}

```
@APIEntry{
typedef void * (*lua_Alloc) (void *ud,
 void *ptr,
 size_t osize,
 size_t nsize);
```

The type of the `@x{memory-allocation function}` used by Lua states.

The allocator function must provide a  
functionality similar to `@id{realloc}`,  
but not exactly the  
same.

Its arguments are

`@id{ud}`, an opaque pointer passed to `@Lid{lua_newstate}`;

`@id{ptr}`, a pointer to the block being allocated/reallocated/freed;

`@id{osize}`, the original size of the block or some code about what  
is being allocated;

and `@id{nsize}`, the new size of the block.

When `@id{ptr}` is not `@id{NULL}`,

`@id{osize}` is the size of the block pointed by `@id{ptr}`,

that is, the size given when it was allocated or reallocated.

When `@id{ptr}` is `@id{NULL}`,

`@id{osize}` encodes the kind of object that Lua is allocating.

`@id{osize}` is any of

`@Lid{LUA_TSTRING}`, `@Lid{LUA_TTABLE}`, `@Lid{LUA_TFUNCTION}`,

`@Lid{LUA_TUSERDATA}`, or `@Lid{LUA_TTHREAD}` when (and only when)

Lua is creating a new object of that type.

When `@id{osize}` is some other value,

Lua is allocating memory for something else.

Lua assumes the following behavior from the allocator function:

When `@id{nsize}` is zero,

the allocator must behave like `@id{free}`

and then return `@id{NULL}`.

When `@id{nsize}` is not zero,

the allocator must behave

like `@id{realloc}`.

In particular, the allocator returns `@id{NULL}`

if and only if it cannot fulfill the request.

Here is a simple implementation for the @x{allocator function}.

It is used in the auxiliary library by @Lid{luaL\_newstate}.

```
@verbatim{
static void *l_alloc (void *ud, void *ptr, size_t osize,
 size_t nsize) {
 (void)ud; (void)osize; /* not used */
 if (nsize == 0) {
 free(ptr);
 return NULL;
 }
 else
 return realloc(ptr, nsize);
}
}
```

Note that @N{ISO C} ensures

that @T{free(NULL)} has no effect and that

@T{realloc(NULL,size)} is equivalent to @T{malloc(size)}.

```
}
```

```
@APIEntry{void lua_arith (lua_State *L, int op);|
```

```
@apii{2|1,1,e}
```

Performs an arithmetic or bitwise operation over the two values  
(or one, in the case of negations)

at the top of the stack,

with the value on the top being the second operand,

pops these values, and pushes the result of the operation.

The function follows the semantics of the corresponding Lua  
operator

(that is, it may call metamethods).

The value of @id{op} must be one of the following constants:

```
@description{
```

```
@item{@defid{LUA_OPADD}| performs addition (@T{+})}
```

```
@item{@defid{LUA_OPSUB}| performs subtraction (@T{-})}
```

```
@item{@defid{LUA_OPMUL}| performs multiplication (@T{*})}
```

```
@item{@defid{LUA_OPDIV}| performs float division (@T{/})}
```

```
@item{@defid{LUA_OPIDIV}| performs floor division (@T{//})}
```

```
@item{@defid{LUA_OPMOD}| performs modulo (@T{%})}
```

```
@item{@defid{LUA_OPPOW}| performs exponentiation (@T{^})}
```

```
@item{@defid{LUA_OPUNM}| performs mathematical negation (unary @T{-})}
```

```
@item{@defid{LUA_OPBNOT}| performs bitwise NOT (@T{~})}
```

```
@item{@defid{LUA_OPBAND}| performs bitwise AND (@T{&})}
```

```
@item{@defid{LUA_OPBOR}| performs bitwise OR (@T{|})}
```

```
@item{@defid{LUA_OPBXOR}| performs bitwise exclusive OR (@T{~})}
```

```

@item{ @defid{LUA_OPSHL}| performs left shift (@T{<<})}
@item{ @defid{LUA_OP SHR}| performs right shift (@T{>>})}

}

}

```

```

@APIEntry{lua_CFunction lua_atpanic (lua_State *L, lua_CFunction
panicf);|
@apii{0,0,-}

```

Sets a new panic function and returns the old one @see{C-error}.

```

}

```

```

@APIEntry{void lua_call (lua_State *L, int nargs, int nresults);|
@apii{nargs+1,nresults,e}

```

Calls a function.

Like regular Lua calls,

@id{lua\_call} respects the @idx{\_\_call} metamethod.

So, here the word @Q{function}

means any callable value.

To do a call you must use the following protocol:

first, the function to be called is pushed onto the stack;

then, the arguments to the call are pushed

in direct order;

that is, the first argument is pushed first.

Finally you call @Lid{lua\_call};

@id{nargs} is the number of arguments that you pushed onto the stack.

When the function returns,

all arguments and the function value are popped

and the call results are pushed onto the stack.

The number of results is adjusted to @id{nresults},

unless @id{nresults} is @defid{LUA\_MULTRET}.

In this case, all results from the function are pushed;

Lua takes care that the returned values fit into the stack space,

but

it does not ensure any extra space in the stack.

The function results are pushed onto the stack in direct order

(the first result is pushed first),

so that after the call the last result is on the top of the stack.

Any error while calling and running the function is propagated upwards

(with a @id{longjmp}).

The following example shows how the host program can do the



equivalent to this Lua code:

```
@verbatim{
a = f("how", t.x, 14)
}
```

Here it is @N{in C}:

```
@verbatim{
lua_getglobal(L, "f"); /* function to be called */
lua_pushliteral(L, "how"); /* 1st argument */
lua_getglobal(L, "t"); /* table to be indexed */
lua_getfield(L, -1, "x"); /* push result of t.x (2nd arg) */
lua_remove(L, -2); /* remove 't' from the stack */
lua_pushinteger(L, 14); /* 3rd argument */
lua_call(L, 3, 1); /* call 'f' with 3 arguments and 1 result */
lua_setglobal(L, "a"); /* set global
'a' */
}
```

Note that the code above is @emph{balanced}:

at its end, the stack is back to its original configuration.

This is considered good programming practice.

```
}
```

```
@APIEntry{
void lua_callk (lua_State *L,
 int nargs,
 int nresults,
 lua_KContext ctx,
 lua_KFunction k);|
@apii{nargs + 1,nresults,e}
```

This function behaves exactly like @Lid{lua\_call},  
but allows the called function to yield @see{continuations}.

```
}
```

```
@APIEntry{typedef int (*lua_CFunction) (lua_State *L);|
```

Type for @N{C functions}.

In order to communicate properly with Lua,

a @N{C function} must use the following protocol,

which defines the way parameters and results are passed:

a @N{C function} receives its arguments from Lua in its stack  
in direct order (the first argument is pushed first).

So, when the function starts,

@T{lua\_gettop(L)} returns the number of arguments received by the function.

The first argument (if any) is at index 1

and its last argument

is at index `@T{lua_gettop(L)}`.

To return values to Lua, a `@N{C function}` just pushes them onto the stack, in direct order (the first result is pushed first), and returns in `C` the number of results.

Any other value in the stack below the results will be properly discarded by Lua.

Like a Lua function, a `@N{C function}` called by Lua can also return many results.

As an example, the following function receives a variable number of numeric arguments and returns their average and their sum:

```
@verbatim{
static int foo (lua_State *L) {
 int n = lua_gettop(L); /* number of arguments */
 lua_Number sum = 0.0;
 int i;
 for (i = 1; i <= n; i++) {
 if (!lua_isnumber(L, i)) {
 lua_pushliteral(L, "incorrect argument");
 lua_error(L);
 }
 sum += lua_tonumber(L, i);
 }
 lua_pushnumber(L, sum/n); /* first result */
 lua_pushnumber(L, sum); /* second result */
 return 2; /* number of results */
}
}
```

```
@APIEntry{int lua_checkstack (lua_State
*L, int n);|
@api{0,0,-}
```

Ensures that the stack has space for at least `@id{n}` extra elements, that is, that you can safely push up to `@id{n}` values into it.

It returns false if it cannot fulfill the request, either because it would cause the stack to be greater than a fixed maximum size (typically at least several thousand elements) or because it cannot allocate memory for the extra space.

This function never shrinks the stack; if the stack already has space for the extra elements, it is left unchanged.

```
}
```

```
@APIEntry{void lua_close (lua_State *L);|
@apii{0,0,-}}
```

Close all active to-be-closed variables in the main thread,  
release all objects in the given Lua state  
(calling the corresponding garbage-collection metamethods, if any),  
and frees all dynamic memory used by this state.

On several platforms, you may not need to call this function,  
because all resources are naturally released when the host program ends.  
On the other hand, long-running programs that create multiple states,  
such  
as daemons or web servers,  
will probably need to close states as soon as they are not needed.

```
}
```

```
@APIEntry{void lua_closeslot (lua_State *L, int index);|
@apii{0,0,e}}
```

Close the to-be-closed slot at the given index and set its value to @nil.  
The index must be the last index previously marked to be closed  
@see{lua\_toclose} that is still active (that is, not closed yet).

A @idx{\_\_close} metamethod cannot yield  
when called through this function.

(This function was introduced in @N{release 5.4.3}.)

```
}
```

```
@APIEntry{int lua_closethread (lua_State *L, lua_State *from);|
@apii{0,?,-}}
```

Resets a thread, cleaning its call stack and closing all pending  
to-be-closed variables.

Returns a status code:

@Lid{LUA\_OK} for no errors in the thread  
(either the original error that stopped the thread or  
errors in closing methods),  
or an error status otherwise.

In case of error,  
leaves the error object on the top of the stack.

The parameter @id{from} represents the coroutine that is resetting @id{L}.

If  
there is no such coroutine,  
this parameter can be @id{NULL}.

(This function was introduced in @N{release 5.4.6}.)

}

```
@APIEntry{int lua_compare (lua_State *L, int index1, int index2, int op);|
@apii{0,0,e}
```

Compares two Lua values.

Returns 1 if the value at index @id{index1} satisfies @id{op}  
when compared with the value at index @id{index2},  
following the semantics of the corresponding Lua operator  
(that is, it may call metamethods).

Otherwise @N{returns 0}.

Also @N{returns 0} if any of the indices is not valid.

The value of @id{op} must be one of the following constants:

@description{

@item{@defid{LUA\_OPEQ}| compares for equality (@T{==})}

@item{@defid{LUA\_OPLT}| compares for less than (@T{<})}

@item{@defid{LUA\_OPLE}| compares for less or equal (@T{<=})}

}

}

```
@APIEntry{void lua_concat (lua_State *L, int n);|
@apii{n,1,e}
```

Concatenates the @id{n} values at the top of the stack,  
pops them, and leaves the result on the top.

If @N{@T{n} is 1}, the result is the single value on the  
stack

(that is, the function does nothing);

if @id{n} is 0, the result is the empty string.

Concatenation is performed following the usual semantics of Lua  
@see{concat}.

}

```
@APIEntry{void lua_copy (lua_State *L, int fromidx, int toidx);|
@apii{0,0,-}
```

Copies the element at index @id{fromidx}

into the valid index @id{toidx},  
replacing the value at that position.  
Values at other positions are not affected.

}

```
@APIEntry{void lua_createtable (lua_State *L, int narr, int nrec);
@apii{0,1,m}}
```

Creates a new empty table and pushes it onto the stack.  
Parameter @id{narr} is a hint for how many elements the table  
will have as a sequence;  
parameter @id{nrec} is a hint for how many other elements  
the table will have.  
Lua may use these hints to preallocate memory for the new table.  
This preallocation may help performance when you know in advance  
how many elements the table will have.  
Otherwise you can use the function @Lid{lua\_newtable}.

}

```
@APIEntry{int lua_dump (lua_State *L,

 lua_Writer writer,
 void *data,
 int strip);
@apii{0,0,-}}
```

Dumps a function as a binary chunk.  
Receives a Lua function on the top of the stack  
and produces a binary chunk that,  
if loaded again,  
results in a function equivalent to the one dumped.  
As it produces parts of the chunk,  
@Lid{lua\_dump} calls function @id{writer} @seeC{lua\_Writer}  
with the given @id{data}  
to write them.

If @id{strip} is true,  
the binary representation may not include all debug information  
about the function,  
to save space.

The value returned is the error code returned by the last  
call to the writer;  
@N{0 means} no errors.

This function does not pop the Lua function from the stack.

}

```
@APIEntry{int lua_error (lua_State *L);|
@apii{1,0,v}
```

Raises a Lua error,  
using the value on the top of the stack as the error object.  
This function does a long jump,  
and therefore never returns  
@seeC{luaL\_error}.

}

```
@APIEntry{int lua_gc (lua_State *L, int what, ...);|
@apii{0,0,-}
```

Controls  
the garbage collector.

This function performs several tasks,  
according to the value of the parameter @id{what}.  
For options that need extra arguments,  
they are listed after the option.  
@description{

```
@item{ @id{LUA_GCCOLLECT}}|
Performs a full garbage-collection cycle.
}
```

```
@item{ @id{LUA_GCSTOP}}|
Stops the garbage collector.
}
```

```
@item{ @id{LUA_GCRESTART}}|
Restarts the garbage collector.
}
```

```
@item{ @id{LUA_GCCOUNT}}|
Returns the current amount of memory (in Kbytes) in use by Lua.
}
```

```
@item{ @id{LUA_GCCOUNTB}}|
Returns the remainder of dividing the current amount of bytes of
memory in use by Lua by 1024.
}
```

```
@item{ @id{LUA_GCSTEP} @T{(int stepsize)}}|
```

Performs an incremental step of garbage collection,  
corresponding to the allocation of @id{stepsize} Kbytes.

}

@item{@id{LUA\_GCISRUNNING}|

Returns a boolean that tells whether the collector is running  
(i.e., not stopped).

}

@item{@id{LUA\_GCINC} (int pause, int stepmul, stepsize)|

Changes the collector to incremental mode  
with the

given parameters @see{incmode}.

Returns the previous mode (@id{LUA\_GCGEN} or @id{LUA\_GCINC}).

}

@item{@id{LUA\_GCGEN} (int minormul, int majormul)|

Changes the collector to generational mode  
with the given parameters @see{genmode}.

Returns the previous mode (@id{LUA\_GCGEN} or @id{LUA\_GCINC}).

}

}

For more details about these options,  
see @Lid{collectgarbage}.

This function should not be called by a finalizer.

}

@APIEntry{lua\_Alloc lua\_getallocf (lua\_State \*L, void \*\*ud);|

@apii{0,0,-}

Returns the @x{memory-allocation function} of a given state.

If @id{ud} is not @id{NULL}, Lua stores in @T{\*ud} the  
opaque pointer given when the memory-allocator function was set.

}

@APIEntry{int lua\_getfield (lua\_State \*L, int index, const char \*k);|

@apii{0,1,e}

Pushes onto the stack the value @T{t[k]},  
where @id{t} is the value at the given index.

As in Lua, this function may trigger a metamethod  
for the @Q{index} event @see{metatable}.

Returns the type of the pushed value.

}

```
@APIEntry{void
*lua_getextraspaces (lua_State *L);|
@apii{0,0,-}
```

Returns a pointer to a raw memory area associated with the given Lua state.

The application can use this area for any purpose; Lua does not use it for anything.

Each new thread has this area initialized with a copy of the area of the @x{main thread}.

By default, this area has the size of a pointer to void, but you can recompile Lua with a different size for this area. (See @id{LUA\_EXTRASPACES} in @id{luaconf.h}.)

}

```
@APIEntry{int lua_getglobal (lua_State *L, const char *name);|
@apii{0,1,e}
```

Pushes onto the stack the value of the global @id{name}. Returns the type of that value.

}

```
@APIEntry{int lua_geti (lua_State *L, int index, lua_Integer i);|
@apii{0,1,e}
```

Pushes onto the stack the value @T{t[i]}, where @id{t} is the value at the given index. As in Lua, this function may trigger a metamethod for the @Q{index} event @see{metatable}.

Returns the type of the pushed value.

}

```
@APIEntry{int lua_getmetatable (lua_State *L, int index);|
@apii{0,0|1,-}
```

If the value at the given index has a metatable, the function pushes that metatable onto the stack and @N{returns 1}. Otherwise,



the function @N{returns 0} and pushes nothing on the stack.

}

```
@APIEntry{int lua_gettable (lua_State *L, int index);|
@apii{1,1,e}
```

Pushes onto the stack the value @T{t[k]},  
where @id{t} is the value at the given index  
and @id{k} is the value on the top of the stack.

This function pops the key from the stack,  
pushing the resulting value in its place.  
As in Lua, this function may trigger a metamethod  
for the @Q{index} event @see{metatable}.

Returns the type of the pushed value.

}

```
@APIEntry{int lua_gettop (lua_State *L);|
@apii{0,0,-}
```

Returns the index of the top element in the stack.  
Because indices start @N{at 1},  
this result is equal to the number of elements in the stack;  
in particular, @N{0 means} an empty stack.

}

```
@APIEntry{int lua_getiuservalue (lua_State *L, int index, int n);|
@apii{0,1,-}
```

Pushes onto the stack the @id{n}-th  
user value associated with the  
full userdata at the given index and  
returns the type of the pushed value.

If the userdata does not have that value,  
pushes @nil and returns @Lid{LUA\_TNONE}.

}

```
@APIEntry{void lua_insert (lua_State *L, int index);|
@apii{1,1,-}
```

Moves the top element into the given valid index,  
shifting up the elements above this index to open space.

This function cannot be called with a pseudo-index,  
because a pseudo-index is not an actual stack position.

}

```
@APIEntry{typedef @ldots lua_Integer;|
```

The type of integers in Lua.

By default this type is @id{long long},  
(usually a 64-bit two-complement integer),  
but that can be changed to @id{long} or @id{int}  
(usually a 32-bit two-complement integer).  
(See @id{LUA\_INT\_TYPE} in @id{luaconf.h}.)

Lua also defines the constants

@defid{LUA\_MININTEGER} and @defid{LUA\_MAXINTEGER},  
with the minimum and the maximum values that fit in this type.

}

```
@APIEntry{int lua_isboolean (lua_State *L, int index);|
@apii{0,0,-}
```

Returns 1

if the value at the given index is a boolean,  
and @N{0 otherwise}.

}

```
@APIEntry{int lua_iscfunction (lua_State *L, int index);|
@apii{0,0,-}
```

Returns 1 if the value at the given index is a @N{C function},  
and @N{0 otherwise}.

}

```
@APIEntry{int lua_isfunction (lua_State *L, int index);|
@apii{0,0,-}
```

Returns 1 if the value at the given index is a function  
(either C or Lua), and @N{0 otherwise}.

}

```
@APIEntry{int lua_isinteger (lua_State *L, int index);|
@apii{0,0,-}
```

Returns 1 if the value at the given index is an integer  
(that is, the value is a number and is represented as an integer),  
and @N{0 otherwise}.

}

```
@APIEntry{int lua_islighuserdata (lua_State *L, int index);|
@apii{0,0,-}}
```

Returns 1 if the value at the given index is a light userdata,  
and @N{0 otherwise}.

}

```
@APIEntry{int lua_isnil (lua_State *L, int index);|
@apii{0,0,-}}
```

Returns 1 if the value at the given index is @nil,  
and @N{0 otherwise}.

}

```
@APIEntry{int lua_isnone (lua_State *L, int index);|
@apii{0,0,-}}
```

Returns  
1 if the given index is not valid,  
and @N{0 otherwise}.

}

```
@APIEntry{int lua_isnoneornil (lua_State *L, int index);|
@apii{0,0,-}}
```

Returns 1 if the given index is not valid  
or if the value at this index is @nil,  
and @N{0 otherwise}.

}

```
@APIEntry{int lua_isnumber (lua_State *L, int index);|
@apii{0,0,-}}
```

Returns 1 if the value at the given index is a number  
or a string convertible to a number,  
and @N{0 otherwise}.

}

```
@APIEntry{int lua_isstring (lua_State *L, int index);|
@apii{0,0,-}
```

Returns 1 if the value at the given index is a string  
or a number (which is always convertible to a string),  
and @N{0 otherwise}.

}

```
@APIEntry{int lua_istable (lua_State *L, int index);|
@apii{0,0,-}
```

Returns 1 if the value at the given index is a table,  
and @N{0 otherwise}.

}

```
@APIEntry{int lua_isthread (lua_State *L, int index);|
@apii{0,0,-}
```

Returns 1 if the value at the given index is a thread,  
and @N{0 otherwise}.

}

```
@APIEntry{int lua_isuserdata (lua_State *L, int index);|
@apii{0,0,-}
```

Returns  
1 if the value at the given index is a userdata  
(either full or light), and @N{0 otherwise}.

}

```
@APIEntry{int lua_isyieldable (lua_State *L);|
@apii{0,0,-}
```

Returns 1 if the given coroutine can yield,  
and @N{0 otherwise}.

}

```
@APIEntry{typedef @ldots lua_KContext;|
```

The type for continuation-function contexts.  
It must be a numeric type.

This type is defined as @id{intptr\_t} when @id{intptr\_t} is available, so that it can store pointers too. Otherwise, it is defined as @id{ptrdiff\_t}.

}

```
@APIEntry{
typedef int (*lua_KFunction) (lua_State *L, int status, lua_KContext ctx);|
```

Type for continuation functions @see{continuations}.

}

```
@APIEntry{void lua_len (lua_State *L, int index);|
@apii{0,1,e}
```

Returns the length of the value at the given index. It is equivalent to the @Char{#} operator in Lua @see{len-op} and may trigger a metamethod for the @Q{length} event @see{metatable}. The result is pushed on the stack.

}

```
@APIEntry{
int lua_load (lua_State *L,
 lua_Reader reader,
 void *data,
 const char *chunkname,
 const char *mode);|
@apii{0,1,-}
```

Loads a Lua chunk without running it. If there are no errors, @id{lua\_load} pushes the compiled chunk as a Lua function on top of the stack. Otherwise, it pushes an error message.

The @id{lua\_load} function uses a user-supplied @id{reader} function to read the chunk @seeC{lua\_Reader}. The @id{data} argument is an opaque value passed to the reader function.

The @id{chunkname} argument gives a name to the chunk, which is used for error messages and in debug information @see{debugI}.

@id{lua\_load} automatically detects whether the chunk is text or binary and loads it accordingly (see program @idx{luac}).

The string @id{mode} works as in function @Lid{load},

with the addition that  
a @id{NULL} value is equivalent to the string @St{bt}.

@id{lua\_load} uses the stack internally,  
so the reader function must always leave the stack  
unmodified when returning.

@id{lua\_load} can return  
@Lid{LUA\_OK},  
@Lid{LUA\_ERRSYNTAX}, or @Lid{LUA\_ERRMEM}.  
The function may also return other values corresponding to  
errors raised by the read function @see{statuscodes}.

If the resulting function has upvalues,  
its first upvalue is set to the value of the @x{global environment}  
stored at index @id{LUA\_RIDX\_GLOBALS} in the registry @see{registry}.  
When loading main chunks,  
this upvalue will be the @id{\_ENV} variable @see{globalenv}.  
Other upvalues are initialized with @nil.

}

```
@APIEntry{lua_State *lua_newstate (lua_Alloc f, void *ud);|
@apii{0,0,-}}
```

Creates a new independent state and returns its main thread.  
Returns @id{NULL} if it cannot create the state  
(due to lack of memory).  
The argument @id{f} is the @x{allocator function};  
Lua will do all memory allocation for this state  
through this function @seeF{lua\_Alloc}.  
The second argument, @id{ud}, is an opaque pointer that Lua  
passes to the allocator in every call.

}

```
@APIEntry{void lua_newtable (lua_State *L);|
@apii{0,1,m}}
```

Creates  
a new empty table and pushes it onto the stack.  
It is equivalent to @T{lua\_createtable(L, 0, 0)}.

}

```
@APIEntry{lua_State *lua_newthread (lua_State *L);|
@apii{0,1,m}}
```

Creates a new thread, pushes it on the stack,  
and returns a pointer to a @Lid{lua\_State} that represents this new thread.  
The new thread returned by this function shares with the original thread  
its global environment,  
but has an independent execution stack.

Threads are subject to garbage collection,  
like any Lua object.

}

```
@APIEntry{void *lua_newuserdatauv (lua_State *L, size_t size, int nuvalue);|
@apii{0,1,m}
```

This function creates and pushes on the stack a new full userdata,  
with @id{nuvalue} associated Lua values, called @id{user values},  
plus an associated block of raw memory with @id{size} bytes.  
(The user values can be set and read with the functions  
@Lid{lua\_setiuservalue} and @Lid{lua\_getiuservalue}.)

The function returns the address of the block of memory.  
Lua ensures that this address is valid as long as  
the  
corresponding userdata is alive @see{GC}.  
Moreover, if the userdata is marked for finalization @see{finalizers},  
its address is valid at least until the call to its finalizer.

}

```
@APIEntry{int lua_next (lua_State *L, int index);|
@apii{1,2|0,v}
```

Pops a key from the stack,  
and pushes a key@En{ }value pair from the table at the given index,  
the @Q{next} pair after the given key.  
If there are no more elements in the table,  
then @Lid{lua\_next} @N{returns 0} and pushes nothing.

A typical table traversal looks like this:

```
@verbatim{
/* table is in the stack at index 't' */
lua_pushnil(L); /* first key */
while (lua_next(L, t) != 0) {
/* uses 'key' (at index -2) and 'value' (at index -1) */
printf("%s - %s\n",
 lua_typename(L, lua_type(L, -2)),
 lua_typename(L, lua_type(L, -1)));
/* removes 'value'; keeps 'key' for next iteration */
```

```
lua_pop(L, 1);
}
}
```

While traversing a table,  
avoid calling `@Lid{lua_tolstring}` directly on a key,  
unless you know that the key is  
actually a string.

Recall that `@Lid{lua_tolstring}` may change  
the value at the given index;  
this confuses the next call to `@Lid{lua_next}`.

This function may raise an error if the given key  
is neither `@nil` nor present in the table.  
See function `@Lid{next}` for the caveats of modifying  
the table during its traversal.

```
}
```

```
@APIEntry{typedef @ldots lua_Number;}
```

The type of floats in Lua.

By default this type is double,  
but that can be changed to a single float or a long double.  
(See `@id{LUA_FLOAT_TYPE}` in `@id{luaconf.h}`.)

```
}
```

```
@APIEntry{int lua_numbertointeger (lua_Number n, lua_Integer *p);}
```

Tries to convert a Lua float to a Lua integer;  
the float `@id{n}` must have an integral value.  
If that value is within the range of Lua integers,  
it is converted to an integer and assigned to `@T{*p}`.  
The macro results in a boolean indicating whether the  
conversion was successful.  
(Note that this range test can be tricky to do  
correctly without this macro, due to rounding.)

This macro may evaluate its  
arguments more than once.

```
}
```

```
@APIEntry{int lua_pcall (lua_State *L, int nargs, int nresults, int msgch);
@apii{nargs + 1,nresults|1,-}}
```



Calls a function (or a callable object) in protected mode.

Both @id{nargs} and @id{nresults} have the same meaning as in @Lid{lua\_call}.

If there are no errors during the call,

@Lid{lua\_pcall} behaves exactly like @Lid{lua\_call}.

However, if there is any error,

@Lid{lua\_pcall} catches it,

pushes a single value on the stack (the error object),

and returns an error code.

Like @Lid{lua\_call},

@Lid{lua\_pcall} always removes the function

and its arguments from the stack.

If @id{msggh} is 0,

then the error object returned on the stack

is exactly the original error object.

Otherwise, @id{msggh} is the stack index of a

@emph{message handler}.

(This index cannot be a pseudo-index.)

In case of runtime errors,

this handler will be called with the error object

and its return value will be the object

returned on the stack by @Lid{lua\_pcall}.

Typically, the message

handler is used to add more debug

information to the error object, such as a stack traceback.

Such information cannot be gathered after the return of @Lid{lua\_pcall},

since by then the stack has unwound.

The @Lid{lua\_pcall} function returns one of the following status codes:

@Lid{LUA\_OK}, @Lid{LUA\_ERRRUN}, @Lid{LUA\_ERRMEM}, or @Lid{LUA\_ERRERR}.

}

@APIEntry{

int lua\_pcallk (lua\_State \*L,

int nargs,

int nresults,

int msggh,

lua\_KContext ctx,

lua\_KFunction k);

@apii{nargs + 1,nresults|1,-}

This function behaves exactly like @Lid{lua\_pcall},

except that it allows the called function to yield @see{continuations}.

}

```
@APIEntry{void lua_pop (lua_State *L, int n);|
@apii{n,0,e}
```

Pops @id{n} elements from the stack.  
It is implemented as a macro over @Lid{lua\_settop}.

}

```
@APIEntry{void lua_pushboolean (lua_State *L, int b);|
@apii{0,1,-}
```

Pushes a boolean value with value @id{b} onto the stack.

}

```
@APIEntry{void
lua_pushcclosure (lua_State *L, lua_CFunction fn, int n);|
@apii{n,1,m}
```

Pushes a new @N{C closure} onto the stack.  
This function receives a pointer to a @N{C function}  
and pushes onto the stack a Lua value of type @id{function} that,  
when called, invokes the corresponding @N{C function}.  
The parameter @id{n} tells how many upvalues this function will have  
@see{c-closure}.

Any function to be callable by Lua must  
follow the correct protocol to receive its parameters  
and return its results @seeC{lua\_CFunction}.

When a @N{C function} is created,  
it is possible to associate some values with it,  
the so called upvalues;  
these upvalues are then accessible to the function whenever it is called.  
This association is called a @x{@N{C closure}} @see{c-closure}.  
To create a @N{C closure},  
first the initial values for its upvalues must be pushed onto the stack.  
(When there are multiple upvalues, the first value is pushed first.)  
Then @Lid{lua\_pushcclosure}  
is called to create and push the @N{C  
function} onto the stack,  
with the argument @id{n} telling how many values will be  
associated with the function.  
@Lid{lua\_pushcclosure} also pops these values from the stack.

The maximum value for @id{n} is 255.

When @id{n} is zero,  
this function creates a @def{light @N{C function}},  
which is just a pointer to the @N{C function}.  
In that case, it never raises a memory error.

}

```
@APIEntry{void lua_pushcfunction (lua_State *L, lua_CFunction f);|
@apii{0,1,-}}
```

Pushes a @N{C function} onto the stack.  
This function is equivalent to @Lid{lua\_pushcclosure} with no upvalues.

}

```
@APIEntry{const char *lua_pushfstring (lua_State *L, const char *fmt, ...);|
@apii{0,1,v}}
```

Pushes onto the stack a formatted string  
and returns a pointer to this string @see{constchar}.  
It is similar to the @ANSI{sprintf},  
but has two important differences.

First,  
you do not have to allocate space for the result;  
the result is a Lua string and Lua takes care of memory allocation  
(and deallocation, through garbage  
collection).

Second,  
the conversion specifiers are quite restricted.  
There are no flags, widths, or precisions.  
The conversion specifiers can only be  
@Char{%%} (inserts the character @Char{%}),  
@Char{%s} (inserts a zero-terminated string, with no size restrictions),  
@Char{%f} (inserts a @Lid{lua\_Number}),  
@Char{%I} (inserts a @Lid{lua\_Integer}),  
@Char{%p} (inserts a pointer),  
@Char{%d} (inserts an @T{int}),  
@Char{%c} (inserts an @T{int} as a one-byte character), and  
@Char{%U} (inserts a @T{long int} as a @x{UTF-8} byte sequence).

This function may raise errors due to memory overflow  
or an invalid conversion specifier.

}

```
@APIEntry{void lua_pushglobaltable (lua_State *L);|
@apii{0,1,-}}
```

Pushes the @x{global environment} onto the stack.

}

```
@APIEntry{void lua_pushinteger (lua_State *L, lua_Integer n);|
@apii{0,1,-}}
```

Pushes an integer with value @id{n} onto the stack.

}

```
@APIEntry{void lua_pushlightuserdata (lua_State *L, void *p);|
@apii{0,1,-}}
```

Pushes a light userdata onto the stack.

Userdata

represent @N{C values} in Lua.

A @def{light userdata} represents a pointer, a @T{void\*}.

It is a value (like a number):

you do not create it, it has no individual metatable,

and it is not collected (as it was never created).

A light userdata is equal to @Q{any}

light userdata with the same @N{C address}.

}

```
@APIEntry{const char *lua_pushliteral (lua_State *L, const char *s);|
@apii{0,1,m}}
```

This macro is equivalent to @Lid{lua\_pushstring},  
but should be used only when @id{s} is a literal string.  
(Lua may optimize this case.)

}

```
@APIEntry{const char *lua_pushlstring (lua_State *L, const char *s, size_t len);|
@apii{0,1,m}}
```

Pushes the string pointed to by @id{s} with size @id{len}  
onto the stack.

Lua will make or reuse an internal copy of the given string,  
so the memory at @id{s} can be freed or reused immediately after  
the function returns.

The string can contain any binary data,  
including @x{embedded zeros}.

Returns a pointer to the internal copy of the string @see{constchar}.

}

```
@APIEntry{void
lua_pushnil (lua_State *L);|
@apii{0,1,-}
```

Pushes a nil value onto the stack.

}

```
@APIEntry{void lua_pushnumber (lua_State *L, lua_Number n);|
@apii{0,1,-}
```

Pushes a float with value @id{n} onto the stack.

}

```
@APIEntry{const char *lua_pushstring (lua_State *L, const char *s);|
@apii{0,1,m}
```

Pushes the zero-terminated string pointed to by @id{s} onto the stack.

Lua will make or reuse an internal copy of the given string, so the memory at @id{s} can be freed or reused immediately after the function returns.

Returns a pointer to the internal copy of the string @see{constchar}.

If @id{s} is @id{NULL}, pushes @nil and returns @id{NULL}.

}

```
@APIEntry{int lua_pushthread (lua_State *L);|
@apii{0,1,-}
```

Pushes the thread represented by @id{L} onto the stack. Returns 1 if this thread is the @x{main thread} of its state.

}

```
@APIEntry{void lua_pushvalue (lua_State *L, int index);|
@apii{0,1,-}
```

Pushes a copy of the element at the given index onto the stack.

```
}
```

```
@APIEntry{
const
char *lua_pushvfstring (lua_State *L,
 const char *fmt,
 va_list argp);
@apii{0,1,v}
```

Equivalent to @Lid{lua\_pushfstring}, except that it receives a @id{va\_list} instead of a variable number of arguments.

```
}
```

```
@APIEntry{int lua_rawequal (lua_State *L, int index1, int index2);
@apii{0,0,-}
```

Returns 1 if the two values in indices @id{index1} and @id{index2} are primitively equal (that is, equal without calling the @idx{\_\_eq} metamethod). Otherwise @N{returns 0}. Also @N{returns 0} if any of the indices are not valid.

```
}
```

```
@APIEntry{int lua_rawget (lua_State *L, int index);
@apii{1,1,-}
```

Similar to @Lid{lua\_gettable}, but does a raw access (i.e., without metamethods). The value at @id{index} must be a table.

```
}
```

```
@APIEntry{int lua_rawgeti (lua_State *L, int index, lua_Integer n);
@apii{0,1,-}
```

Pushes onto the stack the value @T{t[n]}, where @id{t} is the table at the given index. The access is raw, that is, it does not use the @idx{\_\_index} metavalue.

Returns the type of the pushed value.

```
}
```

```
@APIEntry{int lua_rawgetp (lua_State *L, int index, const void *p);
```

```
@apii{0,1,-}
```

Pushes onto the stack the value `@T{t[k]}`,  
where `@id{t}` is the table at the given index and  
`@id{k}` is the pointer `@id{p}` represented as a light userdata.  
The access is raw;  
that is, it does not use the `@idx{__index}` metavalue.

Returns the type of the pushed value.

```
}
```

```
@APIEntry{lua_Unsigned lua_rawlen (lua_State *L, int index);|
@apii{0,0,-}
```

Returns the raw `@Q{length}` of the value at the given index:  
for strings, this is the string length;  
for tables, this is the result of the length operator (`@Char{#}`)  
with no metamethods;  
for userdata, this is the size of the block of memory allocated  
for the userdata.  
For other values, this call `@N{returns 0}`.

```
}
```

```
@APIEntry{void lua_rawset (lua_State *L, int index);|
@apii{2,0,m}
```

Similar to `@Lid{lua_settable}`, but does a raw assignment  
(i.e., without metamethods).  
The value at `@id{index}` must  
be a table.

```
}
```

```
@APIEntry{void lua_rawseti (lua_State *L, int index, lua_Integer i);|
@apii{1,0,m}
```

Does the equivalent of `@T{t[i] = v}`,  
where `@id{t}` is the table at the given index  
and `@id{v}` is the value on the top of the stack.

This function pops the value from the stack.  
The assignment is raw,  
that is, it does not use the `@idx{__newindex}` metavalue.

```
}
```

```
@APIEntry{void lua_rawsetp (lua_State *L, int index, const void *p);|
@apii{1,0,m}
```

Does the equivalent of `@T{t[p] = v}`,  
where `@id{t}` is the table at the given index,  
`@id{p}` is encoded as a light userdata,  
and `@id{v}` is the value on the top of the stack.

This function pops the value from the stack.  
The assignment is raw,  
that is, it does not use the `@idx{__newindex}` metavalue.

```
}
```

```
@APIEntry{
typedef const char * (*lua_Reader) (lua_State *L,
 void *data,
 size_t *size);|
```

The reader function used by `@Lid{lua_load}`.  
Every time `@Lid{lua_load}` needs another piece of  
the chunk,  
it calls the reader,  
passing along its `@id{data}` parameter.  
The reader must return a pointer to a block of memory  
with a new piece of the chunk  
and set `@id{size}` to the block size.  
The block must exist until the reader function is called again.  
To signal the end of the chunk,  
the reader must return `@id{NULL}` or set `@id{size}` to zero.  
The reader function may return pieces of any size greater than zero.

```
}
```

```
@APIEntry{void lua_register (lua_State *L, const char *name, lua_CFunction f);|
@apii{0,0,e}
```

Sets the `@N{C function} @id{f}` as the new value of global `@id{name}`.  
It is defined as a macro:

```
@verbatim{
#define lua_register(L,n,f) \
 (lua_pushcfunction(L, f), lua_setglobal(L, n))
}

}
```

```
@APIEntry{void lua_remove (lua_State *L, int index);|
@apii{1,0,-}
```



Removes the element at the given valid index,  
shifting down the elements above this index to fill the gap.  
This function cannot be called with a pseudo-index,  
because a pseudo-index is not an actual stack position.

}

```
@APIEntry{void
lua_replace (lua_State *L, int index);|
@apii{1,0,-}
```

Moves the top element into the given valid index  
without shifting any element  
(therefore replacing the value at that given index),  
and then pops the top element.

}

```
@APIEntry{int lua_resetthread (lua_State *L);|
@apii{0,?,-}
```

This function is deprecated;  
it is equivalent to @Lid{lua\_closethread} with  
@id{from} being @id{NULL}.

}

```
@APIEntry{int lua_resume (lua_State *L, lua_State *from, int nargs,
int *nresults);|
@apii{?,?,-}
```

Starts and resumes a coroutine in the given thread @id{L}.

To start a coroutine,  
you push the main function plus any arguments  
onto the empty stack of the thread.  
then you call @Lid{lua\_resume},  
with @id{nargs} being the number of arguments.  
This call returns when the coroutine suspends or finishes its execution.

When it returns,  
@id{\*nresults} is updated and  
the top of the stack contains  
the @id{\*nresults} values passed to @Lid{lua\_yield}  
or returned by the body function.

```
@Lid{lua_resume}
```

returns

@Lid{LUA\_YIELD} if the coroutine yields,

@Lid{LUA\_OK} if the coroutine finishes its execution without errors,  
or an error code in case of errors @see{statuscodes}.

In case of errors,  
the error object is on the top of the stack.

To resume a coroutine,  
you remove the @id{\*nresults} yielded values from its stack,  
push the values to be passed as results from @id{yield},  
and then call @Lid{lua\_resume}.

The parameter @id{from} represents the coroutine that is resuming @id{L}.

If there is no such coroutine,  
this parameter can be @id{NULL}.

}

```
@APIEntry{void lua_rotate (lua_State *L, int idx, int n);|
@apii{0,0,-}
```

Rotates the stack elements between the valid index @id{idx} and the top of the stack.

The elements are rotated @id{n} positions in the direction of the top, for a positive @id{n},  
or @T{-n} positions in the direction of the bottom, for a negative @id{n}.

The absolute value of @id{n} must not be greater than the size of the slice being rotated.

This function cannot be called with a pseudo-index, because a pseudo-index is not an actual stack position.

}

```
@APIEntry{void lua_setallocf (lua_State *L, lua_Alloc f, void *ud);|
@apii{0,0,-}
```

Changes the @x{allocator function} of a given state to @id{f} with user data @id{ud}.

}

```
@APIEntry{void lua_setfield (lua_State *L, int index, const char *k);|
@apii{1,0,e}
```

Does the equivalent to @T{t[k] = v},  
where @id{t} is the value at the given index  
and @id{v} is the value on the top of the stack.

This function pops the value from the stack.  
As in Lua, this function may trigger a metamethod  
for the @Q{newindex} event @see{metatable}.

}

```
@APIEntry{void lua_setglobal (lua_State *L, const char *name);|
@apii{1,0,e}
```

Pops a value from the stack and  
sets it as the new value of global @id{name}.

}

```
@APIEntry{void lua_seti (lua_State *L, int index, lua_Integer n);|
@apii{1,0,e}
```

Does the equivalent to @T{t[n] = v},  
where @id{t} is the value at the given index  
and @id{v} is the value on the top of  
the stack.

This function pops the value from the stack.  
As in Lua, this function may trigger a metamethod  
for the @Q{newindex} event @see{metatable}.

}

```
@APIEntry{int lua_setiuservalue (lua_State *L, int index, int n);|
@apii{1,0,-}
```

Pops a value from the stack and sets it as  
the new @id{n}-th user value associated to the  
full userdata at the given index.  
Returns 0 if the userdata does not have that value.

}

```
@APIEntry{int lua_setmetatable (lua_State *L, int index);|
@apii{1,0,-}
```

Pops a table or @nil from the stack and  
sets that value as the new metatable for the value at the given index.  
(@nil means no metatable.)

(For historical reasons, this function returns an @id{int},  
which now is always 1.)

```
}
```

```
@APIEntry{void lua_settable (lua_State *L, int index);|
@apii{2,0,e}
```

Does the equivalent to `@T{t[k] = v}`,  
where `@id{t}` is the value at the given index,  
`@id{v}` is the value on the top of the stack,  
and `@id{k}` is the value just below the top.

This function pops both the key and the value  
from the stack.

As in Lua, this function may trigger a metamethod  
for the `@Q{newindex}` event `@see{metatable}`.

```
}
```

```
@APIEntry{void lua_settop (lua_State *L, int index);|
@apii{?,?,e}
```

Accepts any index, `@N{or 0}`,  
and sets the stack top to this index.  
If the new top is greater than the old one,  
then the new elements are filled with `@nil`.  
If `@id{index} @N{is 0}`, then all stack elements are removed.

This function can run arbitrary code when removing an index  
marked as to-be-closed from the stack.

```
}
```

```
@APIEntry{void lua_setwarnf (lua_State *L, lua_WarnFunction f, void *ud);|
@apii{0,0,-}
```

Sets the `@x{warning function}` to be used by Lua to emit warnings  
`@see{lua_WarnFunction}`.  
The `@id{ud}` parameter sets the value `@id{ud}` passed to  
the warning function.

```
}
```

```
@APIEntry{typedef struct lua_State lua_State;|
```

An opaque structure that points to a thread and indirectly  
(through the thread) to the whole state of a Lua interpreter.  
The Lua library is fully reentrant:  
it has no global variables.

All

information about a state is accessible through this structure.

A pointer to this structure must be passed as the first argument to every function in the library, except to `@Lid{lua_newstate}`, which creates a Lua state from scratch.

}

```
@APIEntry{int lua_status (lua_State *L);|
@apii{0,0,-}}
```

Returns the status of the thread `@id{L}`.

The status can be `@Lid{LUA_OK}` for a normal thread, an error code if the thread finished the execution of a `@Lid{lua_resume}` with an error, or `@Lid{LUA_YIELD}` if the thread is suspended.

You can call functions only in threads with status `@Lid{LUA_OK}`. You can resume threads with status `@Lid{LUA_OK}` (to start a new coroutine) or `@Lid{LUA_YIELD}` (to resume a coroutine).

}

```
@APIEntry{size_t lua_stringtonumber (lua_State *L, const char *s);|
@apii{0,1,-}}
```

Converts the zero-terminated string `@id{s}` to a number, pushes that number into the stack, and returns the total size of the string, that is, its length plus one.

The conversion can result in an integer or a float,

according to the lexical conventions of Lua `@see{lexical}`.

The string may have leading and trailing whitespaces and a sign.

If the string is not a valid numeral,

returns 0 and pushes nothing.

(Note that the result can be used as a boolean, true if the conversion succeeds.)

}

```
@APIEntry{int lua_toboolean (lua_State *L, int index);|
@apii{0,0,-}}
```

Converts the Lua value at the given index to a `@N{C boolean}`

value (@N{0 or 1}).

Like all tests in Lua,

@Lid{lua\_toboolean} returns true for any Lua value different from @false and @nil;

otherwise it returns false.

(If you want to accept only actual boolean values, use @Lid{lua\_isboolean} to test the value's type.)

}

```
@APIEntry{lua_CFunction lua_tocfunction (lua_State *L, int index);|
```

```
@apii{0,0,-}
```

Converts a value at the given index to a @N{C function}.

That value must be a @N{C function};

otherwise, returns @id{NULL}.

}

```
@APIEntry{void lua_toclose (lua_State *L, int index);|
```

```
@apii{0,0,m}
```

Marks the given index in the stack as a

to-be-closed

slot @see{to-be-closed}.

Like a to-be-closed variable in Lua,

the value at that slot in the stack will be closed

when it goes out of scope.

Here, in the context of a C function,

to go out of scope means that the running function returns to Lua,

or there is an error,

or the slot is removed from the stack through

@Lid{lua\_settop} or @Lid{lua\_pop},

or there is a call to @Lid{lua\_closeslot}.

A slot marked as to-be-closed should not be removed from the stack

by any other function in the API except @Lid{lua\_settop} or @Lid{lua\_pop},

unless previously deactivated by @Lid{lua\_closeslot}.

This function should not be called for an index

that is equal to or below an active to-be-closed slot.

Note that, both in case of errors and of a regular return,

by the time the @idx{\_\_close} metamethod runs,

the @N{C stack} was already unwound,

so that any automatic @N{C variable} declared in the calling function

(e.g., a buffer) will be out of scope.

}

```
@APIEntry{lua_Integer lua_tointeger (lua_State
*L, int index);|
@apii{0,0,-}
```

Equivalent to @Lid{lua\_tointegerx} with @id{isnum} equal to @id{NULL}.

```
}
```

```
@APIEntry{lua_Integer lua_tointegerx (lua_State *L, int index, int *isnum);|
@apii{0,0,-}
```

Converts the Lua value at the given index to the signed integral type @Lid{lua\_Integer}. The Lua value must be an integer, or a number or string convertible to an integer @see{coercion}; otherwise, @id{lua\_tointegerx} @N{returns 0}.

If @id{isnum} is not @id{NULL}, its referent is assigned a boolean value that indicates whether the operation succeeded.

```
}
```

```
@APIEntry{const char *lua_tolstring (lua_State *L, int index, size_t *len);|
@apii{0,0,m}
```

Converts the Lua value at the given index to a @N{C string}. If @id{len} is not @id{NULL}, it sets @T{\*len} with the string length. The Lua value must be a string or a number; otherwise, the function returns @id{NULL}. If the value is a number, then @id{lua\_tolstring} also @emph{changes the actual value in the stack to a string}. (This change confuses @Lid{lua\_next} when @id{lua\_tolstring} is applied to keys during a table traversal.)

@id{lua\_tolstring} returns a pointer to a string inside the Lua state @see{constchar}. This string always has a zero (@Char{0}) after its last character (as @N{in C}), but can contain other zeros in its body.

```
}
```

```
@APIEntry{lua_Number lua_tonumber (lua_State *L, int index);|
```

```
@apii{0,0,-}
```

Equivalent to @Lid{lua\_tonumberx} with @id{isnum} equal to @id{NULL}.

```
}
```

```
@APIEntry{lua_Number lua_tonumberx (lua_State *L, int index, int *isnum);|
@apii{0,0,-}
```

Converts the Lua value at the given index to the @N{C type} @Lid{lua\_Number} @seeC{lua\_Number}. The Lua value must be a number or a string convertible to a number @see{coercion}; otherwise, @Lid{lua\_tonumberx} @N{returns 0}.

If @id{isnum} is not @id{NULL}, its referent is assigned a boolean value that indicates whether the operation succeeded.

```
}
```

```
@APIEntry{const void *lua_topointer (lua_State *L, int index);|
@apii{0,0,-}
```

Converts the value at the given index to a generic @N{C pointer} (@T{void\*}). The value can be a userdata, a table, a thread, a string, or a function; otherwise, @id{lua\_topointer} returns @id{NULL}. Different objects will give different pointers. There is no way to convert the pointer back to its original value.

Typically this function is used only for hashing and debug information.

```
}
```

```
@APIEntry{const char *lua_tostring (lua_State *L, int index);|
@apii{0,0,m}
```

Equivalent to @Lid{lua\_tolstring} with @id{len} equal to @id{NULL}.

```
}
```

```
@APIEntry{lua_State *lua_tothread (lua_State *L, int index);|
@apii{0,0,-}
```

Converts the value at the given index to a Lua thread (represented as @T{lua\_State\*}).



This value must be a thread;  
otherwise, the function returns @id{NULL}.

}

```
@APIEntry{void *lua_touserdata (lua_State *L, int index);|
@apii{0,0,-}}
```

If the value at the given index is a full userdata,  
returns its memory-block address.

If the value is a light userdata,  
returns its value (a pointer).

Otherwise, returns  
@id{NULL}.

}

```
@APIEntry{int lua_type (lua_State *L, int index);|
@apii{0,0,-}}
```

Returns the type of the value in the given valid index,  
or @id{LUA\_TNONE} for a non-valid but acceptable index.

The types returned by @Lid{lua\_type} are coded by the following constants  
defined in @id{lua.h}:

```
@defid{LUA_TNIL},
@defid{LUA_TNUMBER},
@defid{LUA_TBOOLEAN},
@defid{LUA_TSTRING},
@defid{LUA_TTABLE},
@defid{LUA_TFUNCTION},
@defid{LUA_TUSERDATA},
@defid{LUA_TTHREAD},
and
@defid{LUA_TLIGHTUSERDATA}.
```

}

```
@APIEntry{const char *lua_typename (lua_State *L, int tp);|
@apii{0,0,-}}
```

Returns the name of the type encoded by the value @id{tp},  
which must be one the values returned by @Lid{lua\_type}.

}

```
@APIEntry{typedef @ldots lua_Unsigned;|
```

The unsigned version of @Lid{lua\_Integer}.

}

```
@APIEntry{int lua_upvalueindex (int i);|
@apii{0,0,-}}
```

Returns the pseudo-index that represents the @id{i}-th upvalue of the running function @see{c-closure}.

@id{i} must be in the range @M{[1,256]}.

}

```
@APIEntry{lua_Number
lua_version (lua_State *L);|
@apii{0,0,-}}
```

Returns the version number of this core.

}

```
@APIEntry{
typedef void (*lua_WarnFunction) (void *ud, const char *msg, int tocont);|
```

The type of @x{warning function}s, called by Lua to emit warnings.

The first parameter is an opaque pointer set by @Lid{lua\_setwarnf}.

The second parameter is the warning message.

The third parameter is a boolean that indicates whether the message is to be continued by the message in the next call.

See @Lid{warn} for more details about warnings.

}

```
@APIEntry{
void lua_warning (lua_State *L, const char *msg, int tocont);|
@apii{0,0,-}}
```

Emits a warning with the given message.

A message in a call with @id{tocont} true should be continued in another call to this function.

See @Lid{warn} for more details about warnings.

}

```
@APIEntry{
```

```
typedef int (*lua_Writer) (lua_State *L,
 const void* p,
 size_t sz,
 void* ud);
```

The type of the writer function used by @Lid{lua\_dump}. Every time @Lid{lua\_dump} produces another piece of chunk, it calls the writer, passing along the buffer to be written (@id{p}), its size (@id{sz}), and the @id{ud} parameter supplied to @Lid{lua\_dump}.

The writer returns an error code: @N{0 means} no errors; any other value means an error and stops @Lid{lua\_dump} from calling the writer again.

```
}
```

```
@APIEntry{void lua_xmove (lua_State *from, lua_State *to, int n);|
@apii{?,?,-}}
```

Exchange values between different threads of the same state.

This function pops @id{n} values from the stack @id{from}, and pushes them onto the stack @id{to}.

```
}
```

```
@APIEntry{int lua_yield (lua_State *L, int nresults);|
@apii{?,?,v}}
```

This function is equivalent to @Lid{lua\_yieldk}, but it has no continuation @see{continuations}. Therefore, when the thread resumes, it continues the function that called the function calling @id{lua\_yield}. To avoid surprises, this function should be called only in a tail call.

```
}
```

```
@APIEntry{
int
lua_yieldk (lua_State *L,
 int nresults,
```

```
lua_KContext ctx,
lua_KFunction k);
@api{?,?,v}
```

Yields a coroutine (thread).

When a @N{C function} calls @Lid{lua\_yieldk}, the running coroutine suspends its execution, and the call to @Lid{lua\_resume} that started this coroutine returns. The parameter @id{nresults} is the number of values from the stack that will be passed as results to @Lid{lua\_resume}.

When the coroutine is resumed again, Lua calls the given @x{continuation function} @id{k} to continue the execution of the @N{C function} that yielded @see{continuations}. This continuation function receives the same stack from the previous function, with the @id{n} results removed and replaced by the arguments passed to @Lid{lua\_resume}. Moreover, the continuation function receives the value @id{ctx} that was passed to @Lid{lua\_yieldk}.

Usually, this function does not return; when the coroutine eventually resumes, it continues executing the continuation function. However, there is one special case, which is when this function is called from inside a line or a count hook @see{debugI}. In that case, @id{lua\_yieldk} should be called with no continuation (probably in the form of @Lid{lua\_yield}) and no results, and the hook should return immediately after the call. Lua will yield and, when the coroutine resumes again, it will continue the normal execution of the (Lua) function that triggered the hook.

This function can raise an error if it is called from a thread with a pending C call with no continuation function (what is called a @emphx{C-call boundary}), or it is called from a thread that is not running inside a resume (typically the main thread).

```
}
```

```
}
```

@sect2{debugI} @title{The Debug Interface}

Lua has no built-in debugging facilities.  
Instead, it offers a special interface  
by means of functions and @emph{hooks}.  
This interface allows the construction of different  
kinds of debuggers, profilers, and other tools  
that need  
@Q{inside information} from the interpreter.

```
@APIEntry{
typedef struct lua_Debug {
int event;
const char *name; /* (n) */
const char *namewhat; /* (n) */
const char *what; /* (S) */
const char *source; /* (S) */
size_t srclen; /* (S) */
int currentline; /* (l) */
int linedefined; /* (S) */
int lastlinedefined; /* (S) */
unsigned char nups; /* (u) number of upvalues */
unsigned char nparams; /* (u) number of parameters */
char isvararg; /* (u) */
char istailcall; /* (t) */
unsigned short ftransfer; /* (r) index of first value transferred */
unsigned short ntransfer; /* (r) number of transferred values */
char short_src[LUA_IDSIZE]; /* (S) */
/* private part */
@rep{other fields}
} lua_Debug;
|
```

A structure used to carry different pieces of  
information about a function or an activation record.

@Lid{lua\_getstack} fills only the private  
part

of this structure, for later use.

To fill the other fields of @Lid{lua\_Debug} with useful information,  
you must call @Lid{lua\_getinfo} with an appropriate parameter.

(Specifically, to get a field,

you must add the letter between parentheses in the field's comment  
to the parameter @id{what} of @Lid{lua\_getinfo}.)

The fields of @Lid{lua\_Debug} have the following meaning:

@description{

`@item{ @id{source} |`  
the source of the chunk that created the function.  
If `@T{source}` starts with a `@Char{ @At}`,  
it means that the function was defined in a file where  
the file name follows the `@Char{ @At}`.  
If `@T{source}` starts with a `@Char{=}`,  
the remainder of its contents describes the source in a user-dependent manner.  
Otherwise,  
the function was defined in a string where  
`@T{source}` is that string.  
`}`

`@item{ @id{srclen} |`  
The length of the string `@id{source}`.  
`}`

`@item{ @id{short_src} |`  
a `@Q{printable}` version of `@T{source}`, to be used in error messages.  
`}`

`@item{ @id{linedefined} |`  
the line number where  
the definition of the function starts.  
`}`

`@item{ @id{lastlinedefined} |`  
the line number where the definition of the function ends.  
`}`

`@item{ @id{what} |`  
the string `@T{"Lua"}` if the function is a Lua function,  
`@T{"C"}` if it is a `@N{C}` function,  
`@T{"main"}` if it is the main part of a chunk.  
`}`

`@item{ @id{currentline} |`  
the current line where the given function is executing.  
When no line information is available,  
`@T{currentline}` is set to `@num{-1}`.  
`}`

`@item{ @id{name} |`  
a reasonable name for the given function.  
Because functions in Lua are first-class values,  
they do not have a fixed name:  
some functions can be the value of multiple global variables,  
while others can be stored only in a table field.  
The `@T{lua_getinfo}` function checks how the function was

called to find a suitable name.  
If it cannot find a name,  
then @id{name} is set to @id{NULL}.  
}

@item{ @id{namewhat} |  
explains the @T{name} field.  
The value of @T{namewhat} can be  
@T{"global"}, @T{"local"}, @T{"method"},  
@T{"field"}, @T{"upvalue"},  
or @T{""} (the empty string),  
according to how the function was called.  
(Lua uses the empty string when no other option seems to apply.)  
}

@item{ @id{istailcall} |  
true if this function invocation was called by a tail call.  
In this case, the caller of this level is not in the stack.  
}

@item{ @id{nups} |  
the number of upvalues of the function.  
}

@item{ @id{nparams} |  
the number of parameters of the function  
(always @N{0} for @N{C} functions).  
}

@item{ @id{isvararg} |  
true if the function is a variadic function  
(always true for @N{C} functions).  
}

@item{ @id{ftransfer} |  
the index in the stack of the first value being @Q{transferred},  
that is, parameters in a call or return values in a return.  
(The other values are in consecutive indices.)  
Using this index, you can access and modify these values  
through @Lid{lua\_getlocal} and @Lid{lua\_setlocal}.  
This field is only meaningful during a  
call hook, denoting the first parameter,  
or a return hook, denoting the first value being returned.  
(For call  
hooks, this value is always 1.)  
}

@item{ @id{ntransfer} |

The number of values being transferred (see previous item).

(For calls of Lua functions,  
this value is always equal to @id{nparams}.)

}

}

}

```
@APIEntry{lua_Hook lua_gethook (lua_State *L);|
@apii{0,0,-}
```

Returns the current hook function.

}

```
@APIEntry{int lua_gethookcount (lua_State *L);|
@apii{0,0,-}
```

Returns the current hook count.

}

```
@APIEntry{int lua_gethookmask (lua_State *L);|
@apii{0,0,-}
```

Returns the current hook mask.

}

```
@APIEntry{int lua_getinfo (lua_State *L, const char *what, lua_Debug *ar);|
@apii{0|1,0|1|2,m}
```

Gets information about a specific function or function invocation.

To get information about a function invocation,  
the parameter @id{ar} must be a valid activation record that was  
filled by a previous call to @Lid{lua\_getstack} or  
given as argument to a hook @seeC{lua\_Hook}.

To get information about a function, you push it onto the stack  
and start the @id{what} string with the character @Char{>}.

(In

that case,

@id{lua\_getinfo} pops the function from the top of the stack.)

For instance, to know in which line a function @id{f} was defined,  
you can write the following code:

```
@verbatim{
```



```

lua_Debug ar;
lua_getglobal(L, "f"); /* get global 'f' */
lua_getinfo(L, ">S", &ar);
printf("%d\n", ar.linedefined);
}

```

Each character in the string @id{what} selects some fields of the structure @id{ar} to be filled or a value to be pushed on the stack. (These characters are also documented in the declaration of the structure @Lid{lua\_Debug}, between parentheses in the comments following each field.)

@description{

@item{ @Char{f}|

pushes onto the stack the function that is running at the given level;

}

@item{ @Char{1}| fills in the field @id{currentline};

}

@item{ @Char{n}| fills in the fields @id{name} and @id{namewhat};

}

@item{ @Char{r}| fills in the fields @id{fttransfer} and @id{ntransfer};

}

@item{ @Char{S}| fills in the fields @id{source}, @id{short\_src}, @id{linedefined}, @id{lastlinedefined}, and @id{what};

}

@item{ @Char{t}| fills in the field @id{istailcall};

}

@item{ @Char{u}| fills in the fields @id{nups}, @id{nparams}, and @id{isvararg};

}

@item{ @Char{L}| pushes onto the stack a table whose indices are the lines on the function with some associated code, that is, the lines where you can put a break point. (Lines with no code include empty lines and comments.) If this option is given together with option @Char{f}, its table is pushed after the function.

This is the only option that can raise a memory error.

}

}

This function returns 0 to signal an invalid option in @id{what};  
even then the valid options are handled correctly.

}

```
@APIEntry{const char *lua_getlocal (lua_State *L, const lua_Debug *ar, int n);|
@apii{0,0|1,-}
```

Gets information about a local variable or a temporary value  
of a given activation record or a given function.

In the first case,  
the parameter @id{ar} must be a valid activation record that was  
filled by a previous call to @Lid{lua\_getstack} or  
given  
as argument to a hook @seeC{lua\_Hook}.  
The index @id{n} selects which local variable to inspect;  
see @Lid{debug.getlocal} for details about variable indices  
and names.

@Lid{lua\_getlocal} pushes the variable's value onto the stack  
and returns its name.

In the second case, @id{ar} must be @id{NULL} and the function  
to be inspected must be on the top of the stack.

In this case, only parameters of Lua functions are visible  
(as there is no information about what variables are active)  
and no values are pushed onto the stack.

Returns @id{NULL} (and pushes nothing)  
when the index is greater than  
the number of active local variables.

}

```
@APIEntry{int lua_getstack (lua_State *L, int level, lua_Debug *ar);|
@apii{0,0,-}
```

Gets information about the interpreter runtime stack.

This function fills parts of a @Lid{lua\_Debug} structure with  
an identification of the @emph{activation record}  
of the function executing at a given level.

@N{Level 0} is the current running function,  
whereas level  
@M{n+1} is the function that has called level @M{n}  
(except for tail calls, which do not count in the stack).  
When called with a level greater than the stack depth,  
@Lid{lua\_getstack} returns 0;  
otherwise it returns 1.

}

```
@APIEntry{const char *lua_getupvalue (lua_State *L, int funcindex, int n);|
@apii{0,0|1,-}}
```

Gets information about the @id{n}-th upvalue  
of the closure at index @id{funcindex}.  
It pushes the upvalue's value onto the stack  
and returns its name.  
Returns @id{NULL} (and pushes nothing)  
when the index @id{n} is greater than the number of upvalues.

See @Lid{debug.getupvalue} for more information about upvalues.

}

```
@APIEntry{typedef void (*lua_Hook) (lua_State *L, lua_Debug *ar);|
```

Type for debugging hook functions.

Whenever a hook is called, its @id{ar} argument has its field  
@id{event} set to the specific event that triggered the hook.  
Lua identifies these events with the following constants:  
@defid{LUA\_HOOKCALL}, @defid{LUA\_HOOKRET},  
@defid{LUA\_HOOKTAILCALL}, @defid{LUA\_HOOKLINE},  
and  
@defid{LUA\_HOOKCOUNT}.

Moreover, for line events, the field @id{currentline} is also set.  
To get the value of any other field in @id{ar},  
the hook must call @Lid{lua\_getinfo}.

For call events, @id{event} can be @id{LUA\_HOOKCALL},  
the normal value, or @id{LUA\_HOOKTAILCALL}, for a tail call;  
in this case, there will be no corresponding return event.

While Lua is running a hook, it disables other calls to hooks.  
Therefore, if a hook calls back Lua to execute a function or a chunk,  
this execution occurs without any calls to hooks.

Hook functions cannot have continuations,

that is, they cannot call @Lid{lua\_yieldk},  
@Lid{lua\_pcallk}, or @Lid{lua\_callk} with a non-null @id{k}.

Hook functions can yield under the following conditions:  
Only count and line events can yield;  
to yield, a hook function must finish its execution  
calling @Lid{lua\_yield} with @id{nresults} equal to zero  
(that is, with no values).

}

```
@APIEntry{void lua_sethook (lua_State *L, lua_Hook f, int mask,
int count);
@apii{0,0,-}}
```

Sets the debugging hook function.

Argument @id{f} is the hook function.  
@id{mask} specifies on which events the hook will be called:  
it is formed by a bitwise OR of the constants  
@defid{LUA\_MASKCALL},  
@defid{LUA\_MASKRET},  
@defid{LUA\_MASKLINE},  
and @defid{LUA\_MASKCOUNT}.  
The @id{count} argument is only meaningful when the mask  
includes @id{LUA\_MASKCOUNT}.

For each event, the hook is called as explained below:

@description{

@item{The call hook| is called when the interpreter calls a function.

The hook is called just after Lua enters the new function.

}

@item{The return hook| is called when the interpreter returns from a function.

The hook is called just before Lua leaves the function.

}

@item{The line hook| is called when the interpreter is about to  
start the execution of a new line of code,  
or when it jumps back in the code (even to the same line).  
This event only happens while Lua is executing a Lua function.

}

@item{The count hook| is called after the  
interpreter executes every  
@T{count} instructions.  
This event only happens while Lua is executing a Lua function.

}

}

Hooks are disabled by setting @id{mask} to zero.

}

```
@APIEntry{const char *lua_setlocal (lua_State *L, const lua_Debug *ar, int n);|
@apii{0|1,0,-}
```

Sets the value of a local variable of a given activation record.

It assigns the value on the top of the stack to the variable and returns its name.

It also pops the value from the stack.

Returns @id{NULL} (and pops nothing) when the index is greater than the number of active local variables.

Parameters @id{ar} and @id{n} are as in the function @Lid{lua\_getlocal}.

}

```
@APIEntry{const char *lua_setupvalue (lua_State *L, int funcindex, int n);|
@apii{0|1,0,-}
```

Sets the value of a closure's upvalue.

It assigns the value on the top of the stack to the upvalue and returns its name.

It also pops the value from the stack.

Returns @id{NULL} (and pops nothing) when the index @id{n} is greater than the number of upvalues.

Parameters

@id{funcindex} and @id{n} are as in the function @Lid{lua\_getupvalue}.

}

```
@APIEntry{void *lua_upvalueid (lua_State *L, int funcindex, int n);|
@apii{0,0,-}
```

Returns a unique identifier for the upvalue numbered @id{n} from the closure at index @id{funcindex}.

These unique identifiers allow a program to check whether different closures share upvalues.

Lua closures that share an upvalue  
(that is, that access a same external local variable)  
will return identical ids for those upvalue indices.

Parameters @id{funcindex} and @id{n} are as in  
the function @Lid{lua\_getupvalue},  
but @id{n} cannot be greater than the number of upvalues.

}

```
@APIEntry{
void lua_upvaluejoin (lua_State *L, int funcindex1, int n1,
 int funcindex2, int n2);|
@apii{0,0,-}
```

Make the @id{n1}-th upvalue of the Lua closure at index @id{funcindex1}  
refer to the @id{n2}-th upvalue of the Lua closure at index @id{funcindex2}.

}

}

}

```
@C{-----}
@sect1{auxlib|@title{The
Auxiliary Library}}
```

```
@simplesect{
```

```
@index{luauxlib.h}
```

The @def{auxiliary library} provides several convenient functions  
to interface C with Lua.

While the basic API provides the primitive functions for all  
interactions between C and Lua,  
the auxiliary library provides higher-level functions for some  
common tasks.

All functions and types from the auxiliary library  
are defined in header file @id{luauxlib.h} and  
have a prefix @id{luaL\_}.

All functions in the auxiliary library are built on  
top of the basic API,  
and so they provide nothing that cannot be done with that API.  
Nevertheless, the use of the auxiliary library ensures  
more consistency to your code.

Several functions in the auxiliary library use internally some extra stack slots.

When a function in the auxiliary library uses less than five slots, it does not check the stack size; it simply assumes that there are enough slots.

Several functions in the auxiliary library are used to check @N{C function} arguments. Because the error message is formatted for arguments (e.g., @St{bad argument #1}), you should not use these functions for other stack values.

Functions called @id{luaL\_check\*} always raise an error if the check is not satisfied.

}

@sect2{ @title{Functions and Types}

Here we list all functions and types from the auxiliary library in alphabetical order.

@APIEntry{void luaL\_addchar (luaL\_Buffer \*B, char c);|  
@apii{?,?,m}

Adds the byte @id{c} to the buffer @id{B}  
@seeC{luaL\_Buffer}.

}

@APIEntry{  
const void luaL\_addgsub (luaL\_Buffer \*B, const char \*s,  
const char \*p, const char \*r);|  
@apii{?,?,m}

Adds a copy of the string @id{s} to the buffer @id{B} @seeC{luaL\_Buffer}, replacing any occurrence of the string @id{p} with the string @id{r}.

}

@APIEntry{void luaL\_addlstring (luaL\_Buffer \*B, const char \*s, size\_t l);|  
@apii{?,?,m}

Adds the string pointed to by @id{s} with length @id{l} to the buffer @id{B}  
@seeC{luaL\_Buffer}.

The string can contain @x{embedded zeros}.

}

@APIEntry{void luaL\_addsize (luaL\_Buffer \*B, size\_t n);|  
@apii{?,?,-}}

Adds to the buffer @id{B} a string of length @id{n} previously copied to the buffer area @seeC{luaL\_prepbuffer}.

}

@APIEntry{void luaL\_addstring (luaL\_Buffer \*B, const char \*s);|  
@apii{?,?,m}}

Adds the zero-terminated string pointed to by @id{s} to the buffer @id{B}  
@seeC{luaL\_Buffer}.

}

@APIEntry{void luaL\_addvalue (luaL\_Buffer \*B);|  
@apii{?,?,m}}

Adds the value on the top of the stack to the buffer @id{B}  
@seeC{luaL\_Buffer}.

Pops the value.

This is the only function on string buffers that can (and must) be called with an extra element on the stack, which is the value to be added to the buffer.

}

@APIEntry{  
void luaL\_argcheck (lua\_State \*L,  
                  int cond,  
                  int arg,  
                  const char \*extrams);|  
@apii{0,0,v}}



Checks whether @id{cond} is true.

If it is not, raises an error with a standard message @seeF{luaL\_argerror}.

}

```
@APIEntry{int
luaL_argerror (lua_State *L, int arg, const char *extramsng);
@apii{0,0,v}
```

Raises an error reporting a problem with argument @id{arg}

of the @N{C function} that called it,

using a standard message

that includes @id{extramsng} as a comment:

```
@verbatim{
bad argument #@rep{arg} to '@rep{funcname}' (@rep{extramsng})
```

```
}
```

This function never returns.

}

```
@APIEntry{
void luaL_argexpected (lua_State *L,
 int cond,
 int arg,
 const char *tname);
@apii{0,0,v}
```

Checks whether @id{cond} is true.

If it is not, raises an error about the type of the argument @id{arg} with a standard message @seeF{luaL\_typeerror}.

}

```
@APIEntry{typedef struct luaL_Buffer luaL_Buffer;|
```

Type for a @def{string buffer}.

A string buffer allows @N{C code} to build Lua strings piecemeal.

Its pattern of use is as follows:

```
@itemize{
```

```
@item{First declare a variable @id{b} of type @Lid{luaL_Buffer}.)}
```

```
@item{Then initialize it with a call @T{luaL_buffinit(L,
&b)}.)}
```

```
@item{
```

Then add string pieces to the buffer calling any of

the @id{luaL\_add\*} functions.

}

@item{

Finish by calling @T{luaL\_pushresult(&b)}.

This call leaves the final string on the top of the stack.

}

}

If you know beforehand the maximum size of the resulting string, you can use the buffer like this:

@itemize{

@item{First declare a variable @id{b} of type @Lid{luaL\_Buffer}.

@item{Then initialize it and preallocate a space of size @id{sz} with a call @T{luaL\_buffinitsize(L, &b, sz)}.

@item{Then produce the string into that space.}

@item{

Finish by calling @T{luaL\_pushresultsz(&b, sz)},

where @id{sz} is the total size of the resulting string

copied into that space (which may be less than or

equal to the preallocated size).

}

}

During its normal operation,

a string buffer uses a variable number of stack slots.

So, while using a buffer, you cannot assume that you know where the top of the stack is.

You can use the stack between successive calls to buffer operations

as long as that use is balanced;

that is,

when you call a buffer operation,

the stack is at the same level

it was immediately after the previous buffer operation.

(The only exception to this rule is @Lid{luaL\_addvalue}.)

After calling @Lid{luaL\_pushresult},

the stack is back to its level when the buffer was initialized,

plus the final string on its top.

}

```
@APIEntry{char *luaL_buffaddr (luaL_Buffer *B);|
@apii{0,0,-}}
```

Returns the address of the current content of buffer @id{B}

@seeC{luaL\_Buffer}.

Note that any addition to the buffer may invalidate this address.

```
}
```

```
@APIEntry{void luaL_buffinit (lua_State *L, luaL_Buffer *B);|
@apii{0,?, -}}
```

Initializes a buffer @id{B}

@seeC{luaL\_Buffer}.

This function does not allocate any space;

the buffer must be declared as a variable.

```
}
```

```
@APIEntry{size_t luaL_bufflen (luaL_Buffer *B);|
@apii{0,0,-}}
```

Returns the length of the current content of buffer @id{B}

@seeC{luaL\_Buffer}.

```
}
```

```
@APIEntry{char *luaL_buffinitsize (lua_State *L, luaL_Buffer
*B, size_t sz);|
@apii{?,?,m}}
```

Equivalent to the sequence

@Lid{luaL\_buffinit}, @Lid{luaL\_prepbuffsize}.

```
}
```

```
@APIEntry{void luaL_buffsub (luaL_Buffer *B, int n);|
@apii{?,?, -}}
```

Removes @id{n} bytes from the buffer @id{B}

@seeC{luaL\_Buffer}.

The buffer must have at least that many bytes.

```
}
```

```
@APIEntry{int luaL_callmeta (lua_State *L, int obj, const char *e);|
@apii{0,0|1,e}}
```

Calls a metamethod.

If the object at index @id{obj} has a metatable and this metatable has a field @id{e}, this function calls this field passing the object as its only argument. In this case this function returns true and pushes onto the stack the value returned by the call. If there is no metatable or no metamethod, this function returns false without pushing any value on the stack.

```
}
```

```
@APIEntry{void luaL_checkany (lua_State *L, int arg);|
@apii{0,0,v}}
```

Checks whether the function has an argument of any type (including @nil) at position @id{arg}.

```
}
```

```
@APIEntry{lua_Integer luaL_checkinteger (lua_State *L,
int arg);|
@apii{0,0,v}}
```

Checks whether the function argument @id{arg} is an integer (or can be converted to an integer) and returns this integer.

```
}
```

```
@APIEntry{const char *luaL_checklstring (lua_State *L, int arg, size_t *l);|
@apii{0,0,v}}
```

Checks whether the function argument @id{arg} is a string and returns this string; if @id{1} is not @id{NULL} fills its referent with the string's length.

This function uses @Lid{lua\_tolstring} to get its result, so all conversions and caveats of that function apply here.

```
}
```

```
@APIEntry{lua_Number luaL_checknumber (lua_State *L, int arg);|
@apii{0,0,v}}
```

Checks whether the function argument @id{arg} is a number and returns this number converted to a @id{lua\_Number}.

```
}
```

```
@APIEntry{
int luaL_checkoption (lua_State *L,
 int arg,
 const char *def,
 const char *const lst[]);
@apii{0,0,v}
```

Checks whether the function argument @id{arg} is a string and searches for this string in the array @id{lst}

(which

must be NULL-terminated).

Returns the index in the array where the string was found.

Raises an error if the argument is not a string or

if the string cannot be found.

If @id{def} is not @id{NULL},

the function uses @id{def} as a default value when

there is no argument @id{arg} or when this argument is @nil.

This is a useful function for mapping strings to @N{C enums}.

(The usual convention in Lua libraries is

to use strings instead of numbers to select options.)

```
}
```

```
@APIEntry{void luaL_checkstack (lua_State *L, int sz, const char *msg);
@apii{0,0,v}
```

Grows the stack size to @T{top + sz} elements,

raising an error if the stack cannot grow to that size.

@id{msg} is an additional text to go into the error message

(or @id{NULL} for no additional text).

```
}
```

```
@APIEntry{const char *luaL_checkstring (lua_State *L, int arg);
@apii{0,0,v}
```

Checks whether the function argument @id{arg} is a string and returns this string.

This function uses @Lid{lua\_tolstring} to get its result,

so

all conversions and caveats of that function apply here.

}

```
@APIEntry{void luaL_checktype (lua_State *L, int arg, int t);|
@apii{0,0,v}
```

Checks whether the function argument @id{arg} has type @id{t}.  
See @Lid{lua\_type} for the encoding of types for @id{t}.

}

```
@APIEntry{void *luaL_checkudata (lua_State *L, int arg, const char *tname);|
@apii{0,0,v}
```

Checks whether the function argument @id{arg} is a userdata  
of the type @id{tname} @seeC{luaL\_newmetatable} and  
returns the userdata's memory-block address @seeC{lua\_touserdata}.

}

```
@APIEntry{void luaL_checkversion (lua_State *L);|
@apii{0,0,v}
```

Checks whether the code making the call and the Lua library being called  
are using the same version of Lua and the same numeric types.

}

```
@APIEntry{int luaL_dofile (lua_State *L, const char *filename);|
@apii{0,?,m}
```

Loads and runs the given file.

It is defined as the following macro:

```
@verbatim{
(luaL_loadfile(L, filename) || lua_pcall(L, 0, LUA_MULTRET, 0))
}
```

It @N{returns 0} (@Lid{LUA\_OK})

if there are no errors,

or 1 in case of errors.

}

```
@APIEntry{int luaL_dostring (lua_State *L, const char *str);|
@apii{0,?,-}
```

Loads and runs the given string.

It is defined as the following macro:

```
@verbatim{
(luaL_loadstring(L, str) || lua_pcall(L, 0, LUA_MULTRET, 0))
}
```

```
}
```

It @N{returns 0} (@Lid{LUA\_OK}) if there are no errors,  
or 1 in case of errors.

```
}
```

```
@APIEntry{int luaL_error (lua_State *L, const char *fmt, ...);|
@apii{0,0,v}
```

Raises an error.

The error message format is given by @id{fmt}  
plus any extra arguments,  
following the same rules of @Lid{lua\_pushfstring}.

It also adds at the beginning of the message the file name and  
the line number where the error occurred,  
if this information is available.

This function never returns,  
but it is an idiom to use it in @N{C functions}  
as @T{return luaL\_error(@rep{args})}.

```
}
```

```
@APIEntry{int luaL_execresult (lua_State *L, int stat);|
@apii{0,3,m}
```

This function produces the return values for  
process-related functions in the standard library  
(@Lid{os.execute}  
and @Lid{io.close}).

```
}
```

```
@APIEntry{
int luaL_fileresult (lua_State *L, int stat, const char *fname);|
@apii{0,1|3,m}
```

This function produces the return values for  
file-related functions in the standard library  
(@Lid{io.open}, @Lid{os.rename}, @Lid{file:seek}, etc.).

```
}
```

```
@APIEntry{int luaL_getmetafield (lua_State *L, int obj, const char *e);|
@apii{0,0|1,m}
```

Pushes onto the stack the field @id{e} from the metatable  
of the object at index @id{obj} and returns the type of the pushed value.

If the object does not have a metatable,  
or if the metatable does not have this field,  
pushes nothing and returns @id{LUA\_TNIL}.

}

```
@APIEntry{int luaL_getmetatable (lua_State *L, const char *tname);|
@apii{0,1,m}
```

Pushes onto the stack the metatable associated with the name @id{tname}  
in the registry @seeC{luaL\_newmetatable},  
or @nil if there is no metatable associated with that name.  
Returns the type of the pushed value.

}

```
@APIEntry{int luaL_getsubtable (lua_State *L, int idx, const
char *fname);|
@apii{0,1,e}
```

Ensures that the value @T{t{fname}},  
where @id{t} is the value at index @id{idx},  
is a table,  
and pushes that table onto the stack.  
Returns true if it finds a previous table there  
and false if it creates a new table.

}

```
@APIEntry{
const char *luaL_gsub (lua_State *L,
 const char *s,
 const char *p,
 const char *r);|
@apii{0,1,m}
```

Creates a copy of string @id{s},  
replacing any occurrence of the string @id{p}  
with the string @id{r}.  
Pushes the resulting string on the stack and returns it.

}

```
@APIEntry{lua_Integer luaL_len (lua_State *L, int index);|
@apii{0,0,e}
```

Returns the @Q{length} of the value at the given index  
as a number;



it is equivalent to the @Char{#} operator in Lua @see{len-op}.

Raises an error if the result of the operation is not an integer.

(This case can only happen through metamethods.)

```
}
```

```
@APIEntry{
int luaL_loadbuffer (lua_State *L,
 const char *buff,
 size_t sz,
 const char *name);|
@apii{0,1,-}
```

Equivalent to @Lid{luaL\_loadbufferx} with @id{mode} equal to @id{NULL}.

```
}
```

```
@APIEntry{
int luaL_loadbufferx (lua_State *L,
 const char *buff,
 size_t sz,
 const char *name,
 const char *mode);|
@apii{0,1,-}
```

Loads a buffer as a Lua chunk.

This function uses @Lid{lua\_load} to load the chunk in the buffer pointed to by @id{buff} with size @id{sz}.

This function returns the same results as @Lid{lua\_load}.

@id{name} is the chunk name,

used for debug information and error messages.

The string @id{mode} works as in the function @Lid{lua\_load}.

```
}
```

```
@APIEntry{int luaL_loadfile (lua_State *L, const char *filename);|
@apii{0,1,m}
```

Equivalent to @Lid{luaL\_loadfilex} with @id{mode} equal to @id{NULL}.

```
}
```

```
@APIEntry{int luaL_loadfilex (lua_State *L, const char *filename,
 const char
```

```
*mode);|
@apii{0,1,m}
```

Loads a file as a Lua chunk.

This function uses @Lid{lua\_load} to load the chunk in the file named @id{filename}.

If @id{filename} is @id{NULL},

then it loads from the standard input.

The first line in the file is ignored if it starts with a @T{#}.

The string @id{mode} works as in the function @Lid{lua\_load}.

This function returns the same results as @Lid{lua\_load}

or @Lid{LUA\_ERRFILE} for file-related errors.

As @Lid{lua\_load}, this function only loads the chunk;

it does not run it.

```
}
```

```
@APIEntry{int luaL_loadstring (lua_State *L, const char *s);|
@apii{0,1,-}}
```

Loads a string as a Lua chunk.

This function uses @Lid{lua\_load} to load the chunk in the zero-terminated string @id{s}.

This function returns the same results as @Lid{lua\_load}.

Also as @Lid{lua\_load}, this function only loads the chunk;

it does not run it.

```
}
```

```
@APIEntry{void luaL_newlib (lua_State *L, const luaL_Reg l[]);|
@apii{0,1,m}}
```

Creates a new table and registers there

the functions in the

list @id{l}.

It is implemented as the following macro:

```
@verbatim{
(luaL_newlibtable(L,l), luaL_setfuncs(L,l,0))
}
```

The array @id{l} must be the actual array,

not a pointer to it.

}

```
@APIEntry{void luaL_newlibtable (lua_State *L, const luaL_Reg l[]);
@apii{0,1,m}}
```

Creates a new table with a size optimized  
to store all entries in the array @id{1}  
(but does not actually store them).

It is intended to be used in conjunction with @Lid{luaL\_setfuncs}  
@seeF{luaL\_newlib}.

It is implemented as a macro.

The array @id{1} must be the actual array,  
not a pointer to it.

}

```
@APIEntry{int luaL_newmetatable (lua_State *L, const char *tname);
@apii{0,1,m}}
```

If the registry already has the key @id{tname},  
returns 0.

Otherwise,  
creates a new table to be used as a metatable for userdata,  
adds to this new table the pair @T{\_\_name = tname},  
adds to the registry the pair @T{[tname] = new table},  
and returns 1.

In both cases,  
the function pushes onto the stack the final value associated  
with @id{tname} in  
the registry.

}

```
@APIEntry{lua_State *luaL_newstate (void);
@apii{0,0,-}}
```

Creates a new Lua state.

It calls @Lid{lua\_newstate} with an  
allocator based on the @N{ISO C} allocation functions  
and then sets a warning function and a panic function @see{C-error}  
that print messages to the standard error output.

Returns the new state,  
or @id{NULL} if there is a @x{memory allocation error}.

```
}
```

```
@APIEntry{void luaL_openlibs (lua_State *L);|
@apii{0,0,e}
```

Opens all standard Lua libraries into the given state.

```
}
```

```
@APIEntry{
T luaL_opt (L, func, arg, dflt);|
@apii{0,0,-}
```

This macro is defined as follows:

```
@verbatim{
(lua_isnoneornil(L,(arg)) ? (dflt) : func(L,(arg)))
}
```

In words, if the argument @id{arg} is nil or absent,  
the macro results in the default @id{dflt}.

Otherwise, it results in the result of calling @id{func}  
with the state @id{L} and the argument index @id{arg} as  
arguments.

Note that it evaluates the expression @id{dflt} only if needed.

```
}
```

```
@APIEntry{
lua_Integer luaL_optinteger
(lua_State *L,
int arg,
lua_Integer d);|
@apii{0,0,v}
```

If the function argument @id{arg} is an integer  
(or it is convertible to an integer),  
returns this integer.

If this argument is absent or is @nil,  
returns @id{d}.

Otherwise, raises an error.

```
}
```

```
@APIEntry{
const char *luaL_optlstring (lua_State *L,
int arg,
const char *d,
size_t *l);|
@apii{0,0,v}
```

If the function argument @id{arg} is a string,  
returns this string.  
If this argument is absent or is @nil,  
returns @id{d}.  
Otherwise, raises an error.

If @id{l} is not @id{NULL},  
fills its referent with the result's length.  
If the result is @id{NULL}  
(only possible when returning @id{d} and @T{d == NULL}),  
its length is considered zero.

This function uses @Lid{lua\_tolstring} to get its result,  
so all conversions and caveats of that function apply here.

}

```
@APIEntry{lua_Number luaL_optnumber
(lua_State *L, int arg, lua_Number d);
@apii{0,0,v}
```

If the function argument @id{arg} is a number,  
returns this number as a @id{lua\_Number}.  
If this argument is absent or is @nil,  
returns @id{d}.  
Otherwise, raises an error.

}

```
@APIEntry{
const char *luaL_optstring (lua_State *L,
int arg,
const char *d);
@apii{0,0,v}
```

If the function argument @id{arg} is a string,  
returns this string.  
If this argument is absent or is @nil,  
returns @id{d}.  
Otherwise, raises an error.

}

```
@APIEntry{char *luaL_prepbuffer (luaL_Buffer *B);
@apii{?,?,m}
```

Equivalent to @Lid{luaL\_prepbuffsize}

with the predefined size @defid{LUAL\_BUFFERSIZE}.

}

```
@APIEntry{char *luaL_prepbuffsize (luaL_Buffer *B, size_t sz);|
@apii{?,?,m}
```

Returns an address to a space of size @id{sz}  
where you can copy a string to be added to buffer @id{B}  
@seeC{luaL\_Buffer}.  
After copying the string into this space you must call  
@Lid{luaL\_addsize} with the size of the string to actually  
add  
it to the buffer.

}

```
@APIEntry{void luaL_pushfail (lua_State *L);|
@apii{0,1,-}
```

Pushes the @fail value onto the stack @see{libraries}.

}

```
@APIEntry{void luaL_pushresult (luaL_Buffer *B);|
@apii{?,1,m}
```

Finishes the use of buffer @id{B} leaving the final string on  
the top of the stack.

}

```
@APIEntry{void luaL_pushresults (luaL_Buffer *B, size_t sz);|
@apii{?,1,m}
```

Equivalent to the sequence @Lid{luaL\_addsize}, @Lid{luaL\_pushresult}.

}

```
@APIEntry{int luaL_ref (lua_State *L, int t);|
@apii{1,0,m}
```

Creates and returns a @def{reference},  
in the table at index @id{t},  
for the object on the top of the stack (and pops the object).

A reference is a unique integer key.

As long as you do not manually add integer keys into the table @id{t},

@Lid{luaL\_ref} ensures the uniqueness of the key it returns.

You can retrieve an object referred by the reference @id{r}

by calling @T{lua\_rawgeti(L, t, r)}.

The function @Lid{luaL\_unref} frees a reference.

If the object on the top of the stack

is @nil,

@Lid{luaL\_ref} returns the constant @defid{LUA\_REFNIL}.

The constant @defid{LUA\_NOREF} is guaranteed to be different from any reference returned by @Lid{luaL\_ref}.

}

@APIEntry{

typedef struct luaL\_Reg {

const char \*name;

lua\_CFunction func;

} luaL\_Reg;

|

Type for arrays of functions to be registered by

@Lid{luaL\_setfuncs}.

@id{name} is the function name and @id{func} is a pointer to the function.

Any array of @Lid{luaL\_Reg} must end with a sentinel entry in which both @id{name} and @id{func} are @id{NULL}.

}

@APIEntry{

void luaL\_requiref (lua\_State \*L, const char \*modname,  
lua\_CFunction openf, int glb);

@apii{0,1,e}

If @T{package.loaded[modname]} is not true,

calls the function @id{openf} with the string @id{modname} as an argument and sets the call result to @T{package.loaded[modname]}, as if that function has been called through @Lid{require}.

If @id{glb} is true,

also stores the module into the global @id{modname}.

Leaves a copy of the module

on the stack.

}

@APIEntry{void luaL\_setfuncs (lua\_State \*L, const luaL\_Reg \*l, int nup);}

@apii{nup,0,m}

Registers all functions in the array @id{1}  
@seeC{luaL\_Reg} into the table on the top of the stack  
(below optional upvalues, see next).

When @id{nup} is not zero,  
all functions are created with @id{nup} upvalues,  
initialized with copies of the @id{nup} values  
previously pushed on the stack  
on top of the library table.  
These values are popped from the stack after the registration.

A function with a @id{NULL} value represents a placeholder,  
which is filled with @false.

}

```
@APIEntry{void luaL_setmetatable (lua_State *L, const char *tname);|
@apii{0,0,-}
```

Sets the metatable of the object on the top of the stack  
as the metatable associated with name @id{tname}  
in the registry @seeC{luaL\_newmetatable}.

}

```
@APIEntry{
typedef struct luaL_Stream {
FILE *f;
lua_CFunction closef;
} luaL_Stream;
|
```

The standard representation for @x{file handles}  
used by the standard I/O library.

A  
file handle is implemented as a full userdata,  
with a metatable called @id{LUA\_FILEHANDLE}  
(where @id{LUA\_FILEHANDLE} is a macro with the actual metatable's name).  
The metatable is created by the I/O library  
@seeF{luaL\_newmetatable}.

This userdata must start with the structure @id{luaL\_Stream};  
it can contain other data after this initial structure.  
The field @id{f} points to the corresponding C stream  
(or it can be @id{NULL} to indicate an incompletely created handle).



The field @id{closef} points to a Lua function that will be called to close the stream when the handle is closed or collected; this function receives the file handle as its sole argument and must return either a true value, in case of success, or a false value plus an error message, in case of error. Once Lua calls this field, it changes the field value to @id{NULL} to signal that the handle is closed.

}

```
@APIEntry{void *luaL_testudata (lua_State *L, int arg, const char *tname);|
@apii{0,0,m}
```

This function works like @Lid{luaL\_checkudata}, except that, when the test fails, it returns @id{NULL} instead of raising an error.

}

```
@APIEntry{const char *luaL_tolstring (lua_State *L, int idx, size_t *len);|
@apii{0,1,e}
```

Converts any Lua value at the given index to a @N{C string} in a reasonable format. The resulting string is pushed onto the stack and also returned by the function @see{constchar}. If @id{len} is not @id{NULL}, the function also sets @T{\*len} with the string length.

If the value has a metatable with a @idx{\_\_tostring} field, then @id{luaL\_tolstring} calls the corresponding metamethod with the value as argument, and uses the result of the call as its result.

}

```
@APIEntry{
void luaL_traceback (lua_State *L, lua_State *L1, const char *msg,
 int level);|
@apii{0,1,m}
```

Creates and pushes a traceback of the stack @id{L1}. If @id{msg} is not @id{NULL}, it is appended at the beginning of the traceback. The @id{level} parameter tells at which level

to start the traceback.

}

```
@APIEntry{int
luaL_typeerror (lua_State *L, int arg, const char *tname);|
@apii{0,0,v}
```

Raises a type error for the argument @id{arg}  
of the @N{C function} that called it,  
using a standard message;  
@id{tname} is a @Q{name} for the expected type.  
This function never returns.

}

```
@APIEntry{const char *luaL_typename (lua_State *L, int index);|
@apii{0,0,-}
```

Returns the name of the type of the value at the given index.

}

```
@APIEntry{void luaL_unref (lua_State *L, int t, int ref);|
@apii{0,0,-}
```

Releases the reference @id{ref} from the table at index @id{t}  
@seeC{luaL\_unref}.  
The entry is removed from the table,  
so that the referred object can be collected.  
The reference @id{ref} is also freed to be used again.

If @id{ref} is @Lid{LUA\_NOREF} or @Lid{LUA\_REFNIL},  
@Lid{luaL\_unref} does nothing.

}

```
@APIEntry{void luaL_where (lua_State *L, int lvl);|
@apii{0,1,m}
```

Pushes onto the stack a string identifying the current position  
of the control at level @id{lvl} in the call stack.

Typically

this string has the following format:

```
@verbatim{
@rep{chunkname}:@rep{currentline}:
}
```

@N{Level 0} is the running function,

@N{level 1} is the function that called the running function,  
etc.

This function is used to build a prefix for error messages.

```
}

}

}
```

```
@C{-----}
@sect1{libraries| @title{The Standard Libraries}}
```

```
@simplesect{
```

The standard Lua libraries provide useful functions that are implemented @N{in C} through the @N{C API}. Some of these functions provide essential services to the language (e.g., @Lid{type} and @Lid{getmetatable}); others provide access to outside services (e.g., I/O); and others could be implemented in Lua itself, but that for different reasons deserve an implementation in C (e.g., @Lid{table.sort}).

All libraries are implemented through the official @N{C API} and are provided as separate @N{C modules}.

Unless otherwise noted, these library functions do not adjust its number of arguments to its expected parameters.

For instance, a function documented as @T{foo(arg)} should not be called without an argument.

The notation @fail means a false value representing some kind of failure.

(Currently, @fail is equal to @nil, but that may change in future versions.)

The recommendation is to always test the success of these functions with @T{(not status)}, instead of @T{(status == nil)}.)

Currently, Lua has the following standard libraries:

```
@itemize{
```

```
@item{ @link{predefined|basic library};}
```

```

@item{ @link{ corolib|coroutine library };}

@item{ @link{ packlib|package library };}

@item{ @link{ strlib|string manipulation };}

@item{ @link{ utf8|basic UTF-8 support };}

@item{ @link{ tablib|table manipulation };}

@item{ @link{ mathlib|mathematical functions } (sin, log, etc.);}

@item{ @link{ iolib|input and output };}

@item{ @link{ oslib|operating system facilities };}

@item{ @link{ debuglib|debug facilities }.}

```

```

}
```

Except for the basic and the package libraries, each library provides all its functions as fields of a global table or as methods of its objects.

To have access to these libraries, the @N{C host} program should call the @Lid{luaL\_openlibs} function, which opens all standard libraries.

Alternatively,

the host program can open them individually by using

@Lid{luaL\_requiref} to call

@defid{luaopen\_base} (for the basic library),

@defid{luaopen\_package} (for the package library),

@defid{luaopen\_coroutine} (for the coroutine library),

@defid{luaopen\_string} (for the string library),

@defid{luaopen\_utf8} (for the UTF-8 library),

@defid{luaopen\_table} (for the table library),

@defid{luaopen\_math} (for the mathematical library),

@defid{luaopen\_io} (for the I/O library),

@defid{luaopen\_os} (for the operating system library),

and @defid{luaopen\_debug} (for the debug library).

These functions are declared in @defid{lualib.h}.

```

}
```

@sect2{predefined| @title{Basic Functions}}

The basic library provides core functions to Lua.

If you do not include this library in your application,  
you should  
check carefully whether you need to provide  
implementations for some of its facilities.

@LibEntry{assert (v [, message])|

Raises an error if  
the value of its argument @id{v} is false (i.e., @nil or @false);  
otherwise, returns all its arguments.

In case of error,

@id{message} is the error object;  
when absent, it defaults to @St{assertion failed!}

}

@LibEntry{collectgarbage ([opt [, arg]])|

This function is a generic interface to the garbage collector.  
It performs different functions according to its first argument, @id{opt}:  
@description{

@item{ @St{collect}}|

Performs a full garbage-collection cycle.  
This is the default option.

}

@item{ @St{stop}}|

Stops automatic execution of the garbage collector.  
The collector will run only when explicitly invoked,  
until a call to restart it.

}

@item{ @St{restart}}|

Restarts automatic execution of the garbage collector.

}

@item{ @St{count}}|

Returns the total memory in use by Lua in Kbytes.  
The value has a fractional part,  
so that it multiplied  
by 1024  
gives the exact number of bytes in use by Lua.

}

@item{ @St{step}}|

Performs a garbage-collection step.

The step `@Q{size}` is controlled by `@id{arg}`.  
With a zero value,  
the collector will perform one basic (indivisible) step.  
For non-zero values,  
the collector will perform as if that amount of memory  
(in Kbytes) had been allocated by Lua.  
Returns `@true` if the step finished a collection cycle.  
}

`@item{ @St{isrunning} |`  
Returns a boolean that tells whether the collector is running  
(i.e., not stopped).  
}

`@item{ @St{incremental} |`  
Change the collector mode to incremental.  
This option can be followed by three numbers:  
the garbage-collector pause,  
the step multiplier,  
and the step size `@see{incmode}`.  
A zero means to not change that value.  
}

`@item{ @St{generational} |`  
Change the collector mode to generational.  
This option can be followed by two numbers:  
the garbage-collector minor multiplier  
and the major multiplier `@see{genmode}`.  
A zero means to not change that value.  
}

}

See `@See{GC}`  
for more details about garbage collection  
and some of these options.

This function should not be called by a finalizer.

}

`@LibEntry{dofile ([filename])|`  
Opens the named file and executes its content as a Lua chunk.  
When called without arguments,  
`@id{dofile}` executes the content of the standard input (`@id{stdin}`).  
Returns all values returned by the chunk.  
In case of errors, `@id{dofile}` propagates the error  
to its caller.  
(That is, `@id{dofile}` does not run in protected mode.)

}

@LibEntry{error (message [, level])|

Raises an error @see{error} with @id{message} as the error object.

This function never returns.

Usually, @id{error} adds some information about the error position at the beginning of the message, if the message is a string.

The @id{level} argument specifies how to get the error position.

With @N{level 1} (the default), the error position is where the

@id{error} function was called.

@N{Level 2} points the error to where the function

that called @id{error} was called; and

so on.

Passing a @N{level 0} avoids the addition of error position information to the message.

}

@LibEntry{\_G|

A global variable (not a function) that

holds the @x{global environment} @see{globalenv}.

Lua itself does not use this variable;

changing its value does not affect any environment,

nor vice versa.

}

@LibEntry{getmetatable (object)|

If @id{object} does not have a metatable, returns @nil.

Otherwise,

if the object's metatable has a @idx{\_\_metatable} field,

returns the associated value.

Otherwise, returns the metatable of the given object.

}

@LibEntry{ipairs (t)|

Returns three values (an iterator function, the table @id{t}, and 0)

so that the construction

@verbatim{

for i,v in ipairs(t) do @rep{body} end

}

will iterate over the key@En{ }value pairs

(@T{1,t[1]}), (@T{2,t[2]}), @ldots,

up to the first absent index.

}

@LibEntry{load (chunk [, chunkname [, mode [, env]])]}

Loads a chunk.

If @id{chunk} is a string, the chunk is this string.

If @id{chunk} is a function,

@id{load}

calls it repeatedly to get the chunk pieces.

Each call to @id{chunk} must return a string that concatenates with previous results.

A return of an empty string, @nil, or no value signals the end of the chunk.

If there are no syntactic errors,

@id{load} returns the compiled chunk as a function;

otherwise, it returns @fail plus the error message.

When you load a main chunk,

the resulting function will always have exactly one upvalue,

the @id{\_ENV} variable @see{globalenv}.

However,

when you load a binary chunk created from a function @seeF{string.dump},

the resulting function can have an arbitrary number of upvalues,

and there is no guarantee that its first upvalue will be

the @id{\_ENV} variable.

(A non-main function may not even have an @id{\_ENV} upvalue.)

Regardless, if the resulting function has any upvalues,

its first upvalue is set to the value of @id{env},

if that parameter is given,

or to the value of the @x{global environment}.

Other upvalues are initialized with @nil.

All

upvalues are fresh, that is,

they are not shared with any other function.

@id{chunkname} is used as the name of the chunk for error messages and debug information @see{debugI}.

When absent,

it defaults to @id{chunk}, if @id{chunk} is a string,

or to @St{=(load)} otherwise.

The string @id{mode} controls whether the chunk can be text or binary (that is, a precompiled chunk).

It may be the string @St{b} (only @x{binary chunk}s),



@St{t} (only text chunks),  
or @St{bt} (both binary and text).  
The default is @St{bt}.

It is safe to load malformed binary chunks;  
@id{load} signals an appropriate error.  
However,  
Lua does not check the consistency of the code inside binary chunks;  
running maliciously crafted bytecode can crash the interpreter.

}

@LibEntry{loadfile ([filename [, mode [, env]])}

Similar to @Lid{load},  
but gets the chunk from file @id{filename}  
or from the standard input,  
if no file name is given.

}

@LibEntry{next (table [, index])}

Allows a program to traverse all fields  
of a table.  
Its first argument is a table and its second argument  
is an index in this table.  
A call to @id{next} returns the next index of the table  
and its associated value.  
When called with @nil as its second argument,  
@id{next} returns an initial index  
and its associated value.  
When called with the last index,  
or with @nil in an empty table,  
@id{next} returns @nil.  
If the second argument is absent, then it is interpreted as @nil.  
In particular,  
you can use @T{next(t)} to check whether a table is empty.

The order in which the indices are enumerated is not specified,  
@emph{even for numeric indices}.  
(To traverse a table in numerical order,  
use a numerical @Rw{for}.)

You should not assign any value to a non-existent field in a table  
during its traversal.

You may however modify existing fields.  
In particular, you may set existing fields to nil.

```
}
```

```
@LibEntry{pairs (t)|
```

If @id{t} has a metamethod @idx{\_\_pairs},  
calls it with @id{t} as argument and returns the first three  
results from  
the call.

Otherwise,  
returns three values: the @Lid{next} function, the table @id{t}, and @nil,  
so that the construction

```
@verbatim{
for k,v in pairs(t) do @rep{body} end
}
```

will iterate over all key@En{ }value pairs of table @id{t}.

See function @Lid{next} for the caveats of modifying  
the table during its traversal.

```
}
```

```
@LibEntry{pcall (f [, arg1, @Cdots])|
```

Calls the function @id{f} with  
the given arguments in @emphx{protected mode}.  
This means that any error @N{inside @T{f}} is not propagated;  
instead, @id{pcall} catches the error  
and returns a status code.

Its first result is the status code (a boolean),  
which is @true if the call succeeds without errors.

In such case, @id{pcall} also returns all results from the call,  
after this first result.

In case of any error, @id{pcall} returns @false plus the error object.  
Note that errors caught by @id{pcall} do not call a message handler.

```
}
```

```
@LibEntry{print (@Cdots)|
```

Receives any number of arguments  
and prints their values to @id{stdout},  
converting  
each argument to a string  
following the same rules of @Lid{tostring}.

The function @id{print} is not intended for formatted output,  
but only as a quick way to show a value,

for instance for debugging.

For complete control over the output,  
use `@Lid{string.format}` and `@Lid{io.write}`.

}

`@LibEntry{rawequal (v1, v2)}`

Checks whether `@id{v1}` is equal to `@id{v2}`,  
without invoking the `@idx{__eq}` metamethod.  
Returns a boolean.

}

`@LibEntry{rawget (table, index)}`

Gets the real value of `@T{table[index]}`,  
without using the `@idx{__index}` metavalues.  
`@id{table}` must be a table;  
`@id{index}` may be any value.

}

`@LibEntry{rawlen (v)}`

Returns the length of the object `@id{v}`,  
which must be a table or a string,  
without invoking the `@idx{__len}` metamethod.  
Returns an integer.

}

`@LibEntry{rawset (table, index, value)}`

Sets the real value of `@T{table[index]}` to `@id{value}`,  
without using the `@idx{__newindex}` metavalues.  
`@id{table}` must be a table,  
`@id{index}` any value different from `@nil` and `@x{NaN}`,  
and  
`@id{value}` any Lua value.

This function returns `@id{table}`.

}

`@LibEntry{select (index, @Cdots)}`

If `@id{index}` is a number,  
returns all arguments after argument number `@id{index}`;  
a negative number indexes from the end (`@num{-1}` is the last argument).  
Otherwise, `@id{index}` must be the string `@T{"#"}`,  
and `@id{select}` returns the total number of extra arguments it received.

}

@LibEntry{setmetatable (table, metatable)|

Sets the metatable for the given table.

If @id{metatable} is @nil,

removes the metatable of the given table.

If the original metatable has a @idx{\_\_metatable} field,

raises an error.

This function returns @id{table}.

To change the metatable of other types from Lua code,

you must use the @link{debuglib|debug library}.

}

@LibEntry{tonumber (e [, base])|

When called with no @id{base},

@id{tonumber} tries to convert its argument to a number.

If the argument is already a number or

a string convertible to a number,

then @id{tonumber} returns this number;

otherwise,

it returns @fail.

The conversion of strings can result in integers or floats,

according to the lexical conventions of Lua @see{lexical}.

The string may have leading and trailing spaces and a sign.

When called with @id{base},

then @id{e} must be a string to be interpreted as

an integer numeral in that base.

The base may be any integer between 2 and 36, inclusive.

In bases @N{above 10}, the letter @Char{A} (in either upper or lower case)

@N{represents 10}, @Char{B} @N{represents 11}, and so forth,

with @Char{Z} representing 35.

If the string @id{e} is not a valid numeral in the given base,

the function returns @fail.

}

@LibEntry{tostring (v)|

Receives a value of any type and

converts it to a string in a human-readable format.

If the metatable of `@id{v}` has a `@idx{__tostring}` field, then `@id{tostring}` calls the corresponding value with `@id{v}` as argument, and uses the result of the call as its result. Otherwise, if the metatable of `@id{v}` has a `@idx{__name}` field with a string value, `@id{tostring}` may use that string in its final result.

For complete control of how numbers are converted, use `@Lid{string.format}`.

}

`@LibEntry{type (v)}`

Returns the type of its only argument, coded as a string.

The possible results of this function are

`@St{nil}` (a string, not the value `@nil`),

`@St{number}`,

`@St{string}`,

`@St{boolean}`,

`@St{table}`,

`@St{function}`,

`@St{thread}`,

and `@St{userdata}`.

}

`@LibEntry{ _VERSION}`

A global variable (not a function) that

holds a string containing the running Lua version.

The current value of this variable is `@St{Lua 5.4}`.

}

`@LibEntry{warn (msg1, @Cdots)}`

Emits a warning with a message composed by the concatenation of all its arguments (which should be strings).

By convention,

a one-piece message starting with `@Char{ @At}`

is intended to be a `@emph{control message}`,

which is a message to the warning system itself.

In particular, the standard warning function in Lua

recognizes the control messages @St{@At{ }off},  
to stop the emission of warnings,  
and  
@St{@At{ }on}, to (re)start the emission;  
it ignores unknown control messages.

}

@LibEntry{xpcall (f, msgh [, arg1, @Cdots])|

This function is similar to @Lid{pcall},  
except that it sets a new @x{message handler} @id{msgh}.

}

}

@sect2{corolib| @title{Coroutine Manipulation}}

This library comprises the operations to manipulate coroutines,  
which come inside the table @defid{coroutine}.  
See @See{coroutine} for a general description of coroutines.

@LibEntry{coroutine.close (co)|

Closes coroutine @id{co},  
that is,  
closes all its pending to-be-closed variables  
and puts the coroutine in a dead state.  
The given coroutine must be dead or suspended.  
In case of error  
(either the original error that stopped the coroutine or  
errors in closing methods),  
returns @false plus the error object;  
otherwise returns @true.

}

@LibEntry{coroutine.create (f)|

Creates a new coroutine, with body @id{f}.  
@id{f} must be a function.  
Returns this new coroutine,  
an object with type @T{"thread"}.

}

```
@LibEntry{coroutine.isyieldable
(co)}
```

Returns @true when the coroutine @id{co} can yield.  
The default for @id{co} is the running coroutine.

A coroutine is yieldable if it is not the main thread and  
it is not inside a non-yieldable @N{C function}.

```
}
```

```
@LibEntry{coroutine.resume (co [, val1, @Cdots])}
```

Starts or continues the execution of coroutine @id{co}.

The first time you resume a coroutine,  
it starts running its body.

The values @id{val1}, @ldots are passed  
as the arguments to the body function.

If the coroutine has yielded,

@id{resume} restarts it;

the values @id{val1}, @ldots are passed  
as the results from the yield.

If the coroutine runs without any errors,

@id{resume} returns @true plus any values passed to @id{yield}  
(when the coroutine yields) or any values returned by the body function  
(when the coroutine terminates).

If there is any error,

@id{resume} returns @false plus the error message.

```
}
```

```
@LibEntry{coroutine.running ()}
```

Returns the running coroutine plus a boolean,

@true

when the running coroutine is the main one.

```
}
```

```
@LibEntry{coroutine.status (co)}
```

Returns the status of the coroutine @id{co}, as a string:

@T{"running"},

if the coroutine is running

(that is, it is the one that called @id{status});

@T{"suspended"}, if the coroutine is suspended in a call to @id{yield},

or if it has not started running yet;

@T{"normal"} if the coroutine is active but not running  
(that is, it has resumed another coroutine);  
and @T{"dead"} if the coroutine has finished its body function,  
or if it has stopped with an error.

}

@LibEntry{coroutine.wrap (f)|

Creates a new coroutine, with body @id{f};

@id{f} must be a function.

Returns a function that resumes the coroutine each time it is called.

Any arguments passed to this function behave as the  
extra arguments to @id{resume}.

The function returns the same values returned by @id{resume},  
except the first boolean.

In case of error,

the function closes the coroutine and propagates the error.

}

@LibEntry{coroutine.yield  
(@Cdots)|

Suspends the execution of the calling coroutine.

Any arguments to @id{yield} are passed as extra results to @id{resume}.

}

}

@sect2{packlib| @title{Modules}}

The package library provides basic  
facilities for loading modules in Lua.

It exports one function directly in the global environment:

@Lid{require}.

Everything else is exported in the table @defid{package}.

@LibEntry{require (modname)|

Loads the given module.

The function starts by looking into the @Lid{package.loaded} table  
to determine whether @id{modname} is already loaded.

If it is, then @id{require} returns the value stored  
at @T{package.loaded[modname]}.

(The absence of a second result in this case



signals that this call did not have to load the module.)  
Otherwise, it tries to find a `@emph{loader}` for the module.

To find a loader,  
`@id{require}` is guided by the table `@Lid{package.searchers}`.  
Each item in this table is a search function,  
that searches for the module in a particular way.  
By changing  
this table,  
we can change how `@id{require}` looks for a module.  
The following explanation is based on the default configuration  
for `@Lid{package.searchers}`.

First `@id{require}` queries `@T{package.preload[modname]}`.  
If it has a value,  
this value (which must be a function) is the loader.  
Otherwise `@id{require}` searches for a Lua loader using the  
path stored in `@Lid{package.path}`.  
If that also fails, it searches for a `@N{C loader}` using the  
path stored in `@Lid{package.cpath}`.  
If that also fails,  
it tries an `@emph{all-in-one}` loader `@seeF{package.searchers}`.

Once a loader is found,  
`@id{require}` calls the loader with two arguments:  
`@id{modname}` and an extra value,  
a `@emph{loader data}`,  
also returned by the searcher.  
The loader data can be any value useful to the module;  
for the default searchers,  
it indicates where the loader was found.  
(For instance, if the loader came from a file,  
this extra value is the file path.)  
If the loader returns any non-nil value,  
`@id{require}` assigns the returned  
value to `@T{package.loaded[modname]}`.  
If the loader does not return a non-nil value and  
has not assigned any value to `@T{package.loaded[modname]}`,  
then `@id{require}` assigns `@true` to this entry.  
In any case, `@id{require}` returns the  
final value of `@T{package.loaded[modname]}`.  
Besides that value, `@id{require}` also returns as a second result  
the loader data returned by the searcher,  
which indicates how `@id{require}` found the module.

If there is any error loading or running the module,  
or if it cannot find any loader for the module,  
then `@id{require}` raises an error.

}

@LibEntry{package.config|

A string describing some compile-time configurations for packages.

This string is a sequence of lines:

@itemize{

@item{The first line is the @x{directory separator} string.

Default is @Char{\} for @x{Windows} and @Char{/} for all other systems.}

@item{The second line is the character that separates templates in a path.

Default is @Char{;}.

@item{The third line is the string that marks the substitution

points in a template.

Default is @Char{?}.

@item{The fourth line is a string that, in a path in @x{Windows}, is replaced by the executable's directory.

Default is @Char{!}.

@item{The fifth line is a mark to ignore all text after it when building the @id{luaopen\_} function name.

Default is @Char{-}.

}

}

@LibEntry{package.cpath|

A string with the path used by @Lid{require} to search for a @N{C loader}.

Lua initializes the @N{C path} @Lid{package.cpath} in the same way it initializes the Lua path @Lid{package.path}, using the environment variable @defid{LUA\_CPATH\_5\_4}, or the environment variable @defid{LUA\_CPATH}, or a default path defined in @id{luaconf.h}.

}

@LibEntry{package.loaded|

A table used by @Lid{require} to control which

modules are already loaded.

When you require a module `@id{modname}` and `@T{package.loaded[modname]}` is not false, `@Lid{require}` simply returns the value stored there.

This variable is only a reference to the real table; assignments to this variable do not change the table used by `@Lid{require}`. The real table is stored in the C registry `@see{registry}`, indexed by the key `@defid{LUA_LOADED_TABLE}`, a string.

}

`@LibEntry{package.loadlib (libname, funcname)}`

Dynamically links the host program with the `@N{C library}` `@id{libname}`.

If `@id{funcname}` is `@St{*}`, then it only links with the library, making the symbols exported by the library available to other dynamically linked libraries. Otherwise, it looks for a function `@id{funcname}` inside the library and returns this function as a `@N{C function}`. So, `@id{funcname}` must follow the `@Lid{lua_CFunction}` prototype `@seeC{lua_CFunction}`.

This is a low-level function. It completely bypasses the package and module system. Unlike `@Lid{require}`, it does not perform any path searching and does not automatically add extensions. `@id{libname}` must be the complete file name of the `@N{C library}`, including if necessary a path and an extension. `@id{funcname}` must be the exact name exported by the `@N{C library}` (which may depend on the `@N{C compiler}` and linker used).

This functionality is not supported by `@N{ISO C}`. As such, it is only available on some platforms (Windows, Linux, Mac OS X, Solaris, BSD, plus other Unix systems that support the `@id{dlfcn}` standard).

This function is inherently insecure, as it allows Lua to call any function in any readable dynamic library in the system. (Lua calls any function assuming the function

has a proper prototype and respects a proper protocol

@see{lua\_CFunction}.

Therefore,

calling an arbitrary function in an arbitrary dynamic library more often than not results in an access violation.)

}

@LibEntry{package.path|

A string with the path used by @Lid{require}

to search for a Lua loader.

At start-up, Lua initializes this variable with

the value of the environment variable @defid{LUA\_PATH\_5\_4} or

the environment variable @defid{LUA\_PATH} or

with a default path defined in @id{luaconf.h},

if those environment variables

are not defined.

A @St{;} in the value of the environment variable

is replaced by the default path.

}

@LibEntry{package.preload|

A table to store loaders for specific modules

@seeF{require}.

This variable is only a reference to the real table;

assignments to this variable do not change the

table used by @Lid{require}.

The real table is stored in the C registry @see{registry},

indexed by the key @defid{LUA\_PRELOAD\_TABLE}, a string.

}

@LibEntry{package.searchers|

A table used by @Lid{require} to control how to find modules.

Each entry in this table is a @def{searcher function}.

When looking for a module,

@Lid{require} calls each of these searchers in ascending order,

with the module name (the argument given to @Lid{require}) as its

sole argument.

If the searcher finds the module,

it returns another function, the module @def{loader},

plus an extra value, a `@emph{loader data}`,  
that will be passed to that loader and  
returned as a second result by `@Lid{require}`.  
If it cannot find the  
module,  
it returns a string explaining why  
(or `@nil` if it has nothing to say).

Lua initializes this table with four searcher functions.

The first searcher simply looks for a loader in the  
`@Lid{package.preload}` table.

The second searcher looks for a loader as a Lua library,  
using the path stored at `@Lid{package.path}`.  
The search is done as described in function `@Lid{package.searchpath}`.

The third searcher looks for a loader as a `@N{C library}`,  
using the path given by the variable `@Lid{package.cpath}`.  
Again,  
the search is done as described in function `@Lid{package.searchpath}`.  
For instance,

if the `@N{C path}` is the string  
`@verbatim{`  
`"/?.so;?.dll;/usr/local/?/init.so"`  
`}`

the searcher for module `@id{foo}`  
will try to open the files `@T{./foo.so}`, `@T{./foo.dll}`,  
and `@T{/usr/local/foo/init.so}`, in that order.  
Once it finds a `@N{C library}`,  
this searcher first uses a dynamic link facility to link the  
application with the library.  
Then it tries to find a `@N{C function}` inside the library  
to  
be used as the loader.

The name of this `@N{C function}` is the string `@St{luaopen_}`  
concatenated with a copy of the module name where each dot  
is replaced by an underscore.

Moreover, if the module name has a hyphen,  
its suffix after (and including) the first hyphen is removed.  
For instance, if the module name is `@id{a.b.c-v2.1}`,  
the function name will be `@id{luaopen_a_b_c}`.

The fourth searcher tries an `@def{all-in-one loader}`.

It searches the `@N{C path}` for a library for  
the root name of the given module.  
For instance, when requiring `@id{a.b.c}`,  
it will search for a `@N{C library}` for `@id{a}`.

If found, it looks into it for an open function for the submodule;  
in our example, that would be @id{luaopen\_a\_b\_c}.  
With this facility, a package can pack several @N{C submodules} into one single library,  
with each submodule keeping its original open function.

All searchers except the first one (preload) return as the extra value the file path where the module was found,  
as returned by @Lid{package.searchpath}.

The  
first searcher always returns the string @St{:preload:}.

Searchers should raise no errors and have no side effects in Lua.  
(They may have side effects in C,  
for instance by linking the application with a library.)

}

@LibEntry{package.searchpath (name, path [, sep [, rep]])}

Searches for the given @id{name} in the given @id{path}.

A path is a string containing a sequence of  
@emph{templates} separated by semicolons.  
For each template,  
the function replaces each interrogation mark (if any)  
in the template with a copy of @id{name}  
wherein all occurrences of @id{sep}  
(a dot, by default)  
were replaced by @id{rep}  
(the system's directory separator, by default),  
and then tries to open the resulting file name.

For instance, if the path is the string

```
@verbatim{
"/?.lua;/?..lc;/usr/local/?/init.lua"
}
```

the search for the name @id{foo.a}  
will try to open the files  
@T{./foo/a.lua}, @T{./foo/a.lc}, and  
@T{/usr/local/foo/a/init.lua}, in that order.

Returns the resulting  
name of the first file that it can  
open in read mode (after closing the file),  
or @fail plus an error message if none succeeds.  
(This error message lists all file names it tried to open.)

}

}

@sect2{strlib| @title{String Manipulation}

@simplesect{

This library provides generic functions for string manipulation, such as finding and extracting substrings, and pattern matching. When indexing a string in Lua, the first character is at @N{position 1} (not @N{at 0}, as in C). Indices are allowed to be negative and are interpreted as indexing backwards, from the end of the string. Thus, the last character is at position @num{-1}, and so on.

The string library provides all its functions inside the table @defid{string}. It also sets a @x{metatable for strings} where the @idx{\_\_index} field points to the @id{string} table. Therefore, you can use the string functions in object-oriented style. For instance, @T{string.byte(s,i)} can be written as @T{s:byte(i)}.

The string library assumes one-byte character encodings.

@LibEntry{string.byte (s [, i [, j]])}

Returns the internal numeric codes of the characters @T{s[i]}, @T{s[i+1]}, @ldots, @T{s[j]}.

The default value for @id{i} @N{is 1};  
the default value for @id{j} @N{is @id{i}}.

These indices are corrected following the same rules of function @Lid{string.sub}.

Numeric codes are not necessarily portable across platforms.

}

@LibEntry{string.char (@Cdots)}

Receives zero or more integers.  
Returns a string with length equal to the number of arguments, in which each character has the internal numeric code equal to its corresponding argument.

Numeric codes are not necessarily portable across platforms.

}

@LibEntry{string.dump (function [, strip])|

Returns a string containing a binary representation  
(a @emph{binary chunk})  
of the given function,  
so that a later @Lid{load} on this string returns  
a copy of the function (but with new upvalues).  
If @id{strip} is a true value,  
the binary representation may not include all debug  
information  
about the function,  
to save space.

Functions with upvalues have only their number of upvalues saved.  
When (re)loaded,  
those upvalues receive fresh instances.  
(See the @Lid{load} function for details about  
how these upvalues are initialized.  
You can use the debug library to serialize  
and reload the upvalues of a function  
in a way adequate to your needs.)

}

@LibEntry{string.find (s, pattern [, init [, plain]])|

Looks for the first match of  
@id{pattern} @see{pm} in the string @id{s}.  
If it finds a match, then @id{find} returns the indices @N{of @T{s}}  
where this occurrence starts and ends;  
otherwise, it returns @fail.  
A third, optional numeric argument @id{init} specifies  
where to start the search;  
its default value @N{is 1} and can be negative.  
A @true as a fourth, optional argument @id{plain}  
turns off the pattern matching facilities,  
so the function does a plain @Q{find substring} operation,  
with no characters in @id{pattern} being considered magic.

If the pattern has  
captures,  
then in a successful match  
the captured values are also returned,  
after the two indices.



}

@LibEntry{string.format (formatstring, @Cdots)}

Returns a formatted version of its variable number of arguments following the description given in its first argument, which must be a string.

The format string follows the same rules as the @ANSI{sprintf}.

The only differences are that the conversion specifiers and modifiers @id{F}, @id{n}, @T{\*}, @id{h}, @id{L}, and @id{l} are not supported and that there is an extra specifier, @id{q}.

Both width and precision, when present, are limited to two digits.

The specifier @id{q} formats booleans, nil, numbers, and strings in a way that the result is a valid constant in Lua source code.

Booleans and nil are written in the obvious way (@id{true}, @id{false}, @id{nil}).

Floats are written in hexadecimal, to preserve full precision.

A string is written between double quotes, using escape sequences when necessary to ensure that it can safely

be read back by the Lua interpreter.

For instance, the call

```
@verbatim{
string.format('%q', 'a string with "quotes" and \n new line')
}
```

may produce the string:

```
@verbatim{
"a string with \"quotes\" and \
new line"
}
```

This specifier does not support modifiers (flags, width, precision).

The conversion specifiers

@id{A}, @id{a}, @id{E}, @id{e}, @id{f}, @id{G}, and @id{g} all expect a number as argument.

The specifiers @id{c}, @id{d}, @id{i}, @id{o}, @id{u}, @id{X}, and @id{x} expect an integer.

When Lua is compiled with a C89 compiler, the specifiers @id{A} and @id{a} (hexadecimal floats) do not support modifiers.

The specifier @id{s} expects a string;

if its argument is not a string,

it is converted to one following the same rules of @Lid{tostring}.

If the specifier has any modifier,  
the corresponding string argument should not contain @x{embedded zeros}.

The specifier @id{p} formats the pointer  
returned by @Lid{lua\_topointer}.  
That gives a unique string identifier for tables, userdata,  
threads,  
strings, and functions.  
For other values (numbers, nil, booleans),  
this specifier results in a string representing  
the pointer @id{NULL}.

}

@LibEntry{string.gmatch (s, pattern [, init])}  
Returns an iterator function that,  
each time it is called,  
returns the next captures from @id{pattern} @see{pm}  
over the string @id{s}.  
If @id{pattern} specifies no captures,  
then the whole match is produced in each call.  
A third, optional numeric argument @id{init} specifies  
where to start the search;  
its default value @N{is 1} and can be negative.

As an example, the following loop  
will iterate over all the words from string @id{s},  
printing one per line:

```
@verbatim{
s = "hello world from Lua"
for w in string.gmatch(s, "%a+") do
 print(w)
end
}
```

The next example collects all pairs @T{key=value} from the  
given string into a table:

```
@verbatim{
t = {}
s = "from=world, to=Lua"
for k, v in string.gmatch(s, "(%w+)=(%w+)") do
 t[k] = v
end
}
```

For this function, a caret @Char{^} at the start of a  
pattern does not  
work as an anchor, as this would prevent the iteration.

}

@LibEntry{string.gsub (s, pattern, repl [, n])}

Returns a copy of @id{s}

in which all (or the first @id{n}, if given)

occurrences of the @id{pattern} @see{pm} have been replaced by a replacement string specified by @id{repl}, which can be a string, a table, or a function.

@id{gsub} also returns, as its second value, the total number of matches that occurred.

The name @id{gsub} comes from @emph{Global SUBstitution}.

If @id{repl} is a string, then its value is used for replacement.

The @N{character @T{%%}} works as an escape character:

any sequence in @id{repl} of the form @T{%%@rep{d}},

with @rep{d} between 1 and 9,

stands for the value of the @rep{d}-th captured substring;

the sequence @T{%%0} stands for the whole match;

the sequence @T{%%} stands for a @N{single @T{%%}}.

If @id{repl} is a table, then the table is queried for every match, using the first capture as the key.

If @id{repl} is a function, then this

function is called every time a

match occurs, with all captured substrings passed as arguments, in order.

In any case,

if the pattern specifies no captures,

then it behaves as if the whole pattern was inside a capture.

If the value returned by the table query or by the function call

is a string or a number,

then it is used as the replacement string;

otherwise, if it is @Rw{false} or @nil,

then there is no replacement

(that is, the original match is kept in the string).

Here are some examples:

```
@verbatim{
```

```
x = string.gsub("hello world", "(%w+)", "%1 %1")
```

```
--> x="hello hello world world"
```

```
x = string.gsub("hello world", "%w+", "%0 %0", 1)
```

```
--> x="hello hello world"
```

```
x = string.gsub("hello world from Lua", "(%w+)%s*(%w+)", "%2 %1")
```

```
--> x="world hello Lua from"
```

```
x = string.gsub("home = $HOME, user = $USER", "%$(%w+)", os.getenv)
```

```
--> x="home = /home/roberto, user = roberto"
```

```
x = string.gsub("4+5 = $return 4+5$", "%$(.)%$", function (s)
```

```
 return load(s)()
```

```
end)
```

```
--> x="4+5 = 9"
```

```
local
```

```
 t = {name="lua", version="5.4"}
```

```
x = string.gsub("$name-$version.tar.gz", "%$(%w+)", t)
```

```
--> x="lua-5.4.tar.gz"
```

```
}
```

```
}
```

```
@LibEntry{string.len (s)|
```

Receives a string and returns its length.

The empty string @T{""} has length 0.

Embedded zeros are counted,

so @T{"a\000bc\000"} has length 5.

```
}
```

```
@LibEntry{string.lower (s)|
```

Receives a string and returns a copy of this string with all

uppercase letters changed to lowercase.

All other characters are left unchanged.

The definition of what an uppercase letter is depends on the current locale.

```
}
```

```
@LibEntry{string.match (s, pattern [, init])|
```

Looks for the first @emph{match} of

the @id{pattern} @see{pm} in the string @id{s}.

If it finds one, then @id{match} returns

the captures from the pattern;

otherwise it returns @fail.

If @id{pattern} specifies no captures,

then the whole match is returned.

A third, optional numeric argument @id{init} specifies

where to start the search;

its default value @N{is 1} and can be negative.

}

@LibEntry{string.pack  
(fmt, v1, v2, @Cdots)|

Returns a binary string containing the values @id{v1}, @id{v2}, etc.  
serialized in binary form (packed)  
according to the format string @id{fmt} @see{pack}.

}

@LibEntry{string.packsize (fmt)|

Returns the length of a string resulting from @Lid{string.pack}  
with the given format.  
The format string cannot have the variable-length options  
@Char{s} or @Char{z} @see{pack}.

}

@LibEntry{string.rep (s, n [, sep])|

Returns a string that is the concatenation of @id{n} copies of  
the string @id{s} separated by the string @id{sep}.  
The default value for @id{sep} is the empty string  
(that is, no separator).  
Returns the empty string if @id{n} is not positive.

(Note that it is very easy to exhaust the memory of your machine  
with a single call to this function.)

}

@LibEntry{string.reverse (s)|

Returns a string that is the string @id{s} reversed.

}

@LibEntry{string.sub (s, i [, j])|

Returns the substring of @id{s} that  
starts at @id{i} and continues until @id{j};  
@id{i}  
and @id{j} can be negative.  
If @id{j} is absent, then it is assumed to be equal to @num{-1}  
(which is the same as the string length).

In particular,  
the call `@T{string.sub(s,1,j)}` returns a prefix of `@id{s}`  
with length `@id{j}`,  
and `@T{string.sub(s,-i)}` (for a positive `@id{i}`)  
returns a suffix of `@id{s}`  
with length `@id{i}`.

If, after the translation of negative indices,  
`@id{i}` is less than 1,  
it is corrected to 1.

If `@id{j}` is greater than the string length,  
it is corrected to that length.

If, after these corrections,  
`@id{i}` is greater than `@id{j}`,  
the function returns the empty string.

}

`@LibEntry{string.unpack (fmt, s [, pos])}`

Returns the values packed in string `@id{s}` `@seeF{string.pack}`  
according to the format string `@id{fmt}` `@see{pack}`.

An optional `@id{pos}` marks where  
to start reading in `@id{s}` (default is 1).

After the read values,  
this function also returns the index of the first unread byte in `@id{s}`.

}

`@LibEntry{string.upper (s)}`

Receives a string and returns a copy  
of this string with all  
lowercase letters changed to uppercase.  
All other characters are left unchanged.  
The definition of what a lowercase letter is depends on the current locale.

}

}

`@sect3{pm| @title{Patterns}`

`@simplesect{`

Patterns in Lua are described by regular strings,  
which are interpreted as patterns by the pattern-matching functions

@Lid{string.find},  
@Lid{string.gmatch},  
@Lid{string.gsub},  
and @Lid{string.match}.

This section describes the syntax and the meaning  
(that is, what they match) of these strings.

}

@sect4{ @title{Character Class:}

A @def{character class} is used to represent a set of characters.

The following combinations are allowed in describing a character class:

@description{

@item{ @rep{x}|

(where @rep{x} is not one of the @emphx{magic characters}

@T{^\$()%.[\]\*+-.?})

represents the character @emph{x} itself.

}

@item{ @T{.}| (a dot) represents all characters. }

@item{ @T{%a}| represents all letters. }

@item{ @T{%c}| represents all control characters. }

@item{ @T{%d}|

represents all digits. }

@item{ @T{%g}| represents all printable characters except space. }

@item{ @T{%l}| represents all lowercase letters. }

@item{ @T{%p}| represents all punctuation characters. }

@item{ @T{%s}| represents all space characters. }

@item{ @T{%u}| represents all uppercase letters. }

@item{ @T{%w}| represents all alphanumeric characters. }

@item{ @T{%x}| represents all hexadecimal digits. }

@item{ @T{% @rep{x}}| (where @rep{x} is any non-alphanumeric character)

represents the character @rep{x}.

This is the standard way to escape the magic characters.

Any non-alphanumeric character

(including all punctuation characters, even the non-magical)

can be preceded by a `@Char{ % }` to represent itself in a pattern.

}

`@item{ @T{[@rep{set}]}|`

represents the class which is the union of all characters in `@rep{set}`.

A range of characters can be specified by separating the end characters of the range, in ascending order, with a `@Char{-}`.

All classes `@T{ % }@emph{x}` described above can also be used as

components in `@rep{set}`.

All other characters in `@rep{set}` represent themselves.

For example, `@T{[%w_]}` (or `@T{[_%w]}`)

represents all alphanumeric characters plus the underscore,

`@T{[0-7]}` represents the octal digits,

and `@T{[0-7!%-]}` represents the octal digits plus the lowercase letters plus the `@Char{-}` character.

You can put a closing square bracket in a set by positioning it as the first character in the set.

You can put a hyphen in a set

by positioning it as the first or the last character in the set.

(You can also use an escape for both cases.)

The interaction between ranges and classes is not defined.

Therefore, patterns like `@T{[%a-z]}` or `@T{[a-%]}`

have no meaning.

}

`@item{ @T{[^@rep{set}]}|`

represents the complement of `@rep{set}`,

where `@rep{set}` is interpreted as above.

}

}

For all classes represented by single letters (`@T{%a}`, `@T{%c}`, etc.), the corresponding uppercase letter represents the complement of the class.

For instance, `@T{%S}` represents all non-space characters.

The definitions of letter, space, and other character groups depend on the current locale.

In particular, the class `@T{[a-z]}` may not be equivalent to `@T{%l}`.

}

`@sect4{ @title{Pattern Item: }`



A @def{pattern item} can be

@itemize{

@item{

a single character class,  
which matches any single character in the class;

}

@item{

a single character class followed by @Char{\*},  
which matches sequences of zero or more characters in the class.  
These repetition items will always match the longest possible sequence;

}

@item{

a single character class followed by @Char{+},  
which matches sequences of one or more characters in the class.  
These repetition items will always match the longest possible sequence;

}

@item{

a single character class followed by @Char{-},  
which also matches sequences of zero or more characters in the class.  
Unlike @Char{\*},  
these repetition items will always match the shortest possible sequence;

}

@item{

a single character class followed by @Char{?},  
which matches  
zero or one occurrence of a character in the class.  
It always matches one occurrence if possible;

}

@item{

@T{%@rep{n}}, for @rep{n} between 1 and 9;  
such item matches a substring equal to the @rep{n}-th captured string  
(see below);

}

@item{

@T{%b@rep{xy}}, where @rep{x} and @rep{y} are two distinct characters;  
such item matches strings that start @N{with @rep{x}}, end @N{with @rep{y}},  
and where the @rep{x} and @rep{y} are @emph{balanced}.

This means that, if one reads the string from left to right,  
counting @M{+1} for an @rep{x} and @M{-1} for a @rep{y},  
the ending @rep{y} is the first @rep{y} where the count reaches 0.

For instance, the item @T{%b()} matches expressions with

balanced parentheses.

}

@item{

@T{%f[@rep{set}]}, a @def{frontier pattern};

such item matches an empty string at any position such that

the next character belongs to @rep{set}

and the previous character does not belong to @rep{set}.

The set @rep{set} is interpreted as previously described.

The beginning and

the end of the subject are handled as if

they were the character @Char{\0}.

}

}

}

@sect4{ @title{Pattern:}

A @def{pattern} is a sequence of pattern items.

A caret @Char{^} at the beginning of a pattern anchors the match at the beginning of the subject string.

A @Char{\$} at the end of a pattern anchors the match at the end of the subject string.

At other positions,

@Char{^} and @Char{\$} have no special meaning and represent themselves.

}

@sect4{ @title{Captures:}

A pattern can contain sub-patterns enclosed in parentheses; they describe @def{captures}.

When a match succeeds, the substrings of the subject string that match captures are stored (@emph{captured}) for future use.

Captures are numbered according to their left parentheses.

For instance, in the pattern @T{"a\*(.)%w(%s\*)"},

the part of the string matching @T{"a\*(.)%w(%s\*)"} is

stored as the first capture, and therefore has @N{number 1};

the character matching @St{.} is captured with @N{number 2},

and the part matching @St{%s\*}

has @N{number 3}.

As a special case, the capture @T{()} captures

the current string position (a number).

For instance, if we apply the pattern @T{"()aa()"} on the

string @T{"flaaap"}, there will be two captures: @N{3 and 5}.

}

@sect4{@title{Multiple matches:}}

The function @Lid{string.gsub} and the iterator @Lid{string.gmatch} match multiple occurrences of the given pattern in the subject.

For these functions,

a new match is considered valid only

if it ends at least one byte after the end of the previous match.

In other words, the pattern machine never accepts the empty string as a match immediately after another match.

As an example,

consider the results of the following code:

```
@verbatim{
```

```
> string.gsub("abc", "()a*()", print);
```

```
--> 1 2
```

```
--> 3 3
```

```
--> 4 4
```

```
}
```

The second and third results come from Lua matching an empty string after @Char{b} and another one after @Char{c}.

Lua does not match an empty string after @Char{a},

because it would end at the same position of the previous match.

```
}
```

```
}
```

@sect3{pack|

@title{Format Strings for Pack and Unpack}

The first argument to @Lid{string.pack},

@Lid{string.packsize}, and @Lid{string.unpack}

is a format string,

which describes the layout of the structure being created or read.

A format string is a sequence of conversion options.

The conversion options are as follows:

@description{

@item{@T{<}|sets little endian}

@item{@T{>}|sets big endian}

@item{@T{=}|sets native endian}

@item{@T{![@rep{n}]}|sets maximum alignment to @id{n}  
(default is native alignment)}

@item{@T{b}|a signed byte (@id{char})}

@item{@T{B}|an unsigned byte (@id{char})}

@item{@T{h}|a signed @id{short} (native size)}

@item{@T{H}|an unsigned @id{short} (native size)}

@item{@T{l}|a signed @id{long} (native size)}

@item{@T{L}|an unsigned @id{long} (native size)}

@item{ @T{j}|a @id{lua\_Integer} }  
 @item{ @T{J}|a @id{lua\_Unsigned} }  
 @item{ @T{T}|a @id{size\_t} (native size) }  
 @item{ @T{i[@rep{n}]}|a signed @id{int} with @id{n} bytes  
 (default is native size) }  
 @item{ @T{I[@rep{n}]}|an  
 unsigned @id{int} with @id{n} bytes  
 (default is native size) }  
 @item{ @T{f}|a @id{float} (native size) }  
 @item{ @T{d}|a @id{double} (native size) }  
 @item{ @T{n}|a @id{lua\_Number} }  
 @item{ @T{c@rep{n} }|a fixed-sized string with @id{n} bytes }  
 @item{ @T{z}|a zero-terminated string }  
 @item{ @T{s[@emph{n}]}|a string preceded by its length  
 coded as an unsigned integer with @id{n} bytes  
 (default is a @id{size\_t}) }  
 @item{ @T{x}|one byte of padding }  
 @item{ @T{X@rep{op} }|an empty item that aligns  
 according to option @id{op}  
 (which is otherwise ignored) }  
 @item{ @Char{ }|(space) ignored }  
 }

(A @St{[@rep{n}]} means an optional integral numeral.)

Except for padding, spaces, and configurations

(options @St{xX <=>!}),

each option corresponds to an argument in @Lid{string.pack}

or a result in @Lid{string.unpack}.

For options @St{!@rep{n}}, @St{s@rep{n}}, @St{i@rep{n}}, and @St{I@rep{n}},

@id{n} can be any integer between 1 and 16.

All integral options check overflows;

@Lid{string.pack} checks whether

the given value fits in the given size;

@Lid{string.unpack} checks whether the read value fits in a Lua integer.

For the unsigned options,

Lua integers are treated as unsigned values too.

Any format string starts as if prefixed by @St{!I=},

that is,

with maximum alignment of 1 (no alignment)

and native endianness.

Native endianness assumes that the whole system is

either big or little endian.

The packing functions will not emulate correctly the behavior

of mixed-endian formats.

Alignment works as follows:

For each option,  
the format gets extra padding until the data starts  
at an offset that is a multiple of the minimum between the  
option size and the maximum alignment;  
this minimum must be a power of 2.  
Options @St{c} and @St{z} are not aligned;  
option @St{s} follows the alignment of its starting integer.

All padding is filled with zeros by @Lid{string.pack}  
and ignored by @Lid{string.unpack}.

}

}

@sect2{utf8| @title{UTF-8 Support}

This library provides basic support for @x{UTF-8}  
encoding.

It provides all its functions inside the table @defid{utf8}.

This library does not provide any support for @x{Unicode} other  
than the handling of the encoding.

Any operation that needs the meaning of a character,  
such as character classification, is outside its scope.

Unless stated otherwise,  
all functions that expect a byte position as a parameter  
assume that the given position is either the start of a byte sequence  
or one plus the length of the subject string.  
As in the string library,  
negative indices count from the end of the string.

Functions that create byte sequences  
accept all values up to @T{0x7FFFFFFF},  
as defined in the original UTF-8 specification;  
that implies byte sequences of up to six bytes.

Functions that interpret byte sequences only accept  
valid sequences (well formed and not overlong).  
By default, they only accept byte sequences  
that result in valid Unicode code points,  
rejecting values greater than @T{10FFFF} and surrogates.  
A boolean argument @id{lax},  
when available,  
lifts these checks,  
so that all values up to @T{0x7FFFFFFF} are accepted.  
(Not well formed and overlong sequences are still rejected.)

@LibEntry{utf8.char (@Cdots)}

Receives zero or more integers,  
converts each one to its corresponding UTF-8 byte sequence  
and returns a string with the concatenation of all these sequences.

}

@LibEntry{utf8.charpattern|}

The pattern (a string, not a function) @St{[\0-\x7F\xC2-\xFD][\x80-\xBF]\*}  
@see{pm},  
which matches exactly one UTF-8 byte sequence,  
assuming that the subject is a valid UTF-8 string.

}

@LibEntry{utf8.codes (s [, lax])}

Returns values so that the construction  
@verbatim{  
for p, c in utf8.codes(s) do @rep{body} end  
}  
will iterate over all UTF-8 characters in string @id{s},  
with @id{p} being the position (in bytes) and @id{c} the code point  
of each character.  
It raises an error if it meets any invalid byte sequence.

}

@LibEntry{utf8.codepoint (s [, i [, j [, lax]])}

Returns the code points (as integers) from  
all characters in @id{s}  
that start between byte position @id{i} and @id{j} (both included).  
The default for @id{i} is 1 and for @id{j} is @id{i}.  
It raises an error if it meets any invalid byte sequence.

}

@LibEntry{utf8.len (s [, i [, j [, lax]])}

Returns the number of UTF-8 characters in string @id{s}  
that start between positions @id{i} and @id{j} (both inclusive).  
The default for @id{i} is @num{1} and for @id{j} is @num{-1}.  
If it finds any invalid byte sequence,

returns @fail plus the position of the first invalid byte.

}

@LibEntry{utf8.offset (s, n [, i])}

Returns the position (in bytes) where the encoding of the

@id{n}-th character of @id{s}

(counting from position @id{i}) starts.

A negative @id{n} gets characters before position @id{i}.

The default for @id{i} is 1 when @id{n} is non-negative

and @T{#s + 1} otherwise,

so that @T{utf8.offset(s, -n)} gets the offset of the

@id{n}-th character from the end of the string.

If the specified character is neither in the subject

nor

right after its end,

the function returns @fail.

As a special case,

when @id{n} is 0 the function returns the start of the encoding

of the character that contains the @id{i}-th byte of @id{s}.

This function assumes that @id{s} is a valid UTF-8 string.

}

}

@sect2{tablib| @title{Table Manipulation}}

This library provides generic functions for table manipulation.

It provides all its functions inside the table @defid{table}.

Remember that, whenever an operation needs the length of a table,

all caveats about the length operator apply @see{len-op}.

All functions ignore non-numeric keys

in the tables given as arguments.

@LibEntry{table.concat (list [, sep [, i [, j]])}

Given a list where all elements are strings or numbers,

returns the string @T{list[i]..sep..list[i+1] @Cdots sep..list[j]}.

The default value for @id{sep} is the empty string,

the default for @id{i} is 1,

and the default for @id{j} is @T{#list}.

If @id{i} is greater than @id{j}, returns the empty string.

}

@LibEntry{table.insert  
(list, [pos,] value)}

Inserts element @id{value} at position @id{pos} in @id{list},  
shifting up the elements

@T{list[pos], list[pos+1], @Cdots, list[#list]}.

The default value for @id{pos} is @T{#list+1},  
so that a call @T{table.insert(t,x)} inserts @id{x} at the end  
of the list @id{t}.

}

@LibEntry{table.move (a1, f, e, t [,a2])}

Moves elements from the table @id{a1} to the table @id{a2},  
performing the equivalent to the following  
multiple assignment:

@T{a2[t],@Cdots = a1[f],@Cdots,a1[e]}.

The default for @id{a2} is @id{a1}.

The destination range can overlap with the source range.

The number of elements to be moved must fit in a Lua integer.

Returns the destination table @id{a2}.

}

@LibEntry{table.pack (@Cdots)}

Returns a new table with all arguments stored into keys 1, 2, etc.  
and with a field @St{n} with the total number of arguments.

Note that the resulting table may not be a sequence,  
if some arguments are @nil.

}

@LibEntry{table.remove (list [, pos])}

Removes  
from @id{list} the element at position @id{pos},  
returning the value of the removed element.

When @id{pos} is an integer between 1 and @T{#list},  
it shifts down the elements

@T{list[pos+1], list[pos+2], @Cdots, list[#list]}

and erases element @T{list[#list]};

The index @id{pos} can also be 0 when @T{#list} is 0,



or `@T{#list + 1}`.

The default value for `@id{pos}` is `@T{#list}`,  
so that a call `@T{table.remove(1)}` removes the last element  
of the list `@id{1}`.

}

`@LibEntry{table.sort (list [, comp])}`

Sorts the list elements in a given order, *in-place*,  
from `@T{list[1]}` to `@T{list[#list]}`.

If `@id{comp}` is given,  
then it must be a function that receives two list elements  
and returns true when the first element must come  
before the second in the final order,  
so that, after the sort,

`@T{i <= j}` implies `@T{not comp(list[j],list[i])}`.

If `@id{comp}` is not given,  
then the standard Lua operator `@T{<}` is used instead.

The `@id{comp}` function must define a consistent order;  
more formally,  
the function must define a strict weak order.  
(A weak order is similar to a total order,  
but it can equate different elements for comparison purposes.)

The sort algorithm is not stable:  
Different elements considered equal by the given order  
may have their relative positions changed by the sort.

}

`@LibEntry{table.unpack (list [, i [, j]])}`

Returns the elements from the given list.

This function is equivalent to

```
@verbatim{
return list[i], list[i+1], @Cdots, list[j]
}
```

By default, `@id{i}` `@N{is 1}` and `@id{j}` is `@T{#list}`.

}

}

`@sect2{mathlib| @title{Mathematical Functions}`

This library provides basic mathematical functions.  
It provides all its functions and constants inside the table `@defid{math}`.  
Functions with the annotation `@St{integer/float}` give  
integer results for integer arguments  
and float results for non-integer arguments.  
The rounding functions  
`@Lid{math.ceil}`, `@Lid{math.floor}`, and `@Lid{math.modf}`  
return an integer when the result fits in the range of an integer,  
or a  
float otherwise.

`@LibEntry{math.abs (x)}`

Returns the maximum value between `@id{x}` and `@id{-x}`. (integer/float)

}

`@LibEntry{math.acos (x)}`

Returns the arc cosine of `@id{x}` (in radians).

}

`@LibEntry{math.asin (x)}`

Returns the arc sine of `@id{x}` (in radians).

}

`@LibEntry{math.atan (y [, x])}`

`@index{atan}` `@index{atan2}`

Returns the arc tangent of `@T{y/x}` (in radians),  
using the signs of both arguments to find the  
quadrant of the result.

It also handles correctly the case of `@id{x}` being zero.

The default value for `@id{x}` is 1,  
so that the call `@T{math.atan(y)}`  
returns the arc tangent of `@id{y}`.

}

`@LibEntry{math.ceil (x)}`

Returns the smallest integral value greater than or equal to `@id{x}`.

}

@LibEntry{math.cos (x)|

Returns the cosine of @id{x} (assumed to be in radians).

}

@LibEntry{math.deg (x)|

Converts the angle @id{x} from radians to degrees.

}

@LibEntry{math.exp (x)|

Returns the value @M{e@sp{x}}  
(where @id{e} is the base of natural logarithms).

}

@LibEntry{math.floor  
(x)|

Returns the largest integral value less than or equal to @id{x}.

}

@LibEntry{math.fmod (x, y)|

Returns the remainder of the division of @id{x} by @id{y}  
that rounds the quotient towards zero. (integer/float)

}

@LibEntry{math.huge|

The float value @idx{HUGE\_VAL},  
a value greater than any other numeric value.

}

@LibEntry{math.log (x [, base])|

Returns the logarithm of @id{x} in the given base.  
The default for @id{base} is @M{e}  
(so that the function returns the natural logarithm of @id{x}).

}

@LibEntry{math.max (x, @Cdots)}

Returns the argument with the maximum value,  
according to the Lua operator @T{<}.

}

@LibEntry{math.maxinteger}

An integer with the maximum value for an integer.

}

@LibEntry{math.min (x, @Cdots)}

Returns the argument with the minimum value,  
according to the Lua operator @T{<}.

}

@LibEntry{math.mininteger}

An integer with the minimum value for an integer.

}

@LibEntry{math.modf (x)}

Returns the integral part of @id{x} and the fractional  
part of @id{x}.  
Its second result is always a float.

}

@LibEntry{math.pi}

The value of @M{@pi}.

}

@LibEntry{math.rad (x)}

Converts the angle @id{x} from degrees to radians.

}

@LibEntry{math.random ([m [, n]])}

When called without arguments,

returns a pseudo-random float with uniform distribution in the range  $@C\{() @M\{[0,1)\}$ .  $@C\{\}$

When called with two integers  $@id\{m\}$  and  $@id\{n\}$ ,  $@id\{\text{math.random}\}$  returns a pseudo-random integer with uniform distribution in the range  $@M\{[m, n]\}$ .

The call  $@T\{\text{math.random}(n)\}$ , for a positive  $@id\{n\}$ , is equivalent to  $@T\{\text{math.random}(1,n)\}$ .

The call  $@T\{\text{math.random}(0)\}$  produces an integer with all bits (pseudo)random.

This function uses the  $@idx\{\text{xoshiro256**}\}$  algorithm to produce pseudo-random 64-bit integers,

which are the results of calls with  $@N\{\text{argument } 0\}$ .

Other results (ranges and floats)

are unbiased extracted from these integers.

Lua initializes its pseudo-random generator with the equivalent of a call to  $@Lid\{\text{math.randomseed}\}$  with no arguments,

so

that  $@id\{\text{math.random}\}$  should generate different sequences of results each time the program runs.

}

$@LibEntry\{\text{math.randomseed} ([x [, y]])\}$

When called with at least one argument,

the integer parameters  $@id\{x\}$  and  $@id\{y\}$  are

joined into a 128-bit  $@emphx\{\text{seed}\}$  that

is used to reinitialize the pseudo-random generator;

equal seeds produce equal sequences of numbers.

The default for  $@id\{y\}$  is zero.

When called with no arguments,

Lua generates a seed with

a weak attempt for randomness.

This function returns the two seed components

that were effectively used,

so that setting them again repeats the sequence.

To ensure a required level of randomness to the initial state

(or contrarily, to have a deterministic sequence,

for instance when debugging a program),

you should call  $@Lid\{\text{math.randomseed}\}$  with explicit arguments.

}

@LibEntry{math.sin (x)|

Returns the sine of @id{x} (assumed to be in radians).

}

@LibEntry{math.sqrt (x)|

Returns the square root of @id{x}.

(You can also

use the expression @T{x^0.5} to compute this value.)

}

@LibEntry{math.tan (x)|

Returns the tangent of @id{x} (assumed to be in radians).

}

@LibEntry{math.tointeger (x)|

If the value @id{x} is convertible to an integer,  
returns that integer.

Otherwise, returns @fail.

}

@LibEntry{math.type (x)|

Returns @St{integer} if @id{x} is an integer,

@St{float} if it is a float,

or @fail if @id{x} is not a number.

}

@LibEntry{math.ult (m, n)|

Returns a boolean,

@true if and only if integer @id{m} is below integer @id{n} when  
they are compared as @x{unsigned integers}.

}

}

@sect2{iolib| @title{Input and Output Facilities}}

The I/O library provides two different styles for file manipulation. The first one uses implicit file handles; that is, there are operations to set a default input file and a default output file, and all input/output operations are done over these default files. The second style uses explicit file handles.

When using implicit file handles, all operations are supplied by table `@defid{io}`. When using explicit file handles, the operation `@Lid{io.open}` returns a file handle and then all operations are supplied as methods of the file handle.

The metatable for file handles provides metamethods for `@idx{__gc}` and `@idx{__close}` that try to close the file when called.

The table `@id{io}` also provides three predefined file handles with their usual meanings from C: `@defid{io.stdin}`, `@defid{io.stdout}`, and `@defid{io.stderr}`. The I/O library never closes these files.

Unless otherwise stated, all I/O functions return `@fail` on failure, plus an error message as a second result and a system-dependent error code as a third result, and some non-false value on success. On non-POSIX systems, the computation of the error message and error code in case of errors may be not `@x{thread safe}`, because they rely on the global C variable `@id{errno}`.

```
@LibEntry{io.close ([file])
```

Equivalent to `@T{file:close()}`.  
Without a `@id{file}`, closes the default output file.

```
}
```

```
@LibEntry{io.flush
()
```

Equivalent to `@T{io.output():flush()}`.

```
}
```

@LibEntry{io.input ([file])}

When called with a file name, it opens the named file (in text mode), and sets its handle as the default input file.

When called with a file handle, it simply sets this file handle as the default input file.

When called without arguments, it returns the current default input file.

In case of errors this function raises the error, instead of returning an error code.

}

@LibEntry{io.lines ([filename, @Cdots])}

Opens the given file name in read mode and returns an iterator function that works like @T{file:lines(@Cdots)} over the opened file.

When the iterator function fails to read any value, it automatically closes the file.

Besides the iterator function,

@id{io.lines} returns three other values:

two @nil values as placeholders,

plus the created file handle.

Therefore, when used in a generic @Rw{for} loop, the file is closed also if the loop is interrupted by an error or a @Rw{break}.

The call

@T{io.lines()} (with no file name) is equivalent to @T{io.input():lines("I")};

that is, it iterates over the lines of the default input file.

In this case, the iterator does not close the file when the loop ends.

In case of errors opening the file, this function raises the error, instead of returning an error code.

}

@LibEntry{io.open (filename [, mode])}

This function opens a file, in the mode specified in the string @id{mode}.

In case of success,

it returns a new file handle.



The @id{mode} string can be any of the following:

```
@description{
@item{ @St{r}| read mode (the default);}
@item{ @St{w}| write mode;}
@item{ @St{a}| append mode;}
@item{ @St{r+}| update mode, all previous data is preserved;}
@item{ @St{w+}| update mode, all previous data is erased;}
@item{ @St{a+}| append update mode, previous data is preserved,
writing is only allowed at the end of file.}
}
```

The @id{mode} string can also have a @Char{b} at the end, which is needed in some systems to open the file in binary mode.

```
}
```

```
@LibEntry{io.output
([file])|
```

Similar to @Lid{io.input}, but operates over the default output file.

```
}
```

```
@LibEntry{io.popen (prog [, mode])|
```

This function is system dependent and is not available on all platforms.

Starts the program @id{prog} in a separated process and returns a file handle that you can use to read data from this program (if @id{mode} is @T{"r"}, the default) or to write data to this program (if @id{mode} is @T{"w"}).

```
}
```

```
@LibEntry{io.read (@Cdots)|
```

Equivalent to @T{io.input():read(@Cdots)}.

```
}
```

```
@LibEntry{io.tmpfile ()|
```

In case of success, returns a handle for a temporary file. This file is opened in update mode and it is automatically removed when the program ends.

}

@LibEntry{io.type (obj)|

Checks whether @id{obj} is a valid file handle.

Returns the string @T{"file"} if @id{obj} is an open file handle,

@T{"closed file"} if @id{obj} is a closed file handle,

or @fail if @id{obj} is not a file handle.

}

@LibEntry{io.write (@Cdots)|

Equivalent to @T{io.output():write(@Cdots)}.

}

@LibEntry{file:close

()|

Closes @id{file}.

Note that files are automatically closed when

their handles are garbage collected,

but that takes an unpredictable amount of time to happen.

When closing a file handle created with @Lid{io.popen},

@Lid{file:close} returns the same values

returned by @Lid{os.execute}.

}

@LibEntry{file:flush ()|

Saves any written data to @id{file}.

}

@LibEntry{file:lines (@Cdots)|

Returns an iterator function that,

each time it is called,

reads the file according to the given formats.

When no format is given,

uses @St{1} as a default.

As an example, the construction

@verbatim{

for c in file:lines(1) do @rep{body} end

```
}
```

will iterate over all characters of the file,  
starting at the current position.  
Unlike @Lid{io.lines}, this function does not close the file  
when the loop ends.

```
}
```

```
@LibEntry{file:read (@Cdots)|
```

Reads the file @id{file},  
according to the given formats, which specify what to read.  
For each format,  
the function  
returns a string or a number with the characters read,  
or @fail if it cannot read data with the specified format.  
(In this latter case,  
the function does not read subsequent formats.)  
When called without arguments,  
it uses a default format that reads the next line  
(see below).

The available formats are

```
@description{
```

```
@item{ @St{n}|
```

reads a numeral and returns it as a float or an integer,  
following the lexical conventions of Lua.  
(The numeral may have leading whitespaces and a sign.)  
This format always reads the longest input sequence that  
is a valid prefix for a numeral;  
if that prefix does not form a valid numeral  
(e.g., an empty string, @St{0x}, or @St{3.4e-})  
or it is too long (more than 200 characters),  
it is discarded and the format returns @fail.

```
}
```

```
@item{ @St{a}|
```

reads the whole file, starting at the current position.  
On end of file, it returns the empty string;  
this format never fails.

```
}
```

```
@item{ @St{1}|
```

reads the next line skipping the end of line,  
returning @fail on end of file.

This

is the default format.

}

@item{ @St{L}|

reads the next line keeping the end-of-line character (if present),  
returning @fail on end of file.

}

@item{ @emph{number}|

reads a string with up to this number of bytes,  
returning @fail on end of file.

If @id{number} is zero,

it reads nothing and returns an empty string,

or @fail on end of file.

}

}

The formats @St{1} and @St{L} should be used only for text files.

}

@LibEntry{file:seek ([whence [, offset]])|

Sets and gets the file position,  
measured from the beginning of the file,  
to the position given by @id{offset} plus a base  
specified by the string @id{whence}, as follows:

@description{

@item{ @St{set}| base is position 0 (beginning of the file);}

@item{ @St{cur}| base is current position;}

@item{ @St{end}| base is end of file;}

}

In case of success, @id{seek} returns the final file position,  
measured in bytes from the beginning of the file.

If @id{seek} fails, it returns @fail,

plus a string describing the error.

The default value

for @id{whence} is @T{"cur"},

and for @id{offset} is 0.

Therefore, the call @T{file:seek()} returns the current  
file position, without changing it;

the call @T{file:seek("set")} sets the position to the  
beginning of the file (and returns 0);

and the call @T{file:seek("end")} sets the position to the  
end of the file, and returns its size.

}

@LibEntry{file:setvbuf (mode [, size])}

Sets the buffering mode for a file.

There are three available modes:

@description{

@item{ @St{no}| no buffering. }

@item{ @St{full}| full buffering. }

@item{ @St{line}| line buffering. }

}

For the last two cases,

@id{size} is a hint for the size of the buffer, in bytes.

The default is an appropriate size.

The specific behavior of each mode is non portable;  
check the underlying @ANSI{setvbuf} in your platform for  
more details.

}

@LibEntry{file:write (@Cdots)}

Writes the value of each of its arguments to @id{file}.

The arguments must be strings or numbers.

In case of success, this function returns @id{file}.

}

}

@sect2{oslib}

@title{Operating System Facilities}

This library is implemented through table @defid{os}.

@LibEntry{os.clock ()}

Returns an approximation of the amount in seconds of CPU time

used by the program,

as returned by the underlying @ANSI{clock}.

}

@LibEntry{os.date ([format [, time]])}

Returns a string or a table containing date and time,  
formatted according to the given string `@id{format}`.

If the `@id{time}` argument is present,  
this is the time to be formatted  
(see the `@Lid{os.time}` function for a description of this value).  
Otherwise, `@id{date}` formats the current time.

If `@id{format}` starts with `@Char{!}`,  
then the date is formatted in Coordinated Universal Time.  
After this optional character,  
if `@id{format}` is the string `@St{*t}`,  
then `@id{date}` returns a table with the following fields:  
`@id{year}`, `@id{month}` (1@En{ }12), `@id{day}` (1@En{ }31),  
`@id{hour}` (0@En{ }23), `@id{min}` (0@En{ }59),  
`@id{sec}` (0@En{ }61, due to leap seconds),  
`@id{wday}` (weekday, 1@En{ }7, Sunday  
@N{is 1}),  
`@id{yday}` (day of the year, 1@En{ }366),  
and `@id{isdst}` (daylight saving flag, a boolean).  
This last field may be absent  
if the information is not available.

If `@id{format}` is not `@St{*t}`,  
then `@id{date}` returns the date as a string,  
formatted according to the same rules as the `@ANSI{strftime}`.

If `@id{format}` is absent, it defaults to `@St{%c}`,  
which gives a human-readable date and time representation  
using the current locale.

On non-POSIX systems,  
this function may be not `@x{thread safe}`  
because of its reliance on `@Cid{gmtime}` and `@Cid{localtime}`.

}

@LibEntry{os.difftime (t2, t1)|

Returns the difference, in seconds,  
from time `@id{t1}` to time `@id{t2}`  
(where the times are values returned by `@Lid{os.time}`).  
In `@x{POSIX}`, `@x{Windows}`, and some other systems,  
this value is exactly `@id{t2}@M{-}@id{t1}`.

}

@LibEntry{os.execute ([command])|

This function is equivalent to the @ANSI{system}.

It passes @id{command} to be executed by an operating system shell.

Its first result is

@true

if the command terminated successfully,

or @fail otherwise.

After this first result

the function returns a string plus a number,

as follows:

@description{

@item{ @St{exit}|

the command terminated normally;

the following number is the exit status of the command.

}

@item{ @St{signal}|

the command was terminated by a signal;

the following number is the signal that terminated the command.

}

}

When called without a @id{command},

@id{os.execute} returns a boolean that is true if a shell is available.

}

@LibEntry{os.exit ([code [, close]])}

Calls the @ANSI{exit} to terminate the host program.

If @id{code} is @true,

the returned status is @idx{EXIT\_SUCCESS};

if @id{code} is @false,

the returned status is @idx{EXIT\_FAILURE};

if @id{code} is a number,

the returned status is this number.

The default value for @id{code} is @true.

If the optional second argument @id{close} is true,

the function closes the Lua state before exiting @seeF{lua\_close}.

}

@LibEntry{os.getenv (varname)}

Returns

the value of the process environment variable @id{varname}  
or @fail if the variable is not defined.

}

@LibEntry{os.remove (filename)|

Deletes the file (or empty directory, on @x{POSIX} systems)  
with the given name.

If this function fails, it returns @fail  
plus a string describing the error and the error code.  
Otherwise, it returns true.

}

@LibEntry{os.rename (oldname, newname)|

Renames the file or directory named @id{oldname} to @id{newname}.

If this function fails, it returns @fail,  
plus a string describing the error and the error code.  
Otherwise, it returns true.

}

@LibEntry{os.setlocale (locale [, category])|

Sets the current locale of the program.

@id{locale} is a system-dependent string specifying a locale;

@id{category} is an optional string describing which category to change:

@T{"all"}, @T{"collate"}, @T{"ctype"},

@T{"monetary"}, @T{"numeric"}, or @T{"time"};

the default category is @T{"all"}.

The function returns the name of the new locale,

or @fail if the request  
cannot be honored.

If @id{locale} is the empty string,

the current locale is set to an implementation-defined native locale.

If @id{locale} is the string @St{C},

the current locale is set to the standard C locale.

When called with @nil as the first argument,

this function only returns the name of the current locale  
for the given category.

This function may be not @x{thread safe}  
because of its reliance on @CId{setlocale}.



}

@LibEntry{os.time ([table])|

Returns the current time when called without arguments,  
or a time representing the local date and time specified by the given table.

This table must have fields @id{year}, @id{month}, and @id{day},  
and may have fields

@id{hour} (default is 12),

@id{min} (default is 0),

@id{sec} (default is 0),

and @id{isdst} (default is @nil).

Other fields are ignored.

For a description of these fields, see the @Lid{os.date} function.

When the function is called,

the values in these fields do not need to be inside their valid ranges.

For instance,

if @id{sec} is -10,

it means 10 seconds before the time specified by the other fields;

if @id{hour} is 1000,

it means 1000 hours after the time specified by the other fields.

The returned value is a number, whose meaning depends on your system.

In @x{POSIX}, @x{Windows}, and some other systems,

this number counts the number

of seconds since some given start time (the @Q{epoch}).

In other systems, the meaning is not specified,

and the number returned by @id{time} can be used only as an argument to

@Lid{os.date} and @Lid{os.difftime}.

When called with a table,

@id{os.time} also normalizes all the fields

documented in the @Lid{os.date} function,

so that they represent the same time as before the call

but with values inside their valid ranges.

}

@LibEntry{os.tmpname ()|

Returns a string with a file name that can

be used for a temporary file.

The file must be explicitly opened before its use

and explicitly removed when no longer needed.

In @x{POSIX} systems,

this function also creates

a file with that name,  
to avoid security risks.  
(Someone else might create the file with wrong permissions  
in the time between getting the name and creating the file.)  
You still have to open the file to use it  
and to remove it (even if you do not use it).

When possible,  
you may prefer to use `@Lid{io.tmpfile}`,  
which automatically removes the file when the program ends.

}

}

@sect2{debuglib| @title{The Debug Library}

This library provides  
the functionality of the @link{debugI|debug interface} to Lua programs.  
You should exert care when using this library.  
Several of its functions  
violate basic assumptions about Lua code  
(e.g., that variables local to a function  
cannot be accessed from outside;  
that userdata metatables cannot be changed by Lua code;  
that Lua programs do not crash)  
and therefore can compromise otherwise secure code.  
Moreover, some functions in this library may be slow.

All functions in this library are provided  
inside the @defid{debug} table.  
All functions that operate  
over a thread  
have an optional first argument which is the  
thread to operate over.  
The default is always the current thread.

@LibEntry{debug.debug ()}

Enters an interactive mode with the user,  
running each string that the user enters.  
Using simple commands and other debug facilities,  
the user can inspect global and local variables,  
change their values, evaluate expressions, and so on.  
A line containing only the word @id{cont} finishes this function,  
so that the caller continues its execution.

Note that commands for `@id{debug.debug}` are not lexically nested within any function and so have no direct access to local variables.

}

`@LibEntry{debug.gethook ([thread])}`

Returns the current hook settings of the thread, as three values: the current hook function, the current hook mask, and the current hook count, as set by the `@Lid{debug.sethook}` function.

Returns `@fail` if there is no active hook.

}

`@LibEntry{debug.getinfo ([thread,] f [, what])}`

Returns a table with information about a function.

You can give the function directly

or you can give a number as the value of `@id{f}`,

which means the function running at level `@id{f}` of the call stack of the given thread:

`@N{level 0}` is the current function (`@id{getinfo}` itself);

`@N{level 1}` is the function that called `@id{getinfo}`

(except for tail calls, which do not count in the stack);

and so on.

If `@id{f}` is a number greater than the number of active functions, then `@id{getinfo}` returns `@fail`.

The returned table can contain all the fields returned by `@Lid{lua_getinfo}`, with the string `@id{what}` describing which fields to fill in.

The default for `@id{what}` is to get all information available, except the table of valid lines.

If present,

the option `@Char{f}`

adds a field named `@id{func}` with the function itself.

If present,

the option `@Char{L}`

adds a field named `@id{activelines}` with the table of valid lines.

For instance, the expression `@T{debug.getinfo(1,"n").name}` returns a name for the current function,

if a

reasonable name can be found,

and the expression `@T{debug.getinfo(print)}`

returns a table with all available information about the @Lid{print} function.

}

@LibEntry{debug.getlocal ([thread,] f, local)|

This function returns the name and the value of the local variable with index @id{local} of the function at level @id{f} of the stack. This function accesses not only explicit local variables, but also parameters and temporary values.

The first parameter or local variable has @N{index 1}, and so on, following the order that they are declared in the code, counting only the variables that are active in the current scope of the function.

Compile-time constants may not appear in this listing, if they were optimized away by the compiler.

Negative indices refer to vararg arguments;

@num{-1} is the first vararg argument.

The function returns @fail

if there is no variable with the given index,

and raises an error when called with a level out of range.

(You can call @Lid{debug.getinfo} to check whether the level is valid.)

Variable names starting with @Char{() (open parenthesis) @C{}}

represent variables with no known names

(internal variables such as loop control variables, and variables from chunks saved without debug information).

The parameter @id{f} may also be a function.

In that case, @id{getlocal} returns only the name of function parameters.

}

@LibEntry{debug.getmetatable (value)|

Returns the metatable of the given @id{value} or @nil if it does not have a metatable.

}

@LibEntry{debug.getregistry ()|

Returns the registry table @see{registry}.

}

@LibEntry{debug.getupvalue (f, up)}

This function returns the name and the value of the upvalue with index @id{up} of the function @id{f}.

The function returns @fail if there is no upvalue with the given index.

(For Lua functions, upvalues are the external local variables that the function uses, and that are consequently included in its closure.)

For @N{C functions}, this function uses the empty string @T{""} as a name for all upvalues.

Variable name @Char{?} (interrogation mark) represents variables with no known names (variables from chunks saved without debug information).

}

@LibEntry{debug.getuservalue (u, n)}

Returns the @id{n}-th user value associated to the userdata @id{u} plus a boolean, @false if the userdata does not have that value.

}

@LibEntry{debug.sethook ([thread,] hook, mask [, count])}

Sets the given function as the debug hook. The string @id{mask} and the number @id{count} describe when the hook will be called. The string mask may have any combination of the following characters, with the given meaning:

```
@description{
@item{ @Char{c} | the hook is called every time Lua calls a function; }
@item{ @Char{r} | the hook is called every time Lua returns from a function; }
@item{ @Char{l} | the hook is called every time Lua enters a new line of code. }
}
```

Moreover, with a @id{count} different from zero, the hook is called also after every @id{count} instructions.

When called without arguments,

@Lid{debug.sethook}

turns off the hook.

When the hook is called, its first parameter is a string describing the event that has triggered its call:

@T{"call"}, @T{"tail call"}, @T{"return"},  
@T{"line"}, and @T{"count"}.

For line events,

the hook also gets the new line number as its second parameter.

Inside a hook,

you can call @id{getinfo} with @N{level 2} to get more information about the running function.

(@N{Level 0} is the @id{getinfo} function,  
and @N{level 1} is the hook function.)

}

@LibEntry{debug.setlocal ([thread,] level, local, value)}

This function assigns the value @id{value} to the local variable with index @id{local} of the function at level @id{level} of the stack.

The function returns @fail if there is no local variable with the given index,

and raises an error when called with a @id{level} out of range.

(You can call @id{getinfo} to check whether the level is valid.)

Otherwise, it returns the name of the local variable.

See @Lid{debug.getlocal} for more information about variable indices and names.

}

@LibEntry{debug.setmetatable (value, table)}

Sets the metatable for the given @id{value} to the given @id{table} (which can be @nil).

Returns @id{value}.

}

@LibEntry{debug.setupvalue (f, up, value)}

This function assigns the value @id{value} to the upvalue with index @id{up} of the function @id{f}.

The function returns @fail if there is no upvalue with the given index.

Otherwise, it returns the name of the upvalue.

See `@Lid{debug.getupvalue}` for more information about upvalues.

}

`@LibEntry{debug.setuservalue (udata, value, n)}`

Sets the given `@id{value}` as the `@id{n}`-th user value associated to the given `@id{udata}`. `@id{udata}` must be a full userdata.

Returns `@id{udata}`, or `@fail` if the userdata does not have that value.

}

`@LibEntry{debug.traceback ([thread,] [message [, level]])}`

If `@id{message}` is present but is neither a string nor `@nil`, this function returns `@id{message}` without further processing.

Otherwise,

it returns a

string with a traceback of the call stack.

The optional `@id{message}` string is appended at the beginning of the traceback.

An optional `@id{level}` number tells at which level to start the traceback (default is 1, the function calling `@id{traceback}`).

}

`@LibEntry{debug.upvalueid (f, n)}`

Returns a unique identifier (as a light userdata) for the upvalue numbered `@id{n}` from the given function.

These unique identifiers allow a program to check whether different closures share upvalues.

Lua closures that share an upvalue (that is, that access a same external local variable) will return identical ids for those upvalue indices.

}

`@LibEntry{debug.upvaluejoin (f1, n1, f2, n2)}`

Make the `@id{n1}`-th upvalue of the Lua closure `@id{f1}` refer to the `@id{n2}`-th upvalue of the Lua closure `@id{f2}`.

```
}

}

}
```

```
@C{-----}
@sect1{lua-sa| @title{Lua Standalone}}
```

Although Lua has been designed as an extension language,  
to be embedded in  
a host @N{C program},  
it is also frequently used as a standalone language.

An interpreter for Lua as a standalone language,  
called simply @id{lua},  
is provided with the standard distribution.

The @x{standalone interpreter} includes  
all standard libraries.

Its usage is:

```
@verbatim{
lua [options] [script [args]]
}
```

The options are:

```
@description{
@item{ @T{-e @rep{stat}}| execute string @rep{stat};}
@item{ @T{-i}| enter interactive mode after running @rep{script};}
@item{ @T{-l @rep{mod}}| @Q{require} @rep{mod} and assign the
result to global @rep{mod};}
@item{ @T{-l @rep{g=mod}}| @Q{require} @rep{mod} and assign the
result to global @rep{g};}
@item{ @T{-v}| print version information;}
@item{ @T{-E}| ignore environment variables;}
@item{ @T{-W}| turn warnings on;}
@item{ @T{--}| stop handling options;}
@item{ @T{-}| execute @id{stdin} as a file and stop handling options.}
}
```

(The form @T{-l @rep{g=mod}} was introduced in @N{release 5.4.4}.)

After handling its options, @id{lua} runs the given @emph{script}.

When

called without arguments,

@id{lua} behaves as @T{lua -v -i}

when the standard input (@id{stdin}) is a terminal,

and as @T{lua -} otherwise.

When called without the option @T{-E},



the interpreter checks for an environment variable `@defid{LUA_INIT_5_4}`  
(or `@defid{LUA_INIT}` if the versioned name is not defined)  
before running any argument.  
If the variable content has the format `@T{ @At@rep{filename} }`,  
then `@id{lua}` executes the file.  
Otherwise, `@id{lua}` executes the string itself.

When called with the option `@T{-E}`,  
Lua does not consult any environment variables.  
In particular,  
the values of `@Lid{package.path}` and `@Lid{package.cpath}`  
are set with the default paths defined in `@id{luaconf.h}`.

The options `@T{-e}`, `@T{-l}`, and `@T{-W}` are handled in  
the order they appear.

For instance, an invocation like

```
@verbatim{
$ lua -e 'a=1' -llib1 script.lua
}
```

will first set `@id{a}` to 1, then require the library `@id{lib1}`,  
and finally run the file `@id{script.lua}` with no arguments.

(Here

`@T{$}` is the shell prompt. Your prompt may be different.)

Before running any code,

`@id{lua}` collects all command-line arguments  
in a global table called `@id{arg}`.

The script name goes to index 0,  
the first argument after the script name goes to index 1,  
and so on.

Any arguments before the script name  
(that is, the interpreter name plus its options)  
go to negative indices.

For instance, in the call

```
@verbatim{
$ lua -la b.lua t1 t2
}
```

the table is like this:

```
@verbatim{
arg = { [-2] = "lua", [-1] = "-la",
 [0] = "b.lua",
 [1] = "t1", [2] = "t2" }
}
```

If there is no script in the call,  
the interpreter name goes to index 0,  
followed by the other arguments.

For instance, the call

```
@verbatim{
```

```
$ lua -e "print(arg[1])"
```

```
}
```

will print @St{-e}.

If there is a script,

the script is called with arguments

@T{arg[1]}, @Cdots, @T{arg[#arg]}.

Like all chunks in Lua,

the script is compiled as a variadic function.

In interactive mode,

Lua repeatedly prompts and waits for a line.

After reading

a line,

Lua first try to interpret the line as an expression.

If it succeeds, it prints its value.

Otherwise, it interprets the line as a statement.

If you write an incomplete statement,

the interpreter waits for its completion

by issuing a different prompt.

If the global variable @defid{\_PROMPT} contains a string,  
then its value is used as the prompt.

Similarly, if the global variable @defid{\_PROMPT2} contains a string,  
its value is used as the secondary prompt  
(issued during incomplete statements).

In case of unprotected errors in the script,  
the interpreter reports the error to the standard error stream.

If the error object is not a string but

has a metamethod @idx{\_\_tostring},

the interpreter calls this metamethod to produce the final message.

Otherwise, the interpreter converts the error object to a string  
and adds a stack traceback to it.

When warnings are on,

they are simply printed in the standard error output.

When finishing normally,

the interpreter closes its main Lua state

@seeF{lua\_close}.

The

script can avoid this step by

calling @Lid{os.exit} to terminate.

To allow the use of Lua as a

script interpreter in Unix systems,

Lua skips the first line of a file chunk if it starts with @T{#}.

Therefore, Lua scripts can be made into executable programs

by using @T{chmod +x} and @N{the @T{#!}} form,

as in

```
@verbatim{
#!/usr/local/bin/lua
}
```

Of course,

the location of the Lua interpreter may be different in your machine.

If @id{lua} is in your @id{PATH},

then

```
@verbatim{
#!/usr/bin/env lua
}
```

is a more portable solution.

```
}
```

@sect1{incompat| @title{Incompatibilities with the Previous Version}}

@simplesect{

Here we list the incompatibilities that you may find when moving a program from @N{Lua 5.3} to @N{Lua 5.4}.

You can avoid some incompatibilities by compiling Lua with appropriate options (see file @id{luaconf.h}).

However,

all these compatibility options will be removed in the future.

More often than not,

compatibility issues arise when these compatibility

options

are removed.

So, whenever you have the chance,

you should try to test your code with a version of Lua compiled

with all compatibility options turned off.

That will ease transitions to newer versions of Lua.

Lua versions can always change the C API in ways that

do not imply source-code changes in a program,

such as the numeric values for constants

or the implementation of functions as macros.

Therefore,

you should never assume that binaries are compatible between

different Lua versions.

Always recompile clients of the Lua API when

using a new version.

Similarly, Lua versions can always change the internal representation

of precompiled chunks;

precompiled chunks are not compatible between different Lua versions.

The standard paths in the official distribution may change between versions.

}

@sect2{ @title{Incompatibilities in the Language}

@itemize{

@item{

The coercion of strings to numbers in arithmetic and bitwise operations has been removed from the core language.

The string

library does a similar job for arithmetic (but not for bitwise) operations using the string metamethods.

However, unlike in previous versions, the new implementation preserves the implicit type of the numeral in the string.

For instance, the result of `@T{"1" + "2"}` now is an integer, not a float.

}

@item{

Literal decimal integer constants that overflow are read as floats, instead of wrapping around.

You can use hexadecimal notation for such constants if you want the old behavior (reading them as integers with wrap around).

}

@item{

The use of the `@idx{__lt}` metamethod to emulate `@idx{__le}` has been removed.

When needed, this metamethod must be explicitly defined.

}

@item{

The semantics of the numerical `@Rw{for}` loop over integers changed in some details.

In particular, the control variable never wraps around.

}

@item{

A label for a `@Rw{goto}` cannot be declared where a label with the same name is visible, even if this other label is declared in an enclosing

block.

}

@item{

When

finalizing an object,

Lua does not ignore @idx{\_\_gc} metamethods that are not functions.

Any value will be called, if present.

(Non-callable values will generate a warning,  
like any other error when calling a finalizer.)

}

}

}

@sect2{ @title{Incompatibilities in the Libraries}

@itemize{

@item{

The function @Lid{print} does not call @Lid{tostring}  
to format its arguments;

instead, it has this functionality hardwired.

You should use @idx{\_\_tostring} to modify how values are printed.

}

@item{

The pseudo-random number generator used by the function @Lid{math.random}  
now starts with a somewhat random seed.

Moreover, it uses a different algorithm.

}

@item{

By default, the decoding functions in the @Lid{utf8} library  
do not accept surrogates as valid code points.

An extra parameter in these functions makes them more permissive.

}

@item{

The options @St{setpause} and @St{setstepmul}  
of the function @Lid{collectgarbage} are deprecated.

You should use the new option @St{incremental} to set  
them.

}

@item{

The function @Lid{io.lines} now returns four values,  
instead of just one.

That can be a problem when it is used as the sole argument to another function that has optional parameters, such as in `@T{load(io.lines(filename, "L"))}`.

To fix that issue, you can wrap the call into parentheses, to adjust its number of results to one.

```
}
```

```
}
```

```
}
```

```
@sect2{ @title{Incompatibilities in the API}
```

```
@itemize{
```

```
@item{
```

Full userdata now has an arbitrary number of associated user values. Therefore, the functions `@id{lua_newuserdata}`, `@id{lua_setuservalue}`, and `@id{lua_getuservalue}` were replaced by `@Lid{lua_newuserdatauv}`, `@Lid{lua_setiuservalue}`, and `@Lid{lua_getiuservalue}`, which have an extra argument.

For compatibility, the old names still work as macros assuming one single user value.

Note, however, that userdata with zero user values are more efficient memory-wise.

```
}
```

```
@item{
```

The function `@Lid{lua_resume}` has an extra parameter. This out parameter returns the number of values on the top of the stack that were yielded or returned by the coroutine. (In previous versions, those values were the entire stack.)

```
}
```

```
@item{
```

The function `@Lid{lua_version}` returns the version number, instead of an address of the version number. The Lua core should work correctly with libraries using their own static copies of the same core, so there is no need to check whether they are using the same address space.

```
}
```

@item{  
The constant @id{LUA\_ERRGCMM} was removed.  
Errors in finalizers are never propagated;  
instead, they generate a warning.  
}

@item{  
The options @idx{LUA\_GCSETPAUSE} and @idx{LUA\_GCSETSTEPMUL}  
of the function @Lid{lua\_gc} are deprecated.  
You should use the new option @id{LUA\_GCINC} to set them.  
}

}

}

}

@C{=====}

@sect1{BNF| @title{The Complete Syntax of Lua}

Here is the complete syntax of Lua in extended BNF.

As usual in extended BNF,

@bnfNter{A} means 0 or more @bnfNter{A}s,

and @bnfNter{[A]} means an optional

@bnfNter{A}.

(For operator precedences, see @See{prec};

for a description of the terminals

@bnfNter{Name}, @bnfNter{Numeral},

and @bnfNter{LiteralString}, see @See{lexical}.)

@index{grammar}

@Produc{

@producname{chunk}@producbody{block}

@producname{block}@producbody{@bnfrep{stat} @bnfoft{retstat}}

@producname{stat}@producbody{

@bnfter{;}

@OrNL varlist @bnfter{=} explist

@OrNL functioncall

@OrNL label

@OrNL @Rw{break}

@OrNL @Rw{goto} Name

@OrNL @Rw{do} block @Rw{end}

```

@OrNL @Rw{while} exp @Rw{do} block @Rw{end}
@OrNL @Rw{repeat} block @Rw{until} exp
@OrNL @Rw{if} exp @Rw{then} block
@bnfrep{ @Rw{elseif} exp @Rw{then} block}
@bnfoft{ @Rw{else} block} @Rw{end}
@OrNL @Rw{for} @bnfNter{Name} @bnfter{=} exp @bnfter{,} exp @bnfoft{ @bnfter{,} exp}
@Rw{do} block @Rw{end}
@OrNL @Rw{for} namelist @Rw{in} explist @Rw{do} block @Rw{end}
@OrNL @Rw{function} funcname funcbody
@OrNL @Rw{local} @Rw{function} @bnfNter{Name} funcbody
@OrNL @Rw{local} attnamelist @bnfoft{ @bnfter{=} explist}
}

@producname{attnamelist}@producbody{
@bnfNter{Name} attrib @bnfrep{ @bnfter{,} @bnfNter{Name} attrib}}

@producname{attrib}@producbody{ @bnfoft{ @bnfter{<} @bnfNter{Name} @bnfter{>}}}

@producname{retstat}@producbody{ @Rw{return}
@bnfoft{explist} @bnfoft{ @bnfter{;}}}}

@producname{label}@producbody{ @bnfter{:} Name @bnfter{:}}

@producname{funcname}@producbody{ @bnfNter{Name} @bnfrep{ @bnfter{.} @bnfNter{Name}}
@bnfoft{ @bnfter{:} @bnfNter{Name}}}}

@producname{varlist}@producbody{var @bnfrep{ @bnfter{,} var}}

@producname{var}@producbody{
@bnfNter{Name}
@Or prefixexp @bnfter{[]} exp @bnfter{[]}
@Or prefixexp @bnfter{.} @bnfNter{Name}
}

@producname{namelist}@producbody{ @bnfNter{Name} @bnfrep{ @bnfter{,} @bnfNter{Name}}}}

@producname{explist}@producbody{exp @bnfrep{ @bnfter{,} exp}}

@producname{exp}@producbody{
@Rw{nil}
@Or @Rw{false}
@Or @Rw{true}
@Or @bnfNter{Numeral}
@Or @bnfNter{LiteralString}
@Or @bnfter{...}
@Or functiondef
@OrNL prefixexp

```



```

@Or tableconstructor
@Or exp
binop exp
@Or unop exp
}

@producname{prefixexp}@producbody{ var @Or functioncall @Or @bnfter{(} exp @bnfter{)}}

@producname{functioncall}@producbody{
prefixexp args
@Or prefixexp @bnfter{:} @bnfNter{Name} args
}

@producname{args}@producbody{
@bnfter{(} @bnfoft{explist} @bnfter{)}
@Or tableconstructor
@Or @bnfNter{LiteralString}
}

@producname{functiondef}@producbody{ @Rw{function} funcbody}

@producname{funcbody}@producbody{ @bnfter{(} @bnfoft{parlist} @bnfter{)} block @Rw{end}}

@producname{parlist}@producbody{ namelist @bnfoft{@bnfter{,} @bnfter{...}}
@Or @bnfter{...}}

@producname{tableconstructor}@producbody{ @bnfter{@Open} @bnfoft{fieldlist} @bnfter{@Close}}

@producname{fieldlist}@producbody{ field @bnfrep{fieldsep field} @bnfoft{fieldsep}}

@producname{field}@producbody{ @bnfter{[] exp @bnfter{[]} @bnfter{=} exp @Or @bnfNter{Name}
@bnfter{=} exp @Or exp}

@producname{fieldsep}@producbody{ @bnfter{,} @Or @bnfter{;}}

@producname{binop}@producbody{
@bnfter{+} @Or @bnfter{-} @Or @bnfter{*} @Or @bnfter{/} @Or @bnfter{//}
@Or @bnfter{^} @Or @bnfter{%}
@OrNL
@bnfter{&} @Or @bnfter{~} @Or @bnfter{[]} @Or @bnfter{>>} @Or @bnfter{<<}
@Or @bnfter{..}
@OrNL
@bnfter{<} @Or @bnfter{<=} @Or @bnfter{>} @Or @bnfter{>=}
@Or @bnfter{==} @Or @bnfter{~=}
@OrNL
@Rw{and} @Or @Rw{or}}

@producname{unop}@producbody{ @bnfter{-} @Or @Rw{not} @Or @bnfter{#} @Or

```

@bnfter{~}}

}

}

@C{=====}

}

@C{-----}

Found in path(s):

\* /opt/cola/permits/1771012052\_1692696990.443187/0/lu-lua-v5-4-6-0-g6443185-tar-gz/lu-lua-6443185/manual/manual.of

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2010.02.23

Marcelo Vanzin <mvanzin@vmware.com>

This release tag contains commits up to the following id:

8baa8588d5fd4cf64efb17164cb70c86c758d0c6

2010.01.19 Marcelo Vanzin <mvanzin@vmware.com>

This release tag contains commits up to the following id:

8ee82a5774ae7badeb98ecf4dc629c7e9aac7077

2009.12.16 Marcelo Vanzin <mvanzin@vmware.com>

This release tag contains commits up to the following id:

0d28106da5684dc31ea52ebb5a2dc6a0af5c1d61

2009.11.16 Marcelo Vanzin <mvanzin@vmware.com>  
This release tag contains commits up to the following id:  
6f4cdd0f38be020d722f2393c0b78d7cd13f04d2

2009.10.15 Marcelo Vanzin <mvanzin@vmware.com>  
This release tag contains commits up to the following id:  
d2f1b83daab1d7882fd651ad1cc77c729bbd9760

2009.09.18 Marcelo Vanzin <mvanzin@vmware.com>  
This release tag contains commits up to the following id:  
8bb94fbfbdf65b53b87279cf81529756dba7a2ca

Other changes not captured in the git logs:

\* Resync with internal dev branch  
(2009.08.24)

\* hgfsmounter/hgfsmounter.c: allow hgfs users to set ttl to 0 at mount time.

\* lib/guestApp/guestApp.c, lib/include/conf.h, lib/include/netutil.h,  
lib/include/procMgr.h, lib/include/system.h, lib/vixTools/vixTools.c,  
lib/vmCheck/vmcheck.c: remove (now unused) Netware checks.

\* lib/message/\*, modules/freebsd/vmhgfs/Makefile,  
modules/linux/vmhgfs/Makefile.\*, modules/solaris/vmhgfs/Makefile: remove  
unused message transport abstraction. The rpcChannel library is now used to  
do RPC abstraction.

\* modules/\*/vmmemctl/\*: refactor of the vmmemctl module as part of adding  
support for Mac OS guests.

\* modules/linux/pvscsi/pvscsi.c: don't clobber RESERVATION\_CONFLICT sdstat  
up from linux pvscsi driver.

\* modules/linux/shared/\*: VMCI changes unrelated to the guest driver.

\* modules/linux/vmhgfs/fsutil.c, modules/linux/vmhgfs/inode.c: fix the case  
where two directories refer to the same inode.

\* scripts/linux/\*: support older versions of NetworkManager.

2009-08-24 Marcelo  
Vanzin <mvanzin@vmware.com>

\* Resync with internal trunk (2009.08.19)

- \* configure.ac: remove support for Linux kernels < 2.6.9.
- \* lib/include/vmtools.h, lib/vmtools/vmtoolsLog.c, doc/api/services/util.txt: add new log handled that allows appending to existing log files, and fix an issue where old log files would be "rotated" whenever the config file was reloaded.
- \* lib/appUtil/appUtilX11.c, lib/ghIntegration/ghIntegrationX11.c, lib/include/appUtil.h: fix compilation issues on FreeBSD when unity was enabled.
- \* lib/dnd/dndLinux.c, lib/include/vmblock\_user.h, tests/testVmblock/\*: add vmblock tests and, as part of the change, do some refactoring of vmblock related functions.
- \* lib/guestInfo/guestInfo.c, lib/include/wiper.h, lib/wiper/\*, toolbox/toolboxcmd-shrink.c, toolbox/toolboxShrink.c: refactor the wiper structures so that they behave the same on Win32 and other platforms, and also reuse data structures already in use by other parts of the code. This fixes an "use after free" issue that toolbox-cmd had on Win32.
- \* lib/guestInfo/guestInfo.c, lib/guestInfo/guestInfoInt.h, lib/guestInfo/guestInfoPosix.c, lib/guestRpc/nicinfo.x, lib/include/guestInfo.h, lib/include/netutil.h, lib/include/slashProc.h, lib/netutil/netUtilLinux.c, lib/slashProc/\*, services/plugins/guestInfo/guestInfoServer.c: add support for sending more network-related information to the host, such as routing tables and name servers.
- \* lib/hgfsBd/hgfsBd.c: don't log RPC errors when HGFS is disabled.
- \* lib/hgfsHelper/\*, lib/include/hgfsHelper.h, lib/vixTools/vixTools.c: new library with functions to query information about HGFS; expose some HGFS properties through VIX.
- \* lib/hgfsServer/\*, lib/hgfsServerPolicyGuest/hgfsServerPolicyGuest.c, lib/include/hgfsServerPolicy.h: fix checking of whether an object belongs to a particular share; this was causing issues with invalid information being returned in certain cases.
- \* lib/hgfsServer/\*, lib/include/hgfsProto.h: changes to support new VIX API calls (mostly affecting Win32 only).
- \* lib/include/guestCaps.h, lib/include/unityCommon.h: add boilerplate for new RPCs for setting windows as sticky / non-sticky (not yet implemented).



- \* lib/include/hgfsProto.h: new definitions for the next version of the HGFS protocol.
- \* lib/include/xdrutil.h: make XDRUTIL\_ARRAYAPPEND() more type-safe when using GCC.
- \* lib/misc/codesetOld.c: fix some issues with UTF16 -> UTF8 conversion.
- \* lib/rpcChannel/rpcChannel.c, libvmttools/signalSource.c, libvmttools/vmtools.c, libvmttools/vmtoolsConfig.c: g\_assert -> ASSERT.
- \* lib/unityWindowTracker/unityWindowTracker.c: fix issue with z-ordering of modal dialogs.
- \* libvmttools/vmtoolsConfig.c: fix some old config translation issues.
- \* modules/freebsd/shared/\*, modules/freebsd/vmblock/\*: make vmblock work on FreeBSD 8.
- \* modules/freebsd/vmmemctl/\*, modules/linux/vmmemctl/\*, modules/solaris/vmmemctl/\*, : refactoring and code changes to support the driver on Mac OS X.
- \* modules/linux/vmblock/\*, modules/linux/vmci/\*, modules/linux/vsock/linux/\*: remove compatibility code for older kernels.
- \* modules/linux/vmhgfs/\*: fix memory leak in HgfsAccessInt().
- \* modules/linux/vmxnet3/\*: fix kunmap usage in vmxnet3\_shm, and reset the shared pages when the char device is closed.
- \* modules/linux/vsock/linux/af\_vsock.{c,h}, modules/linux/vsock/linux/util.c: add vsock protocol negotiation for notifyOn ops. This allows the driver to negotiate with the remove end which version of the notification protocol to use.
- \* modules/linux/vsock/linux/notify.c, modules/linux/vsock/linux/notify.h, modules/linux/vsock/linux/notifyQState.c, modules/linux/vsock/linux/vsockPacket.h: add pktOn protocol. This new protocol improves performance by detecting changes in the queue state instead of sending WAITING\_READ and WAITING\_WRITE packets.
- \* services/plugins/hgfsServer/hgfsPlugin.c, services/plugins/resolutionSet/resolutionSet.c, services/vmtoolsd/mainLoop.c, services/vmtoolsd/pluginMgr.c,

services/vmtoolsd/toolsRpc.c: load plugins even when an RPC channel cannot be instantiated (i.e., when running outside of a virtual machine); this allows plugins to perform actions (at load time) also when running outside virtual machines (e.g., to undo some configuration done when the OS was run in a VM).

\* services/vmtoolsd/mainLoop.c, services/vmtoolsd/mainPosix.c, services/vmtoolsd/toolsCoreInt.h: handle SIGHUP differently; instead of stopping the service, just re-load the config data. This should make it easier to integrate the tools service with other tools such as logrotate.

\* toolbox/toolbox-cmd.c, toolbox/toolboxcmd-stat.c: remove memory info query, which didn't really return useful information.

\* vmware-user/copyPasteUI.cpp: if the clipboard/primary with most recent timestamp has no data on it, try the other before giving up during copy/paste.

2009-07-22 Marcelo Vanzin <mvanzin@vmware.com>

\* Resync with internal trunk (2009.07.17)

\* configure.ac: fix detection of "dot" and its usage in the doxygen config file.

\* configure.ac, libguestlib/Makefile.am, libguestlib/vmguestlib.pc.in: install vmguestlib headers and add new pkgconfig script.

\* lib/dndGuest/dnd.{cc,hh}, lib/include/dndBase.h, vmware-user/dndUI.{cpp,h}: fix an issue where the DnD code would prevent drops to other windows in Unity mode, instead of just intercepting drops to the desktop.

\* lib/dndGuest/dnd.{cc,hh}, lib/dndGuest/dndRpc.hh, lib/dndGuest/dndRpcV3.cc, lib/include/dndBase.h, vmware-user/dndUI.{cpp,h}: fix an issue where the host Unity code would cause an undesired drop event.

\* lib/dndGuest/dnd.{cc,hh}, lib/dndGuest/dndRpc.hh, lib/dndGuest/dndRpcV3.cc, lib/include/dndBase.h: cleanup mouse simulation code, and fix an issue where a drag would be canceled if the contents were dragged out of a guest and then back in.

\* lib/dndGuest/dndRpcV3.cc, vmware-user/copyPasteDnDWrapper.cpp, vmware-user/dndUI.cpp, vmware-user/dndUI.h, vmware-user/dragDetWnd.cpp, vmware-user/dragDetWnd.h: several DnD fixes; make the DnD code behave more like other GTK applications (based on analysing the flow of signals on a test widget), and get rid of one of the detection windows, merging both the Unity and non-Unity windows. Also, some code refactoring.

- \* lib/ghIntegration/\*, lib/guestRpc/\*, lib/include/guestCaps.h, lib/include/unityCommon.h: add stubs for a few new GHI functions (setting window focus, tray icon updates and enhanced app info) - currently only implemented on Win32.
- \* lib/ghIntegration/ghIntegrationX11.c: examine WM\_CLASS when determining which DE Tools are running in. The previous code was failing to show a few entries set as "OnlyShowIn=xxx" because checking WM\_NAME wasn't enough to properly detect the desktop environment in certain cases.
- \* lib/guestApp/guestAppPosixX11.c: use gconftool-2 to detect the user's browser, since gnome-open fails to open "file://" URLs which contain query strings. Also, use "kde-open" when running under KDE.
- \* lib/guestInfo/guestInfo.c, lib/include/wiper.h, lib/wiper/wiperPosix.c: allow shrinking LVM partitions.
- \* lib/include/appUtil.h: partial refactoring of icon retrieval code.
- \* lib/include/dblInkList.h, lib/misc/dblInkList.c: inline linked list functions.
- \* lib/include/guest\_os.h, lib/misc/hostinfoPosix.c: add a couple of distros to the known distro list.
- \* lib/include/netutil.h, lib/netUtil/netUtilLinux.c: add Linux interface name, index lookup routines.
- \* lib/include/system.h, lib/system/systemLinux.c, services/plugins/timeSync/timeSync.c: fixes a few bugs in the backwards time sync code, mostly due to unit mismatches.
- \* lib/include/unityWindowTracker.h, lib/unity/unity.c, lib/unity/unityPlatform.h, lib/unity/unityPlatformX11Window.c, lib/unityWindowTracker/unityWindowTracker.c: expose two new properties in the window tracker to save an RPC to retrieve those properties.
- \* lib/include/vmtoolsApp.h, services/vmtoolsd/mainLoop.c, services/vmtoolsd/pluginMgr.c, services/vmtoolsd/toolsCoreInt.h: add support for "application providers", which allow plugins to add support to new kinds of application frameworks through vmtoolsd.
- \* lib/unity/unityPlatformX11.c: only enable GIO channels when Unity is actually active.

- \* lib/unity/\*: cleanup old GTK1 code.
- \* libvmtools/vmtoolsConfig.c: don't complain if config file is empty.
- \* modules/linux/dkms.conf, modules/linux/dkms.sh: fix dkms.conf, and provide a script to create a dkms tree from open-vm-tools.
- \* modules/linux/shared/vmci\_queue\_pair.h, modules/linux/vmci/vmciKernelIf.c: remove two (now) unneeded functions.
- \* modules/linux/vmhgfs/\*: code cleanups, properly initialize the list head, and allow receives to timeout so that hibernation works.
- \* modules/linux/vmxnet/vmxnet.c, modules/linux/vmxnet3/vmxnet3\_drv.c: fix drivers for kernels 2.6.29+.
- \* modules/linux/vmxnet3/\*: add shared memory support for faster communication between user space and the device backend; this doesn't affect the regular driver functionality, but is used by some VMware code not part of Tools.
- \* modules/linux/vsock/\*: fix an issue where it was possible for users to send VMCI datagrams directly to the hypervisor.
- \* scripts/common/vmware-user.desktop: work around a bug in KDE where desktop files with "NoDisplay" fail to autostart.
- \* scripts/freebsd/suspend-vm-default: use netif to bring down interfaces, since dhclient doesn't understand "-r" in the default install.
- \* services/plugins/vmbackup/\*: add some new code used by enhancements being done in the Win32 version of the plugin.
- \* services/vmtoolsd/mainPosix.c: fix running in background when executing vmtoolsd while relying on PATH.
- \* services/vmtoolsd/Makefile.am: point to the correct plugin install directory.
- \* toolbox/\*: better command line handling in the CLI utility, plus some code cleanup.
- \* vmware-user/copyPaste.c, vmware-user/copyPasteDnDWrapper.cpp, vmware-user/copyPasteDnDWrapper.h, vmware-user/dnd.c: properly unregister RPCs to avoid multiple registrations (and the ensuing ASSERT) in certain cases.

\* vmware-user/copyPasteUI.{cpp,h}: change way data is retrieved from the clipboard, using the gtk+ clipboard wait APIs (which turn out to be more reliable than the previous approach).

2009-06-18 Marcelo Vanzin <mvanzin@vmware.com>

\* Resync with internal trunk (2009.06.15)

\* docs/api/Makefile.am: replace all variables in the doxygen conf file with the correct values.

\* lib/appUtil/appUtilX11.c: try alternate file extensions during icon search. Sometimes a package lists its icon as icon-foo.png, but the package didn't include icon-foo.png. Instead, it included icon-foo.xpm. Ex: Ubuntu

8.04's hwtest.

\* lib/guestApp/guestAppPosixX11.c: change detection of the default browser so that the new help system works; the help files are not yet available in open-vm-tools.

\* lib/hgfs/\*, lib/include/cpName.h, lib/include/cpNameLite.h, lib/include/hgfsUtil.h: avoid compiling certain parts of the source in kernel modules.

\* lib/hgfsServer/\*: return correct error when files / directories don't exist.

\* lib/include/hgfsChannel.h, modules/linux/vmhgfs/\*: added support for vsock channel for HGFS.

\* lib/include/util.h, lib/misc/utilMem.c: un-inline a bunch of functions to reduce the size of binaries.

\* lib/include/vm\_tools\_version.h: bumped Tools version.

\* lib/resolution/resolutionX11.c: fix for issue where the host would send a "topology set" command with a top-left corner that was not (0, 0) and cause the screen to be reconfigured in the wrong way.

\* lib/unity/unityPlatformX11Window.c: check for errors in calls to XQueryTree.

\*

lib/wiper/wiperPosix.c: check return of fgets() to avoid compiler warnings.

\* libvmtools/vmtools.c: fix initialization of wiper library on Win32.

\* modules/Makefile.am: install vsock header file on Linux.

- \* modules/freebsd/vmhgfs/\*, modules/linux/vmci/\*, modules/linux/vsock/\*: changes related to 64-bit Mac drivers, don't affect either the FreeBSD or Linux drivers.
- \* modules/linux/vmhgfs/hgfs.h: removed duplicate file.
- \* modules/linux/vmhgfs/fsutil.c, modules/linux/vmhgfs/inode.c, modules/linux/vmhgfs/module.h: fix issue where two files would get the same inode number in some situations.
- \* modules/linux/vmxnet/vmxnet.c: re-probe vmxnet2 device features on resume from hibernate, to cover the case where a VM is resumed on a platform with a different version of the device backend (bug #2209565).
- \* scripts/resume-vm-default, scripts/suspend-vm-default: use NetworkManager to handle networking where it is available.
- \* services/plugins/hgfsServer/Makefile.am, services/plugins/vix/Makefile.am: fix installation of vmusr plugins that are shared with vmsvc.
- \* services/plugins/timeSync/timeSync.c: fix backwards time sync.
- \* services/vmtoolsd/cmdLine.c, toolbox/toolbox-cmd.c: print build number as part of "-v" output.
- \* toolbox/toolboxcmd-shrink.c: correctly ignore unsupported partitions when shrinking.
- \* toolbox/toolbox-gtk.c: changes for the new help system, not yet available for open-vm-tools.
- \* toolbox/toolboxInt.{c,h}, toolbox/toolboxScripts.c: some code refactoring.
- \* vmware-user/Makefile.am: fix linking when compiling without gtkmm.

2009-05-22 Marcelo Vanzin <mvanzin@vmware.com>

- \* Resync with internal trunk (2009.05.18)
- \* configure.ac, m4/vmtools.m4: check for PAM and enable PAM support when available.
- \* configure.ac, services/plugins/\*/Makefile.am, tests/\*/Makefile.am: avoid the "-rpath" hack to create plugins, using plugin\_LTLIBRARIES instead (and manually fixing things when necessary). Thanks to Dominique Leuenberger for the suggestion (and sample patch).

- \* docs/api/Makefile.am: fix doc target directories.
- \* configure.ac, lib/Makefile.am, lib/deployPkg/\*, lib/include/deployPkg.h: remove the deployPkg code, which depends on some VMware code that is not yet open source.
- \* lib/backdoor/\*, lib/hgfs/\*, lib/hgfsBd/\*, lib/include/\*, lib/include/compat/\*, lib/message/\*, lib/misc/dbllnk1st.c, lib/rpcOut/rpcout.c: as part of sharing code between user-level code and kernel modules, some files have been tagged with more than one license.
- \* lib/dndGuest/\*, lib/include/dndBase.h, lib/include/dndMsg.h, lib/include/unity\*, lib/unity/unityPlatformX11.c: implement mouse movement from within the guest; this avoids a dependency on "unofficial" mouse APIs in the VMware host code, making DnD more reliable, and makes a few things (such as cancelling an ongoing DnD operation) easier.
- \* lib/file/filePosix.c: make File\_FullPath()'s behavior consistent when the input path starts with a '/
- \* lib/ghIntegration/ghIntegration.c: send more info about the "start menu" contents to the host (only usable for Windows guests).
- \* lib/ghIntegration/ghIntegrationX11.c: prettify the category names of menu items. This is a temporary solution before actually reading this information from .desktop files.
- \* lib/guestApp/guestApp.c, libguestlib/vmGuestLib.c, lib/include/guestApp.h, toolbox/toolbox-gtk.c, vmware-user/foreignVM\*, vmware-user/vmware-user.cpp, configure.ac, lib/Makefile.am, lib/include/socketMgr.h, lib/socketMgr.\*: remove code related to "foreign VM" support, which was never really used.
- \* lib/guestInfo/guestInfo.c, lib/include/wiper.h, lib/wiper/wiperPosix.c: properly report disk info for LVM volumes.
- \* lib/hgfsServer/hgfsDirNotify\*, lib/hgfsServer/hgfsServer.c: add support for directory / file monitoring. It's currently only implemented on Mac OS X.
- \* lib/hgfsServer/hgfsServer\*: fix issue where it was possible to create a file on a read-only share on Windows hosts.
- \* lib/hgfsServer/hgfsServer\*, lib/hgfsServerManagerGuest/\*, lib/include/hgfs\*.h, services/plugins/hgfsServer/hgfsPlugin.c, services/plugins/vix/foundryToolsDaemon.c: some refactoring caused by the

work to make HGFS support pluggable transports.

\* lib/include/procMgr.h, lib/procMgr/procMgrPosix.c:  
remove ProcMgr\_GetAsyncStatus().

\* lib/include/vmsupport.h, scripts/vm-support, xferlogs/xferlogs.c,  
services/plugins/guestInfo/guestInfoServer.c: new feature to automatically  
collect support data from the guest from the VMware UI.

\* lib/panicDefault/\*, lib/user/\*: change file names to avoid clash with  
another file (Mac OS linker doesn't really like that).

\* lib/rpcChannel/rpcChannel.c: try to reinitialize the outbound channel on  
failure.

\* lib/vixTools/vixTools.c, lib/include/vixCommands.h,  
lib/include/vixOpenSource.h: add backend for new VIX API call to list the  
guest's filesystems.

\*

libvmtools/vmtoolsLog.c: lazily open the log file, instead of opening it  
during configuration of the log system. This way two processes can use the  
same conf file and not overwrite each other's log files (assuming the conf  
data is sane).

\* modules/Makefile.am, modules/linux/vmci/Makefile.kernel,  
modules/linux/vsock/Makefile.kernel: don't store VMCI module symbols in  
/tmp during build; this avoids a possible symlink attack that could cause  
data to be overwritten when building open-vm-tools.

\* modules/\*/\*, vmblock-fuse/\*: remove a lot of duplicated files by either  
moving them to a shared location or reusing files that were already  
available elsewhere.

\* modules/freebsd/vmblock/subr.c, modules/freebsd/vmblock/vmblock\_k.h,  
modules/freebsd/vmblock/vnoops.c: fix a possible kernel crash caused by  
trying to read / write to the mount point (something vmware-user does to  
detect whether it's using fuse or non-fuse vmblock).

\* modules/linux/pvscsi/\*: adds  
support for a generic msg framework that is  
currently used to deliver hot-plug/unplug notifications; get rid of a few  
divisions; fix a bug where pvscsi\_probe could return 0 (aka success) if  
a call to kmalloc() failed; remove a few unused fields.

\* modules/linux/shared/vmci\*: mostly changes related to the host VMCI drivers  
(removed user-level queue-pair daemon, added support for trusted VMCI  
endpoints) to keep binary compatibility between the host and guest VMCI



drivers.

\* modules/linux/hgfs/inode.c: check host's access rights when checking file permissions, so that permissions are correctly checked when the guest's user id is different from the host's user id.

\* modules/linux/bdhandler.\*, modules/linux/filesystem.c; modules/linux/tcp.\*, modules/linux/transport.\*,: postpone opening the channels so that module can load successfully even if shared folders are disabled on the host; fix a synchronization problem between recv and close/open; allow

hibernation to work by timing out the recv thread; correctly handle failures in recv, including injecting a dummy error to the pending requests when the recv thread exits; move the recv code to the channel's implementation so that it can be simpler.

\* modules/linux/vmxnet3/vmxnet3.c, modules/linux/shared/compat\_pci.h: fix Wake-On-LAN for 2.6.27 and newer Linux guests.

\* modules/linux/vsock/linux/\*: changes to support trusted VMCI host apps; pull out notification and stats logging code into their own files.

\* modules/solaris/vmhgfs/vnode.c: do not substitute errors returned by uiomove() calls with EIO, propagate returned error code (which is EFAULT) up the stack.

\* services/vmtoolsd/Makefile.am, scripts/common/linux/pam.d/vmtoolsd-x64, scripts/common/linux/pam.d/64/vmtoolsd: install the 64-bit PAM config file with the correct name.

\* services/plugins/powerOps/powerOps.c: fix running default scripts by making sure the path to the script is absolute.

\*

services/vmtoolsd/Makefile.am, services/vmtoolsd/pluginMgr.c: use info from the configure step to define the plugin path; this avoids requiring a symlink to be placed in /etc/vmware-tools for vmtoolsd to be able to find the plugins.

\* services/vmtoolsd/toolsRpc.c: send the build information to the host so it's logged in the VM's logs.

\* toolbox/toolbox-cmd.c, toolbox/toolboxcmd-\*, toolbox/toolboxCmdInt.h: make string comparison case-insensitive on Win32.

\* toolbox/toolboxcmd-shrink.c: properly finish the shrinking process by sending the "disk.shrink" RPC to the host.

- \* toolbox/toolboxScripts.c: fix showing default settings for power ops scripts (should show default script enabled, not script disabled).
- \* vmblock-fuse/Makefile.am: fix compilation on FreeBSD.
- \* vmware-user/copyPasteUI.cpp: disallow copy-paste text of size greater than 4MB, instead of truncating the data.
- \* vmware-user/dndUI.\*, lib/dndGuest/dnd.cc, lib/include/dndBase.h: remove drag timeout callback (which was not needed), and add new signal to indicate that a GH DnD was cancelled.
- \* vmware-user/Makefile.am: remove C++ link hack (not needed now since vmware-user has C++ code already).

2009-04-23 Marcelo Vanzin <mvanzin@vmware.com>

- \* Resync with internal trunk (2009.04.17)
- \* configure.ac, Makefile.am, docs/\*: build API docs for vmtools; the documentation files are provided under a BSD-style license.
- \* configure.ac, Makefile.am, guestd/\*, lib/Makefile.am, lib/guestInfo/\*, lib/include/vmbackup\_def.h, lib/include/vmBackup.h, lib/vmBackupLib/\*, libvmtools/Makefile.am, services/plugins/vmbackup/vmbackup\_def.h: remove guestd from open-vm-tools, and clean up code in other places that was only there because of guestd.
- \* configure.ac, modules/solaris/vmblock/\*, modules/solaris/vmmemctl/\*: add Solaris vmblock and vmmemctl driver sources. The vmmemctl module also includes a user-level daemon (vmmemctld.c).
- \* lib/conf/conf.c, lib/include/conf.h, libvmtools/vmtoolsConfig.c: remove unused config options.
- \* lib/deployPkg/toolsDeployPkg.h: code refactoring.
- \* lib/dnd/dndClipboard.c: if size of clipboard exceeds the maximum backdoor packet size, only keep text data (dropping the RTF data).
- \* lib/dnd/dndLinux.c, lib/include/dnd.h, lib/include/vmblock.h, vmware-user/copyPaste.c, vmware-user/dnd.c, vmware-user/vmware-user.cpp, vmware-user/vmwareuserint.h, vmware-user-suid-wrapper/main.c: detect whether plain vmblock or vmblock-fuse is being used, allowing the same executable to be used with either.
- \* lib/dndGuest/\*, vmware-user/copyPaseDnDWrapper.{cpp,h},

vmware-user/dndUI.{cpp,h}, vmware-user/dragDetWnd.{cpp,h}:  
vmware-user/vmware-user.cpp: more DnD V3 protocol work.

\* lib/ghIntegration/\*, lib/include/guestCaps.h, lib/include/unityCommon.h:  
work related to mapping Outlook folders over HGFS and exposing the Windows  
Recycle Bin to the host (doesn't really affect open-vm-tools).

\*

lib/ghIntegration/ghIntegrationX11.c: restore the native environment when  
launching external applications. This doesn't really affect open-vm-tools.

\* lib/guestRpc/\*, vmware-user/copyPasteUI.{cpp,h}: implement RTF and file  
contents copy & paste.

\* lib/include/circList.h, lib/include/vm\_basic\_math.h,  
lib/include/vm\_device\_version.h, modules/linux/\*, modules/Makefile.am:  
changes to share files between the user space code and the kernel code,  
instead of duplicating the same source files in different places.

\* lib/include/rpcChannel.h, lib/rpcChannel/\*, tests/testDebug/testDebug.c,  
test/vmrpcdbg/debugChannel.c: some code cleanup, and fix crash when dealing  
with multiple reset messages.

\* lib/include/system.h, lib/system/systemLinux.c,  
services/vmtoolsd/mainPosix.c: remove System\_Daemon() (replaced with  
Hostinfo\_Daemonize()).

\* lib/include/unityCommon.h, lib/unity/\*: resurrect UNITY\_RPC\_WINDOW\_SHOW  
and UNITY\_RPC\_WINDOW\_HIDE RPCs.

\* lib/procMgr/procMgrPosix.c:  
fix ProcMgr\_IsProcessRunning().

\* lib/system/systemLinux.c: fix shutdown / reboot commands on Solaris; fix  
rebuilding of native environment from variables set by VMware scripts (this  
last one doesn't really affect open-vm-tools).

\* lib/unicode/unicodeSimpleTypes.c: speed up UnicodeIANALookup, and fix case  
where C++ constructors could call UnicodeIANALookup before Unicode\_Init()  
was called by lazily creating the internal cache.

\* libguestlib/\*: link libguestlib against libvmtools. This avoids having  
two definitions of certain symbols (like Debug()) when an application  
links to both libraries.

\* modules/linux/vmblock/linux/control.c: only set directory entry owner when  
needed.

\* modules/linux/vmhgfs/bdhandler.{c,h}, modules/linux/vmhgfs/dir.c, modules/linux/vmhgfs/file.c, modules/linux/vmhgfs/filesystem.c, modules/linux/vmhgfs/fsutil.c, modules/linux/vmhgfs/inode.c, modules/linux/vmhgfs/module.{c,h}, modules/linux/vmhgfs/page.c, modules/linux/vmhgfs/request.{c,h}, modules/linux/vmhgfs/super.c, modules/linux/vmhgfs/tcp.{c,h}, modules/linux/vmhgfs/transport.{c,h}: cleanup use of atomic variables in HGFS; add a transport abstraction layer, and add an initial version of a socket-based transport (not yet stable and not yet supported by any released VMware product).

\* modules/linux/vmxnet3/vmxnet3.c: fix build on kernel 2.6.29.

\* modules/linux/vsock/af\_vsock.c: export more functions to other kernel modules; some changes to statistics gathering code.

\* modules/solaris/vmhgfs/filesystem.c: make module loadable on Solaris 9.

\* modules/solaris/vmhgfs/vnode.c: unify mapping of HGFS to Solaris error codes.

\* scripts/\*: restart network before running user scripts in resume scripts.

\* services/plugin/powerOps/powerOps.c: fix running default power scripts.

\* services/vmtoolsd/pluginMgr.c: better error logging.

\* toolbox/toolbox-cmd.c: fix help string.

\* vmblock-fuse/block.c: fix vmblock-fuse compilation on FreeBSD.

2009-03-18 Marcelo Vanzin <mvanzin@vmware.com>

\* Resync with internal trunk (2009.03.13)

\* configure.ac: check for FreeBSD kernel tree when building modules; warn about which version of make to use when building kernel modules on FreeBSD and Solaris; add compiler defines for identifying Solaris 9 and 11.

\* configure.ac, modules/Makefile.am: handle SYSDIR on FreeBSD.

\* guestd/main.c, modules/solaris/vmhgfs/Makefile: remove HGFS-related that is now obsolete with the recent changes to the HGFS module on Solaris.

\* guestd/toolsDaemon.c: default to the configuration dir when the power script path is not absolute.

\* guestd/toolsDaemon.c, lib/include/guestInfo.h, lib/netUtil/netUtilLinux.c:

handle case when all network interfaces have been disabled and send an "unknown" IP address to the host.

\* `guestd/toolsDaemon.c`, `services/vmtoolsd/toolsRpc.c`: always send `TOOLS_VERSION_UNMANAGED` from an open-vm-tools build, so there's no need for a config file option anymore.

\* `hgfsclient/*`: make it link to `libvmtools` to avoid code duplication.

\* `lib/appUtil/appUtil.c`: update list of "skippable" apps when figuring out an application's path.

\* `lib/auth/authPosix.c`, `scripts/linux/pam.d/*`, `guestd/Makefile.am`, `services/vmtoolsd/Makefile.am` : change the name of the PAM application to "vmtoolsd" to reflect the new service name.

\* `lib/dnd/dndFileContentsUtil.h`, `lib/dnd/dndInt.h`, `lib/dndGuest/*.hh`, and corresponding files in `lib/include`: relocate private headers.

\* `lib/ghIntegration/ghIntegration.c`, `lib/ghIntegration/ghIntegrationInt.h`, `lib/ghIntegration/ghIntegrationX11.c`, `lib/include/unityCommon.h`: glue code for Outlook mirrored folder, which does not affect open-vm-tools.

\* `lib/guestRpc/guestlibV3.x`, `lib/include/vmGuestLib.h`, `libguestlib/vmGuestLib.c`: add new `guestlib` counters.

\* `lib/include/conf.h`, `toolbox/toolbox-gtk.c`: remove the need for the "helpdir" config option; this doesn't really affect open-vm-tools since the help files are not yet included.

\* `lib/include/guest_os.h`, `lib/misc/hostinfoPosix.c`: more guest OS names; fix name used to identify Solaris to match what VMware's host code expects.

\* `lib/include/guestStats.h`: documentation changes.

\* `lib/include/hostinfo.h`, `lib/user/hostinfoPosix.c`: add a new function that behaves like `daemon(3)`, but is more Mac OS-friendly.

\* `lib/include/toolsLogger.h`, `lib/Makefile.am`, `lib/toolsLogger/*`: removed library, which is not used anymore.

\* `lib/include/vm_basic_types.h`, `lib/misc/timeutil.c`: fixes to compile under (Open) Solaris 11.

\* `lib/include/vmtoolsApp.h`, `services/plugins/vmbackup/stateMachine.c`, `services/vmtoolsd/mainLoop.c`, `services/vmtoolsd/mainPosix.c`,

services/vmtoolsd/serviceObj.c, services/vmtoolsd/toolsCoreInt.h: add new signal handler to gather debugging information from a running vmtoolsd instance.

\* lib/misc/posixPosix.c: fix off-by-one error.

\* lib/unity/unity.c, lib/unity/unityPlatform.h,  
lib/unity/unityPlatformX11.c,

lib/unity/unityPlatformX11Settings.c: always send Unity updates using RPCI; this avoids a possible race between replying to an incoming RPC and sending an Unity update from a different thread; also, API documentation updates.

\* lib/unity/unityPlatformX11.c: verify the DnD detection window was initialized before actually using it.

\* lib/unity/unityPlatformX11Settings.c, lib/unity/unityPlatformX11Window.c: reset `_NET_WM_DESKTOP` as necessary before exiting Unity; this could cause guest taskbars to disappear when in Unity mode.

\* lib/unity/unityPlatformX11.c, lib/unity/unityPlatformX11Window.c,  
lib/unity/unityX11.h: examine `WM_CLIENT_LEADER` when gathering application information; certain applications use this property to define the window where the `WM_COMMAND` property should be.

\* lib/vixTools/vixTools.c: do not follow symlinks when deleting files in the guest using the VIX API.

\* lib/vmtools/vmtools.c,

lib/vmtools/vmtoolsLog.c: allow the logging subsystem to be re-configured, and clean up the logging data when unloading the library; allow `{USER}` and `{PID}` to be used in log file paths.

\* modules/freebsd/vmblock/subr.c, modules/freebsd/vmblock/vnops.c: fix kernel panic on FreeBSD 7.

\* modules/linux/\*/Makefile: remove GCC version check.

\* modules/linux/\*/compat\_wait.h: fix `COMPAT_DEFINE_WAIT` for "vanilla" 2.4 kernels.

\* modules/linux/vmhgfs/Makefile.normal: fix build of HGFS module on 2.4 kernels.

\* modules/linux/vmxnet/\*, modules/linux/vmxnet3/\*: avoid using compat functions when they're not needed; add compatibility functions for newer Linux kernels.

\* modules/linux/vsock/linux/af\_vsock.c: fix two races; one when the socket

state changed between calls to VsockVmciRecvStreamCB and VsockVmciRecvPktWork, and another when trying to read from the socket after a RST arrived after the socket got a detach notification.

\* modules/solaris/vmxnet3/\*:

add Solaris vmxnet3 driver.

\* rpctool/\*: add "rpctool", a simple, stand-alone tool to send RPC commands to the host software.

\* services/plugins/guestInfo/guestInfoServer.c: don't cache configuration data.

\* services/plugins/guestInfo/perfMonLinux.c: fix problem with overwriting flags after GuestInfoMonitorReadMeminfo() was called. (Same as fix to lib/guestInfo on previous release.)

\* services/plugins/powerOps/powerOps.c: handle power ops-related options sent from the host.

\* services/vmtoolsd/mainLoop.c: handle re-loading the configuration file.

\* services/vmtoolsd/mainPosix.c: exec after forking on Mac OS, since CoreFoundation classes don't work after a fork.

\* services/vmtoolsd/pluginMgr.c: allow both 32 and 64 bit plugins to be installed on Solaris by loading them from the appropriate directory; add library loading code that is not really needed (nor used) in open-vm-tools.

\* services/vmtoolsd/toolsRpc.c: send another "capability" the host expects from Tools.

\* toolbox/toolbox-gtk.c: add F1 shortcut to invoke help.

\* toolbox/toolboxScripts.c: fix issue with freeing data that should not be freed.

\* vmware-user/\*: implement the new DnD protocol (V3).

2009-02-18 Marcelo Vanzin <mvanzin@vmware.com>

\* Resync with internal trunk (2009.02.13)

\* configure.ac, m4/vmtools.m4: clean up a lot of the library detection code.

\* configure.ac: remove support for gtk+ 1.2 (code already depended on it in

any case); enforce need for glib 2.6.0 or later due to new code being added; add detection for gtkmm; check for C++ compiler when it's needed; reorder the include path to avoid clashing with system headers in some situations.

\* guestd/foundryToolsDaemon.\*, vmware-user/foundryToolsDaemon.\*, guestd/Makefile.am, vmware-user/Makefile.am: moved shared source files to a new place to avoid duplication.

\* hgfsmounter/hgfsmounter.c: add support for Solaris.

\* lib/appUtil/appUtilX11.c: fix loading of icons when the name has a period.

\* lib/dnd/dndClipboard.c, lib/dnd/dndInt.h, lib/dnd/dndMsg.c, lib/dnd/Makefile.am, lib/dndGuest/\*, lib/include/copyPasteBase.h, lib/include/copyPaste.hh, lib/include/copyPasteRpc.hh, lib/include/copyPasteRpcV3.hh, lib/include/dndBase.h, lib/include/dndClipboard.h, lib/include/dndFileContentsUtil.h, lib/include/dndFileList.hh, lib/include/dnd.h, lib/include/dnd.hh, lib/include/dndInt.h, lib/include/dndMsg.h, lib/include/dndRpc.hh, lib/include/dndRpcV3.hh, lib/include/dndTransportGuestRpc.hh, lib/include/dndTransport.hh, lib/include/libExport.hh, vmware-user/copyPaste.cpp, vmware-user/copyPasteUI.{cpp,h}, vmware-user/copyPasteV3.h, vmware-user/copyPasteWrapper.{cpp,h}, vmware-user/dnd.cpp, vmware-user/Makefile.am, vmware-user/vmware-user.{c,cpp}, vmware-user/vmwareuserInt.h, vmware-user/stringxx/string.{cc,hh}, vmware-user/stringxx/ubstr\_t.hh: add support for new version of the DnD protocol.

\* lib/guestInfo/guestInfoPerfMonLinux.c: fix problem with overwriting flags after GuestInfoMonitorReadMeminfo() was called.

\* lib/guestRpc/guestlibV3.x, lib/include/vmGuestLib.h, libguestlib/vmGuestLib.c: add new host stats.

\* lib/guestRpc/Makefile.am: fix a few compatibility issues with non-GNU versions of make.

\* lib/hgfsServer/hgfsServer.c, lib/hgfsServer/hgfsServerInt.h, lib/hgfsServer/hgfsServerLinux.c, \*/hgfsProto.h, modules/freebsd/vmhgfs/vnops.c, modules/freebsd/vmhgfs/vnopscommon.{c,h}: don't trust the local VFS layer, check the HGFS server to see if an operation would succeed.

\* lib/include/rpcChannel.h, lib/rpcChannel/\*: add new Guest RPC channel abstraction library used by the new "core services" code.



- \* lib/include/vmrpcdbg.h, tests/\*: add test code from the "core services" project.
- \* lib/include/vmtoolsApp.h, lib/include/vmtoolsd\_version.h, services/vmtoolsd/\*: add "vmtoolsd", the new service "shell" used in the "core services" project.
- \* lib/unity/unityPlatformX11Window.c:  
don't send initial "region" updates for shaped windows. This works around an issue where resizing a shaped window would not work as expected in Unity mode.
- \* lib/wiper/wiperPosix.c: fix major number detection for disks on newer Linux kernels.
- \* libvmtools/Makefile.am: link more libraries needed by vmtoolsd and the new plugins.
- \* modules/linux/pvscsi/pvscsi.c, modules/linux/pvscsi/pvscsi\_version.h: use PCI-specific memory allocation functions and update driver version.
- \* modules/linux/vmci/vmciKernelIf.c: disable queue pair support in the host version of the driver on older Linux kernels. This doesn't affect the guest driver.
- \* modules/linux/vmci/vmci\_queue\_pair.h: implement MSG\_PEEK support on Linux driver.
- \* modules/linux/vmhgfs/bdhandler.c, modules/linux/vmhgfs/compat\_sched.h, modules/linux/vmmemctl/os.c: fix issue with HGFS module interfering with suspend / hibernation on newer Linux kernels (bug #2523263).
- \*  
modules/linux/vmhgfs/compat\_cred.h, modules/linux/vmhgfs/file.c, modules/linux/vmhgfs/filesystem.c, modules/linux/vmhgfs/inode.c: changes for compatibility with newer Linux kernels, where it's not possible to change fsuid/capabilities directly anymore.
- \* modules/linux/vmhgfs/compat\_pagemap.h, modules/linux/vmhgfs/page.c: fix warning, and compatibility changes for newer Linux kernels (2.6.28.1 and newer; bug #2530616).
- \* modules/linux/vmhgfs/inode.c: fix creation of symlinks (bug #2531303).
- \* modules/linux/vmxnet/vmxnet.c: use PCI-specific memory allocation functions.

\* modules/linux/vmxnet/vmxnet.c, modules/linux/vmxnet3/vmxnet3.c: add option to disable LRO.

\* modules/linux/vsock/af\_inet.{c,h}, modules/linux/vsock/util.{c,h}: add MSG\_PEEK support; remove ifdefs that were disabling support for queue pairs on the host kernel module; fix compilation with certain versions of gcc (bug #2531283).

\* modules/solaris/vmhgfs/\*: move backdoor handling code to the HGFS driver; this makes the user-level code to handle the driver (currently in vmware-guestd) obsolete.

\* modules/solaris/vmxnet/\*: add vmxnet driver for Solaris, under the CDDL.

\* services/plugins/\*: add all currently available "core services" plugins. The current set of plugins provide the functionality available in vmware-guestd; there are a few plugins that replace functionality from vmware-user, but not all features are ported yet (and vmtoolsd - with vmware-user plugins - and vmware-user cannot run at the same time).

\* toolbox/toolboxAbout.c: fix the copyright character.

\* toolbox/toolbox-cmd.c: reword a few messages, fix typos.

\* toolbox/toolboxCmdInt.h, toolbox/toolboxcmd-record.c, toolbox/toolbox-gtk.c, toolbox/toolboxRecord.c: remove the "record" functionality from tools (due to internal request).

\* toolbox/toolboxInt.c, toolbox/toolboxScripts.c, toolbox/toolbox-scripts.c: changes to use the new config file format used by the "core services" code.

\* \*/Makefile.am: make sure 'rm' and 'mv' are being used instead of \$(RM) and \$(MV) (which are not defined by automake; bug #2492040).

2009-01-21 Marcelo Vanzin <mvanzin@vmware.com>

\* Resync with internal trunk (2009.01.19)

\* configure.ac: detect the presence of FUSE libraries.

\* configure.ac, Makefile.am: compile kernel modules for Solaris, and vmblock-fuse module if FUSE is available.

\* lib/ghIntegration/ghIntegrationX11.c: retrieved localized application names.

\* lib/guestInfo/guestInfo.c, lib/guestInfo/guestInfoPosix.c,

lib/include/hostinfo.h, lib/misc/hostinfo\_misc.c, lib/misc/hostinfoPosic.c,  
lib/vixTools/vixTools.c: refactoring to move code shared with other VMware  
products to a common library.

- \* lib/guestRpc/guestlibV3.x, lib/guestRpc/Makefile.am,  
lib/include/vmGuestLib.h, libguestlib/\*: add new iteration of the  
"guestlib" protocol. This is a more extensible solution than the current  
protocol, and should make it easier  
to add new information when needed.
- \* lib/include/dynarray.h, lib/include/dynbuf.h, lib/misc/dynarray.c,  
lib/misc/dynbuf.c: make some DynArray/DynBuf functions inline for speed.
- \* lib/include/unityCommon.h: more documentation about the Unity protocol.
- \* lib/unity/unityPlatformX11.c: fix Unity<->guest desktop ID mappings.
- \* libvmtools/vmtoolsLog.c: change the way log domains are configured; now  
sub-domains inherit the default handler for the app if no handler is  
specified.
- \* modules/freebsd/vmhgfs/state.c, modules/freebsd/vmhgfs/state.h,  
modules/freebsd/vmhgfs/vnopscommon.{c,h}: implement support for mmap on  
the Mac OS driver, which allows running executables from an HGFS  
share. The FreeBSD module still does not support this functionality.
- \* modules/freebsd/vmhgfs/transport.{c,h}: refactoring for sharing structure  
definitions.
- \* modules/linux/pvscsi/pvscsi.c, modules/linux/vmblock/linux/module.c,  
modules/linux/vmci/vmci\_drv.c, modules/linux/hgfs/module.c,  
  
modules/linux/vmmemctl/os.c, modules/linux/vmsync/sync.c,  
modules/linux/vmxnet/vmxnet.c, modules/linux/vmxnet3/vmxnet3.c: add support  
for Novell's proprietary module info tag ("supported").
- \* modules/linux/vmci/vmciKernelIf.c: add support for VMCI queue pairs on  
the host. This does not affect the driver when it runs inside virtual  
machines.
- \* modules/linux/vmci/\*.h, modules/linux/vsock/\*.h: some changes in the common  
code to support Mac OS X, and also queue pairs on the Solaris VMCI module.
- \* modules/linux/vsock/af\_vsock.{c,h}: add functions for registering with  
the vsock driver from within the kernel.
- \* modules/linux/\*/Makefile: add \$(LINUXINCLUDE) to the compiler flags; this  
allows compiling the modules against recent kernels which removed that

from \$(KBUILD\_CPPFLAGS).

- \* modules/Makefile.am: add support for compiling Solaris kernel modules.
- \* modules/solaris/vmhgfs/\*: initial release of the Solaris HGFS driver in open-vm-tools. Driver is licensed under the CDDL 1.0.
- \* vmblock-fuse/\*: add the user-level implementation of the vmblock driver, which is build on top of FUSE, to open-vm-tools. vmware-user hasn't yet been modified to use this version of vmblock.
- \* vmware-user/copyPaseV3.h: new header introduced during development of the next version of copy paste / DnD for X11 platforms.

2008-11-23 Marcelo Vanzin <mvanzin@vmware.com>

- \* Resync with internal trunk (2008.12.19)
- \* configure.ac, \*/Makefile.am: standardize on using libtool archives for the libraries. This also means several makefiles were removed, since there's no need to build two archives of the same library anymore.
- \* configure.ac: add logic to detect glib 2.6; this is the minimum version required by the "Core Services" project. Currently it's an optional dependency.
- \* configure.ac: disable Unity when user specifies --disable-multimon.
- \* configure.ac: actually build the pvscsi modules if the detected kernel version supports it.
- \* configure.ac, Makefile.am, lib/guestInfo/Makefile.am, lib/stubs/Makefile.am, libvmtools/\*, lib/include/vmtools.h: add the "vmtools" shared library used in the "Core Services" project. The library is a collection of a lot of other libraries used by most VMware Tools programs, and adds some functionality on top of glib that is used in the "Core Services" project. Currently no other components from that project are available as part of open-vm-tools.
- \* lib/deployPkg/deployPkgLog.h, lib/deployPkg/toolsDeployPkg.h: moved private headers out of the public header directory.
- \* lib/guestRpc/Makefile.am, modules/Makefile.am: fix the makefiles so that it's possible to build open-vm-tools from a directory different from the source dir.

- \* lib/hgfsServer/hgfsServer.c: changes to support aliases on Mac OS hosts.
  - \* lib/hgfsServer/hgfsServerLinux.c: changes to map Windows attributes to Mac OS FileInfo.
  - \* lib/include/circList.h: removed unused file.
  - \*  
lib/include/unityCommon.h, lib/unity/unity.c: changes to add documentation to various application RPCs used in Tools.
  - \* lib/misc/posixPosix.c, toolbox/toolboxScripts.c: fix include path for syslimits.h on FreeBSD.
  - \* lib/unity/unityPlatformX11.c: better detection of the guest's work area boundaries; fixes a problem when dragging a Window in Unity mode with the host's task bar on the left/right of screen would result in weird behavior.
  - \* lib/unity/unityPlatformX11Settings.c, lib/unity/unityPlatformX11Window.c, lib/unity/unityX11.h: preserve the \_NET\_WM\_DESKTOP setting when hiding windows; this fixes a problem where hiding a panel and later restoring it would result in the wrong \_NET\_WM\_DESKTOP property being set for the panel, causing it to only display on the first virtual desktop.
  - \* modules/linux/vmci/\*: minor changes related to internal development of the Mac OS drivers.
  - \* modules/linux/vmhgfs/page.c: fix HGFS driver for kernel 2.6.28.
  - \*  
modules/linux/vsock/linux/af\_vsock.c: added code to gather some performance statistics for the driver.
  - \* toolbox/toolbox-gtk.c: a few fixes to the help functionality.
  - \* vmware-user/vmware-user.c, vmware-user-suid-wrapper/main.c: change the "blockFd" argument to have an extra dash so it follows the convention of common command line parsing libraries.
  - \* Other bug fixes and changes in shared code that don't affect open-vm-tools.
- 2008-11-18 Marcelo Vanzin <mvanzin@vmware.com>
- \* Resync with internal trunk (2008.11.14)
  - \* lib/include/vm\_version.h: Bumped TOOLS\_VERSION.
  - \* guestd/toolsDaemon.c, lib/include/vm\_app.h: changes related to host-side

configuration of power operations.

\* hgfsclient/hgfsclient.c, lib/dnd/dndCommon.c, lib/dnd/dndLinux.c, lib/hgfs/\*, lib/hgfsServer/\*, lib/include/cpName.h, lib/include/dnd.h, lib/include/hgfsEscape.h, lib/include/staticEscape.h, modules/\*/vmhgfs/\*, vmware-user/dnd.c: refactor the HGFS character escaping code; escape

invalid characters when the sender allows characters in the file name that the receiver does not allow.

\* lib/hgfsServer/hgfsServerLinux.c: return proper error code when the remote path points to a non-existent directory.

\* lib/deployPkg/deployPkg.c, lib/deployPkg/deployPkgLog.c, lib/include/deployPkg.h, lib/include/rpcin.h, lib/rpcin/rpcin.c: refactoring for the Tools Core Services project.

\* lib/dnd/dndCommon.c: don't ASSERT if the staging directory is not actually a directory.

\* lib/dynxdr/xdrutil.c, lib/include/xdrutil.h: more XDR-related utility functions.

\* lib/file/file.c, lib/file/fileLockPrimitive.c, lib/include/vm\_basic\_defs.h: replace use of strtok with strtok\_r.

\* lib/guestApp/guestApp.c, lib/include/guestApp.h: more utility functions.

\* lib/guestApp/guestApp.c, lib/include/backdoor\_def.h, vmware-user/pointer.c: add the ability to detect whether the mouse hardware can be used in absolute mode, which allows for auto grab / auto ungrab to work.

\* lib/guestInfo/guestInfo.c, lib/guestInfo/guestInfoPosix.c, lib/guestRpc/nicinfo.x: provide the prefix length of an IPv6 address in a separate field of the NicInfo struct.

\* lib/guestInfo/guestInfoPerfMonLinux.c: reduce log spew.

\* lib/guestInfo/guestInfoServer.c, lib/include/guestInfo.h: changes related to how the VMware code in the host handles Tools version information.

\* lib/include/unityCommon.h: changes related to documenting the Unity API.

\* lib/include/unity.h, lib/unity/\*: remove a few unused RPCs, add a new function used to notify the host of the status of Unity.

\* modules/freebsd/vmhgfs/state.c, modules/vmhgfs/freebsd/vnops.c,

- modules/vmhgfs/freebsd/vnopscommon.\*: support symlinks on FreeBSD and Mac OS.
- \* modules/freebsd/vmhgfs/worker.c: fix mutex not being unlocked in some error paths.
- \* modules/linux/dkms.conf: add rudimentary dkms support.
- \* modules/linux/pvscsi/\*: add a driver for VMware's paravirtualized SCSI device.
- \* modules/linux/\*/Makefile, modules/linux/vmci/Makefile.kernel, modules/linux/vsock/Makefile.kernel: add support for exporting symbols, needed for dependent modules to load if a kernel  $\geq 2.6.26$  is compiled with CONFIG\_MODVERSIONS. Make the vsock module reference the vmci module's symbols.
- \* modules/vmmemctl/freebsd/os.c: add sysctl to get driver status. Information can be retrieved with "sysctl vm.vmmemctl".
- \* modules/linux/vmci/vmci\_defs.h, modules/linux/vmci/vmci\_call\_defs.h, modules/linux/vsock/vmciHostKernelAPI.h: changes related to VMCI work on VMware ESX.
- \* modules/linux/vsock/linux/\*: improve performance of some applications by improving the poll behavior and sending less packets when waiting for a response.
- \* modules/linux/vmsnc/sync.c: fix panic on kernels  $< 2.6.20$ .
- \* modules/linux/vmxnet3/vmxnet3.c, modules/linux/vmxnet3/vmxnet3\_int.h, modules/linux/vmxnet3/vmxnet3\_version.h: inherit net device features to avoid having the kernel setting the PSH flag on every TCP packet (among other issues).
- \* modules/\*/\*/\*: Reflected changes from elsewhere.
- \* scripts/common/vmware-user.desktop: add missing "Type" information; fixes auto-start of vmware-user on Ubuntu 8.10.
- \* toolbox/\*: fix a GTK+ warning caused when trying to unref a dialog instance from a signal callback.
- \* vmware-user/copyPaste.c: work around an issue when OpenOffice's "cut" command is used; it sets the timestamp of both the clipboard and the primary selection, but only puts data in the clipboard.

\* Other files: minor refactorings, and changes unrelated to open-vm-tools.

2008-10-13 Adar Dembo <adar@vmware.com>

\* Resync with internal trunk (2008.10.09)

\* configure.ac, modules/Makefile.am: Added a command-line option to skip privileged operations during make install (requested by Dennis Leroy). Integrated new vmxnet3 kernel module.

\* configure.ac, lib/guestInfo/Makefile.am, lib/guestInfo/guestInfoPerfMonLinux.c, lib/include/vm\_procps.h: Removed open-vm-tools dependency on libproc-dev by providing some procps bits and pieces in our own vm\_procps.h (Sourceforge bug 1960947).

\* hgfsmounter/Makefile.am: Removed chown calls. Only call chmod if we're running as root (requested by Dennis Leroy).

\* \*/foreignVMToolsDaemon.c, \*/foundryToolsDaemon.[ch], lib/guestInfo/guestInfo.c, lib/guestInfo/guestInfoServer.c, lib/include/guestInfoServer.h, lib/include/vixTools.h, lib/rpcin/rpcin.c, lib/vixTools/vixTools.c, vmware-user/copyPaste.c, vmware-user/vmware-user.c: More refactoring from the Tools core services project.

\* \*/foundryToolsDaemon.c: Changed HGFS mounting behavior such that the global HGFS share is mounted at /mnt/hgfs instead of relying on "mount -a".

\* guestd/toolsDaemon.[ch], lib/include/backdoor\_def.h, lib/include/system.h, lib/include/vm\_app.h, lib/system/systemLinux.c: Added backwards time synchronization functionality. Moved Tools scripts checking from VMX to guestd.

\* hgfsmounter/hgfsmounter.c: Added handling for multiple "-o" flags on the command line.

\* lib/dynxdr/dynxdr.c: Fixed x\_putint32 behavior on 64-bit Solaris.

\* lib/file/\*, lib/include/codeset.h, lib/include/file.h, lib/include/fileIO.h, lib/include/hostinfo.h, lib/include/loglevel\_user.h, lib/include/productState.h, lib/include/timeutil.h, lib/include/unicodeTypes.h, lib/include/vixCommands.h, lib/include/vix.h, lib/include/vm\_basic\_asm.h, lib/include/vm\_basic\_types.h, lib/include/vm\_legal.h, lib/include/vm\_product.h,



lib/include/win32util.h, lib/include/x86cpuid.h, lib/misc/codeset.c,  
lib/misc/codesetOld.[ch], lib/misc/posixPosix.c, lib/misc/timeutil.c,  
lib/region/region.c, lib/string/bsd\_vsnprintf.c, lib/unicode/\*,  
lib/user/hostinfoPosix.c, modules/freebsd/vmhgfs/sha1.c,  
modules/\*/vm\_device\_version.h, modules/linux/\*/vmci\_iocontrols.h,  
modules/linux/\*/vmci\_version.h, modules/linux/vmhgfs/hgfsEscape.h:  
Changes from work unrelated to open-vm-tools  
on internal trunk.

\* lib/ghIntegration/ghIntegrationX11.c: Fixed some bugs in menu-spec and  
desktop-entry-spec support in Linux guests.

\* lib/guestApp/guestApp.c, lib/include/guestApp.h,  
lib/include/statelogger\_backdoor\_def.h, toolbox/Makefile.am,  
toolbox/toolbox-cmd.c, toolbox/toolbox-gtk.c, toolbox/toolboxCmdInt.h,  
toolbox/toolboxGtkInt.h, toolbox/toolboxInt.h, toolbox/toolboxRecord.c,  
toolbox/toolboxcmd-record.c: Patches from Yiwen Zhang to add basic  
record/replay controls to the gtk and command-line toolbox apps.

\* lib/guestInfo/guestInfoPosix.c: Fixed a bug where we assumed the  
primary interface's addresses were all IPv4 addresses.

\* lib/guestInfo/guestInfoServer.c: Fixed a memory leak.

\* lib/guestRpc/Makefile.am, lib/guestRpc/unityActive.x,  
lib/include/guestCaps.h, lib/include/unityCommon.h, lib/unity/unity.c,  
vmware-user/Makefile.am: Added new unityActive xdr protocol, used for  
tracking whether Unity is enabled or not.

\* lib/hgfsServer/hgfsServer.c, lib/hgfsServer/hgfsServerLinux.c,  
lib/hgfsServerPolicyGuest/hgfsServerPolicyGuest.c,  
lib/include/hgfsProto.h:  
Fixed bug where we were invalidating HGFS  
handles on the share of entire drive ("/"). Added optional symlink  
following behavior to HGFS server. Fixed a UTF-8 validation issue.  
Added volume ID field to attribute fields.

\* lib/include/vm\_tools\_version.h: Bumped internal Tools backdoor  
version.

\* lib/include/vm\_version.h: Bumped TOOLS\_VERSION.

\* lib/procMgr/progMgrPosix.c: Fixed impersonation behavior so that  
uids are passed to setresuid instead of gids. Added alternate way to  
list processes in situations where a process lacks a command line.

\* lib/region/region.c: Reforked xorg miregion.c and apply open-vm-tools  
specific patches.

\* lib/unity/\*, lib/unityWindowTracker/unityWindowTracker.c: Fixed an overflow that lead to a panic when a window title exceeded 1024 bytes. Fixed some initialization assumptions when using virtual desktops.

\* lib/unity/unityPlatformX11Window.c:  
Fixed an issue with restacking windows above non-existent windows. Other minor fixes.

\* modules/\*/\*/\*: Reflected changes from elsewhere.

\* modules/linux/\*/Makefile.kernel: Changed clean target to remove Module.markers and modules.order.

\* modules/linux/vsock/include/compat\_sock.h,  
modules/linux/vsock/\*: Fixed several issues in vsock.

2008-09-03 Adar Dembo <adar@vmware.com>

\* Resync with internal trunk (2008.08.29)

\* Makefile.am, alocal.m4, m4/\*: Moved macros to 'm4' subdir.

\* compile, config.guess, config.sub, config/\*, depcomp, install-sh,  
ltmain.sh, missing: Moved auxiliary build tools to 'config' subdir.

\* configure.ac: Moved macros and auxiliary build tools into separate subdirectories. Added command line option to force the use of gtk1 over gtk2. Cosmetic fixes. Reworked libicu detection. Switched over to libtool-2.2. Added library check for new gdk symbol. Added library check for libnotify. Reworked use of macros from AC\_PATH\_XTRA and some X11 library checks.

\* \*/foundryToolsDaemon.c, toolbox/toolbox-cmd.c, guestd/main.c,  
lib/guestInfo/guestInfoPerfMonLinux.c, lib/guestInfo/guestInfoPosix.c,  
lib/misc/posixPosix.c, lib/panic/panic.c, lib/system/systemLinux.c,  
modules/linux/vsock/linux/util.c, xferlogs/xferlogs.c: Added checks for return codes of certain functions and passed %s to formatted string functions where appropriate (needed to compile on Ubuntu Intrepid).

\* lib/appUtil/appUtilX11.c: Fixed command line skipping logic and added more icon paths. Removed unnecessary chdir(2) canonicalization logic.

\* lib/deployPkg/runDeployPkgPosix.c, lib/file/fileIO.c,  
lib/file/fileIOPosix.c, lib/file/fileLockPrimitive.c,  
lib/file/filePosix.c, lib/hgfsServer/hgfsServerLinux.c,  
lib/include/bsdfmt.h, lib/include/file.h, lib/include/fileIO.h,  
lib/include/iovector.h, lib/include/msgfmt.h, lib/include/str.h,

lib/include/vm\_basic\_defs.h, lib/include/vm\_basic\_types.h,  
lib/misc/hostname.c, lib/misc/idLinux.c, lib/misc/posixPosix.c,  
lib/SLPv2Parser/\*.c,  
lib/wiper/wiperPosix.c, toolbox/toolboxScripts.c:  
Added FreeBSD compatibility glue.

\* guestd/toolsDaemon.c, lib/file/file.c,  
lib/foundryMsg/foundryPropertyListCommon.c, lib/image/imageUtilPng.c,  
lib/include/appUtil.h, lib/include/backdoor\_def.h, lib/include/conf.h,  
lib/include/cpuid\_info.h, lib/include/guest\_os.h,  
lib/include/hostinfo.h, lib/include/imageUtil.h,  
lib/include/imageUtilTypes.h, lib/include/log.h,  
lib/include/loglevel\_user.h, lib/include/netutil.h,  
lib/include/posix.h, lib/include/timeutil.h, lib/include/util.h,  
lib/include/uuid.h, lib/include/vix.h, lib/include/vixOpenSource.h,  
lib/include/vm\_atomic.h, lib/include/vm\_legal.h,  
lib/include/vm\_version.h, lib/include/x86cpuid.h,  
lib/misc/codesetOld.c, lib/misc/timeutil.c, lib/string/bsd\_vsnprintf.c,  
lib/user/util.c, lib/user/utilPosix.c, lib/vixTools/vixTools.c,  
modules/linux/\*/vmci\_kernel\_if.h, modules/linux/vmxnet/compat\_timer.h,  
toolbox/toolboxCmdInt.h, toolbox/toolboxcmd-\*.c:  
Changes  
from work unrelated to open-vm-tools on internal trunk.

\* lib/ghIntegration/ghIntegration.c,  
lib/guestRpc/ghiGetBinaryHandlers.x: Don't send oversized messages.  
Increased maximum number of binary handlers.

\* lib/ghIntegration/ghIntegrationX11.c, lib/guestApp/guestAppPosix.c,  
lib/include/guestApp.h, lib/include/system.h, lib/system/systemLinux.c,  
toolbox/toolbox-gtk.c: Improved "run program" functionality by  
restoring program environment and stripping any VMware wrapper script  
changes to LD\_LIBRARY\_PATH.

\* lib/guestApp/guestAppPosixX11.c: Now using glib to open URLs instead  
of system(3). Improved gnome and kde session detection.

\* lib/guestApp/Makefile.am: This library needed GTK\_CPPFLAGS too.

\* lib/guestInfo/guestInfoInt.h, lib/guestInfo/guestInfoPosix.c,  
lib/guestInfo/guestInfoServer.c: Added logic to optionally convert  
subnet mask to an ASCII string.

\* lib/guestRpc/Makefile.am: Cleaned up generated xdr headers better.

\* lib/hgfsServer/hgfsServer.c, lib/hgfsServer/hgfsServerInt.h,  
lib/hgfsServer/hgfsServerLinux.c:

Fixed problems when packing V3  
replies.

\* lib/hgfsServer/hgfsServerLinux.c: Fixed UTF-8 normal form D/C conversions on the root directory.

\* lib/include/dndGuest.h: Changed preprocessor usage to allow gtk1 to access UnityDnD.

\* lib/include/dnd.h, vmware-user/copyPaste.c: Code motion.

\* lib/include/guestCaps.h: Resort the capabilities table.

\* lib/include/rpcin.h, lib/rpcIn/rpcin.c, : Beginnings of the Tools core services. This is a full-fledged refactoring of the Tools userlevel apps to a "service" vs. "plugin" programming model.

\* lib/include/vmblock.h, modules/\*/vmblock/block.c, modules/\*/vmblock/stubs.c, modules/\*/vmblock/stubs.h: Changes needed to support the fuse-based implementation of vmblock (coming soon).

\* lib/include/vm\_tools\_version.h: Some Tools version bumps.

\* modules/\*/\*/\*: Reflected changes from elsewhere.

\* modules/\*/\*/compat/compat\_stdarg.h: Added compatibility wrappers for stdarg features.

\* modules/freebsd/vmhgfs/debug.\*: Cosmetic fixes.

\* modules/freebsd/vmhgfs/\*: Make driver compliant with HGFSv3.

\* modules/\*/vmmemctl/vmballoon.c: Allow module to yield the processor when allocating many pages.

\* modules/linux/\*/autoconf/cachector1.c,  
modules/linux/\*/include/compat\_sched.h,  
modules/linux/\*/include/compat\_semaphore.h,  
modules/linux/\*/include/compat\_slab.h,  
modules/linux/vmblock/linux/filesystem.c,  
modules/linux/\*/Makefile.kernel,  
modules/linux/vmhgfs/bdhandler.c, modules/linux/vmhgfs/filesystem.c,  
modules/linux/vmhgfs/module.h, modules/linux/vmhgfs/request.c,  
modules/linux/vmsync/sync.c, modules/linux/vsock/linux/af\_vsock.c: Fix modules for 2.6.27 kernels.

\* modules/linux/\*/Makefile: Fixed DRIVER target.

\* modules/linux/vmci/vmci\_drv.c: Moved interrupt registration to be after driver initialization.

\* modules/linux/vsock/linux/af\_vsock.c,  
modules/linux/vsock/linux/af\_vsock.c: Added optimized flow control protocol.

\* toolbox/toolboxScripts.c,  
toolbox/toolboxShrink.c: Cosmetic fixes.

\* vmware-user/copyPaste.c, vmware-user/dnd.c: Fixed edge case behavior with file copy paste and DnD.

\* vmware-user/modconfig.c, vmware-user/notify.c,  
vmware-user/vmware-user.c, vmware-user/vmwareuserInt.h: Added stubbed modconfig module out-of-date notification framework. Not useful for open-vm-tools, hence the stubs.

2008-08-08 Adar Dembo <adar@vmware.com>

\* Resync with internal trunk (2008.07.24)

\* configure.ac, \*/Makefile.am: Landed support for command line Toolbox, Unity, vsock, and vmci. Refactored and reformatted a few things. Improved portability by using \$(SED) and AC\_PROG\_SED instead of "sed", \$(MKDIR\_P) and AC\_PROG\_MKDIR\_P instead of "mkdir -p", \$(LN\_S) and AC\_PROG\_LN\_S instead of "ln -s". Changed icu feature detection and linking to rely on C++ linker instead of C linker. Fixed module compilation checks on FreeBSD. Fixed \$(DESTDIR) handling (patch by Mike Auty). Refactored lib/strUtil into lib/misc.

Changed hgfsmounter

install hook to symlink mount.vmhgfs. Renamed libghIntegrationStub to libGhIntegrationStub. Fixed compilation of lib/guestApp when using --without-x (reported by Martin Preishuber). Renamed libunityStub to libUnityStub. Fix build on FreeBSD by using ":@" instead of "=" when exporting module directories. The vmware-user desktop link now executes vmware-user-suid-wrapper. Properly install vmware-user-suid-wrapper.

\* \*/foundryToolsDaemon.c, lib/vixTools/vixTools.c: Use a larger result packet when handling impersonated HGFS requests (since HGFSv3 uses larger packets).

\* guestd/main.c: Moved foreign VM check.

\* guestd/toolsDaemon.\*: Added plumbing for HGFS usability library calls.

\* hgfsmounter/hgfsmounter.c: Added support for passing options to

the MacOS HGFS driver.

\* lib/appUtil/\*, lib/include/appUtil.h: New library for Unity support.

\* lib/auth/authPosix.c: Don't try using PAM from the Tools.

\* lib/dnd/dndCommon.c, lib/dnd/dndLinux.c, lib/file/file.c,  
lib/file/fileIOPosix.c,  
lib/file/filePosix.c, lib/include/dnd.h,  
lib/include/loglevel\_user.h, lib/include/panic.h, lib/include/posix.h,  
lib/include/strutil.h, lib/unicode/unicodeBase.h,  
lib/include/unicodeOperations.h, lib/include/vix.h,  
lib/include/vm\_app.h, lib/include/vm\_assert.h,  
lib/include/vm\_product.h, lib/include/x86cpuid.h, lib/misc/codeset.c,  
lib/misc/hashTable.c, lib/misc/strutil.c, lib/misc/timeutil.c,  
lib/panic/panic.c, lib/string/bsd\_vsnprintf.c, lib/strUtil/\*,  
lib/unicode/unicodeCommon.c, lib/unicode/unicodeSimpleBase.c,  
lib/unicode/unicodeStatic.c, lib/user/hostinfoPosix.c,  
lib/user/util.c, lib/user/utilPosix.c: Changes from work unrelated to  
open-vm-tools on the internal trunk.

\* lib/backdoor/backdoorInt.h, lib/deployPkg/runDeployPkgInt.h,  
lib/dnd/dndInt.h, lib/file/fileInt.h, lib/guestInfo/guestInfoInt.h,  
lib/hgfs/cpNameInt.h, lib/hgfsServer/hgfsServerInt.h,  
lib/impersonate/impersonateInt.h, lib/include/backdoorInt.h,  
lib/include/bsd\_output\_int.h,  
lib/include/cpNameInt.h,  
lib/include/dndInt.h, lib/include/fileInt.h,  
lib/include/guestInfoInt.h, lib/hgfsServer/hgfsServerInt.h,  
lib/include/impersonateInt.h, lib/include/runDeployPkgInt.h,  
lib/include/toolsLoggerInt.h, lib/include/unicodeInt.h,  
lib/string/bsd\_output\_int.h, lib/toolsLogger/toolsLoggerInt.h,  
lib/unicode/unicodeInt.h: Moved some internal header files out of  
the general include directory and into the appropriate libraries.

\* lib/ghIntegration/\*: New library for Unity support.

\* lib/guestApp/guestAppPosixX11.c: Reset the value of LD\_LIBRARY\_PATH  
before running the web browser.

\* lib/guestInfo/guestInfoPosix.c, lib/include/guest\_os.h: Fixed a typo  
in Mandriva guest detection. Added Asianux.

\* lib/guestInfo/guestInfoServer.c: Fixed behavior for sending nicInfo  
updates to the host (patch by Jason Lunz).

\* lib/guestRpc/ghi\*.\*: New xdr protocol for Unity support.

- \* lib/guestRpc/nicinfo.x: Correctly applied LGPL to file.
  
- \* lib/hgfs/cpNameLinux.c:  
Allow building for versions of Solaris newer than 10.
  
- \* lib/hgfsServer/hgfsServer.c,  
lib/hgfsServerPolicyGuest/hgfsServerPolicyGuest.c,  
lib/include/hgfsServerPolicy.h: Provide an override setting for disabling case conversion during file lookups.
  
- \* lib/hgfsServer/hgfsServerLinux.c: Only perform case insensitive file lookups if a case sensitive lookup fails.
  
- \* lib/image/imageUtilPng.c, lib/include/imageUtil.h,  
lib/include/imageUtilTypes.h: New library for Unity support.
  
- \* lib/include/conf.h, toolbox/toolbox-gtk.c: Robustified the help page discovery mechanism.
  
- \* lib/include/dndGuest.h: Allow inclusion of header into source files without GTK2 support.
  
- \* lib/unity/\*, lib/include/guestCaps.h, lib/include/unityCommon.h: New library for Unity support.
  
- \* lib/include/hgfsUtil.h: Fixed a precedence issue in a macro.
  
- \* lib/raster/\*, lib/include/rasterConv.h: New library for Unity support.
  
- \* lib/region/\*, lib/include/region.h: New library for Unity support.
  
- \* lib/include/system.h:  
Added new OS type for WinXP 64-bit, reformatted enums.
  
- \* lib/unityWindowTracker/\*, lib/include/unityWindowTracker.h: New library for Unity support.
  
- \* lib/include/vm\_version.h: Bumped TOOLS\_VERSION.
  
- \* lib/wiper/wiperPosix.c: Replaced BSD\_VERSION with \_\_FreeBSD\_version.
  
- \* modules/\*/\*/\*: Reflected changes from elsewhere.
  
- \* modules/freebsd/vmhgfs/\*: Reflected changes from MacOS HGFS work, and fixed file permissions so that they're not all owned by root.

- \* modules/linux/vmblock/linux/dentry.c: Changed d\_revalidate to properly invalidate negative dentries.
  - \* modules/linux/vmci/\*: Landed the Virtual Machine Communication Interface guest module.
  - \* modules/linux/vmmemctl/os.c: Fixed vmmemctl to build on 2.6.26 (reported by Pavol Rusnak).
  - \* modules/linux/vmsync/sync.c: Fixed vmsync to build on 2.6.26 (reported by Pavol Rusnak).
  - \* modules/linux/vsock/\*: Landed the VMCI sockets interface module.
  - \* modules/linux/vmxnet/vmxnet.c, modules/linux/vmxnet/vmxnet2\_def.h, modules/linux/vmxnet/vmxnetInt.h: Increased rx ring size for enhanced vmxnet2.
  - \* toolbox/\*: Refactored pieces of GTK Toolbox and landed the command line Toolbox. Fixed mnemonic collisions in the GTK Toolbox.
  - \* vmware-user/copyPaste.c: Fixed several bugs with file copy paste behavior.
  - \* vmware-user/notify.c, vmware-user/vmware-user.c, vmware-user/vmwareuserInt.h: Added stubs for notification framework.
  - \* vmware-user/pointer.c: Reverted fix for bug with clipboard retry behavior.
  - \* vmware-user/vmware-user.c: Fixed build with gtk 1.2 (reported by Stephen Duncan). Added signal handlers for SIGUSR1/SIGUSR2 used by VMware Tools installer to reload vmware-user cleanly during a Tools upgrader. Reload vmware-user on a fatal X I/O error. Don't panic if run outside of a VM. Don't leave Unity mode on a Tools reset.
- 2008-07-01 Adar Dembo <adar@vmware.com>
- \* Resync with internal trunk (2008.06.30)
  - \* configure.ac, lib/guestApp/\*, toolbox/Makefile.am, vmware-user/Makefile.am: Split lib/guestApp into two libraries, one with X11 functionality, and one without. Improved detection of gnome-open.
  - \* guestd/\*, lib/netUtil/netUtilLinux.c: guestd now compiles for MacOS



guests.

\* `guestd/main.c`, `lib/include/system.h`, `lib/system/systemLinux.c`:  
Refactored `GuestdWritePidfile` into `System_Daemon`.

\* `guestd/toolsDaemon.c`: Fixed a backwards time synchronization issue.  
Thanks to Eric Castan for reporting the bug.

\* `lib/conf/conf.c`, `lib/include/conf.h`: Removed obsolete configuration  
keys and values.

\* `lib/file/*`, `lib/dict/*`, `lib/foundryMsg/*`, `lib/include/backdoor_def.h`,  
`lib/include/codeset.h`, `lib/include/config.h`,  
`lib/include/file_extensions.h`, `lib/include/fileInt.h`,  
`lib/include/loglevel_user.h`, `lib/include/msg.h`, `lib/include/msgid.h`,  
`lib/include/posix.h`, `lib/include/preference.h`, `lib/include/unity.h`,  
`lib/include/vixCommands.h`, `lib/include/vix.h`,  
`lib/include/vmbackup_def.h`, `lib/include/vmBackup.h`,  
`lib/include/vm_basic_defs.h`, `lib/include/vm_basic_types.h`,  
`lib/include/vm_product.h`,  
`lib/include/win32util.h`,  
`lib/include/x86cpuid.h`, `lib/misc/codeset.c`, `lib/misc/codesetOld.c`,  
`lib/misc/codesetOld.h`, `lib/misc/posixPosix.c`, `lib/strUtil/strutil.c`,  
`lib/user/hostinfoPosix.c`, `lib/user/util.c`,  
`lib/vmBackupLib/stateMachine.c`, `modules/*/vmxnet/net.h`: Changes from  
work unrelated to `open-vm-tools` on the internal trunk.

\* `lib/guestRpc/Makefile.am`: Added comment about misuse of `CFLAGS`.

\* `lib/hgfsServer/hgfsServer.c`: Corrected pointer arithmetic so that  
new node and search allocation works consistently in 64-bit apps.

\* `lib/hgfsServer/hgfsServerLinux.c`, `lib/include/hgfsProto.h`: Added  
`HGFS_ATTR_HIDDEN_FORCED` and set it when returning hidden files.

\* `lib/hgfsServer/*`, `lib/hgfsServerPolicy/hgfsServerPolicyGuest.c`,  
`lib/include/hgfsServerInt.h`, `lib/include/hgfsServerPolicy.h`:  
Refactored and cleaned up some code.

\* `lib/include/resolution.h`, `lib/resolution/*`,  
`vmware-user/vmware-user.c`: Refactored some functions.

\* `lib/include/vm_legal.h`:  
Added another patent to the patent string.

\* `lib/include/vm_tools_version.h`: Added a pair of Tools version macros.

\* `lib/include/vm_version.h`: Bumped Tools product version.

- \* lib/Makefile.am: Included a fix for compilation --without-x. Thanks to Mark Foster for reporting the issue.
- \* lib/misc/Makefile.am, lib/misc/shared/Makefile.am: Realphabetized some sources and added missing source files.
- \* lib/misc/posixWin32.c: Removed unneeded file from tree.
- \* lib/procMgr/procMgrPosix.c: Made safe for -fPIC and for MacOS.
- \* modules/\*/\*/\*: Reflected changes from elsewhere.
- \* modules/freebsd/vmhgfs/\*: Added some code to handle codeset conversions between UTF-8 precomposed and decomposed strings.
- \* modules/linux/vmhgfs/\*: Refactored string escaping/unescaping code.
- \* toolbox/\*: Added mnemonics for some buttons.
- \* vmware-user/pointer.c: Fixed bug in clipboard retry behavior.
- \* vmware-user/vmware-user.c: Added handlers for SIGUSR1 and SIGUSR2 to facilitate smooth vmware-user upgrades with respect to the vmblock kernel module.

2008-06-20 Elliot Lee <elliot@vmware.com>

- \* Resync with internal trunk (2008.06.13)
- \* FreeBSD 7/8 fixes from Martin Blapp.
- \* Fix getpwnam\_r etc. on FreeBSD & Solaris.
- \* configure.ac: Add --without-kernel-modules, --with-linux-release, and --with-linuxdir (gissa).
- \* configure.ac, lib/guestRpc/\*, lib/guestInfo/guestInfo.c, lib/guestInfo/guestInfoServer.c, lib/dynxdr/\*, {vmware-user,guestd}/foreignVMTToolsNetworking.c, guestd/Makefile.am, {vmware-user,guestd}/foundryToolsDaemon.c, lib/include/dynxdr.h, lib/include/guestInfo.h, lib/include/vmxrpc.h, lib/include/xdrutil.h, lib/Makefile.am, lib/netUtil/\*, lib/vixTools/Makefile.am: Add support for XDR encoding of RPC values, including the NicInfoV2 structure.
- \* guestd/stub.c, hgfsclient/Makefile.am, hgfsclient/stub.c,

hgfsclient/stub-user-util.c, hgfsmounter/Makefile.am,  
hgfsmounter/stub.c, lib/stubs/\*, libguestlib/Makefile.am,  
libguestlib/stubs.c,  
toolbox/Makefile.am, toolbox/stub.c,  
vmware-user/stub.c: Centralize stubs.

\* lib/guestInfo/guestInfoPerfMonLinux.c: Convert ioInRate and  
ioOutRate to be in terms of KB instead of pages.

\* lib/hgfsBd/hgfsBd.c, lib/hgfsServer/hgfsServer.c,  
lib/hgfsServer/hgfsServerLinux.c: Large packet support, and  
additional case-insensitivity fixes.

\* lib/include/hgfsBd.h, lib/include/hgfs.h,  
lib/include/hgfsProto.h: Add HGFS error code.

\* lib/hgfs/hgfsUtil.c, lib/guestInfo/Makefile.am,  
lib/guestInfo/guestInfoPosix.c, lib/guestApp/guestApp.c,  
lib/foundryMsg/foundryMsg.c, lib/file/fileLockPrimitive.c,  
lib/file/fileIOPosix.c, lib/file/fileLockPosix.c,  
guestd/toolsDaemon.c, guestd/debugStdio.c, guestd/main.c,  
lib/hgfsServerManagerGuest/hgfsServerManagerGuest.c,  
lib/include/codeset.h, lib/include/cpuid\_info.h,  
lib/include/dnd.h, lib/include/file\_extensions.h,  
lib/include/fileInt.h, lib/include/ghIntegration.h,  
lib/include/guestApp.h, lib/include/guestStats.h,  
lib/include/hgfsServerInt.h,  
lib/include/hgfsUtil.h,  
lib/include/hostinfo.h, lib/include/loglevel\_user.h,  
lib/include/netutil.h, lib/include/panic.h, lib/include/posix.h,  
lib/include/unicode\*.h, lib/include/util.h, lib/include/vix.h,  
lib/include/vixTools.h, lib/include/vm\_app.h,  
lib/include/vm\_basic\_defs.h, lib/include/vm\_product.h,  
lib/include/vm\_tools\_version.h, lib/include/vm\_version.h,  
lib/include/x86cpuid.h, lib/misc/codeset.c, lib/misc/codesetOld.c,  
lib/misc/codesetOld.h, lib/misc/hashTable.c, lib/misc/hostname.c,  
lib/misc/timeutil.c, lib/panic/panic.c, lib/string/str.c,  
lib/sync/syncMutex.c, lib/system/systemLinux.c, lib/unicode/\*.c,  
lib/unityStub/\*, lib/user/hostinfo.c, lib/user/hostinfoPosix.c,  
lib/vixTools/\*, modules/linux/vmxnet/\*, toolbox/debugStdio.c,  
vmware-user/debugStdio.c, vmware-user/dnd.c, vmware-user/main.c:  
Bug fixes.

\* modules/linux/vmxnet/\*: Remove unused BPF code. Add ethtool  
callbacks to get & set driver settings.

\* lib/user/util.c: Add function for getting backtraces.

\*

lib/resolution/\*, vmware-user/\*, lib/Makefile.am, configure.ac:

Move resolution-changing code into separate library.

\* guestd/main.c, lib/include/tools.h: Allow disabling tools version reporting to the host, via config file.

\* lib/rpcIn/\*, lib/include/rpcin.h, guestd/toolsDaemon.c, toolbox/toolbox-gtk.c: Updated RPC API

\* lib/include/dndGuest.h: Helper API for DnD code

\* modules/freebsd/vmhgfs/\*, modules/freebsd/vmmemctl/\*, modules/freebsd/vmblock/\*, modules/linux/vmhgfs/\*, modules/linux/vmmemctl/\*: Reflect changes from main source tree.

\* vmware-user/copyPaste.c: Copy/paste cleanup.

\* vmware-user/vmware-user.c: Updated locking code to use X11 display instead of lockfiles.

2008-06-03 Adar Dembo <adar@vmware.com>

\* Resync with internal trunk (2008.05.28).

\* configure.ac, Makefile.am, \*/Makefile.am: Added rudimentary `make install` support. Fixes Sourceforge bug 1839981.

\* configure.ac, Makefile.am, vmware-user-suid-wrapper/\*: Added vmware-user-suid-wrapper to help autostart vmware-user. Added some informational tags to AC\_DEFINE macros.

\* \*/debugStdio.c: Fixed a format string vulnerability in Debug. Allocate fd on the stack in DebugToFile.

\* lib/auth/authPosix.c, lib/dnd/dndCommon.c, lib/dnd/dndLinux.c lib/impersonate/impersonate.c: Add inclusion of vmware.h and refactor some include statements.

\* lib/file/file.c, lib/include/file.h: Added File\_UnlinkNoFollow function.

\* lib/file/fileIO.c, lib/file/fileLockPrimitive.c, lib/include/fileIO.h: Added error case for ENAMETOOLONG to FileIO\_Lock. Constified 'buf' in FileIO\_Pwrite.

\* lib/file/fileIOPosix.c: Removed coalescing and decoalescing code. Consolidated some Unicode calls.

- \* lib/file/filePosix.c: Reworked some error handling logic.
- \* lib/foundryMsg/foundryMsg.c: Refactored buffer encoding and decoding logic into a single pair of functions.
- \* lib/foundryMsg/foundryThreads.c, lib/include/foundryThreads.h  
lib/include/util.h, lib/misc/util\_misc.c: Changed generic thread type from uintptr\_t to Util\_ThreadID.
- \* lib/hgfsServer/\*, lib/hgfs/hgfsProto.h, modules/linux/vmhgfs/\*: Additional HGFSv3 fixes and refactoring.
- \* lib/include/dblInkLst.h, lib/misc/dblInkLst.c: Constified argument to DbLInkLst\_IsLinked.
- \* lib/include/dnd.h: Added support for DnD of RTF.
- \* lib/include/fileInt.h: Removed prototype of FileLockFileSize.
- \* lib/include/hashTable.h, lib/misc/hashTable.c: Cosmetic changes. Added HashTable\_ReplaceIfEqual.
- \* lib/include/loglevel\_user.h: Added hpet loglevel.
- \* lib/include/msg.h: Removed prototype of MsgSetPostStderrBlock.
- \* lib/include/posix.h: Removed certain includeCheck allowances.
- \* lib/include/productState.h: Added VDM client product.
- \* lib/include/unicode\*, lib/unicode/\*: Ongoing i18n work.
- \* lib/include/vixCommands.h: Added command to set snapshot information.
- \* lib/include/vix.h: Added more errors and a new flag.
- \* lib/include/vixOpenSource.h: Reworked asserts and added VIX\_ASSERT.
- \* lib/include/vm\_app.h:  
Added Tools tray app.
- \* lib/include/vm\_product.h: Reworked VMRC product definitions and added VDM client product definitions.
- \* lib/include/vm\_tools\_version.h: Added WS65 Tools version.

- \* lib/include/vm\_version.h: Bumped Tools version. Added logic for VMRC product.
- \* lib/include/x86cpuid.h: Modified a flag and trimmed an unneeded macro.
- \* lib/misc/codesetOld.c: Implement UTF-16 codest conversion to UTF-8 for CURRENT\_IS\_UTF8.
- \* lib/misc/dynbuf.c: Modified dynbuf growing behavior.
- \* lib/misc/posixDlopen.c, lib/misc/posixInt.h, lib/misc/posixPosix.h: Refactored codeset conversion code into PosixConvertToCurrent.
- \* lib/misc/posixWin32.c: Added some path checks.
- \* lib/misc/timeutil.c: Win32-wrappified TimeUtil\_GetTimeFormat.
- \* lib/misc/vmstdio.c: Reduce virtual memory usage and add '\r' as a line ending in StdIO\_ReadNextLine.
- \* lib/rpcout/rpcout.c: Added comments.
- \* lib/str/str.c: Cosmetic changes.
- \* lib/vixTools/vixTools.c: Added unlink(2) logic to avoid deleting symlink targets. Cosmetic changes.
- \* modules/\*/\*/\*: Reflect changes from elsewhere in the source tree.
- \* modules/linux/vmhgfs/super.c: Fix vmhgfs to properly report the available space on the host (Sourceforge bug 1924246).
- \* vmware-user/vmware-user.c: Add advisory locking code to help maintain only one vmware-user instance per X session.
- \* xferlogs/xferlogs.c: Fix a formatted string vulnerability.

2008-05-12 Elliot Lee <elliot@vmware.com>

- \* Resync with internal trunk (2008.05.08).
- \* configure.ac, \*\*/Makefile.am: Use CPPFLAGS instead of CFLAGS to eliminate warning about proc/sysinfo.h.
- \* guestd/foreignVMTToolsNetworking.c,  
vmware-user/foreignVMTToolsNetworking.c  
lib/hgfsServer/hgfsServerLinux.c, lib/include/hgfsServerInt.h,

modules/linux/vmhgfs/bdhandler.c, modules/linux/vmhgfs/dir.c,  
modules/linux/vmhgfs/file.c, modules/linux/vmhgfs/filesystem.h,  
modules/linux/vmhgfs/fsutil.h, modules/linux/vmhgfs/inode.c,  
modules/linux/vmhgfs/link.c, modules/linux/vmhgfs/module.h,  
modules/linux/vmhgfs/page.c,  
modules/linux/vmhgfs/request.c,  
modules/linux/vmhgfs/request.h: Whitespace cleanups.

\* guestd/main.c: Removed "blessed app" code for starting  
vmware-user. Hooray!

\* lib/deployPkg/deployPkg.c: Remove unneeded Utf8 conversion for  
Windows.

\* lib/file/filePosix.c: Use new Posix\_RealPath implementation.

\* lib/guestApp/guestApp.c, lib/include/guestApp.h: Remove/cleanup  
UTF-8 related RPC functions.

\* lib/guestInfo/guestInfoPerfMonLinux.c,  
lib/guestInfo/guestInfoPosix.c, lib/include/guestInfo.h,  
lib/include/guestInfoInt.h, lib/include/guestStats.h: Rename  
structures to GuestMemInfo, GuestNicInfo, and GuestDiskInfo.

\* lib/guestInfo/guestInfoServer.c, lib/include/guest\_msg\_def.h: As  
above, and also GUESTMSG\_MAX\_IN\_SIZE moved to guest\_msg\_def.h, and  
misc locking updates. Also add GuestInfoServer\_Main(), and cleanup  
whitespace.

\* lib/hgfsServer/hgfsServer.c: Cleanup UTF-8 handling.

\* lib/include/codeset.h: Update defines  
that indicate whether the  
current platform is using UTF-8.

\* lib/include/dnd.h: Add prototypes for a couple of string  
conversion functions.

\* lib/include/file\_extensions.h: Add OVF and Archived OVF file extensions.

\* lib/include/file.h: C++ guard thingies. Update a couple of  
function prototypes to work on file descriptors instead of  
filenames.

\* lib/include/hashTable.h, lib/include/guest\_os.h,  
lib/include/loglevel\_defs.h, lib/include/stats\_user\_defs.h,  
lib/include/stats\_user\_setup.h, lib/include/str.h,  
lib/include/unicodeTypes.h, lib/include/util.h: Allow inclusion in

kernel modules...

\* lib/include/loglevel\_user.h: As above, and add a couple of loglevel variables.

\* lib/include/util.h, lib/misc/util\_misc.c: Allow inclusion in kernel modules as above, and add some utility functions on Windows for manipulating canonical paths.

\* lib/include/hgfsProto.h, lib/include/hgfsUtil.h: Move request/reply payload macros to hgfsProto.h.

\* lib/include/hgfsServerPolicy.h:  
Add ShareList management prototypes and structure members.

\* lib/include/msg.h: Add function prototypes for creating and posting lists of messages.

\* lib/include/system.h: Add types & functions related to desktop switch monitoring on Windows.

\* lib/include/unicodeOperations.h: Add/update inline unicode operations.

\* lib/include/vixCommands.h: Add VIX requests and events.

\* lib/include/vmbackup\_def.h, lib/vmBackupLib/stateMachine.c: Move backup status enum to public header.

\* lib/include/vm\_basic\_asm\_x86\_64.h: Div643232 now also works on MSC.

\* lib/include/vm\_basic\_defs.h: Add debug output macros for Windows drivers.

\* lib/include/vm\_basic\_types.h: Update the FMTPD macro, add SCANF\_DECL macro for arg checking on scanf-like functions.

\* lib/include/x86cpuid.h: Defines for AMD L2/L3 cache separately, and CPUID for Nehalem.

\* lib/misc/codesetOld.c: Bug fixes and general unicode handling updates.

\* lib/system/systemLinux.c: Use Posix\_Getenv/Posix\_Setenv impls.

\*

lib/vixTools/vixTools.c, lib/vmBackupLib/scriptOps.c: Bug fixes.

\* modules/freebsd/\*, modules/linux/\*: Updates to correspond to updates of files in main tree.



- \* modules/freebsd/vmhgfs/hgfs\_kernel.h: Bug fixes.
- \* modules/freebsd/vmxnet/vm\_device\_version: Add SCSI\_IDE\_HOSTED\_CHANNEL define, update SCSI\_MAX\_CHANNELS.
- \* modules/freebsd/vmxnet/vmnet.def: Add capabilities for IPv6 checksumming and TSO, and large packet TSO.
- \* lib/include/vmblock.h, modules/linux/vmblock/linux/control.c, modules/linux/vmblock/linux/vmblockInt.h: Use a macro to better abstract the vmblock mount point & device.
- \* vmware-user/vmware-user.c: Add SIGPIPE to the list of signals that vmware-user handles.

2008-05-02 Adar Dembo <adar@vmware.com>

- \* Resync with internal trunk (2008.04.19).
- \* configure.ac, guestd/Makefile.am, hgfsclient/Makefile.am, lib/misc/\*/Makefile.am, lib/string/\*/Makefile.am, toolbox/Makefile.am, vmware-user/Makefile.am, xferlogs/Makefile.am: Added libicu support for codeset conversions. This includes some makefile logic as well as autoconf arguments for controlling libicu behavior at compile-time.
- \* \*/foreignVMTToolsNetworking.c, lib/vixTools/vixTools.c: Unicode fixes.
- \* \*/foundryToolsDaemon.c, lib/foundryMsg/vixTranslateErrOpenSource.c, lib/panic/panic.c, lib/printer/printer.c: Added calls to Win32 Unicode wrappers.
- \* guestd/main.c: Cleaned up guestInfo server when guestd shuts down.
- \* guestd/toolsDaemon.c, vmware-user/resolution.c: Disabled multi-mon advertisement for Win2k.
- \* lib/auth/authPosix.c, lib/dnd/dndLinux.c, lib/file/\*, lib/impersonate/impersonatePosix.c, lib/include/mntinfo.h, lib/sync/syncWaitQPosix.c, lib/user/hostinfoPosix.c, lib/user/util.c, lib/user/utilPosix.c, lib/wiper/wiperPosix.c: Added calls to POSIX Unicode wrappers.
- \* lib/file/\*: Replaced calls to string functions with calls to the "safe" family of string functions.
- \* lib/dict/dictll.c, lib/include/dictll.h: Detect and tolerate UTF-8 dictionary

files that contain the UTF-8 BOM.

- \* lib/err/\*, lib/include/err.h, lib/include/msgfmt.h,  
lib/include/msg.h: Added support for localization of error strings.
  
- \* lib/foundryMsg/foundryThreads.c, lib/include/foundryThreads.h,  
lib/misc/util\_misc.c: Added opaque type for threads/process IDs.
  
- \* lib/guestInfo/guestInfoServer.c: Removed separate thread context.
  
- \* lib/hgfsServer/\*, lib/include/hgfs\*.h: Additional HGFSv3 cleanup.
  
- \* lib/hgfsServer/hgfsServerLinux.c: Added calls to POSIX Unicode wrappers. Fixed some alias detection code for MacOS.
  
- \* lib/include/backdoor\_def.h: Added backdoor call for debugging events.
  
- \* lib/include/bsdfmt.h, lib/string/bsd\_vsnprintf.c,  
lib/string/bsd\_vsnprintfw.c: Replaced BSDFmt\_WCSony with  
BSDFmt\_WChartoUTF8.
  
- \* lib/include/codeset.h, lib/include/codesetOld.h, lib/misc/codeset.c,  
lib/misc/codesetOld.c, lib/string/convertutf.h: Implemented  
libc-backed codeset layer. When building without libc, fallback on  
codesetOld.
  
- \* lib/include/guestApp.h:  
Added wide versions of dictionary functions.
  
- \* lib/include/loglevel\_user.h: Added two new loglevels.
  
- \* lib/include/posix.h, lib/misc/posixPosix.c: Added new POSIX wrappers.
  
- \* lib/include/str.h: Clarified the use of some functions.
  
- \* lib/include/syncMutex.h, lib/include/syncWaitQ.h: Removed unneeded  
macros.
  
- \* lib/include/unicode\*.h, lib/unicode/\*: Ongoing Unicode work.
  
- \* lib/include/util.h: Added Util\_FreeStringList, removed Util\_FreeList.
  
- \* lib/include/uuid.h: Added new UUID creation scheme.
  
- \* lib/include/vix\*.h: Tweaked some VIX commands, errors, and properties.
  
- \* lib/include/vmBackup.h, lib/vmBackupLib/scriptOps.c,  
lib/vmBackupLib/stateMachine.c: Moved disabled targets logic from

library to Windows VSS provider.

\* lib/include/vm\_basic\_asm\_x86\*.h: Allow emitted FX functions to modify main memory as a side effect.

\* lib/include/vm\_tools\_version.h: Bump Tools version.

\* lib/include/vm\_version.h: Added several product versions.

\* modules/linux/vmhgfs/\*:

Additional cleanup for HGFSv3. Use new kthread wrapper when possible. Bump module version.

\* modules/linux/vmmemctl/\*: Use new kthread wrapper when possible. Remove dead delayed work code. Bump module version.

\* modules/linux/\*/compat\_kthread.c: Added kthread wrapper implementation for modules that use kernel threads.

\* modules/\*/\*/\*: Reflect header file changes from elsewhere in the source code tree.

\* vmware-user/copyPaste.c, vmware-user/pointer.c, vmware-user/vmwareuserInt.h: Stop wastefully polling for pointer updates if the VMX is new enough.

\* xferlogs/xferlogs.c: Fixed a warning in the call to fwrite. (Thanks to Denis Leroy for reporting this bug.)

2008-04-14 Elliot Lee <elliot@vmware.com>

\* Resync with internal trunk (2008.04.01).

\* Fixed legal header on all LGPL-licensed files.

\* vmware-user/resolution.c: Normalize the display topology that comes in from the host, and report 'global\_offset' capability.

\* toolbox/Makefile.am, vmware-user/Makefile.am, lib/misc/Makefile.am, lib/misc/atomic.c, lib/Makefile.am, lib/atomic/\*, hgfsclient/Makefile.am: Move libAtomic stuff into libmisc

\* vmware-user/foundryToolsDaemon.c, lib/vixTools/vixTools.c, lib/include/hgfsServerInt.h, guestd/toolsDaemon.c, guestd/foundryToolsDaemon.c: Remove WIN9XCOMPAT, and some SOCKET\_MGR code.

- \* vmware-user/copyPaste.c: Copy/paste fixes for cross-platform operation.
- \* modules/linux/vmxnet/vmnet\_def.h: Add SG\_SPAN\_PAGES capability.
- \* modules/linux/vmxnet/vm\_device\_version.h: Update some device limits.
- \* modules/linux/\*/compat\_sched.h: Add TASK\_COMM\_LEN define.
- \* modules/linux/\*/compat\_kernel.h,  
modules/linux/\*/kernelStubsLinux.c: Add vsnprintf define.
- \* modules/linux/\*/x86cpuid.h: Add new CPUs.
- \* modules/linux/vmhgfs/vmhgfs\_version.h: Bump HGFS version.
- \* modules/linux/\*/vm\_basic\_asm\_x86.h,  
modules/linux/\*/vm\_basic\_asm\_x86\_64.h,  
lib/include/vm\_basic\_asm\_x86.h, lib/include/vm\_basic\_asm\_x86\_64.h:  
Formatting fixes, and change asm directives used.
- \* modules/linux/vmhgfs/module.h,  
modules/linux/vmhgfs/filesystem.c,  
modules/linux/vmhgfs/bdhandler.c,  
modules/linux/\*/compat\_kthread.h: compat\_kthread fixes.
- \* modules/freebsd/vmxnet/net\_compat.h,  
modules/freebsd/vmxnet/if\_vxn.c: Updates for FreeBSD 7.0.  
(Thanks to Martin Blapp for contributing to these changes.)
- \* lib/misc/util\_misc.c, lib/include/loglevel\_user.h,  
lib/user/hostinfoPosix.c, lib/misc/hostname.c: Bugfix.
- \* lib/unityStub/unityStub.c, lib/include/unity.h: Add stub and enums related to DnD support.
- \* lib/unicode/unicodeSimpleTypes.c,  
lib/unicode/unicodeSimpleTransforms.c,  
lib/unicode/unicodeSimpleBase.c, lib/unicode/unicodeCommon.c,  
lib/include/unicodeTypes.h,  
lib/include/unicodeTransforms.h,  
lib/include/unicodeBase.h, lib/include/unicodeCommon.h: Add additional Unicode-related functions.
- \* lib/sync/syncMutex.c, lib/include/syncMutex.h: Add TryLock method.

- \* lib/strUtil/strutil.c: Add int64-related functions.
  
- \* lib/string/str.c:  
Compile fix
  
- \* lib/string/bsd\_output\_shared.c: Better handling of floating point on Windows.
  
- \* lib/include/progMgr.h, lib/procMgr/procMgrPosix.c: Clarify that the strings are in UTF-8, do conversion as needed.
  
- \* lib/include/posix.h, lib/misc/posixPosix.c, lib/misc/posixWin32.c, lib/file/filePosix.c: Add new Posix\_ function implementations, and uncodify existing ones.
  
- \* lib/misc/hashTable.c, lib/include/hashTable.h: Add lock-less hash table functions.
  
- \* lib/misc/util\_misc.c, lib/include/w32util.h: Add a couple of Win32 utility functions.
  
- \* lib/include/vm\_version.h: Add WS5 config version.
  
- \* lib/include/vm\_atomic.h: Add typecasts to atomic operations to make compilers stop complaining, and expand the AtomicUseFence option.
  
- \* lib/include/vm\_app.h: Add a couple of HGFS-related options.
  
- \* lib/include/vix.h: Update a few errors and other macros.
  
- \* lib/include/vixCommands.h, lib/foundry/foundryMsg.c: Change a bunch of structure members from int32 to uint32, and add a parsing function.
  
- \* lib/include/msgfmt.h, lib/include/msg.h: Additional message-handling prototypes.
  
- \* lib/include/guestInfoInt.h, lib/include/guestInfo.h, lib/guestInfo/Makefile.am, lib/guestInfo/guestInfoServer.c, lib/guestInfo/guestInfoPosix.c, lib/guestInfo/guestInfoPerfMonLinux.c: Add IPv6 support, and the ability to read mem stats on Linux.
  
- \* lib/include/fileIO.h, lib/file/fileIOPosix.c: Add MacOS function related to Time Machine.
  
- \* lib/guestApp/guestApp.c: Use Posix\_ variants of functions.

\* lib/ghIntegrationStub/ghIntegrationStub.c: Add GHI capabilities stubs.

\* lib/dnd/dndCommon.c, lib/file/file.c: Use new Unicode\_Format() function, bugfix.

\* guestd/main.c: Fix a security bug.

\* configure.ac: Allow calling libdnet 'dumbnet' for Debian systems. Detect libprocps.

2008-03-19 Adar Dembo <adar@vmware.com>

\* Resync with internal trunk (2008.03.13).

\* vm\_version.h: Updated Tools version.

\* configure.ac: Added dynamic dnet detection and --without-dnet flag.

\* guestd/debugStdio.c, lib/include/system.h, lib/system/systemLinux.c: Modified debugging to file behavior to prepend debug strings with human readable timestamps.

\* guestd/main.c, guestd/toolsDaemon.c, lib/conf/conf.c, lib/guestApp/guestApp.c, lib/include/guestApp.h: Internationalized GuestApp\_GetInstallPath and GuestApp\_GetconfPath.

\* lib/auth/authPosix.c, lib/dnd/dndLinux.c, lib/file/\*, lib/impersonate/impersonatePosix.c, lib/include/fileInt.h, lib/include/posix.h, lib/misc/posix\*.c: Refactored, extended, and made use of the set of POSIX internationalization-safe function wrappers.

\* lib/dnd/dndCommon.c, lib/include/dnd.h, lib/include/dndInt.h, vmware-user/copyPaste.c, vmware-user/dnd.c: Replaced some duplicated UTF-8 formatting code with calls to lib/unicode.

\* lib/guestInfo/guestInfoPosix.c: Replaced the old syscall-based implementation of nicinfo with a simpler implementation that uses dnet.

\* lib/guestInfo/guestInfoServer.c, lib/include/guestInfo.h, lib/include/guestInfoInt.h: Added Win32 implementation of meminfo. POSIX implementation to follow.

\* lib/hgfsServer/hgfsServerLinux.c: Replaced a direct readlink(3) call with a call to the POSIX wrapper for readlink(3). Relax an overeager

ASSERT in symlink checking when using the special empty share.

\* lib/include/codeset.h, lib/string/bsd\_vsnprintf.c, lib/string/str.c, lib/unicode/unicodeSimpleOperations.c, lib/unicode/unicodeSimpleUTF16.h: Refactored ICU routines from unicodeSimpleUtf16.h to codeset.h, which is now licensed under the ICU license (BSD variant).

\* lib/include/file.h, lib/file/file.c: Added function File\_StripSlashes.

\* lib/include/hgfsProto.h: Removed an A acute from a comment to allow the file to be built on Windows systems where the default language isn't English.

\* lib/include/hostinfo.h, lib/include/util.h, lib/user/hostinfoPosix.c, lib/user/util.c, lib/user/utilPosix.c: More conversions to lib/unicode. Added Util\_ZeroFreeStringW function for Windows in util.h.

\* lib/include/msg.h: Removed obsolete NO\_MSGFMT macro.

\* lib/include/unicodeBase.h, lib/unicode/unicodeCommon.c, lib/unicode/unicodeSimpleBase.c: Added some more encoding functions.

\* lib/include/vixCommands.h, lib/include/vixOpenSource.h: Added another user credential type, some command flags, some command layouts, some error codes, some properties, and tweaked existing commands.

\* lib/include/vixTools.h: Added VixToolsUserIsMemberOfAdministratorGroup function.

\* lib/include/vm\_assert.h, lib/include/vm\_basic\_defs.h: Move IMPLIES to vm\_basic\_defs.h. Removed some vprobes definitions.

\* lib/include/vmBackup.h, lib/vmBackupLib/scriptOps.c, lib/vmBackupLib/stateMachine.c: Added infrastructure to disable quiescing targets from a config file.

\* lib/include/vm\_basic\_asm.h: Changed \_\_GET\_CPUID2 handling for Windows.

\* lib/include/vm\_produ.h: Added VDM product.

\* lib/include/vm\_tools\_version.h: Bumped internal Tools version.

\* lib/include/win32util.h, lib/misc/hostname.c, lib/misc/util\_misc: Refactored functions to separate set of Win32 wrappers (next to the POSIX wrappers mentioned earlier).

- \* lib/misc/codeset.c: Made CodeSetGetCurrentCodeSet non-static.
- \* lib/misc/\*/Makefile.am: Added POSIX wrappers to build system.
- \* lib/strUtil/strutil.c: Fixed bug in StrUtil\_EndsWith function.
- \* lib/include/unicodeTypes.h, lib/unicode/unicodeSimpleTypes.c: Removed ISO-8859-11 encoding. Added cross-reference of IANA character set names, windows code pages, and ICU encodings.
- \* lib/vixTools/vixTools.c: Impersonation tweaks.
- \* modules/\*/\*/\*: Reflect header file changes from elsewhere in the source code tree.

2008-03-11 Adar Dembo <adar@vmware.com>

- \* vm\_version.h: Updated Tools version.
- \* modules/vmblock/linux/\*: Make vmblock build under 2.6.25-rc2.  
The dentry and mount objects have been moved out of struct nameidata and into the new struct path. Also, path\_release() is now path\_put().
- \* modules/vmsync/linux/\*:  
Make vmsync build under 2.6.25-rc2.  
The same changes were needed here as in vmblock above.

2008-03-10 Adar Dembo <adar@vmware.com>

- \* vm\_version.h: Updated Tools version.
- \* modules/vmhgfs/linux/\*: Make vmhgfs build under 2.6.25-rc1.  
The iget() function has been removed and filesystems are now expected to implement it themselves using iget\_locked().

2008-02-27 Elliot Lee <elliot@vmware.com>

- \* configure.ac, guestd/Makefile.am, toolbox/Makefile.am, vmware-user/Makefile.am: Allow passing custom LDFLAGS in to build process (patch by Mike Auty).
- \* Resync with internal trunk (2008.02.27).
- \* guestd/foundryToolsDaemon.c, lib/vixTools/vixTools.c, vmware-user/foundryToolsDaemon.c: Win9x compat changes.
- \* guestd/toolsDaemon.c: Style fixes.



- \* hgfsmounter/hgfsmounter.c: Bug fixes.
  
- \* lib/dnd/dndLinux.c, lib/dnd/dndCommon.c: Move some code to the platform-independent file, some DnDv3 support.
  
- \* lib/include/dnd.h, lib/include/dndInt.h: DnDv3 support.
  
- \* lib/file/file.c, lib/file/fileIO.c,  
lib/file/fileIOPosix.c,  
lib/file/fileLockPrimitive.c, lib/file/filePosix.c,  
lib/include/file\_extensions.h, lib/include/fileInt.h,  
lib/include/fileIO.h: Move functions around, Unicode fixes, misc fixes.
  
- \* lib/foundryMsg/foundryPropertyListCommon.c: Error handling fixes.
  
- \* lib/hgfsServer/\*.c, lib/include/hgfs\*.h,  
modules/freebsd/vmhgfs/\*, modules/linux/vmhgfs/\*: HGFS v3 support, updates to improve code re-use between the FreeBSD and MacOS X ports, and updates to make the Linux port build on 2.6.25-rc1 (but not rc2, yet).
  
- \* lib/include/auth.h, lib/include/codeset.h,  
lib/include/hostinfo.h, lib/include/str.h, lib/include/unicode\*.h,  
lib/include/vm\_basic\_types.h, lib/misc/hostname.c,  
lib/unicode/\*.c, lib/user/hostinfoPosix.c: Unicode fixes.
  
- \* lib/include/backdoor\_def.h: Add a new command for use by the BIOS in checking the GuestOS against Darwin.
  
- \* lib/include/dynarray.h, lib/misc/dynarray.c,  
lib/misc/Makefile.am, lib/misc/shared/Makefile.am: Add Dynarray implementation.
  
- \*  
lib/include/bsdfmt.h, lib/include/bsd\_output\_int.h,  
lib/string/bsd\_output\_shared.c, lib/string/bs\_vsnprintf.c,  
lib/string/bsd\_vsnwprintf.c, lib/string/str.c: Rework built-in printf implementation, esp. for Unicode fixes.
  
- \* lib/include/ghIntegration.h: Shuffle types around.
  
- \* lib/include/loglevel\_user.h, lib/include/unity.h,  
lib/syncDriver/syncDriverPosix.c, lib/user/util.c,  
toolbox/toolbox-gtk.c: Misc fixes.
  
- \* lib/include/vmBackup.h, lib/vmBackupLib/scriptOps.c,

lib/vmBackupLib/stateMachine.c, lib/vmBackupLib/vmBackupInt.h:

Rework scripts for freeze & thaw operations.

\* lib/include/vm\_product.h, lib/include/vm\_version.h: Add new product defs (VMRC).

\* lib/include/vm\_tools\_version.h: Add ESX 3.5U1 product.

\* lib/include/vixCommands.h, lib/include/vix.h: Add new VIX commands and error code.

\* lib/include/win32util.h: Add misc Win32 utilities.

\* modules/\*/\*/\*: Reflect header file changes from elsewhere in the source code tree.

2008-02-13

Adar Dembo <adar@vmware.com>

\* Resync with internal trunk (2008.02.12).

\* configure.ac, lib/unityStub/\*, lib/ghIntegrationStub/\*, lib/Makefile.am, vmware-user/Makefile.am, vmware-user/vmware-user.c: Added lib/unityStub and lib/ghIntegrationStub. Unity and guest-host integration features for X11 guests are on the way.

\* configure.ac, guestd/Makefile.am, lib/fileUtf8/\*, lib/vixTools/vixTools.c, vmare-user/Makefile.am: lib/file is now fully internationalized. Removed unneeded lib/fileUtf8.

\* foundryToolsDaemon.c: Fixed a leak of the sync driver handle.

\* guestd/toolsDaemon.c: Send guestd's "config directory" to the VMX for publishing.

\* hgfsmounter/hgfsmounter.c: Port to MacOS.

\* lib/dnd/\*, lib/err/err.c, lib/file/\*, lib/include/dnd\*, lib/include/file\*, lib/include/unicode\*, lib/include/util.h, lib/unicode/\*, lib/user/utilPosix.c: More Unicodification.

\* lib/file/file.c, lib/include/file.h: Added File\_EnsureDirectory.

\* lib/foundryMsg/foundryMsg.c, lib/guestInfo/guestInfoServer.c, lib/misc/codeset.c, lib/misc/vmstdio.c, lib/SLPv2Parser/SLPv2MsgAssembler.c, lib/user/util.c: Removed some unneeded casts.

\* lib/foundryMsg/foundryThreads.c, lib/include/foundryThreads.h: Added FoundryThreads\_Free.

\* lib/guestInfo/\*, lib/include/guest\_os.h, lib/include/guestInfo.h: Refactored GetSystemBitness. Removed osNames.h.

\* lib/hgfsServer/hgfsServerLinux.c: Modified MacOS alias resolution code so as not to mount volumes. Made HGFS query volume code more resilient to failures.

\* lib/include/backdoor\_def.h: Added commands for VAssert.

\* lib/include/escape.h, lib/misc/escape.c: Escape\_Do is no longer declared inline.

\* lib/include/hashTable.h, lib/misc/hashTable.c, lib/misc/Makefile.am, lib/misc/shared/Makefile.am: Renamed from hash.[ch].

\* lib/include/iovector.h, lib/include/vm\_basic\_types.h: Added SectorType definition.

\* lib/include/loglevel\_user.h: Added additional log levels.

\* lib/include/msgfmt.h: Modified for use in VMKERNEL.  
Added  
MsgFmt\_GetArgswithBuf.

\* lib/include/msg.h: Added Msg\_AppendVob for ESX.

\* lib/include/stats\_user\*: Modified some preprocessing steps. Added SETUP\_WANT\_GETVAL to retrieve named stat counter values.

\* lib/include/str.h: Modified behavior Str\_\* family of functions for Windows.

\* lib/include/strutil.h, lib/strUtil/strutil.c: Removed Split, Grep, GrepFd, and GrepFree. Added EndsWith and DecimalStrToUInt.

\* lib/include/syncWaitQ.h, lib/sync/\*: Modified SyncWaitQ\_Add and SyncWaitQ\_Remove to use PollDevHandle fd types instead of int fd types.

\* lib/include/timeutil.h, lib/misc/timeutil.c: Added TimeUtil\_GetLocalWindowsTimeZoneIndex and some helper functions.

\* lib/include/util.h, lib/user/utilPosix.c: Added Util\_BumpNoFds.

\* lib/include/vixCommands.h: Added commands for device hotplug and

remote debugging.

\* lib/include/vix.h, lib/include/vixOpenSource.h: Added some new errors and properties. Added more VM manipulation functions.

\* lib/include/vm\_atomic.h:  
Comment cleanup and added VMKERNEL-specific calls for fencing.

\* lib/include/vm\_basic\_asm\_x86\_64.h: Added inline routines to save and restore ES1.

\* lib/include/vm\_basic\_types.h: Added some types and cleaned up a bit.

\* lib/include/vm\_legal.h: Updated COPYRIGHT\_YEARS.

\* lib/include/vm\_product.h: Added hostd service name.

\* lib/include/x86cpuid.h: Cleaned up the file and added some definitions for Penryn processors.

\* lib/misc/codeset.c: Added new UTF-16 --> UTF-8 conversion routine.

\* lib/misc/util\_misc.c, lib/user/util.c: Moved Util\_GetCurrentThreadId and friends to util\_misc.c.

\* lib/procMgr/procMgrPosix.c: Cleaned up some code and reworked asynchronous process execution so as to properly track the grandchild's pid instead of the child's pid.

\* lib/string/bsd\*: Reorganized BSD formatter.

\* lib/string/str.c: Updated unit tests. Added some Windows corner case behavior for Str\_Vsnwprintf.

\* lib/strUtil/strutil.c: Fixed some corner cases in existing functions that call strtoul.

\* lib/vixTools/vixTools.c: Changed signature of VixToolsImpersonateUser. Changed error code handling in a few places.

\* modules/freebsd/vmhgfs\*: Refactored a lot of code so that it can be safely reused within the MacOS vmhgfs module.

\* modules/\*/\*/kernelStubs\*: Removed dead System\_Uptime function.

\* modules/linux/\*/compat\_wait.h: Reworked VMW\_HAVE\_EPOLL macro. Added

waitqueue helper macros for older kernels.

\* modules/linux/vmhgfs/file.c, modules/linux/vmhgfs/fsutil.\*,  
modules/linux/vmhgfs/inode.c: Added HgfsSetUidGid function and used it  
to preserve uid/gid after creating a directory.

\* modules/linux/vmhgfs/vmhgfs\_version.h: Bumped driver version.

\* modules/linux/vmsync/compat\_workqueue.h: Basic implementation of  
work queues and delayed work queues (using taskqueues and timers) for  
older kernels.

\* modules/linux/vmsync/sync.c: Modified internal state to use new  
compatible work queue implementation.

\* modules/linux/vmxnet/compat\_ioport.h,  
modules/linux/vmxnet/compat\_netdevice.h,  
modules/linux/vmxnet/compat\_pci.h,  
modules/linux/vmxnet/compat\_skbuff.h,  
modules/linux/vmxnet/vmxnetInt.h:  
Added and refactored  
compatibility macros for use in vmxnet3 and vmci sockets modules.

\* modules/linux/vmxnet/vmxnet.c: Hide some kernel functions behind  
compatibility macros.

2008-01-23 Adar Dembo <adar@vmware.com>

\* Resync with internal trunk (2008.01.08).

\* configure.ac, guestd/Makefile.am, hgfsclient/Makefile.am,  
lib/Makefile.am, toolbox/Makefile.am, vmware-user/Makefile.am:  
integrated lib/unicode for internationalizing strings.

\* guestd/main.c: Stopped using pgrep for finding existing instances  
of guestd. Removed ancient bandwidth test code.

\* guestd/toolsDaemon.c: Moved initial send of the guest's uptime from  
when guestd sends its version to when guestd registers its  
capabilities.

\* lib/file/\*, lib/include/file\*.h : Massive overhaul of lib/file to  
integrate the new unicode strings that are i18n-safe. Quite  
a bit of  
cleanup and refactoring as well.

\* lib/file/file.c: Addition of File\_PrependToPath function.

\* lib/file/fileIOPosix.c: Addition of FileIO\_SetExcludedFromTimeMachine and FileIO\_PrivilegedPosixOpen functions.

\* lib/fileUTF8/fileUTF8Linux.c, lib/include/fileUTF8.h: Removal of some casts and addition of FileUTF8\_GetSize function.

\* lib/foundryMsg/foundryMsg.c, lib/misc/vmstdio.c,  
lib/SLPv2Parser/SLPv2MsgAssembler.c: Addition of some casts.

\* lib/foundryMsg/foundryPropertyListCommon.c: Robustified some error cases.

\* lib/foundryMsg/vixTranslateErrOpenSource.c,  
lib/include/vixOpenSource.h: Added VIX\_E\_OUT\_OF\_MEMORY error code.  
Added Vix\_TranslateCOMError function. Added VIX\_DEBUG macro.

\* lib/guestInfo/guestInfoServer.c, lib/include/guestInfo.h: Added some casts and refactored some functions. Also fixed a crash that hinders backwards compatibility.

\* lib/hgfs/cpNameUtil.c, lib/hgfs/cpNameUtilLinux.c,  
lib/hgfsBd/hgfsBd.c, lib/include/cpName.h, lib/include/cpNameLite.h,  
lib/include/escBitvector.h,  
lib/include/hgfsUtil.h,  
lib/message/messageBackdoor.c, lib/message/message.c,  
lib/message/messageStub.c, lib/rpcout/rpcout.c,  
modules/freebsd/vmhgfs/kernelStubs.h: Made safe for inclusion in MacOS kernel module code.

\* lib/include/backdoor.h: Refactored some type definitions.

\* lib/include/bsd\_output\_int.h, lib/include/safetime.h,  
lib/string/bsd\_output\_shared.c: Made safe for Win64 builds.

\* lib/include/dynbuf.h: Added DynBuf\_AppendString function.

\* lib/include/err.h: Assorted cleanup.

\* lib/include/escape.h, lib/misc/escape.c: Converted Escape\_Do to be inline. Some cleanup.

\* lib/include/guest\_os.h: Assorted cleanup.

\* lib/include/hash.h, lib/misc/hash.c, lib/misc/Makefile.am,  
lib/misc/shared/Makefile.am: Added basic hash table implementation.

\* lib/include/hostinfo.h, lib/user/hostinfoPosix.c: Refactored and added several timekeeping functions.

- \* lib/include/localconfig.h, lib/include/util\_shared.h: Modified statements for include check.
- \* lib/include/log.h: Changed the value of some macros when debugging.
- \* lib/include/loglevel\_defs.h: Refactored some code, added macros for use in the VMM.
- \* lib/include/loglevel\_user.h: Added loglevels for some new components.
- \* lib/include/msgfmt.h: Added new functions.
- \* lib/include/msg.h: Added new Msg\_LocalizeList function.
- \* lib/include/netutil.h: Modified prototypes for two Windows-only functions.
- \* lib/include/preference.h: Added new Preference\_GetInt64 and Preference\_SetFromString functions.
- \* lib/include/strutil.h, lib/strUtil/strutil.c: Cleaned up and added some new functions.
- \* lib/include/su.h: Cleanup.
- \* lib/include/syncMutex.h, lib/sync/syncMutex.c: Added NetWare implementation of some synchronization primitives.
- \* lib/include/unicode\*, lib/unicode/\*: New library for handling Unicode-aware strings.
- \* lib/include/util.h, lib/user/util.c: Assorted refactoring and addition of some new functions, one related to backtracing.
- \*  
lib/include/vixCommands.h: New commands for vprobes, replay, message dialogs, and others, plus cleanup of some existing commands.
- \* lib/include/vm\_assert.h: Added IMPLIES macro.
- \* lib/include/vm\_atomic.h, lib/include/vm\_basic\_asm.h: Refactored for safe Win64 builds.
- \* lib/include/vm\_basic\_defs.h: Added compatibility code for \_\_va\_copy.
- \* lib/include/vm\_basic\_types.h: Added FMTH for printing the value of

handles. Set a new `#pragma` to ignore `size_t` truncation warnings on Windows. Added several other macros, as well as a `ssize_t` definition for some versions of BSD.

\* `lib/include/vm_legal.h`: Added more patents to the patent string.

\* `lib/include/vm_product.h`: Added new macros for some products.

\* `lib/include/vm_tools_version.h`: Added macros for certain older Tools versions and for `PRODUCT_BUILD_NUMBER` refactoring.

\* `lib/include/vm_version.h`: Tweaked some product expiration dates and versions. Refactored many uses of `BUILD_NUMBER` to `PRODUCT_BUILD_NUMBER`.

\* `lib/include/x86cpuid.h`:  
Tweaked definition of `RDTSCP` flag. Refactored `BIT_MASK` macro to `VMW_BIT_MASK`.

\* `lib/misc/base64.c`: Modified calling contract for `Base64_EasyEncode`.

\* `lib/misc/codeset.c`: Tweaked casts and preprocessor conditioning.

\* `lib/misc/idLinux.c`: Added `IdAuthCreateWithFork` and reworked several other functions to work around a bug in Apple's detection of GUI processes.

\* `lib/misc/util_misc.c`: Moved `W32Util_GetLongPathName` and `W32Util_LookupSidForAccount` elsewhere.

\* `lib/rpcin/rpcin.c`: Addition of a ping `GuestRPC` callback.

\* `lib/string/str.c`: Removed a comment.

\* `lib/sync/syncWaitQPosix.c`: Added code to disable a workaround for a MacOS bug when appropriate (it was fixed in Leopard).

\* `lib/vixTools/vixTools.c`: Refactored some code, added code to modify the guest's networking configuration, added some casts, and added code to prevent renaming a file to itself.

\* `modules/freebsd/*/Makefile`, `modules/linux/*/Makefile.normal`: Set a make variable so the module file will be build in the parent directory.  
Removed some unused rules.

\* `modules/freebsd/vmhgfs/kernelStubsBSD.c`,  
`modules/linux/vmhgfs/kernelStubsLinux.c`: Removed unused function.



- \* modules/linux/\*/include/driver-config.h: Added check to prevent uintptr\_t from being declared twice.
- \* modules/linux/vmblock/linux/filesystem.c, modules/linux/vmblock/Makefile.kernel: Added check for newer kernels where the slab allocator's constructor function expects three arguments. Makes it work with 2.6.25-rc1 (but not rc2, yet).
- \* modules/linux/vmblock/linux/vmblock\_version.h: Bumped module version.
- \* modules/linux/vmhgfs/filesystem.c, modules/linux/vmhgfs/inode.c, modules/linux/vmhgfs/module.h, modules/linux/vmhgfs/page.c: Added support for writeback caching in conformant kernels.
- \* modules/linux/vmhgfs/vmhgfs\_version.h: Bumped module version.
- \* modules/linux/vmxnet/vmxnetInt.h: Renamed a type and removed the inclusion of unnecessary headers. Pruned said headers from codebase.

2007-11-15

Elliot Lee <elliot@vmware.com>

- \* Bandsaw release (2007.11.15).
- \* configure.ac: Handle building modules for multiple OS's. Improve X detection to allow building --without-x. Improve Gtk+ detection. Detect libdnet on Solaris. Detect which -Wwarning flags the compiler can handle.
- \* vmware-user/foreignVMTToolsNetworking.c, lib/vixTools/vixTools.c, guestd/foreignVMTToolsNetworking.c, lib/include/netutil.h, lib/include/guestInfo.h, lib/netUtil/netUtilLinux.c, lib/include/guestInfoInt.h, lib/guestInfo/guestInfoPosix.c, lib/guestInfo/guestInfoServer.c: Move to new NicInfo structures.
- \* vmware-user/foundryToolsDaemon.c, guestd/foundryToolsDaemon.c: Make sure requestMsg is not NULL before looking inside it.
- \* guestd/main.c: Cleanup of HGFS pserver and mounting code. Check for some type of signal when sending an RPC.
- \* guestd/toolsDaemon.c, vmware-user/resolution.c: Have the guest tell the host whether screen resolution changes should be sent, instead of having the host guess it based on the OS type set in the .vmx file. Better timeout checking to avoid problems when host & guest time diverge.

- \* hgfsmounter/hgfsmounter.c: FreeBSD support. Fixes to compile on old systems.
- \* lib/backdoor/backdoor.c: Tweak for FreeBSD kernel modules.
- \* lib/include/mntinfo.h, lib/dnd/dndLinux.c, lib/wiper/wiperPosix.c, lib/syncDriver/syncDriverPosix.c: Fixes to compile on new systems w/gcc 4.2.
- \* lib/err/err.c, lib/err/errPosix.c, lib/err/Makefile.am: Move Err\_Errno2String function into POSIX-specific source file.
- \* lib/file/fileIOPosix.c: Handle EDQUOT if applicable. Fixes to compile on new systems where SYS\_\_llseek may not be available. Better reporting of errors, by translating errno into FILEIO\_\* error codes.
- \* lib/file/fileLockPosix.c: Fixes to compile on old systems. Add a bunch of functions to the FileLock\* API.
- \* lib/file/fileLockPrimitive.c, lib/include/fileInt.h: Bunch of file locking cleanups and bug fixes.
- \* lib/file/filePosix.c:  
Bunch of MacOS-related fixes. Add File\_GetTimes(), FilePosixGetParent(), FilePosixGetBlockDevice(), etc.
- \* lib/fileUtf8/fileUTF8Linux.c: Add FileUTF8\_GetTimes() function.
- \* lib/foundry/foundryMsg.c, lib/include/vixCommands.h: Add VIX\_USER\_CREDENTIAL\_HOST\_CONFIG\_HASHED\_SECRET credential type, and a bunch of VIX commands relating to record-replay.
- \* lib/foundryMsg/vixTranslateErrOpenSource.c: Translate a couple more error codes.
- \* lib/guestInfo/guestInfoPosix.c, lib/guestInfo/Makefile.am: Use libdnet on Solaris to retrieve networking info.
- \* lib/hgfs/cpNameUtil.c, lib/hgfs/cpNameUtilInt.h, lib/hgfs/cpNameUtilLinux.c: Couple more CPName <-> UTF8 conversion routines. Some MacOS changes as well.
- \* lib/hgfs/hgfsUtil.c, lib/include/hgfs.h, modules/linux/vmhgfs/fsutil.c: Handle ENAMETOOLONG.
- \* lib/hgfs/staticEscape.c, lib/hgfs/hgfsBd.c: Handle FreeBSD as

well.

\* lib/hgfsServer/hgfsServer.c: Tie in the cpNameUtil UTF8 changes on MacOS.

\* lib/hgfsServer/hgfsServerLinux.c:

Make the getdents() wrapper

work on a wider range of Linux systems. Add "alias" resolution on MacOS, and tie in the cpNameUtil UTF8 changes on MacOS.

\* lib/hgfsServer/hgfsServerPolicyGuest.c: Handle FreeBSD.

\* lib/include/backdoor\_def.h: Add BDOOR\_CMD\_LAZYTIMEREMULATION and BDOOR\_CMD\_BIOSBBS.

\* lib/include/str.h, lib/include/bsd\_output.h,

lib/include/bsd\_output\_int.h: include compat\_stdarg.h, change vsnwprintf prototype, add HAVE\_BSD\_WPRINTF define, other compat fixups.

\* lib/include/cpNameUtil.h, lib/include/codeset.h,

lib/misc/codeset.c: Changes to correspond to cpNameUtil UTF8 changes.

\* lib/include/compat/compat\_stdarg.h: New header for doing stdarg easily across platforms.

\* lib/include/cpName.h: FreeBSD fixes.

\* lib/include/dnd.h: Add Dnd\_SetClipboard and Dnd\_GetFileList().

\* lib/include/escBitvector.h: FreeBSD fixes.

\* lib/include/file.h, lib/include/fileUTF8.h: Add new MacOS routines and File\_GetTimes/FileUTF8\_GetTimes.

\* lib/include/hgfsProto.h:

Explanation of the whole cpNameUtil and codeset UTF8 changes and how they tie in with HGFS.

\* lib/include/hgfsUtil.h: Random compatibility changes.

\* lib/include/loglevel\_user.h: Add a few LOGLEVEL\_VAR definitions.

\* lib/include/msg.h: s/USE\_MSGFMT/NO\_MSGFMT/

\* lib/include/osNames.h: Add Windows 2003 Datacenter Edition, and user-visible 64bit suffix macro.

- \* lib/misc/random.c, lib/include/random.h: Add Random\_Quick() and Random\_QuickSeed() routines.
- \* lib/misc/idLinux.c, lib/include/su.h: Add Id\_AuthGetLocal() and Id\_GetAuthExternal() routines, and compat fixes.
- \* lib/misc/timeutil.c, lib/include/timeutil.h: Add TimeUtil\_UnixTimeToNtTime() routine.
- \* lib/include/util.h: Add a couple of MacOS routines.
- \* lib/include/vmBackup.h, lib/vmBackupLib/stateMachine.c: add a couple of structure elements for Windows backup fixes.
- \* lib/include/vm\_basic\_asm.h: fixes for reading TSC on 64-bit platforms.
- \* lib/include/vm\_basic\_defs.h: Add other va\_copy macros.
- \*  
lib/include/vm\_basic\_types.h: Fixes for compiling on a wide range of systems.
- \* lib/include/vm\_legal.h: Change the PATENTS\_STRING
- \* lib/include/vm\_product.h: Add "License Infrastructure" product.
- \* lib/include/vm\_tools\_version.h: Change tools versions listed for various upcoming product releases.
- \* lib/include/vm\_version.h: Update the versions.
- \* lib/include/x86cpuid.h: Define more CPU flags & fields, add new CPU models. Fixes for fully writable TSC detection.
- \* lib/message/message.c, lib/message/messageBackdoor.c: Fixes for FreeBSD.
- \* lib/misc/util\_misc.c: Handle MacOS.
- \* lib/rpcIn/rpcin.c: Fail a badly-formed RPC instead of ASSERT()'ing into oblivion.
- \* lib/string/bsd\_vsnprintf.c: Various fixes to synchronize with bsd\_vsnwprintf.c.
- \* lib/string/Makefile.am, lib/string/shared/Makefile.am,

lib/string/str.c lib/string/bsd\_vsnwprintf.c: New file to implement vsnwprintf() for compat purposes.

\* lib/vixTools/vixTools.c: New FileUTF8 routines.

\* Makefile.am,

modules/Makefile.am: --without-x fixes, add

xferlogs, move kernel module building into separate Makefile.am

\* modules/freebsd/\*: Add FreeBSD kernel modules (vmblock, vmhgfs, vmmemctl, vmxnet).

\* modules/linux/\*/include/compat\_\*.h,

modules/linux/\*/autoconf/cachector.c,

modules/linux/\*/autoconf/cachecreate.c,

modules/linux/\*/backdoor.c, modules/linux/vmhgfs/filesystem.c,

modules/linux/vmhgfs/hgfsBd.c, lib/procMgr/procMgrPosix.c,

lib/rpcOut/rpcout.c, lib/user/util.c, lib/vmCheck/vmcheck.c,

libguestlib/Makefile.am, lib/deployPkg/runDeployPkgPosix.c,

lib/include/vm\_atomic.h: Compat fixes.

\* modules/linux/\*/kernelStubs.h: Update for FreeBSD.

\* modules/linux/\*/include/\*.h, modules/linux/\*/backdoor\_def.h,

modules/linux/\*/cpName.h, modules/linux/\*/hgfs.h,

modules/linux/\*/hgfsProto.h, modules/linux/\*/hgfsUtil.[ch],

modules/linux/\*/kernelStubsLinux.c,

modules/linux/\*/messageBackdoor.c, modules/linux/\*/message.c,

modules/linux/\*/rpcout.c, modules/linux/\*/rpcin.c,

modules/linux/\*/staticEscape.c,

modules/linux/\*/vm\_basic\_asm.h,

modules/linux/\*/vm\_basic\_defs.h, modules/linux/\*/vm\_basic\_types.h,

modules/linux/\*/x86cpuid.h, modules/linux/\*/compat\_\*.h: Pull in

updated files from main source tree.

\* modules/linux/\*/Makefile.kernel: Remove CC\_WARNINGS/CC\_OPTS gunk.

\* modules/linux/\*/README, modules/linux/\*/Makefile.normal: Build foo.o driver by default on systems with VM\_KBUILD=no.

\* modules/linux/vmhgfs/vmhgfs\_version.h: Updated VMHGFS driver version.

\* modules/linux/vmmemctl/os.[ch],

modules/linux/vmmemctl/vmballoon.c: Implement and use os\_yield()

to deprioritize the Balloon\_Deallocate operation.

- \* modules/linux/vmsync/\*: New sync driver to make VM snapshots consistent.
- \* modules/linux/vmxnet/bpf\_meta.h: New file.
- \* modules/linux/vmxnet/net\_dist.h: Update NET\_MAX\_IMPL\_PKT\_OVHD value.
- \* modules/linux/vmxnet/vm\_device\_version.h: Mention VMXNET3
- \* modules/linux/vmxnet/vmkapi\_status.h: Updated VMK\_ERR codes.
- \* modules/linux/vmxnet/vmkapi\_types.h:  
Add VMK\_CONST64(U) macros.
- \* modules/linux/vmxnet/vmxnet2\_def.h,  
modules/linux/vmxnet/vmnet\_def.h,  
modules/linux/vmxnet/vmxnet\_def.h,  
modules/linux/vmxnet/vmxnetInt.h, modules/linux/vmxnet/vmxnet.c:  
Add (optional) BPF support.
- \* modules/linux/vmxnet/vmxnetInt.h, modules/linux/vmxnet/vmxnet.c:  
Add vmxnet\_link\_check to propagate device link status to netdev.
- \* common/vm-support: New script to gather support info from a VM.
- \* scripts/\*/\*-default: New poweron/poweroff/suspend/resume scripts for a VM. Add support for dropping user-provided scripts into a subdirectory.
- \* toolbox/toolboxAbout.c: Eliminate warnings about unused variables.
- \* toolbox/toolboxShrink.c: Update wording of message.
- \* toolbox/copyPaste.c: Try cutting & pasting UTF8 text if we can.
- \* xferlogs/\*: New log transfer utility.

2007-10-26 Elliot Lee <elliot@vmware.com>

- \* Initial import of 2007.09.04-56574 code ("Axe" release).
- \* Import 2007.10.08 snapshot, which includes patches to fix the --without-x flag, and compilation with gcc 4.2.

Found in path(s):

## 1.313 rtmpdump

a107cef9b392616dff54fabfd37f985ee2190a6f

### 1.313.1 Available under license :

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Version 2.1, February 1999

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## 1.314 runc 1.1.8

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# 1.317 linux-kernel 5.10.194

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/\* nicstar.c v0.22 Jawaid Bazyar (bazyar@hypermall.com)

\* nicstar.c, M. Welsh (matt.welsh@cl.cam.ac.uk)

\*

\* Hacked October, 1997 by Jawaid Bazyar, Interlink Advertising Services Inc.

\* <http://www.hypermall.com/>

\* 10/1/97 - commented out CFG\_PHYIE bit - we don't care when the PHY

\* interrupts us (except possibly for removal/insertion of the cable?)

\* 10/4/97 - began heavy inline documentation of the code. Corrected typos

\* and spelling mistakes.

\* 10/5/97 - added code to handle PHY interrupts, disable PHY on

\* loss of link, and correctly re-enable PHY when link is

\* re-established. (put back CFG\_PHYIE)

\*

\* Modified to work with the IDT7721 nicstar -- AAL5 (tested) only.

\*

\* R. D. Rechenmacher <ron@fnal.gov>, Aug. 6, 1997

\*

\* Linux driver for the IDT77201 NICStAR PCI ATM controller.

\* PHY component is expected to be 155 Mbps S/UNI-Lite or IDT 77155;

\* see `init_nicstar()` for PHY initialization to change this. This driver

\* expects the Linux ATM stack to support scatter-gather

lists

\* `(skb->atm.iovcnt != 0)` for Rx skb's passed to `vcc->push`.

\*

\* Implementing minimal-copy of received data:

\* IDT always receives data into a small buffer, then large buffers

\* as needed. This means that data must always be copied to create

\* the linear buffer needed by most non-ATM protocol stacks (e.g. IP)

\* Fix is simple: make large buffers large enough to hold entire

\* SDU, and leave `<small_buffer_data>` bytes empty at the start. Then

\* copy small buffer contents to head of large buffer.

\* Trick is to avoid fragmenting Linux, due to need for a lot of large

\* buffers. This is done by 2 things:

\* 1) `skb->destructor / skb->atm.recycle_buffer`

\* combined, allow `nicstar_free_rx_skb` to be called to

\* recycle large data buffers

\* 2) `skb_clone` of received buffers

\* See `nicstar_free_rx_skb` and `linearize_buffer` for implementation

\* details.

\*

\*

\*

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\* M. Welsh, 6 July 1996  
\*  
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\*/

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```
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```

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under certain conditions; type `show c'
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```
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```

```
<signature of Ty Coon>, 1 April 1989
Ty Coon, President of Vice
```

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The End

# 1.319 spring-context 5.2.24.RELEASE

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 * limitations under the License.
 */
/**
 * Indicates that a component is only eligible for registration when all
 * { @linkplain #value specified conditions } match.
 *
 * <p>A condition is any state that can be determined programmatically
 * before the bean definition is due to be registered (see { @link Condition } for details).
 *
 * <p>The { @code @Conditional } annotation may be used in any of the following ways:
 *
 * as a type-level annotation on any class directly or indirectly annotated with
 * { @code @Component }, including { @link Configuration @Configuration } classes
 * as a meta-annotation, for the purpose of composing custom stereotype
 * annotations
 * as a method-level annotation on any { @link Bean @Bean } method
 *
 *
 * <p>If a { @code @Configuration } class is marked with { @code @Conditional },
 * all of the { @code @Bean } methods, { @link Import @Import } annotations, and
 * { @link ComponentScan @ComponentScan } annotations associated with that
 * class will be subject to the conditions.
 *
 * <p>NOTE: Inheritance of { @code @Conditional } annotations
 * is not supported; any conditions from superclasses or from overridden
 * methods will not be considered. In order to enforce these semantics,
 * { @code @Conditional } itself is not declared as
```

\* { @link java.lang.annotation.Inherited  
@Inherited}; furthermore, any  
\* custom <em>composed annotation</em> that is meta-annotated with  
\* { @code @Conditional} must not be declared as { @code @Inherited}.  
\*  
\* @author Phillip Webb  
\* @author Sam Brannen  
\* @since 4.0  
\* @see Condition  
\*/

Found in path(s):

\* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/context/annotation/Conditional.java

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\* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/jmx/access/InvalidInvocationException.java

\* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/jmx/export/UnableToRegisterMBeanException.java

\*

/opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/context/ApplicationContextAware.java

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\* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/remoting/rmi/CodebaseAwareObjectInputStream.java

\* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/jmx/export/notification/UnableToSendNotificationException.java

\* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/remoting/support/UrlBasedRemoteAccessor.java

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\* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/jmx/export/MBeanExportException.java

\* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/ui/context/ThemeSource.java

\* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/remoting/rmi/RmiClientInterceptor.java

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\* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/remoting/support/RemoteInvocationTraceInterceptor.java

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/opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/remoting/RemoteConnectFailureException.java

\* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/scheduling/TriggerContext.java

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\* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/jmx/export/metadata/InvalidMetadataException.java

\* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/ejb/config/JeeNamespaceHandler.java

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\* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/ejb/config/RemoteStatelessSessionBeanDefinitionParser.java

\* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/ui/context/Theme.java

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\* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/remoting/rmi/RmiBasedExporter.java

\* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/context/event/ApplicationContextEvent.java

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/opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/remoting/RemoteInvocationFailureException.java



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\* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/context/annotation/EnableMBeanExport.java

\* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/context/ApplicationContextException.java

\* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/jndi/JndiLookupFailureException.java

\* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/scheduling/support/DelegatingErrorHandlingRunnable.java

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\* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/format/Formatter.java

\* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/scripting/support/RefreshableScriptTargetSource.java

\* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/ejb/config/JndiLookupBeanDefinitionParser.java

\* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/ui/context/support/SimpleTheme.java

\* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/jmx/access/MBeanInfoRetrievalException.java

\* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/instrument/classloading/LoadTimeWeaver.java

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\* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/context/weaving/LoadTimeWeaverAware.java

\* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/jmx/export/MBeanExporterListener.java

\* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/validation/BindingResultUtils.java

\* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/remoting/RemoteProxyFailureException.java

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/opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/jmx/MBeanServerNotFoundException.java

\* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/ui/context/HierarchicalThemeSource.java

\* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/context/event/ContextRefreshedEvent.java

\* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/format/number/AbstractNumberFormatter.java

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jar/org/springframework/jmx/export/annotation/AnnotationMBeanExporter.java  
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jar/org/springframework/remoting/soap/SoapFaultException.java  
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jar/org/springframework/remoting/support/DefaultRemoteInvocationFactory.java  
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jar/org/springframework/context/config/ContextNamespaceHandler.java  
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jar/org/springframework/validation/DataBinder.java

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\* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/scheduling/concurrent/ForkJoinPoolFactoryBean.java  
\* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/context/support/FileSystemXmlApplicationContext.java  
\*  
/opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/jmx/export/assembly/MetadataMBeanInfoAssembler.java  
\* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/context/support/GenericGroovyApplicationContext.java  
\* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/ejb/access/SimpleRemoteStatelessSessionProxyFactoryBean.java  
\* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-

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jar/org/springframework/cache/interceptor/NameMatchCacheOperationSource.java
* /opt/cola/permits/1812856512_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-
jar/org/springframework/context/annotation/EnableLoadTimeWeaving.java
* /opt/cola/permits/1812856512_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-
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*
/opt/cola/permits/1812856512_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-
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jar/org/springframework/context/annotation/ConfigurationMethod.java
* /opt/cola/permits/1812856512_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-
jar/org/springframework/validation/BindingResult.java
* /opt/cola/permits/1812856512_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-
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* /opt/cola/permits/1812856512_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-
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*
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* /opt/cola/permits/1812856512_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-
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* /opt/cola/permits/1812856512_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-
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*
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* /opt/cola/permits/1812856512_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-
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* /opt/cola/permits/1812856512_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-
jar/org/springframework/validation/Errors.java
* /opt/cola/permits/1812856512_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-
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* /opt/cola/permits/1812856512_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-
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* /opt/cola/permits/1812856512_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-
jar/org/springframework/context/support/MessageSourceSupport.java
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 jar/org/springframework/cache/interceptor/AbstractFallbackCacheOperationSource.java  
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 jar/org/springframework/validation/SmartValidator.java  
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 jar/org/springframework/scripting/ScriptCompilationException.java  
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 jar/org/springframework/context/annotation/AdviceModeImportSelector.java  
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jar/org/springframework/remoting/rmi/RmiInvocationWrapper.java  
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jar/org/springframework/scheduling/config/TaskManagementConfigUtils.java  
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/opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-  
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jar/org/springframework/format/datetime/standard/YearFormatter.java  
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jar/org/springframework/jndi/JndiLocatorSupport.java  
\* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-  
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jar/org/springframework/context/support/LiveBeansView.java  
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jar/org/springframework/context/annotation/ScopedProxyCreator.java  
\* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-  
jar/org/springframework/context/expression/CachedExpressionEvaluator.java  
\* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-  
jar/org/springframework/format/datetime/standard/DateTimeConverters.java  
\* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-  
jar/org/springframework/validation/AbstractPropertyBindingResult.java  
\* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-  
jar/org/springframework/context/weaving/AspectJWeavingEnabler.java  
\* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-  
jar/org/springframework/cache/annotation/CachingConfigurer.java  
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/opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-  
jar/org/springframework/context/event/DefaultEventListenerFactory.java  
\* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-  
jar/org/springframework/jmx/export/ assembler/SimpleReflectiveMBeanInfoAssembler.java  
\* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-  
jar/org/springframework/scheduling/concurrent/ThreadPoolExecutorFactoryBean.java  
\* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-  
jar/org/springframework/scheduling/SchedulingTaskExecutor.java  
\* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-  
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\* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-  
jar/org/springframework/context/EmbeddedValueResolverAware.java  
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/opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-  
jar/org/springframework/validation/MessageCodeFormatter.java  
\* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-

jar/org/springframework/context/event/GenericApplicationListener.java  
 \* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-  
 jar/org/springframework/scheduling/annotation/AsyncAnnotationBeanPostProcessor.java  
 \* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-  
 jar/org/springframework/cache/interceptor/CacheResolver.java  
 \* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-  
 jar/org/springframework/format/datetime/standard/DateTimeFormatterRegistrar.java  
 \* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-  
 jar/org/springframework/instrument/classloading/WeavingTransformer.java  
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 \* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-  
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 \* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-  
 jar/org/springframework/remoting/rmi/JndiRmiClientInterceptor.java  
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* /opt/cola/permits/1812856512_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-
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* /opt/cola/permits/1812856512_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-
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* /opt/cola/permits/1812856512_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-
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* /opt/cola/permits/1812856512_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-
jar/org/springframework/jndi/JndiTemplate.java
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* /opt/cola/permits/1812856512_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-
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* /opt/cola/permits/1812856512_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-
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* /opt/cola/permits/1812856512_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-
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* /opt/cola/permits/1812856512_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-
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* /opt/cola/permits/1812856512_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-
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jar/org/springframework/cache/config/CacheAdviceParser.java

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\* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/remoting/support/SimpleHttpServerFactoryBean.java  
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\* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/jmx/export/metadata/ManagedAttribute.java  
\* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/remoting/rmi/RmiServiceExporter.java  
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\* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/cache/interceptor/CacheableOperation.java  
\* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/jndi/JndiCallback.java  
\* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/remoting/rmi/RmiRegistryFactoryBean.java  
\* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/cache/annotation/AbstractCachingConfiguration.java  
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\* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/context/event/GenericApplicationListenerAdapter.java  
\* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/context/support/PropertySourcesPlaceholderConfigurer.java  
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\* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/ejb/access/AbstractSlsbInvokerInterceptor.java  
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/opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/remoting/rmi/RemoteInvocationSerializingExporter.java  
\* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/context/Lifecycle.java  
\* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/scheduling/annotation/AsyncAnnotationAdvisor.java  
\* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/context/annotation/AdviceMode.java  
\* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/context/support/MessageSourceAccessor.java  
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*/
/**
* Abstract the invocation of a cache operation.
*
* <p>Does not provide a way to transmit checked exceptions but
* provide a special exception that should be used to wrap any
* exception that was thrown by the underlying invocation.
* Callers are expected to handle this issue type specifically.
*
* @author Stephane Nicoll
* @since 4.1
*/
```

Found in path(s):

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* /opt/cola/permits/1812856512_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-
jar/org/springframework/cache/interceptor/CacheOperationInvoker.java
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\* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/context/ApplicationContext.java  
\* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/cache/interceptor/BasicOperation.java  
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\* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/format/AnnotationFormatterFactory.java  
\* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/context/annotation/PropertySources.java  
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* /opt/cola/permits/1812856512_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-
jar/org/springframework/context/i18n/SimpleTimeZoneAwareLocaleContext.java
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/opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/cache/interceptor/NamedCacheResolver.java  
\* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/context/config/LoadTimeWeaverBeanDefinitionParser.java  
\* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/cache/interceptor/BeanFactoryCacheOperationSourceAdvisor.java  
\* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-

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jar/org/springframework/jmx/export/naming/MetadataNamingStrategy.java
* /opt/cola/permits/1812856512_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-
jar/org/springframework/format/support/FormattingConversionServiceFactoryBean.java
* /opt/cola/permits/1812856512_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-
jar/org/springframework/context/config/MBeanExportBeanDefinitionParser.java
*
/opt/cola/permits/1812856512_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-
jar/org/springframework/format/number/NumberFormatAnnotationFormatterFactory.java
* /opt/cola/permits/1812856512_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-
jar/org/springframework/scheduling/annotation/AnnotationAsyncExecutionInterceptor.java
* /opt/cola/permits/1812856512_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-
jar/org/springframework/scheduling/concurrent/ReschedulingRunnable.java
* /opt/cola/permits/1812856512_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-
jar/org/springframework/format/number/CurrencyStyleFormatter.java
* /opt/cola/permits/1812856512_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-
jar/org/springframework/scheduling/support/MethodInvokingRunnable.java
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/opt/cola/permits/1812856512_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-
jar/org/springframework/cache/concurrent/ConcurrentMapCacheFactoryBean.java
* /opt/cola/permits/1812856512_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-
jar/org/springframework/instrument/classloading/glassfish/GlassFishLoadTimeWeaver.java
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jar/org/springframework/context/annotation/ClassPathScanningCandidateComponentProvider.java
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* /opt/cola/permits/1812856512_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-
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jar/org/springframework/context/support/AbstractApplicationContext.java
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/opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/context/annotation/ConfigurationClassPostProcessor.java  
\* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/cache/annotation/CachePut.java  
\* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/context/annotation/ConfigurationClassEnhancer.java  
\* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/validation/beanvalidation/LocalValidatorFactoryBean.java  
\* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/context/index/CandidateComponentsIndexLoader.java  
\* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/validation/beanvalidation/SpringValidatorAdapter.java  
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/opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/context/annotation/CommonAnnotationBeanPostProcessor.java  
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\* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/validation/support/BindingAwareConcurrentModel.java  
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\* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/context/annotation/Lazy.java  
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\* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/context/annotation/ConfigurationClassUtils.java  
\* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/ui/ConcurrentModel.java  
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- \* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/context/annotation/ImportAware.java

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- \* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/format/datetime/joda/LocalDateTimeParser.java
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- \*/opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/validation/beanvalidation/OptionalValidatorFactoryBean.java
- \* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/format/datetime/joda/MillisecondInstantPrinter.java
- \* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/format/datetime/joda/ReadablePartialPrinter.java
- \* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/context/i18n/LocaleContext.java
- \* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/format/datetime/joda/DateTimeParser.java



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* /opt/cola/permits/1812856512_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-
jar/org/springframework/format/datetime/joda/LocalTimeParser.java
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/opt/cola/permits/1812856512_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-
jar/org/springframework/context/annotation/Description.java
* /opt/cola/permits/1812856512_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-
jar/org/springframework/format/datetime/joda/ReadableInstantPrinter.java
* /opt/cola/permits/1812856512_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-
jar/org/springframework/scheduling/concurrent/CustomizableThreadFactory.java
* /opt/cola/permits/1812856512_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-
jar/org/springframework/context/support/MessageSourceResourceBundle.java
* /opt/cola/permits/1812856512_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-
jar/org/springframework/context/annotation/FilterType.java
* /opt/cola/permits/1812856512_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-
jar/org/springframework/context/i18n/TimeZoneAwareLocaleContext.java
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```
*/
```

```
/**
```

```
* {@link FactoryBean} that obtains a WebSphere {@link javax.management.MBeanServer}
```

```
* reference through WebSphere's proprietary {@code AdminServiceFactory} API,
```

```
* available on WebSphere 5.1 and higher.
```

```
*
```

```
* <p>Exposes the {@code MBeanServer} for bean references.
```

```
*
```

```
* <p>This {@code FactoryBean} is
```

```
 a direct alternative to {@link MBeanServerFactoryBean},
```

```
* which uses standard JMX 1.2 API to access the platform's {@link MBeanServer}.
```

```
*
```

```
* <p>See the javadocs for WebSphere's
```

```
* <a
```

```
href="https://www.ibm.com/support/knowledgecenter/SSEQTJ_9.0.0/com.ibm.websphere.javadoc.doc/web/apidocs/
/com/ibm/websphere/management/AdminServiceFactory.html">{@code AdminServiceFactory}
```

```
* and
```

```
* <a
href="https://www.ibm.com/support/knowledgecenter/SSEQTJ_9.0.0/com.ibm.websphere.javadoc.doc/web/apidocs
/com/ibm/websphere/management/MBeanFactory.html">{ @code MBeanFactory}.
*
* @author Juergen Hoeller
* @author Rob Harrop
* @since 2.0.3
* @see javax.management.MBeanServer
* @see MBeanServerFactoryBean
*/
```

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```
* /opt/cola/permits/1812856512_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-
jar/org/springframework/jmx/support/WebSphereMBeanServerFactoryBean.java
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jar/org/springframework/jmx/export/metadata/ManagedOperationParameter.java
* /opt/cola/permits/1812856512_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-
jar/org/springframework/remoting/support/RemoteInvocationFactory.java
*
/opt/cola/permits/1812856512_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-
jar/org/springframework/jmx/export/SpringModelMBean.java
* /opt/cola/permits/1812856512_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-
jar/org/springframework/remoting/support/RemoteInvocationExecutor.java
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- \* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/format/datetime/standard/TemporalAccessorParser.java
- \* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/cache/annotation/Caching.java
- \* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/context/annotation/ScopeMetadataResolver.java
- \* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/context/config/AbstractPropertyLoadingBeanDefinitionParser.java
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- \* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/cache/annotation/CacheEvict.java
- \* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/remoting/support/RemoteInvocationUtils.java
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- \* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/format/datetime/standard/MonthDayFormatter.java
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- \* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/cache/Cache.java
- \*
- /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/context/support/StaticMessageSource.java
- \* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/context/event/ApplicationEventMulticaster.java
- \* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/context/MessageSource.java
- \* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/cache/interceptor/CacheOperationSource.java
- \* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/jmx/access/MBeanClientInterceptor.java
- \* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/cache/CacheManager.java
- \* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/context/event/EventListenerMethodProcessor.java
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- /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/cache/annotation/CacheAnnotationParser.java
- \* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/context/support/ReloadableResourceBundleMessageSource.java
- \* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/jmx/export/annotation/AnnotationJmxAttributeSource.java
- \* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/context/annotation/ClassPathBeanDefinitionScanner.java
- \* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/scripting/support/StandardScriptFactory.java
- \* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/context/support/BeanDefinitionDsl.kt
- \*
- /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/context/weaving/DefaultContextLoadTimeWeaver.java
- \* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/cache/interceptor/AbstractCacheInvoker.java
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- \* /opt/cola/permits/1812856512\_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-

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jar/org/springframework/context/annotation/ConfigurationClass.java
* /opt/cola/permits/1812856512_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-
jar/org/springframework/context/event/ApplicationListenerMethodAdapter.java

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### 1.323.1 Available under license :

```
NR START END SECTORS SIZE NAME UUID
1 32 7679 7648 3.7M 8f8378c0-01
2 7680 16383 8704 4.3M 8f8378c0-02
5 7936 12799 4864 2.4M
6 12544 16127 3584 1.8M
```

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```
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```
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This is free software, and you are welcome to redistribute
it
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```
#!/usr/bin/env bash
MIT licenses will each have a unique MD5 sum since they contain a unique copyright.
This script will read the license file into memory, strip out the copyright, and then
generate an MD5 that is not unique and can be matched against a known MIT MD5 sum.
set -e
```

```
calculate_md5_sum() {
 local FILE="$1"

 # Read the contents of the file into a variable
 local raw_license_text=$(<"$FILE")

 # Convert to lowercase
 local lowercase_license_text="${raw_license_text,,}"

 # Remove anything before the beginning of the license
 local stripped_license_text=$(awk '/permission is hereby granted,/{p=1} p' <<< "$lowercase_license_text")

 # Replace line breaks (Windows or Linux) with a single space
 local replaced_linebreaks=$(tr '\r\n' ' ' <<< "$stripped_license_text")

 # Replace multiple spaces with a single space
 local normalized_license_text=$(tr -s ' ' <<< "$replaced_linebreaks")

 # Strip away any non-printable, non-whitespace characters
 local clean_unprintable_license_text=$(tr
 -cd '[:print:][:space:]' <<< "$normalized_license_text")

 # Remove punctuation and special characters
 local clean_license_text=$(echo "$clean_unprintable_license_text" | sed 's/[^a-zA-Z]//g')

 # Calculate the MD5 sum of the cleaned license text
 local MD5SUM=$(echo -n "$clean_license_text" | md5sum | awk '{print $1}')
```

```

Output the MD5 sum
echo "$MD5SUM"
}

Check if the FILE argument is provided
if [-z "$1"]; then
echo "Please provide a FILE as an argument."
exit 1
fi

Invoke the function with the provided FILE argument
calculate_md5_sum "$1"
WEV @@ WEV[B "1
x ?"U@,5 @mISmIN<GimCN7g1u|E
43mI,5WEV @@ WEV @mImImIAmImImI0mImImI*mImI
A0mImImI...
lost+found...

;9GimCN7g

!#$%&'()*+,-
./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~

!#$%&'()*+,-
./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~

!#$%&'()*+,-
./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~

!#$%&'()*+,-
./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~WEV @@
WEV[B "1
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```

# 1.324 busybox 1.30.1

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## 1.325 nfs-utils 1.2.3

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Version 2, June 1991

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```
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```

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```

```
Ty Coon, President of Vice
```

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```
rpc.statd -- Network Status Monitor (NSM) protocol daemon for Linux.
Copyright (C) 1995-1999, 2002, 2005 Jeffrey A. Uphoff
```

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# 1.326 spring-framework 5.2.24.RELEASE

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## 1.328 hibernate 5.4.20.Final

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```
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/*
* Hibernate, Relational Persistence for Idiomatic Java
*
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* See the lgpl.txt file in the root directory or <http://www.gnu.org/licenses/lgpl-2.1.html>.
*/
package org.hibernate.graph.internal.parse;
}

/**
* Antlr grammar describing the Hibernate EntityGraph Language.
*/
class GeneratedGraphParser extends Parser;

options {
// call the vocabulary (H)ibernate (E)ntity(G)raph (L)anguage
exportVocab=HEGL;

k = 2;

// buildAST = true;
buildAST = false;
}

{
// ~~~~~
// semantic actions/callouts

protected void startAttribute(Token attributeName) {
}
```

```

protected void startQualifiedAttribute(Token attributeName, Token qualifier) {
}

protected void finishAttribute() {
}

protected void startSubGraph(Token subType) {
}

protected void finishSubGraph()
{
}

graph
: attributeNode (COMMA attributeNode)*
;

attributeNode
: attributePath (subGraph)? { finishAttribute(); }
;

attributePath
: path:NAME (DOT qualifier:NAME)? {
if (qualifier == null) {
startAttribute(path);
}
else {
startQualifiedAttribute(path, qualifier);
}
}
;

subGraph
: LPAREN (subtype:NAME COLON)? { startSubGraph(subtype); } attributeNode (COMMA attributeNode)*
RPAREN {
finishSubGraph();
}
;

// **** LEXER ****

/**
* Lexer for the Hibernate EntityGraph Language grammar

```

```

*/
class GraphLexer extends Lexer;

options {
 // call the vocabulary (H)ibernate (E)ntity(G)raph (L)anguage
 exportVocab=HEGL;

 k = 2;

 // Allow any char but \uffff (16 bit -1, ANTLR's EOF character)
 charVocabulary = '\u0000'..\ufffe';

 caseSensitive = false;
 testLiterals = false;
}

COLON: ':';

COMMA: ',';

DOT: '.';

LPAREN: '(';

RPAREN: ')';

WHITESPACE
: (' '
 |
 | '\t'
 | '\r' '\n' { newline(); }
 | '\n' { newline(); }
 | '\r' { newline(); }
)
{ setType(Token.SKIP); } //ignore this token
;

/**
 * In this grammar, basically any string since we (atm) have no keywords
 */
NAME
: NAME_START (NAME_CONTINUATION)*
;

protected
NAME_START
: '_'

```

```
| '$'
| 'a'..'z'
// HHH-558 : Allow unicode chars in identifiers
//| '\u0080'..'ufffe'
;
```

```
protected
NAME_CONTINUATION
: NAME_START
| '0'..'9'
;
```

Found in path(s):

```
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/graph.g
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```

```
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*/
// "proprietary" methods is better (this class is "proprietary" too).
```

Found in path(s):

```
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-
jar/org/hibernate/graph/EntityGraphs.java
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*/
/**
* Subclass used to simply instantiation of singular attributes representing an entity's
* version.
*/
```

Found in path(s):

```
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-
jar/org/hibernate/metamodel/model/domain/internal/SingularAttributeImpl.java
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```

```
/*
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*
*/
```

```

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*/
/**
* JTA platform implementation intended for use with WebSphere Application Server (WAS).
* <p/>
* WAS, unlike every other app server on the planet, does not allow direct access to the JTS TransactionManager.
* Instead, for common transaction-related tasks users must utilize a proprietary API known as
ExtendedJTATransaction.
* <p/>
* Even more unfortunate, the exact TransactionManagerLookup to use inside of WAS is highly dependent upon
* WAS version
* the WAS container in which Hibernate will be utilized
*
* <p/>
* This class is reported to work on WAS version 6 in any of the standard J2EE/Java EE component containers.
*
* @author Gavin
King
* @author Jesper Udby
* @author Steve Ebersole
*/

```

Found in path(s):

```

* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-
jar/org/hibernate/engine/transaction/jta/platform/internal/WebSphereExtendedJtaPlatform.java
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```

```

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*/

```

Found in path(s):

```

* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-
jar/org/hibernate/sql/ForUpdateFragment.java
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-
jar/org/hibernate/loader/plan/build/spi/ExpandingQuerySpace.java
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-
jar/org/hibernate/tool/schema/internal/exec/ScriptTargetOutputToWriter.java
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-
jar/org/hibernate/ejb/HibernateEntityManager.java
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-
jar/org/hibernate/hql/spi/id/cte/CteValuesListBuilder.java
*

```

/opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/query/criteria/internal/expression/ListIndexExpression.java  
\* /opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/cfg/PropertyInferredData.java  
\* /opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/result/Output.java  
\* /opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/boot/package-info.java  
\* /opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/persister/collection/QueryableCollection.java  
\* /opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/engine/jdbc/connections/internal/BasicConnectionCreator.java  
\* /opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/engine/transaction/spi/IsolationDelegate.java  
\*  
/opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/param/ExplicitParameterSpecification.java  
\* /opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/stat/internal/StatsNamedContainer.java  
\* /opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/hql/spi/id/global/IdTableInfoImpl.java  
\* /opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/resource/transaction/backend/jta/internal/synchronization/SynchronizationCallbackCoordinator.java  
\* /opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/boot/jaxb/internal/stax/HbmEventReader.java  
\* /opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/boot/model/source/spi/HibernateTypeSource.java  
\*  
/opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/event/internal/EntityCopyAllowedLoggedObserver.java  
\* /opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/engine/jdbc/internal/package-info.java  
\* /opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/mapping/PrimitiveArray.java  
\* /opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/engine/jdbc/env/spi/LobCreatorBuilder.java  
\* /opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/loader/plan/spi/CompositeQuerySpace.java  
\* /opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/hql/internal/classic/QueryTranslatorImpl.java  
\* /opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/tuple/IdentifierProperty.java  
\*  
/opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/dialect/Oracle12cDialect.java  
\* /opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/type/descriptor/java/BooleanTypeDescriptor.java

\* /opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/annotations/Target.java

\* /opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/annotations/OptimisticLocking.java

\* /opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/tool/hbm2ddl/ConnectionHelper.java

\* /opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/action/internal/EntityActionVetoException.java

\* /opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/loader/entity/CollectionElementLoader.java

\*

/opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/engine/transaction/jta/platform/internal/SunOneJtaPlatform.java

\* /opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/loader/plan/exec/query/spi/QueryBuildingParameters.java

\* /opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/engine/spi/Managed.java

\* /opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/bytecode/enhance/spi/EnhancementException.java

\* /opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/engine/jdbc/spi/JdbcCoordinator.java

\* /opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/id/uuid/StandardRandomStrategy.java

\* /opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/type/descriptor/sql/JdbcTypeFamilyInformation.java

\*

/opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/query/criteria/internal/compile/CompilableCriteria.java

\* /opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/internal/JdbcSessionContextImpl.java

\* /opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/resource/transaction/backend/jta/internal/synchronization/ManagedFlushChecker.java

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\* /opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/engine/jdbc/internal/LobCreatorBuilder.java  
\* /opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/SessionEventListener.java  
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\* /opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/mapping/Formula.java

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\* /opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/query/procedure/internal/ProcedureParameterImpl.java

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 \* /opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-  
 jar/org/hibernate/boot/jaxb/internal/MappingBinder.java  
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 jar/org/hibernate/query/internal/NativeQueryImpl.java  
 \* /opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-  
 jar/org/hibernate/engine/spi/CompositeTracker.java  
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 /opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-  
 jar/org/hibernate/property/access/internal/PropertyAccessStrategyEmbeddedImpl.java  
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 jar/org/hibernate/UnknownEntityTypeException.java  
 \* /opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-  
 jar/org/hibernate/engine/jdbc/dialect/spi/DialectFactory.java  
 \* /opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-  
 jar/org/hibernate/event/spi/PreCollectionRemoveEventListener.java  
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 jar/org/hibernate/boot/model/source/spi/DiscriminatorSource.java  
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 \* /opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-  
 jar/org/hibernate/collection/internal/PersistentSortedSet.java  
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 \* /opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-  
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 jar/org/hibernate/hql/internal/ast/tree/SessionFactoryAwareNode.java  
 \* /opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-  
 jar/org/hibernate/boot/model/source/spi/AnyKeySource.java

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* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-
jar/org/hibernate/persister/walking/spi/AssociationVisitationStrategy.java
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-
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/opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-
jar/org/hibernate/tuple/CreationTimestampGeneration.java
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-
jar/org/hibernate/hql/spi/id/inline/AbstractInlineIdsBulkIdHandler.java
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-
jar/org/hibernate/hql/spi/id/inline/InlineIdsIdsInClauseDeleteHandlerImpl.java
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-
jar/org/hibernate/persister/walking/spi/CompositionDefinition.java
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-
jar/org/hibernate/engine/jdbc/batch/internal/package-info.java
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-
jar/org/hibernate/type/descriptor/java/LocalDateJavaDescriptor.java
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/opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-
jar/org/hibernate/engine/internal/MutableEntityEntryFactory.java
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-
jar/org/hibernate/annotations/DynamicInsert.java
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-
jar/org/hibernate/query/criteria/internal/CriteriaDeleteImpl.java
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-
jar/org/hibernate/internal/CoordinatingEntityNameResolver.java
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-
jar/org/hibernate/tool/hbm2ddl/FileExporter.java
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-
jar/org/hibernate/loader/plan/build/spi/ExpandingCompositeQuerySpace.java
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-
jar/org/hibernate/engine/jdbc/WrappedNClob.java
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/opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-
jar/org/hibernate/loader/custom/CollectionReturn.java
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-
jar/org/hibernate/dialect/MySQLMyISAMDialect.java
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-
jar/org/hibernate/id/IdentifierGeneratorHelper.java
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/\*\*

\* Used to pass along the CDI BeanManager, if any, to be used.

\*

\* According to JPA, strictly, the BeanManager should be passed in

\* at boot-time and be ready for use at that time. However not all

\* environments can do this (WildFly e.g.). To accommodate such

\* environments, Hibernate provides 2 options:

\*

\* \* a proprietary CDI extension SPI (that we have proposed to  
\* the CDI spec group as a standard option) that can be used  
\* to provide delayed BeanManager access. To use this solution,  
\* the reference passed as the BeanManager during bootstrap

\* should be typed as { @link ExtendedBeanManager }

\* \* delayed access to the BeanManager

reference. Here, Hibernate

\* will not access the reference passed as the BeanManager during

\* bootstrap until it is first needed. Note however that this has

\* the effect of delaying any deployment problems until after

\* bootstrapping.

\*

\* This setting is used to configure Hibernate ORM's access to

\* the BeanManager (either directly or via { @link ExtendedBeanManager }).

\*/

Found in path(s):

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 * Expert Group and released to the public domain, as explained at
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 *
 * Modified for https://jira.jboss.org/jira/browse/ISPN-299
 * Includes ideas described in http://portal.acm.org/citation.cfm?id=1547428
 *
 */
/**
 * A hash table supporting full concurrency of retrievals and
 * adjustable expected concurrency for updates. This class obeys the
 * same functional specification as { @link java.util.Hashtable }, and
 * includes versions of methods corresponding to each method of
 * <tt>Hashtable</tt>. However, even though all operations are
 * thread-safe, retrieval
 * operations do not entail locking,
 * and there is not any support for locking the entire table
 * in a way that prevents all access. This class is fully
 * interoperable with <tt>Hashtable</tt> in programs that rely on its
 * thread safety but not on its synchronization details.
 *
 * <p/>
 * <p> Retrieval operations (including <tt>get</tt>) generally do not
 * block, so may overlap with update operations (including
 * <tt>put</tt> and <tt>remove</tt>). Retrievals reflect the results
 * of the most recently completed update operations holding
 * upon their onset. For aggregate operations such as <tt>putAll</tt>
 * and <tt>clear</tt>, concurrent retrievals may reflect insertion or
 * removal of only some entries. Similarly, Iterators and
 * Enumerations return elements reflecting the state of the hash table
 * at some point at or since the creation of the iterator/enumeration.
 * They do not throw { @link java.util.ConcurrentModificationException }.
 *
 * However, iterators are designed to be used by only one thread at a time.
 *
 * <p/>
 * <p> The allowed concurrency among update operations is guided by
 * the optional <tt>concurrencyLevel</tt> constructor argument
 * (default <tt>16</tt>), which is used as a hint for internal sizing. The
 * table is internally partitioned to try to permit the indicated
 * number of concurrent updates without contention. Because placement
 * in hash tables is essentially random, the actual concurrency will
 * vary. Ideally, you should choose a value to accommodate as many
 * threads as will ever concurrently modify the table. Using a
 * significantly higher value than you need can waste space and time,
 * and a significantly lower value can lead to thread contention. But
 * overestimates and underestimates within an order of magnitude do
 * not usually have much noticeable impact. A value of one is
 * appropriate when it is known that only one thread will modify and

```

```

* all others will only read. Also, resizing
this or any other kind of
* hash table is a relatively slow operation, so, when possible, it is
* a good idea to provide estimates of expected table sizes in
* constructors.
* <p/>
* <p>This class and its views and iterators implement all of the
* optional methods of the { @link Map } and { @link Iterator }
* interfaces.
* <p/>
* <p>This class is copied from Infinispan, and was originally written
* by Doug Lea with assistance from members of JCP JSR-166 Expert Group and
* released to the public domain, as explained at
* http://creativecommons.org/licenses/publicdomain</p>
* <p/>
* <p/>
* <p> Like { @link java.util.Hashtable } but unlike { @link HashMap }, this class
* does not allow <tt>null</tt> to be used as a key or value.
*
* @param <K> the type of keys maintained by this map
* @param <V> the type of mapped values
*
* @author Doug Lea
*/

```

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* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-
jar/org/hibernate/internal/util/collections/BoundedConcurrentHashMap.java

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* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-
jar/org/hibernate/internal/util/collections/ConcurrentReferenceHashMap.java

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\* /opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/bytecode/package.html

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\* /opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/exception/package.html

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Found in path(s):

\* /opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/graph/spi/GraphImplementor.java  
\* /opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/resource/beans/spi/ManagedBeanRegistry.java  
\* /opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/cache/spi/QueryResultsCache.java  
\* /opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/stat/NaturalIdCacheStatistics.java  
\* /opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/hql/internal/ast/tree/CollectionPathNode.java  
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/opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/type/internal/TypeConfigurationRegistry.java  
\* /opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/metamodel/model/domain/IdentifiableDomainType.java  
\* /opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/metamodel/model/domain/internal/EmbeddableTypeImpl.java  
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\* /opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/cache/spi/support/CollectionTransactionAccess.java  
\* /opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/cache/spi/support/NaturalIdTransactionalAccess.java  
\* /opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/metamodel/model/convert/internal/JpaAttributeConverterImpl.java  
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\* /opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/boot/model/convert/internal/AbstractConverterDescriptor.java  
\* /opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/graph/spi/GraphHelper.java  
\* /opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/cache/spi/support/DomainDataRegionImpl.java  
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\* /opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/metamodel/model/domain/internal/AbstractPluralAttribute.java  
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\* /opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-  
jar/org/hibernate/cache/spi/SecondLevelCacheLogger.java

\* /opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/jpa/event/internal/EmptyCallbackBuilder.java

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/opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/boot/AttributeConverterInfo.java

\* /opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/graph/spi/AppliedGraph.java

\* /opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/metamodel/model/convert/package-info.java

\* /opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/cache/spi/support/EntityNonStrictReadWriteAccess.java

\* /opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/resource/beans/container/internal/NotYetReadyException.java

\* /opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/resource/beans/spi/ProvidedInstanceManagedBeanImpl.java

\* /opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/cache/spi/TimestampsCache.java

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/opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/cache/internal/TimestampsCacheEnabledImpl.java

\* /opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/cache/cfg/package-info.java

\* /opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/cache/spi/AbstractCacheTransactionSynchronization.java

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\* /opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/cache/cfg/spi/DomainDataRegionConfig.java

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\* /opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/resource/beans/container/internal/ContainerManagedLifecycleStrategy.java

\* /opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/resource/beans/container/internal/NamedBeanQualifier.java

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\* /opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/cache/internal/DisabledCaching.java

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\* /opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/boot/model/convert/package-info.java  
\* /opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/jpa/event/internal/EmptyCallbackRegistryImpl.java  
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Found in path(s):

\* /opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/order-by-render.g  
\* /opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/order-by.g

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\* /opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/hibernate-configuration-3.0.dtd

\* /opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/hibernate-mapping-3.0.dtd

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#

org.hibernate.jpa.HibernatePersistenceProvider

Found in path(s):

\* /opt/cola/permits/1820832905\_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/META-INF/services/javax.persistence.spi.PersistenceProvider

## 1.329 e2fsprogs 1.43.7

### 1.329.1 Available under license :

This package was added to the e2fsprogs debian source package by Theodore Ts'o <[tytso@mit.edu](mailto:tytso@mit.edu)> on Sat Mar 15 15:33:37 EST 2003

It is part of the main e2fsprogs distribution, which can be found at:

<http://sourceforge.net/projects/e2fsprogs>

Upstream Author: Theodore Ts'o <[tytso@mit.edu](mailto:tytso@mit.edu)>

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This is the Debian GNU/Linux prepackaged version of the static EXT2 file system consistency checker (e2fsck.static). The EXT2 utilities

were written by Theodore Ts'o <tytso@mit.edu> and Remy Card  
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Index: tdbsa/tdb.c

-----  
--- tdbsa.orig/tdb.c

+++ tdbsa/tdb.c

@@ -4,11 +4,11 @@ Rev: 23371

Last Changed Date: 2007-06-06 20:14:06 -0400 (Wed, 06 Jun 2007)

\*/

/\*

- Unix SMB/CIFS implementation.  
+ trivial database library - standalone version

- trivial database library - private includes

-

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Gadi Oxman, August 1995

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```

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```

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```

```
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```

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This is the Debian GNU/Linux prepackaged version of the EXT2 file system utilities (e2fsck, mke2fs, etc.). The EXT2 utilities were written by Theodore Ts'o <tytso@mit.edu> and Remy Card <card@masi.ibp.fr>.

Sources were obtained from <http://sourceforge.net/projects/e2fsprogs>

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It is part of the main e2fsprogs distribution, which can be found at:

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#

# This is a Makefile stub which handles the creation of BSD shared  
# libraries.

#

# In order to use this stub, the following makefile variables must be defined.

#

# BSDLIB\_VERSION = 1.0



```

BSDLIB_IMAGE = libce
BSDLIB_MYDIR = et
BSDLIB_INSTALL_DIR = $(SHLIBDIR)
#

all:: image

real-subdirs:: Makefile
@echo " MKDIR pic"
@mkdir -p pic

BSD_LIB = $(BSDLIB_IMAGE).so.$(BSDLIB_VERSION)
BSDLIB_PIC_FLAG = -fpic

image: $(BSD_LIB)

$(BSD_LIB): $(OBJS)
(cd pic; ld -Bshareable -o $(BSD_LIB) $(LDFLAGS_SHLIB) $(OBJS))
$(MV) pic/$(BSD_LIB) .
$(RM) -f ../$(BSD_LIB)
(cd ..; $(LN) $(LINK_BUILD_FLAGS) \
`echo $(my_dir) | sed -e 's;lib/;;'`/$(BSD_LIB) $(BSD_LIB))

install-shlibs install:: $(BSD_LIB)
@echo " INSTALL_PROGRAM $(BSDLIB_INSTALL_DIR)/$(BSD_LIB)"
@$(INSTALL_PROGRAM) $(BSD_LIB) \
$(DESTDIR)$$(BSDLIB_INSTALL_DIR)/$(BSD_LIB)
@-$(LDCONFIG)

install-strip: install

install-shlibs-strip: install-shlibs

uninstall-shlibs uninstall::
$(RM) -f $(DESTDIR)$$(BSDLIB_INSTALL_DIR)/$(BSD_LIB)

clean::
$(RM)
-rf pic
$(RM) -f $(BSD_LIB)
$(RM) -f ../$(BSD_LIB)

```

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This is the Debian GNU/Linux prepackaged version of the ss command-line interface parsing library. It is currently distributed together with the EXT2 file system utilities, which are otherwise packaged as "e2fsprogs".

This package was put together by Yann Dirson <dirson@debian.org>, from sources obtained from a mirror of:  
[tsx-11.mit.edu/pub/linux/packages/ext2fs/](http://tsx-11.mit.edu/pub/linux/packages/ext2fs/)

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Theodore Ts'o  
23-June-2007

-----  
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```
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Because of this blurred distinction, using the ordinary General Public License for libraries did not effectively promote software sharing, because most developers did not use the libraries. We concluded that weaker conditions might promote sharing better.

However, unrestricted linking of non-free programs would deprive the users of those programs of all benefit from the free status of the libraries themselves. This Library General Public License is intended to permit developers of non-free programs to use free libraries, while preserving your freedom as a user of such programs to change the free libraries that are incorporated in them. (We have not seen how to achieve this as regards changes in header files, but we have achieved it as regards changes in the actual functions of the Library.) The hope is that this will lead to faster development of free libraries.

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This package was added to the e2fsprogs debian source package by Theodore Ts'o <tytso@mit.edu> on Fri Dec 14 22:24:35 EST 2007

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## 1.330 python 3.11.6

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Python was created in the early 1990s by Guido van Rossum at Stichting Mathematisch Centrum (CWI, see <https://www.cwi.nl>) in the Netherlands as a successor of a language called ABC. Guido remains Python's principal author, although it includes many contributions from others.

In 1995, Guido continued his work on Python at the Corporation for National Research Initiatives (CNRI, see <https://www.cnri.reston.va.us>) in Reston, Virginia where he released several versions of the

software.

In May 2000, Guido and the Python core development team moved to BeOpen.com to form the BeOpen PythonLabs team. In October of the same year, the PythonLabs team moved to Digital Creations, which became Zope Corporation. In 2001, the Python Software Foundation (PSF, see <https://www.python.org/psf/>) was formed, a non-profit organization created specifically to own Python-related Intellectual Property. Zope Corporation was a sponsoring member of the PSF.

All

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Release	Derived from	Year	Owner	GPL-compatible? (1)
0.9.0 thru 1.2		1991-1995	CWI	yes
1.3 thru 1.5.2	1.2	1995-1999	CNRI	yes
1.6	1.5.2	2000	CNRI	no
2.0	1.6	2000	BeOpen.com	no
1.6.1	1.6	2001	CNRI	yes (2)
2.1	2.0+1.6.1	2001	PSF	no
2.0.1	2.0+1.6.1	2001	PSF	yes
2.1.1	2.1+2.0.1	2001	PSF	yes
2.1.2	2.1.1	2002	PSF	yes
2.1.3	2.1.2	2002	PSF	yes
2.2 and above	2.1.1	2001-now	PSF	yes

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- javaee\_5.xsd
- javaee\_web\_services\_1\_2.xsd
- javaee\_web\_services\_client\_1\_2.xsd
- javaee\_6.xsd
- javaee\_web\_services\_1\_3.xsd
- javaee\_web\_services\_client\_1\_3.xsd
- web-app\_3\_0.xsd
- web-common\_3\_0.xsd
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For the following XML

Schemas for Java EE Deployment Descriptors:

- javaee\_5.xsd
- javaee\_web\_services\_1\_2.xsd
- javaee\_web\_services\_client\_1\_2.xsd
- javaee\_6.xsd
- javaee\_web\_services\_1\_3.xsd
- javaee\_web\_services\_client\_1\_3.xsd
- jsp\_2\_2.xsd
- web-app\_3\_0.xsd
- web-common\_3\_0.xsd
- web-fragment\_3\_0.xsd
- javaee\_7.xsd
- javaee\_web\_services\_1\_4.xsd
- javaee\_web\_services\_client\_1\_4.xsd
- jsp\_2\_3.xsd
- web-app\_3\_1.xsd
- web-common\_3\_1.xsd
- web-fragment\_3\_1.xsd
- javaee\_8.xsd
- web-app\_4\_0.xsd

- web-common\_4\_0.xsd
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- jsp\_2\_2.xsd
- web-app\_3\_0.xsd
- web-common\_3\_0.xsd
- web-fragment\_3\_0.xsd
- javaee\_7.xsd
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- jsp\_2\_3.xsd
- web-app\_3\_1.xsd
- web-common\_3\_1.xsd
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Python was created in the early 1990s by Guido van Rossum at Stichting Mathematisch Centrum (CWI, see <http://www.cwi.nl>) in the Netherlands as a successor of a language called ABC. Guido remains Python's principal author, although it includes many contributions from others.

In 1995, Guido continued his work on Python at the Corporation for National Research Initiatives (CNRI, see <http://www.cnri.reston.va.us>) in Reston, Virginia where he released several versions of the software.

In May 2000, Guido and the Python core development team moved to BeOpen.com to form the BeOpen PythonLabs team. In October of the same year, the PythonLabs team moved to Digital Creations, which became Zope Corporation. In 2001, the Python Software Foundation (PSF, see <https://www.python.org/psf/>) was formed, a non-profit organization created specifically to own Python-related Intellectual Property. Zope Corporation was a sponsoring member of the PSF.

All

Python releases are Open Source (see <http://www.opensource.org> for the Open Source Definition). Historically, most, but not all, Python releases have also been GPL-compatible; the table below summarizes the various releases.

Release	Derived from	Year	Owner	GPL-compatible? (1)
0.9.0 thru 1.2		1991-1995	CWI	yes
1.3 thru 1.5.2	1.2	1995-1999	CNRI	yes
1.6	1.5.2	2000	CNRI	no
2.0	1.6	2000	BeOpen.com	no
1.6.1	1.6	2001	CNRI	yes (2)
2.1	2.0+1.6.1	2001	PSF	no
2.0.1	2.0+1.6.1	2001	PSF	yes

2.1.1	2.1+2.0.1	2001	PSF	yes
2.1.2	2.1.1	2002	PSF	yes
2.1.3	2.1.2	2002	PSF	yes
2.2 and above	2.1.1	2001-now	PSF	yes

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procfs provides functions to retrieve system, kernel and process metrics from the pseudo-filesystem proc.

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Protocol Buffers for Go with Gadgets

Go support for Protocol Buffers - Google's data interchange format

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Index: tdbsa/tdb.c

-----  
--- tdbsa.orig/tdb.c

+++ tdbsa/tdb.c

@@ -4,11 +4,11 @@ Rev: 23371

Last Changed Date: 2007-06-06 20:14:06 -0400 (Wed, 06 Jun 2007)

\*/

/\*

- Unix SMB/CIFS implementation.  
+ trivial database library - standalone version

- trivial database library - private includes

-

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Gadi Oxman, August 1995

-----  
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```

```
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This is the Debian GNU/Linux prepackaged version of the EXT2 file system utilities (e2fsck, mke2fs, etc.). The EXT2 utilities were written by Theodore Ts'o <tytso@mit.edu> and Remy Card <card@masi.ibp.fr>.

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This package was added to the e2fsprogs debian source package by Theodore Ts'o <tytso@mit.edu> on Sat Mar 15 15:33:37 EST 2003

It is part of the main e2fsprogs distribution, which can be found at:

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```

DAMAGE.
#
This is a Makefile stub which handles the creation of BSD shared
libraries.
#
In order to use this stub, the following makefile variables must be defined.
#
BSDLIB_VERSION = 1.0
BSDLIB_IMAGE = libce
BSDLIB_MYDIR = et
BSDLIB_INSTALL_DIR = $(SHLIBDIR)
#

all:: image

real-subdirs:: Makefile
@echo " MKDIR pic"
@mkdir -p pic

BSD_LIB = $(BSDLIB_IMAGE).so.$(BSDLIB_VERSION)
BSDLIB_PIC_FLAG = -fpic

image: $(BSD_LIB)

$(BSD_LIB): $(OBJS)
(cd pic; ld -Bshareable -o $(BSD_LIB) $(LDFLAGS_SHLIB) $(OBJS))
$(MV) pic/$(BSD_LIB) .
$(RM) -f ../$(BSD_LIB)
(cd ..; $(LN) $(LINK_BUILD_FLAGS) \
`echo $(my_dir) | sed -e 's;lib/;;'"/$(BSD_LIB) $(BSD_LIB)`)

install-shlibs install:: $(BSD_LIB)
@echo " INSTALL_PROGRAM $(BSDLIB_INSTALL_DIR)/$(BSD_LIB)"
@$(INSTALL_PROGRAM) $(BSD_LIB) \
$(DESTDIR)$$(BSDLIB_INSTALL_DIR)/$(BSD_LIB)
@-$(LDCONFIG)

install-strip: install

install-shlibs-strip: install-shlibs

uninstall-shlibs uninstall::
$(RM) -f $(DESTDIR)$$(BSDLIB_INSTALL_DIR)/$(BSD_LIB)

clean::
$(RM)
-rf pic
$(RM) -f $(BSD_LIB)

```

\$(RM) -f ../\$(BSD\_LIB)

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This is the Debian GNU/Linux prepackaged version of the ss command-line interface parsing library. It is currently distributed together with the EXT2 file system utilities, which are otherwise packaged as "e2fsprogs".

This package was put together by Yann Dirson <dirson@debian.org>, from sources obtained from a mirror of:  
[tsx-11.mit.edu/pub/linux/packages/ext2fs/](http://tsx-11.mit.edu/pub/linux/packages/ext2fs/)

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before you ship. The release schedules for this package are flexible, if you give me enough lead time.

Theodore Ts'o  
23-June-2007

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```
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```

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```
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Version 2, June 1991

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<signature of Ty Coon>, 1 April 1990  
Ty Coon, President of Vice

That's all there is to it!  
This is the Debian GNU/Linux prepackaged version of the Common Error Description library. It is currently distributed together with the EXT2 file system utilities, which are otherwise packaged as "e2fsprogs".

This package was put together by Yann Dirson <dirson@debian.org>, from sources obtained from a mirror of:  
[tsx-11.mit.edu:/pub/linux/packages/ext2fs/](http://tsx-11.mit.edu/pub/linux/packages/ext2fs/)

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jseward@bzip.org

bzip2/libbzip2 version 1.0.4 of 20 December 2006

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@vskip 20pt plus 1fil
@end macro

@macro copyrightstart{ }
@end macro

@macro copyrightend{ }
@end macro
```

```
@node Copyrights and Licenses, , Acknowledgments, Top
@comment node-name, next, previous, up
@appendix Copyrights and Licenses
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GSS-API mechglue layer.

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@item GSS-API CFX, SPNEGO, naming extensions, API extensions.

@item KCM credential cache.

@item HDB LDAP backend.

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AES in libcrypto

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rijndael-alg-fst.c

@version 3.0 (December 2000)

Optimised ANSI C code for the Rijndael cipher (now AES)

@author Vincent Rijmen <vincent.rijmen@esat.kuleuven.ac.be>

@author Antoon Bosselaers <antoon.bosselaers@esat.kuleuven.ac.be>

@author Paulo Barreto <paulo.barreto@terra.com.br>

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Written by: Philip Hazel  
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...

/\*\*  
\*\*\*\*\*

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```
/* intact.
/*
/* Enhancements by Stanley Yamane:
/* o reverse lookup table for the decode function
/* o reserve string buffer space in advance
/*
/******
```

...

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...

```
g711
...
```

```
/*
* SpanDSP - a series of DSP components for telephony
*
* g711.h - In line A-law and u-law conversion routines
*
* Written by Steve Underwood <steveu@coppice.org>
```

```

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*/

...

g722
...

/*
* SpanDSP - a series of DSP components for telephony
*
* g722_decode.c - The ITU G.722 codec, decode part.
*
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*
* Based in part on a single channel G.722 codec which is:
*
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* Computer Science, Speech Group
* Chengxiang Lu and Alex Hauptmann
*/

```

...

```

libc++
...

```

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...

```
sigslot
```

```
...
```

```
// sigslot.h: Signal/Slot classes
```

```
//
```

```
// Written by Sarah Thompson (sarah@telergy.com) 2002.
```

```
//
```

```
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```

```
// the proviso that the author takes on no responsibility or liability for any
```

```
// use.
```

```
...
```

```
spl_sqrt_floor
```

```
...
```

/\*

\* Written by Wilco Dijkstra, 1996. The following email exchange establishes the  
\* license.

\*

\* From: Wilco Dijkstra <Wilco.Dijkstra@ntlworld.com>;

\* Date: Fri, Jun 24, 2011 at 3:20 AM

\* Subject: Re: sqrt routine

\* To: Kevin Ma <kma@google.com>;

\* Hi Kevin,

\* Thanks for asking. Those routines are public domain (originally posted to  
\* comp.sys.arm a long time ago), so you can use them freely for any purpose.

\* Cheers,

\* Wilco

\*

\* -----

Original Message -----

\* From: "Kevin Ma" <kma@google.com>;

\* To: <Wilco.Dijkstra@ntlworld.com>;

\* Sent: Thursday, June 23, 2011 11:44 PM

\* Subject: Fwd: sqrt routine

\* Hi Wilco,

\* I saw your sqrt routine from several web sites, including

\* <http://www.finesse.demon.co.uk/steven/sqrt.html>.

\* Just wonder if there's any copyright information with your Successive  
\* approximation routines, or if I can freely use it for any purpose.

\* Thanks.

\* Kevin

\*/

---

# usrsctp

---

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...

# zlib

...

version 1.2.11, January 15th, 2017

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# 1.359 systemd 231

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# 1.361 zlib 1.2.5

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/\* zlib.h -- interface of the 'zlib' general purpose compression library  
version 1.2.5, April 19th, 2010

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Jean-loup Gailly      Mark Adler  
jloup@gzip.org      madler@alumni.caltech.edu

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\*/

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Local-Date: Fri, 06 Jun 2003 13:18:52 -0400  
Date: Fri, 6 Jun 2003 10:18:52 -0700  
From: Juan Gomez <juang@us.ibm.com>  
To: Stephen Frost <sfrost@debian.org>  
X-Mailer: Lotus Notes Release 5.0.2a (Intl) 23 November 1999  
Subject: Re: Juan C. Gomez license in OpenLDAP Source

Stephen,

"There is no restriction on modifications and derived works" on the work I did for the openldap server as long as this is consistent with the openldap license. Please forward this email to Kurt so he does the appropriate changes to the files to reflect this.

Regards, Juan

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MA

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Local-Date: Thu, 05 Jun 2003 16:53:32 -0400  
Date: Thu, 5 Jun 2003 16:53:32 -0400 (EDT)  
From: Mark Adamson <adamson@andrew.cmu.edu>  
To: Stephen Frost <sfrost@debian.org>  
Subject: Re: Mark Adamson license in OpenLDAP source

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After discussing this license with the OpenLDAP Foundation we received clarification on it:

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- \* To: Stephen Frost <sfrost@snowman.net>
- \* Subject: Re: OpenLDAP Licenseing issues
- \* From: "Kurt D. Zeilenga" <Kurt@OpenLDAP.org>
- \* Date: Wed, 28 May 2003 10:55:44 -0700
- \* Cc: Steve Langasek <vorlon@netexpress.net>,debian-legal@lists.debian.org, openldap-devel@OpenLDAP.org
- \* In-reply-to: <20030528162613.GB8524@ns.snowman.net>
- \* Message-id: <5.2.0.9.0.20030528094229.02924780@127.0.0.1>
- \* Old-return-path: <Kurt@OpenLDAP.org>

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Regards, Kurt

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## 1.363 jaxb-core 2.3.3

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# 1.371 util-linux 2.34-0.1ubuntu9.6

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Source: <https://github.com/tatsuhiro-t/nhttp2>

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- \*
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The implementations of GSSAPI mechglue in GSSAPI-SPNEGO in "src/lib/gssapi", including the following files:

lib/gssapi/generic/gssapi\_err\_generic.et  
lib/gssapi/mechglue/g\_accept\_sec\_context.c  
lib/gssapi/mechglue/g\_acquire\_cred.c  
lib/gssapi/mechglue/g\_canon\_name.c  
lib/gssapi/mechglue/g\_compare\_name.c  
lib/gssapi/mechglue/g\_context\_time.c  
lib/gssapi/mechglue/g\_delete\_sec\_context.c  
lib/gssapi/mechglue/g\_dsp\_name.c  
lib/gssapi/mechglue/g\_dsp\_status.c  
lib/gssapi/mechglue/g\_dup\_name.c  
lib/gssapi/mechglue/g\_exp\_sec\_context.c  
lib/gssapi/mechglue/g\_export\_name.c  
lib/gssapi/mechglue/g\_glue.c  
lib/gssapi/mechglue/g\_imp\_name.c  
lib/gssapi/mechglue/g\_imp\_sec\_context.c

lib/gssapi/mechglue/g\_init\_sec\_context.c  
lib/gssapi/mechglue/g\_initialize.c  
lib/gssapi/mechglue/g\_inquire\_context.c  
lib/gssapi/mechglue/g\_inquire\_cred.c  
lib/gssapi/mechglue/g\_inquire\_names.c  
lib/gssapi/mechglue/g\_process\_context.c  
lib/gssapi/mechglue/g\_rel\_buffer.c  
lib/gssapi/mechglue/g\_rel\_cred.c  
lib/gssapi/mechglue/g\_rel\_name.c  
lib/gssapi/mechglue/g\_rel\_oid\_set.c  
lib/gssapi/mechglue/g\_seal.c  
lib/gssapi/mechglue/g\_sign.c  
lib/gssapi/mechglue/g\_store\_cred.c  
lib/gssapi/mechglue/g\_unseal.c  
lib/gssapi/mechglue/g\_userok.c  
lib/gssapi/mechglue/g\_utils.c  
lib/gssapi/mechglue/g\_verify.c  
lib/gssapi/mechglue/gssd\_pname\_to\_uid.c  
lib/gssapi/mechglue/mglueP.h  
lib/gssapi/mechglue/oid\_ops.c  
lib/gssapi/spnego/gssapiP\_spnego.h  
lib/gssapi/spnego/spnego\_mech.c

and the initial implementation of incremental propagation, including the following new or changed files:

include/iprop\_hdr.h  
kadmin/server/ipropd\_svc.c  
lib/kdb/iprop.x  
lib/kdb/kdb\_convert.c  
lib/kdb/kdb\_log.c  
lib/kdb/kdb\_log.h  
lib/krb5/error\_tables/kdb5\_err.et  
slave/kpropd\_rpc.c  
slave/kproplog.c

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jar/org/fusesource/jansi/AnsiRenderer.java  
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* httpd@ncsa.uiuc.edu
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For the test\zb.c component:

/\* ZeusBench V1.01

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Written by Adam Twiss (adam@zeus.co.uk). March 1996

Thanks to the following people for their input:

Mike Belshe (mbelshe@netscape.com)

Michael Campanella (campanella@stevms.enet.dec.com)

\*/

Apache HTTP Server

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```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Strict//EN" "http://www.w3.org/TR/xhtml1/DTD/xhtml1-strict.dtd">
<html xmlns="http://www.w3.org/1999/xhtml" lang="en" xml:lang="en"><head>
<meta content="text/html; charset=UTF-8" http-equiv="Content-Type" />
<!--
XX
X
```

This file is generated from xml source: DO NOT EDIT

```
XX
X
```

```
-->
<title>The Apache License, Version 2.0 - Apache HTTP Server Version 2.4</title>
<link href="/style/css/manual.css" rel="stylesheet" media="all" type="text/css" title="Main stylesheet" />
<link href="/style/css/manual-loose-100pc.css" rel="alternate stylesheet" media="all" type="text/css" title="No
Sidebar - Default font size" />
<link href="/style/css/manual-print.css" rel="stylesheet" media="print" type="text/css" /><link rel="stylesheet"
type="text/css" href="/style/css/prettify.css"
/>
<script src="/style/scripts/prettify.min.js" type="text/javascript">
</script>

<link href="/images/favicon.ico" rel="shortcut icon" /></head>
<body id="manual-page" class="no-sidebar"><div id="page-header">
<p class="menu">Modules | Directives | FAQ | Glossary | Sitemap</p>
<p class="apache">Apache HTTP Server Version 2.4</p>
</div>
<div class="up"></div>
<div id="path">
Apache > HTTP Server > Documentation > Version 2.4</div><div id="page-
content"><div id="preamble"><h1>The Apache License, Version 2.0</h1>
<div class="toplang">
<p>Available
Languages: en </p>
</div>

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```

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```
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```

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</div>

</div>

```
<div class="bottomlang">
```

```
<p>Available Languages: en </p>
```

```
</div><div class="top"></div><div
```

```
class="section"><h2>Comments</h2><div
```

```
class="warning">Notice:<br
```

```
/>This is not a Q&A section. Comments placed here should be pointed towards suggestions on improving the documentation or server, and may be removed by our moderators if they are either implemented or considered invalid/off-topic. Questions on how to manage the Apache HTTP Server should be directed at either our IRC channel, #httpd, on Libera.chat, or sent to our mailing lists.</div>
```

```
<script type="text/javascript"><!--><![CDATA[//><!--
```

```
var comments_shortcode = 'httpd';
```

```
var comments_identifier = 'http://httpd.apache.org/docs/2.4/license.html';
```

```
(function(w, d) {
```

```
 if (w.location.hostname.toLowerCase() == "httpd.apache.org") {
```

```
 d.write('<div id="comments_thread"></div>');
```

```
 var s = d.createElement('script');
```

```
 s.type = 'text/javascript';
```

```
 s.async = true;
```

```
 s.src = 'https://comments.apache.org/show_comments.lua?site=' + comments_shortcode + '&page=' +
```

```
comments_identifier;
```

```
 (d.getElementsByTagName('head')[0] || d.getElementsByTagName('body')[0]).appendChild(s);
```

```
 }
```

```
 else {
```

```
 d.write('<div id="comments_thread">Comments are disabled for this page at the moment.</div>');
```

```
 }
```

```
})(window, document);
```

```
//--><![></script></div><div id="footer">
```

```
<p class="apache">Copyright 2024 The Apache Software Foundation.
Licensed under the Apache License, Version 2.0.</p>
<p class="menu">Modules | Directives | FAQ | Glossary | Sitemap</p></div><script type="text/javascript"><!--<!--><![CDATA[<!--<!--
if (typeof(prettyPrint) !== 'undefined') {
 prettyPrint();
}
--><![<![</script>
</body></html>
```

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- doc/example/pcsc\_demo.c
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## xwd v1.0.7

### xwd utility

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## CUP Parser Generator for Java v 0.11b

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Ext headers	GL/gltext.h	Khronos
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	GL/wgltext.h	Khronos
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include/GL/gl.h :

Mesa 3-D  
graphics library

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```
include/GL/glext.h
include/GL/glxext.h
include/GL/wglxext.h :
```

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## 1.385 coreutils 8.25

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Version 3, 29 June 2007

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### Appendix: How to Apply These Terms to Your New Libraries

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To apply these terms, attach the following notices to the library. It is safest to attach them to the start of each source file to most effectively convey the exclusion of warranty; and each file should have at least the "copyright" line and a pointer to where the full notice is found.

<one line to give the library's name and a brief idea of what it does.>

Copyright (C) <year>

<name of author>

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Also add information on how to contact you by electronic and paper mail.

You should also get your employer (if you work as a programmer) or your  
school, if any, to sign a "copyright disclaimer" for the library, if  
necessary.

Here is a sample; alter the names:

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library `Frob' (a library for tweaking knobs) written by James Random Hacker.

<signature of Ty Coon>, 1 April 1990  
Ty Coon, President of Vice

That's all there is to it!

@node GNU GPL

@appendixsec GNU GENERAL PUBLIC LICENSE

@cindex GPL, GNU General Public License

@cindex License, GNU GPL

@center Version 2, June 1991

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The precise terms and conditions for copying, distribution and modification follow.

@iftex

@unnumberedsubsec TERMS AND CONDITIONS FOR COPYING, DISTRIBUTION AND MODIFICATION

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These requirements apply to the modified work as a whole. If identifiable sections of that work are not derived from the Program, and can be reasonably considered independent and separate works in themselves, then this License, and its terms, do not apply to those sections when you distribute them as separate works. But when you distribute the same sections as part of a whole which is a work based on the Program, the distribution of the whole must be on the terms of this License, whose permissions for other licensees extend to the entire whole, and thus to each and every part regardless of who wrote it.

Thus, it is not the intent of this section to claim rights or contest your rights to work written entirely by you; rather, the intent is to exercise the right to control the distribution of derivative or collective works based on the Program.

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@enumerate a

@item

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@item

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or,

@item

Accompany it with the information you received as to the offer to distribute corresponding source code. (This alternative is allowed only for noncommercial distribution and only if you received the program in object code or executable form with such an offer, in accord with Subsection b above.)

@end enumerate

The source code for a work means the preferred form of the work for making modifications to it. For an executable work, complete source code means all the source code for all modules it contains, plus any associated interface definition files, plus the scripts used to control compilation and installation of the executable. However, as a special exception, the source code distributed need not include anything that is normally distributed (in either source or binary form) with the major components (compiler, kernel, and so on) of the operating system on which the executable runs, unless that component itself accompanies the executable.

If distribution of executable

or object code is made by offering

access to copy from a designated place, then offering equivalent access to copy the source code from the same place counts as distribution of the source code, even though third parties are not compelled to copy the source along with the object code.

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@heading END OF TERMS AND CONDITIONS

@end iftex

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@center END OF TERMS AND CONDITIONS

@end ifinfo

@page

@unnumberedsubsec Appendix: How to Apply These Terms to Your New Programs

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To do so, attach the following notices to the program. It is safest to attach them to the start of each source file to most effectively convey the exclusion

of warranty; and each file should have at least the ``copyright" line and a pointer to where the full notice is found.



@smallexample

@var{one line to give the program's name and a brief idea of what it does.}

Copyright (C) @var{yyyy} @var{name of author}

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You should have received a copy of the GNU General Public License along with this program; if not, write to the Free Software Foundation, Inc., 51 Franklin Street, Fifth Floor, Boston, MA 02110-1301, USA.  
@end smallexample

Also add information on how to contact you by electronic and paper mail.

If the program is interactive, make it output a short notice like this when it starts in an interactive mode:

@smallexample

Gnomovision version 69, Copyright (C) 19@var{yy} @var{name of author}

Gnomovision comes with ABSOLUTELY NO WARRANTY; for details type `show w'.

This is free software, and you are welcome to redistribute it under certain conditions; type `show c' for details.

@end smallexample

The hypothetical commands @samp{show w} and @samp{show c} should show the appropriate parts of the General Public License. Of course, the commands you use may be called something other than @samp{show w} and @samp{show c}; they could even be mouse-clicks or menu items---whatever suits your program.

You should also get your employer (if you work as a programmer) or your school, if any, to sign a ``copyright disclaimer" for the program, if necessary. Here is a sample; alter the names:

@example

Yoyodyne, Inc., hereby disclaims all copyright interest in the program

`Gnomovision' (which makes passes at compilers) written by James Hacker.

@var{signature of Ty Coon}, 1 April 1989

Ty Coon, President of Vice

@end example

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@node GNU LGPL

@appendixsec GNU LESSER GENERAL PUBLIC LICENSE

@cindex LGPL, GNU Lesser General Public License

@cindex License, GNU LGPL

@center Version 2.1, February 1999

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@iftex

@unnumberedsubsec TERMS AND CONDITIONS FOR COPYING, DISTRIBUTION AND MODIFICATION

@end iftex

@ifinfo

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@end ifinfo

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"Source code" for a work means the preferred form of the work for making modifications to it. For a library, complete source code means all the source code for all modules it contains, plus any associated interface definition files, plus the scripts used to control compilation and installation of the library.

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The modified work must itself be a software library.

@item

You

must cause the files modified to carry prominent notices stating that you changed the files and the date of any change.

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If a facility in the modified Library refers to a function or a table of data to be supplied by an application program that uses the facility, other than as an argument passed when the facility is invoked, then you must make a good faith effort to ensure that, in the event an application does not supply such function or table, the facility still operates, and performs whatever part of its purpose remains meaningful.

(For example, a function in a library to compute square roots has a purpose that is entirely well-defined independent of the application. Therefore, Subsection 2d requires that any application-supplied function or table used by this function must be optional: if the application does not supply it, the square root

function must still compute square roots.)

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In addition, mere aggregation of another work not based on the Library with

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@item

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If distribution of object code is made by offering access to copy from a designated place, then offering equivalent access to copy the source code from the same place satisfies the requirement to distribute the source code, even though third parties are not compelled to copy the source along with the object code.

@item

A program that contains no derivative of any portion of the Library, but is designed to work with the Library by being compiled or

linked with it, is called a ``work that uses the Library". Such a work, in isolation, is not a derivative work of the Library, and therefore falls outside the scope of this License.

However, linking a ``work that uses the Library" with the Library creates an executable that is a derivative of the Library (because it contains portions of the Library), rather than a ``work that uses the library". The executable is therefore covered by this License. Section 6 states terms for distribution of such executables.

When a ``work that uses the Library" uses material from a header file that is part of the Library, the object code for the work may be a derivative work of the Library even though the source code is not. Whether this is true is especially significant if the work can be linked without the Library, or if the work is itself a library. The threshold for this to be true is not precisely defined by law.

If such an object file uses only numerical parameters, data structure layouts and accessors, and small macros and small inline functions (ten lines or less in length), then the use of the object file is unrestricted, regardless of whether it is legally a derivative work. (Executables containing this object code plus portions of the Library will still fall under Section 6.)

Otherwise, if the work is a derivative of the Library, you may distribute the object code for the work under the terms of Section 6. Any executables containing that work also fall under Section 6, whether or not they are linked directly with the Library itself.

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```
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# 1.391 iconv 1.14

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