

Package ‘ijtiff’

April 20, 2018

Type Package

Title TIFF I/O for 'ImageJ' Users

Version 1.1.0

Maintainer Rory Nolan <rorynolan@gmail.com>

Description Correctly import TIFF files that were saved from 'ImageJ' and write TIFF files than can be correctly read by 'ImageJ' <<https://imagej.nih.gov/ij/>>. Full support for TIFF files with floating point (real-numbered) pixels. Also supports text image I/O.

License GPL-3

SystemRequirements libtiff

Encoding UTF-8

LazyData true

RoxygenNote 6.0.1

URL <https://www.github.com/ropensci/ijtiff>

BugReports <https://www.github.com/ropensci/ijtiff/issues>

VignetteBuilder knitr

Depends R (>= 2.10)

Imports checkmate, magrittr, filesstrings (>= 2.1.0), stringr, purrr, Rcpp, fields, grDevices, readr, rlang

Suggests knitr, testthat, rmarkdown, covr, magick, abind, tiff

LinkingTo Rcpp

NeedsCompilation yes

Author Rory Nolan [aut, cre] (<<https://orcid.org/0000-0002-5239-4043>>),
Simon Urbanek [ctb],
Sergi Padilla-Parra [ths] (<<https://orcid.org/0000-0002-8010-9481>>),
Jeroen Ooms [rev] (<<https://orcid.org/0000-0002-4035-0289>>),
Jon Clayden [rev] (<<https://orcid.org/0000-0002-6608-0619>>)

Repository CRAN

Date/Publication 2018-04-20 00:05:08 UTC

R topics documented:

count_imgs	2
display	3
ijtiff	3
ijtiff_img	4
read_tags	5
read_tif	6
text-image-io	7
tiff_tag_data	8
write_tif	9

Index	11
--------------	-----------

count_imgs	<i>Count the number of images in a TIFF file.</i>
------------	---

Description

TIFF files can hold many images. Often this is sensible, e.g. each image could be a time-point in a video or a slice of a z-stack. Sometimes ImageJ-written images have one image per channel per slice.

Usage

```
count_imgs(path)
```

Arguments

path	A string. The path to the tiff file to read.
------	--

Details

For those familiar with TIFF files, this function counts the number of directories in a TIFF file.

Value

A number.

Examples

```
count_imgs(system.file("img", "Rlogo.tif", package="ijtiff"))
count_imgs(system.file("img", "2ch_ij.tif", package="ijtiff"))
```

display	<i>Basic image display.</i>
---------	-----------------------------

Description

Display an image that has been read in by `read_tif()` as it would look in 'ImageJ'. This function wraps `fields::image.plot()`.

Usage

```
display(img, col = grDevices::grey.colors(999, 0, 1), ...)
```

Arguments

<code>img</code>	A numeric matrix.
<code>col</code>	Colour lookup table to use for display.
<code>...</code>	Arguments passed to <code>fields::image.plot()</code> . These arguments should be fully named.

Examples

```
img <- read_tif(system.file("img", "Rlogo.tif", package = "ijtiff"))
display(img) # first channel, first frame
display(img[, , 1, 1]) # first (red) channel, first frame
display(img[, , 2, ]) # second (green) channel, first frame
display(img[, , 3, ]) # third (blue) channel, first frame
```

ijtiff	<i>ijtiff: TIFF I/O for ImageJ users</i>
--------	--

Description

Correctly import TIFF files that were saved from ImageJ and write TIFF files than can be correctly read by ImageJ. Full support for TIFF files with float/real-numbered pixels. Also supports text image I/O.

ijtiff_img	ijtiff_img class.
------------	-------------------

Description

A class for images which are read or to be written by the ijtiff package.

Usage

```
ijtiff_img(img, ...)
```

Arguments

img	An array representing the image. <ul style="list-style-type: none"> • For a single-plane, grayscale image, use a matrix <code>img[y, x]</code>. • For a multi-plane, grayscale image, use a 3-dimensional array <code>img[y, x, plane]</code>. • For a multi-channel, single-plane image, use a 4-dimensional array with a redundant 4th slot <code>img[y, x, channel,]</code> (see ijtiff_img 'Examples' for an example). • For a multi-channel, multi-plane image, use a 4-dimensional array <code>img[y, x, channel, plane]</code>.
...	Named arguments which are set as attributes.

Value

A 4 dimensional array representing an image, indexed by `img[y, x, channel, frame]` (this is consistent with the EBImage package (<https://bioconductor.org/packages/EBImage/>)) with selected attributes.

Examples

```
img <- matrix(1:4, nrow = 2) # to be a single-channel, grayscale image
ijtiff_img(img, description = "single-channel, grayscale")
img <- array(seq_len(2 ^ 3), dim = rep(2, 3)) # 1 channel, 2 frame
ijtiff_img(img, description = "blah blah blah")
img <- array(seq_len(2 ^ 3), dim = c(2, 2, 2, 1)) # 2 channel, 1 frame
ijtiff_img(img, description = "blah blah")
img <- array(seq_len(2 ^ 4), dim = rep(2, 4)) # 2 channel, 2 frame
ijtiff_img(img, software = "R")
```

read_tags	<i>Read TIFF tag information without actually reading the image array.</i>
-----------	--

Description

TIFF files contain metadata about images in their *TIFF tags*. This function is for reading this information without reading the actual image.

Usage

```
read_tags(path, all = TRUE)
```

Arguments

path	A string. The path to the tiff file to read.
all	TIFF files can contain multiple images. With <code>all = TRUE</code> , the information about all images is returned in a list of lists. To just get the information about some images, pass those image numbers to the <code>all</code> parameter (see examples). <code>all = FALSE</code> is equivalent to <code>all = 1</code> .

Value

A list of lists.

Author(s)

Simon Urbanek, Kent Johnson, Rory Nolan.

See Also

[read_tif\(\)](#)

Examples

```
read_tags(system.file("img", "Rlogo.tif", package="ijttiff"))
read_tags(system.file("img", "2ch_ij.tif", package="ijttiff"))
read_tags(system.file("img", "2ch_ij.tif", package="ijttiff"), all = c(2, 4))
```

`read_tif`*Read an image stored in the TIFF format*

Description

Reads an image from a TIFF file/content into a numeric array or list.

Usage

```
read_tif(path, list_safety = "error", msg = TRUE)
```

Arguments

<code>path</code>	A string. The path to the tiff file to read.
<code>list_safety</code>	A string. This is for type safety of this function. Since returning a list is unlikely and probably unexpected, the default is to error. You can instead opt to throw a warning (<code>list_safety = "warning"</code>) or to just return the list quietly (<code>list_safety = "none"</code>).
<code>msg</code>	Print an informative message about the image being read?

Details

TIFF files have the capability to store multiple images, each having multiple channels. Typically, these multiple images represent the sequential frames in a time-stack or z-stack of images and hence each of these images has the same dimension. If this is the case, they are all read into a single 4-dimensional array `img` where `img` is indexed as `img[y, x, channel, frame]` (where we have `y, x` to comply with the conventional `row, col` indexing of a matrix - it means that images displayed as arrays of numbers in the R console will have the correct orientation). However, it is possible that the images in the TIFF file have varying dimensions (most people have never seen this), in which case they are read in as a list of images, where again each element of the list is a 4-dimensional array `img`, indexed as `img[y, x, channel, frame]`.

A (somewhat random) set of TIFF tags are attributed to the read image. These are `IMAGEDEPTH`, `BITSPERSAMPLE`, `SAMPLESPERPIXEL`, `SAMPLEFORMAT`, `PLANARCONFIG`, `COMPRESSION`, `THRESHHOLDING`, `XRESOLUTION`, `YRESOLUTION`, `RESOLUTIONUNIT`, `INDEXED` and `ORIENTATION`. More tags should be added in a subsequent version of this package. You can read about TIFF tags at <https://www.awaresystems.be/imaging/tiff/tifftags.html>.

TIFF images can have a wide range of internal representations, but only the most common in image processing are supported (8-bit, 16-bit and 32-bit integer and 32-bit float samples).

Value

An object of class `ijriff_img` or a list of `ijriff_imgs`.

Note

- 12-bit TIFFs are not supported.
- There is no standard for packing order for TIFFs beyond 8-bit so we assume big-endian packing

Author(s)

Simon Urbanek wrote most of this code for the 'tiff' package. Rory Nolan lifted it from there and changed it around a bit for this 'ijtiff' package. Credit should be directed towards Lord Urbanek.

See Also

[write_tif](#)

Examples

```
img <- read_tif(system.file("img", "Rlogo.tif", package = "ijtiff"))
img <- read_tif(system.file("img", "2ch_ij.tif", package = "ijtiff"))
str(img) # we see that `ijtiff` correctly recognises this image's 2 channels
```

text-image-io

Read/write an image array to/from disk as text file(s).

Description

Write images (arrays) as tab-separated .txt files on disk. Each channel-frame pair gets its own file.

Usage

```
write_txt_img(img, path, rds = FALSE)
```

```
read_txt_img(path)
```

Arguments

img	An image, represented by a 4-dimensional array, like an ijtiff_img .
path	The name of the input/output output file(s), <i>without</i> a file extension.
rds	In addition to writing a text file, save the image as an RDS (a single R object) file?

Examples

```
## Not run:
img <- read_tif(system.file('img', 'Rlogo.tif', package = 'ijtiff'))
write_txt_img(img, 'temp')
img <- read_txt_img('temp_ch1.txt')
## End(Not run)
```

tiff_tag_data *TIFF tag information.*

Description

A dataset containing the information on all known baseline and extended TIFF tags.

Usage

```
tiff_tag_data
```

Format

A data frame with 96 rows and 10 variables:

code_dec decimal numeric code of the TIFF tag

code_hex hexadecimal numeric code of the TIFF tag

name the name of the TIFF tag

short_description a short description of the TIFF tag

tag_type the type of TIFF tag: either baseline or extended

url the URL of the TIFF tag at <https://www.awaresystems.be>

libtiff_name the TIFF tag name in the libtiff C library

c_type the C type of the TIFF tag data in libtiff

count the number of elements in the TIFF tag data

default the default value of the data held in the TIFF tag

Source

<https://www.awaresystems.be>

`write_tif`*Write images in TIFF format*

Description

Write images into a TIFF file.

Usage

```
write_tif(img, path, bits_per_sample = "auto", compression = "none",
          msg = TRUE)
```

Arguments

<code>img</code>	An array representing the image. <ul style="list-style-type: none">• For a single-plane, grayscale image, use a matrix <code>img[y, x]</code>.• For a multi-plane, grayscale image, use a 3-dimensional array <code>img[y, x, plane]</code>.• For a multi-channel, single-plane image, use a 4-dimensional array with a redundant 4th slot <code>img[y, x, channel,]</code> (see ijtiff_img 'Examples' for an example).• For a multi-channel, multi-plane image, use a 4-dimensional array <code>img[y, x, channel, plane]</code>.
<code>path</code>	file name or a raw vector
<code>bits_per_sample</code>	number of bits per sample (numeric scalar). Supported values are 8, 16, and 32. The default "auto" automatically picks the smallest workable value based on the maximum element in <code>img</code> . For example, if the maximum element in <code>img</code> is 789, then 16-bit will be chosen because 789 is greater than $2^8 - 1$ but less than or equal to $2^{16} - 1$.
<code>compression</code>	A string, the desired compression algorithm. Must be one of "LZW", "none", "PackBits", "RLE", "JPEG", or "deflate".
<code>msg</code>	Print an informative message about the image being written?

Value

The input `img` (invisibly).

Author(s)

Simon Urbanek wrote most of this code for the 'tiff' package. Rory Nolan lifted it from there and changed it around a bit for this 'ijtiff' package. Credit should be directed towards Lord Urbanek.

See Also

[read_tif\(\)](#)

Examples

```
img <- read_tif(system.file("img", "Rlogo.tif", package="ijtiff"))
temp_dir <- tempdir()
write_tif(img, paste0(temp_dir, "/", "Rlogo"))
img <- matrix(1:4, nrow = 2)
write_tif(img, paste0(temp_dir, "/", "tiny2x2"))
list.files(temp_dir, pattern = "tif$")
```

Index

*Topic **datasets**

- tiff_tag_data, 8
- count_imgs, 2
- display, 3
- fields::image.plot(), 3
- ijtiff, 3
- ijtiff-package (ijtiff), 3
- ijtiff_img, 4, 4, 6, 7, 9
- read_tags, 5
- read_tif, 6
- read_tif(), 3, 5, 9
- read_txt_img (text-image-io), 7
- text-image-io, 7
- tiff_tag_data, 8
- write_tif, 7, 9
- write_txt_img (text-image-io), 7