Package ‘magick’

August 26, 2019

Type  Package
Title  Advanced Graphics and Image-Processing in R
Version  2.2
Description  Bindings to 'ImageMagick': the most comprehensive open-source image processing library available. Supports many common formats (png, jpeg, tiff, pdf, etc) and manipulations (rotate, scale, crop, trim, flip, blur, etc). All operations are vectorized via the Magick++ STL meaning they operate either on a single frame or a series of frames for working with layers, collages, or animation. In RStudio images are automatically previewed when printed to the console, resulting in an interactive editing environment. The latest version of the package includes a native graphics device for creating in-memory graphics or drawing onto images using pixel coordinates.
License  MIT + file LICENSE
URL  https://docs.ropensci.org/magick (website)
     https://github.com/ropensci/magick (devel)
BugReports  https://github.com/ropensci/magick/issues
SystemRequirements  ImageMagick++: ImageMagick-c++-devel (rpm) or libmagick++-dev (deb)
VignetteBuilder  knitr
Imports  Rcpp (>= 0.12.12), magrittr, curl
LinkingTo  Rcpp
Suggests  av (>= 0.3), spelling, jsonlite, methods, knitr, markdown, rsvg, webp, pdf tools, ggplot2, raster, rgdal, gapminder, IRdisplay, tesseract (>= 2.0), gifski
Encoding  UTF-8
RoxygenNote  6.1.1
Language  en-US
NeedsCompilation  yes
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### Description

Functions for image calculations and analysis. This part of the package needs more work.

### Usage

```r
image_compare(image, reference_image, metric = "", fuzz = 0)

image_compare_dist(image, reference_image, metric = "", fuzz = 0)

image_fft(image)
```
animation

Arguments

- **image**: magick image object returned by `image_read()` or `image_graph()`
- **reference_image**: another image to compare to
- **metric**: string with a **metric** from `metric_types()` such as "AE" or "phash"
- **fuzz**: relative color distance (value between 0 and 100) to be considered similar in the filling algorithm

Details

For details see Image++ documentation. Short descriptions:

- `image_compare` calculates a metric by comparing image with a reference image.
- `image_fft` returns Discrete Fourier Transform (DFT) of the image as a magnitude / phase image pair. I wish I knew what this means.

Here `image_compare()` is vectorized over the first argument and returns the diff image with the calculated distortion value as an attribute.

See Also

Other image: `_index_`, `animation`, `attributes`, `color`, `composite`, `device`, `edges`, `editing`, `effects`, `fx`, `geometry`, `morphology`, `ocr`, `options`, `painting`, `segmentation`, `transform`, `video`

Examples

```r
out1 <- image_blur(logo, 3)
out2 <- image_oilpaint(logo, 3)
input <- c(logo, out1, out2, logo)
if(magick_config()$version >= "6.8.7"){
  diff_img <- image_compare(input, logo, metric = "AE")
  attributes(diff_img)
}
```

__animation__

**Image Frames and Animation**

Description

Operations to manipulate or combine multiple frames of an image. Details below.
Usage

image_animate(image, fps = 10, loop = 0, dispose = c("background", "previous", "none"))

image_morph(image, frames = 8)

image_mosaic(image, operator = NULL)

image_montage(image)

image_flatten(image, operator = NULL)

image_average(image)

image_append(image, stack = FALSE)

image_apply(image, FUN, ...)

Arguments

image magick image object returned by image_read() or image_graph()
fps frames per second
loop how many times to repeat the animation. Default is infinite.
dispose a frame disposal method from dispose_types()
frames number of frames to use in output animation
operator string with a composite operator from compose_types()
stack place images top-to-bottom (TRUE) or left-to-right (FALSE)
FUN a function to be called on each frame in the image
... additional parameters for FUN

Details

For details see Magick++ STL documentation. Short descriptions:

- image_animate coalesces frames by playing the sequence and converting to gif format.
- image_morph expands number of frames by interpolating intermediate frames to blend into each other when played as an animation.
- image_mosaic inlays images to form a single coherent picture.
- image_montage creates a composite image by combining frames.
- image_flatten merges frames as layers into a single frame using a given operator.
- image_average averages frames into single frame.
- image_append stack images left-to-right (default) or top-to-bottom.
- image_apply applies a function to each frame
The `image_apply` function calls an image function to each frame and joins results back into a single image. Because most operations are already vectorized this is often not needed. Note that `FUN()` should return an image. To apply other kinds of functions to image frames simply use `lapply`, `vapply`, etc.

See Also

Other image: `_index_`, `analysis`, `attributes`, `color`, `composite`, `device`, `edges`, `editing`, `effects`, `fx`, `geometry`, `morphology`, `ocr`, `options`, `painting`, `segmentation`, `transform`, `video`

Examples

```r
# Combine images
logo <- image_read("https://jeroen.github.io/images/Rlogo.png")
oldlogo <- image_read("https://developer.r-project.org/Logo/Rlogo-3.png")

# Create morphing animation
both <- image_scale(c(oldlogo, logo), "400")
image_average(image_crop(both))
image_animate(image_morph(both, 10))

# Create thumbnails from GIF
banana <- image_read("https://jeroen.github.io/images/banana.gif")
length(banana)
image_average(banana)
image_flatten(banana)
image_append(banana)
image_append(banana, stack = TRUE)

# Append images together
wizard <- image_read("wizard:"
image_append(image_scale(c(image_append(banana[c(1,3)], stack = TRUE), wizard)))

image_composite(banana, image_scale(logo, "300"))

# Break down and combine frames
front <- image_scale(banana, "300")
background <- image_background(image_scale(logo, "400"), 'white')
frames <- image_apply(front, function(x){image_composite(background, x, offset = "+70+30")})
image_animate(frames, fps = 10)
```

---

### Description

Convert a Magck image to `EBImage` class. Note that EBImage only supports multi-frame images in greyscale.
attributes

Usage

as_EBImage(image)

Arguments

image magick image object returned by \texttt{image_read()} or \texttt{image_graph()}

\begin{tabular}{ll}
\hline
attributes & \textit{Image Attributes} \\
\hline
\end{tabular}

Description

Attributes are properties of the image that might be present on some images and might affect image manipulation methods.

Usage

image_comment(image, comment = NULL)

image_info(image)

Arguments

image magick image object returned by \texttt{image_read()} or \texttt{image_graph()}

comment string to set an image comment

Details

Each attribute can be get and set with the same function. The \texttt{image_info()} function returns a data frame with some commonly used attributes.

See Also

Other image: \_\_index\_, analysis, animation, color, composite, device, edges, editing, effects, fx, geometry, morphology, ocr, options, painting, segmentation, transform, video
**Description**

This enables a `addTaskCallback` that automatically updates the viewer after the state of a magick graphics device has changed. This is enabled by default in RStudio.

**Usage**

```r
autoviewer_enable()

autoviewer_disable()
```

**Examples**

```r
# Only has effect in RStudio (or other GUI with a viewer):
autoviewer_enable()

img <- magick::image_graph()
plot(1)
abline(0, 1, col = "blue", lwd = 2, lty = "solid")
abline(0.1, 1, col = "red", lwd = 3, lty = "dotted")

autoviewer_disable()
abline(0.2, 1, col = "green", lwd = 4, lty = "twodash")
abline(0.3, 1, col = "black", lwd = 5, lty = "dotdash")

autoviewer_enable()
abline(0.4, 1, col = "purple", lwd = 6, lty = "dashed")
abline(0.5, 1, col = "yellow", lwd = 7, lty = "longdash")
```

---

**coder_info**

**Magick Configuration**

**Description**

ImageMagick can be configured to support various additional tool and formats via external libraries. These functions show which features ImageMagick supports on your system.

**Usage**

```r
coder_info(format)

magick_config()
```
Arguments

format  image format such as png, tiff or pdf.

Details

Note that coder_info raises an error for unsupported formats.

References

https://www.imagemagick.org/Magick++/CoderInfo.html

Examples

coder_info("png")
coder_info("jpg")
coder_info("pdf")
coder_info("tiff")
coder_info("gif")

color  Image Color

Description

Functions to adjust contrast, brightness, colors of the image. Details below.

Usage

image_modulate(image, brightness = 100, saturation = 100, hue = 100)

image_quantize(image, max = 256, colorspace = "rgb", dither = NULL, treedepth = NULL)

image_map(image, map, dither = FALSE)

image_channel(image, channel = "lightness")

image_separate(image, channel = "default")

image_combine(image, colorspace = "sRGB", channel = "default")

image_transparent(image, color, fuzz = 0)

image_background(image, color, flatten = TRUE)

image_colorize(image, opacity, color)
color

image_contrast(image, sharpen = 1)
image_normalize(image)
image_enhance(image)
image_equalize(image)
image_median(image, radius = 1)

Arguments

- **image**: magick image object returned by `image_read()` or `image_graph()`.
- **brightness**: modulation of brightness as percentage of the current value (100 for no change).
- **saturation**: modulation of saturation as percentage of the current value (100 for no change).
- **hue**: modulation of hue is an absolute rotation of -180 degrees to +180 degrees from the current position corresponding to an argument range of 0 to 200 (100 for no change).
- **max**: preferred number of colors in the image. The actual number of colors in the image may be less than your request, but never more.
- **colorspace**: string with a colorspace from `colorspace_types` for example "gray", "rgb" or "cmyk".
- **dither**: apply Floyd/Steinberg error diffusion to the image: averages intensities of several neighboring pixels.
- **treedepth**: depth of the quantization color classification tree. Values of 0 or 1 allow selection of the optimal tree depth for the color reduction algorithm. Values between 2 and 8 may be used to manually adjust the tree depth.
- **map**: reference image to map colors from.
- **channel**: a string with a channel from `channel_types` for example "alpha" or "hue" or "cyan".
- **color**: a valid color string such as "navyblue" or "#000080". Use "none" for transparency.
- **fuzz**: relative color distance (value between 0 and 100) to be considered similar in the filling algorithm.
- **flatten**: should image be flattened before writing? This also replaces transparency with background color.
- **opacity**: percentage of opacity used for coloring.
- **sharpen**: enhance intensity differences in image.
- **radius**: replace each pixel with the median color in a circular neighborhood.

Details

For details see *Magick++ STL* documentation. Short descriptions:

- `image_modulate` adjusts brightness, saturation and hue of image relative to current.
• **image_quantize** reduces number of unique colors in the image.
• **image_map** replaces colors of image with the closest color from a reference image.
• **image_channel** extracts a single channel from an image and returns as grayscale.
• **image_transparent** sets pixels approximately matching given color to transparent.
• **image_background** sets background color. When image is flattened, transparent pixels get background color.
• **image_colorize** overlays a solid color frame using specified opacity.
• **image_contrast** enhances intensity differences in image
• **image_normalize** increases contrast by normalizing the pixel values to span the full range of colors
• **image_enhance** tries to minimize noise
• **image_equalize** equalizes using histogram equalization
• **image_median** replaces each pixel with the median color in a circular neighborhood

Note that colors are also determined by image properties `imagetype` and `colorspace` which can be modified via `image_convert()`.

**See Also**

Other image: `_index_`, `analysis`, `animation`, `attributes`, `composite`, `device`, `edges`, `editing`, `effects`, `fx`, `geometry`, `morphology`, `ocr`, `options`, `painting`, `segmentation`, `transform`, `video`

**Examples**

```r
# manually adjust colors
logo <- image_read("logo:")
image_modulate(logo, brightness = 200)
image_modulate(logo, saturation = 150)
image_modulate(logo, hue = 200)

# Reduce image to 10 different colors using various spaces
image_quantize(logo, max = 10, colorspace = 'gray')
image_quantize(logo, max = 10, colorspace = 'rgb')
image_quantize(logo, max = 10, colorspace = 'cmyk')

# Change background color
translogo <- image_transparent(logo, 'white')
image_background(translogo, "pink", flatten = TRUE)

# Compare to flood-fill method:
image_fill(logo, "pink", fuzz = 20)

# Other color tweaks
image_colorize(logo, 50, "red")
image_contrast(logo)
image_normalize(logo)
image_enhance(logo)
image_equalize(logo)
```
image_median(logo)

# Alternate way to convert into black-white
image_convert(logo, type = 'grayscale')

---

**composite**

**Image Composite**

### Description

Similar to the ImageMagick `composite` utility: compose an image on top of another one using a `CompositeOperator`.

### Usage

```r
image_composite(image, composite_image, operator = "atop",
    offset = "+0+0", gravity = "northwest", compose_args = ")

image_border(image, color = "lightgray", geometry = "10x10",
    operator = "copy")

image_frame(image, color = "lightgray", geometry = "25x25+6+6")

image_shadow_mask(image, geometry = "50x10+30+30")

image_shadow(image, color = "black", bg = "white",
    geometry = "50x10+30+30", operator = "atop", offset = "+20+20")
```

### Arguments

- **image**: magick image object returned by `image_read()` or `image_graph()`.
- **composite_image**: composition image.
- **operator**: string with a `composite operator` from `compose_types()`.
- **offset**: string with either a `gravity_type` or a `geometry_point` to set position of top image.
- **gravity**: string with `gravity` value from `gravity_types`.
- **compose_args**: additional arguments needed for some composite operations.
- **color**: a valid `color string` such as "navyblue" or "#000080". Use "none" for transparency.
- **geometry**: a `geometry string` to set height and width of the border, e.g. "10x8". In addition `image_frame` allows for adding shadow by setting an offset e.g. "20x10+7+2".
- **bg**: background color.
Details

The `image_composite` function is vectorized over both image arguments: if the first image has \( n \) frames and the second \( m \) frames, the output image will contain \( n \times m \) frames.

The `image_border` function creates a slightly larger solid color frame and then composes the original frame on top. The `image_frame` function is similar but has an additional feature to create a shadow effect on the border (which is really ugly).

See Also

Other image: `_index_`, `analysis`, `animation`, `attributes`, `color`, `device`, `edges`, `editing`, `effects`, `fx`, `geometry`, `morphology`, `ocr`, `options`, `painting`, `segmentation`, `transform`, `video`

Examples

```r
# Compose images using one of many operators
imlogo <- image_scale(image_read("logo:"), "x275")
rlogo <- image_read("https://developer.r-project.org/Logo/Rlogo-3.png")

# Standard is atop
image_composite(imlogo, rlogo)

# Same as 'blend 50' in the command line
image_composite(imlogo, rlogo, operator = "blend", compose_args="50")

# Offset can be geometry or gravity
image_composite(logo, rose, offset = "+100+100")
image_composite(logo, rose, gravity = "East")

# Add a border frame around the image
image_border(imlogo, "red", "10x10")
image_frame(imlogo)
image_shadow(imlogo)
```

device

Magick Graphics Device

Description

Graphics device that produces a Magick image. Can either be used like a regular device for making plots, or alternatively via `image_draw` to open a device which draws onto an existing image using pixel coordinates. The latter is vectorized, i.e. drawing operations are applied to each frame in the image.

Usage

```r
image_graph(width = 800, height = 600, bg = "white",
            pointsize = 12, res = 72, clip = TRUE, antialias = TRUE)
```
image_draw(image, pointsize = 12, res = 72, antialias = TRUE, ...)

image_capture()

Arguments

width in pixels
height in pixels
bg background color
pointsize size of fonts
res resolution in pixels
clip enable clipping in the device. Because clipping can slow things down a lot, you can disable it if you don’t need it.
antialias TRUE/FALSE: enables anti-aliasing for text and strokes
image an existing image on which to start drawing
... additional device parameters passed to plot.window such as xlim, ylim, or mar.

Details

The device is a relatively recent feature of the package. It should support all operations but there might still be small inaccuracies. Also it is a bit slower than some of the other devices, in particular for rendering text and clipping. Hopefully this can be optimized in the next version.

By default image_draw sets all margins to 0 and uses graphics coordinates to match image size in pixels (width x height) where (0,0) is the top left corner. Note that this means the y axis increases from top to bottom which is the opposite of typical graphics coordinates. You can override all this by passing custom xlim, ylim or mar values to image_draw.

The image_capture function returns the current device as an image. This only works if the current device is a magick device or supports dev.capture.

See Also

Other image: _index_, analysis, animation, attributes, color, composite, edges, editing, effects, fx, geometry, morphology, ocr, options, painting, segmentation, transform, video

Examples

# Regular image
frink <- image_read("https://jeroen.github.io/images/frink.png")

# Produce image using graphics device
fig <- image_graph(res = 96)
ggplot2::qplot(mpg, wt, data = mtcars, colour = cyl)
dev.off()

# Combine
out <- image_composite(fig, frink, offset = "+70+30")
print(out)
# Edge / Line Detection

**Description**

Best results are obtained by finding edges with `image_canny()` and then performing Hough-line detection on the edge image.

**Usage**

```r
image_edge(image, radius = 1)

image_canny(image, geometry = "0x1+10%+30%")

image_hough_draw(image, geometry = NULL, color = "red",
                 bg = "transparent", size = 3, overlay = FALSE)

image_hough_txt(image, geometry = NULL, format = c("mvg", "svg"))
```

**Arguments**

- `image`: magick image object returned by `image_read()` or `image_graph()`.
- `radius`: edge size in pixels.
- `geometry`: geometry string, see details.
- `color`: a valid color string such as "navyblue" or "#000080". Use "none" for transparency.
- `bg`: background color.
size     size in points to draw the line
overlay  composite the drawing atop the input image. Only for bg = 'transparent'.
format   output format of the text, either svg or mvg

Details

For Hough-line detection, the geometry format is \{W\}x\{H\}+\{threshold\} defining the size and
threshold of the filter used to find 'peaks' in the intermediate search image. For canny edge detection
the format is \{radius\}x\{sigma\}+\{lower\%\}+\{upper\%\}. More details and examples are available
at the imagemagick website.

See Also

Other image: _index_, analysis, animation, attributes, color, composite, device, editing,
effects, fx, geometry, morphology, ocr, options, painting, segmentation, transform, video

Examples

```r
if(magick_config()$version > "6.8.9"){
  shape <- demo_image("shape_rectangle.gif")
  rectangle <- image_canny(shape)
  rectangle %>% image_hough_draw('5x5+20')
  rectangle %>% image_hough_txt(format = 'svg') %>% cat()
}
```

---

**Image Editing**

**Description**

Read, write and join or combine images. All image functions are vectorized, meaning they operate
either on a single frame or a series of frames (e.g. a collage, video, or animation). Besides paths
and URLs, image_read() supports commonly used bitmap and raster object types.

**Usage**

```r
image_read(path, density = NULL, depth = NULL, strip = FALSE)
image_read_svg(path, width = NULL, height = NULL)
image_read_pdf(path, pages = NULL, density = 300, password = "")
image_read_video(path, fps = 1, format = "png")
image_write(image, path = NULL, format = NULL, quality = NULL,
depth = NULL, density = NULL, comment = NULL, flatten = FALSE)
```
image_convert(image, format = NULL, type = NULL, colorspace = NULL,
    depth = NULL, antialias = NULL, matte = NULL)

image_data(image, channels = NULL, frame = 1)

image_raster(image, frame = 1, tidy = TRUE)

image_display(image, animate = TRUE)

image_browse(image, browser = getOption("browser"))

image_strip(image)

image_blank(width, height, color = "none", pseudo_image = ")

image_destroy(image)

image_join("

image_attributes(image)

demo_image(path)

Arguments

path a file, url, or raster object or bitmap array
density resolution to render pdf or svg
depth color depth (either 8 or 16)
strip drop image comments and metadata
width in pixels
height in pixels
pages integer vector with page numbers. Defaults to all pages.
password user password to open protected pdf files
fps how many images to capture per second of video. Set to NULL to get all frames from the input video.
format output format such as "png", "jpeg", "gif", "rgb" or "rgba".
image magick image object returned by image_read() or image_graph()
quality number between 0 and 100 for jpeg quality. Defaults to 75.
comment text string added to the image metadata for supported formats
flatten should image be flattened before writing? This also replaces transparency with background color.
type string with imagetype value from image_types for example grayscale to convert into black/white
colorspace string with a colorspace from colorspace_types for example "gray", "rgb" or "cmyk"
antialias
enable anti-aliasing for text and strokes

matte
set to TRUE or FALSE to enable or disable transparency

channels
string with image channel(s) for example "rgb", "rgba", "cmyk", "gray", or "ycbcr". Default is either "gray", "rgb" or "rgba" depending on the image

frame
integer setting which frame to extract from the image

tidy
converts raster data to long form for use with geom_raster. If FALSE output is the same as as.raster().

animate
support animations in the X11 display

browser
argument passed to browseURL

color
a valid color string such as "navyblue" or "#000080". Use "none" for transparency.

pseudo_image
string with pseudo image specification for example "radial-gradient:purple-yellow"

... several images or lists of images to be combined

Details
All standard base vector methods such as [, [[, c(), as.list(), as.raster(), rev(), length(), and print() can be used to work with magick image objects. Use the standard img[i] syntax to extract a subset of the frames from an image. The img[[i]] method is an alias for image_data() which extracts a single frame as a raw bitmap matrix with pixel values.

For reading svg or pdf it is recommended to use image_read_svg() and image_read_pdf() if the rsvg and pdftools R packages are available. These functions provide more rendering options and better quality than built-in svg/pdf rendering delegates from imagemagick itself.

X11 is required for image_display() which is only works on some platforms. A more portable method is image_browse() which opens the image in a browser. RStudio has an embedded viewer that does this automatically which is quite nice.

Image objects are automatically released by the garbage collector when they are no longer reachable. Because the GC only runs once in a while, you can also call image_destroy() explicitly to release the memory immediately. This is usually only needed if you create a lot of images in a short period of time, and you might run out of memory.

See Also
Other image: _index_, analysis, animation, attributes, color, composite, device, edges, effects, fx, geometry, morphology, ocr, options, painting, segmentation, transform, video

Examples
# Download image from the web
frink <- image_read("https://jeroen.github.io/images/frink.png")
worldcup_frink <- image_fill(frink, "orange", "+100+200", 20)
image_write(worldcup_frink, "output.png")

# extract raw bitmap array
bitmap <- frink[[1]]
# effects

## Image Effects

**Description**

High level effects applied to an entire image. These are mostly just for fun.

**Usage**

```r
image_despeckle(image, times = 1L)
image_reducenoise(image, radius = 1L)
image_noise(image, noisetype = "gaussian")
image_blur(image, radius = 1, sigma = 0.5)
image_charcoal(image, radius = 1, sigma = 0.5)
image_oilpaint(image, radius = 1)
image_emboss(image, radius = 1, sigma = 0.5)
image_implode(image, factor = 0.5)
image_negate(image)
```
Arguments

- **image**: magick image object returned by `image_read()` or `image_graph()`.
- **times**: number of times to repeat the despeckle operation.
- **radius**: radius, in pixels, for various transformations.
- **noisetype**: string with a noisetype value from `noise_types`.
- **sigma**: the standard deviation of the Laplacian, in pixels.
- **factor**: image implode factor (special effect).

See Also

Other image: `_index_`, `analysis`, `animation`, `attributes`, `color`, `composite`, `device`, `edges`, `editing`, `fx`, `geometry`, `morphology`, `ocr`, `options`, `painting`, `segmentation`, `transform`, `video`.

Examples

```r
logo <- image_read("logo:")
image_despeckle(logo)
image_reducenoise(logo)
image_noise(logo)
image_blur(logo, 10, 10)
image_charcoal(logo)
image_oilpaint(logo, radius = 3)
image_emboss(logo)
image_implode(logo)
image_negate(logo)
```

---

**fx**  

Image FX

Description

Apply a custom an fx expression to the image.

Usage

```r
image_fx(image, expression = "p", channel = NULL)
```

Arguments

- **image**: magick image object returned by `image_read()` or `image_graph()`.
- **expression**: string with a fx expression.
- **channel**: a value of `channel_types()` specifying which channel(s) to set.
## geometry

### Geometry Helpers

#### Description

ImageMagick uses a handy geometry syntax to specify coordinates and shapes for use in image transformations. You can either specify these manually as strings or use the helper functions below.

#### Usage

```r
geometry_point(x, y)

geometry_area(width = NULL, height = NULL, x_off = 0, y_off = 0)

geometry_size_pixels(width = NULL, height = NULL, preserve_aspect = TRUE)

geometry_size_percent(width = 100, height = NULL)
```

#### Arguments

- `x`: left offset in pixels
- `y`: top offset in pixels
- `width`: in pixels
- `height`: in pixels

### Examples

```r
# Show image_fx() expression
if(magick_config()$version > "6.8.8"){
  img <- image_convert(logo, colorspace = "Gray")
  image_fx(img, expression = "pow(p, 0.5")
  image_fx(img, expression = "rand()")

  gradient_x <- image_convolve(img, kernel = "Prewitt")
  gradient_y <- image_convolve(img, kernel = "Prewitt:90")
  gradient <- c(image_fx(gradient_x, expression = "p^2"),
                 image_fx(gradient_y, expression = "p^2"))
  gradient <- image_flatten(gradient, operator = "Plus")
  #gradient <- image_fx(gradient, expression = "sqrt(p")
  gradient
}
```
**geometry**

- **x_off** - offset in pixels on x axis
- **y_off** - offset in pixels on y axis
- **preserve_aspect** - if FALSE, resize to width and height exactly, losing original aspect ratio. Only one of percent and preserve_aspect may be TRUE.

**Details**

See ImageMagick Manual for details about the syntax specification. Examples of geometry strings:

- "500x300" – *Resize image keeping aspect ratio, such that width does not exceed 500 and the height does not exceed 300.*
- "500x300!" – *Resize image to 500 by 300, ignoring aspect ratio*
- "500x" – *Resize width to 500 keep aspect ratio*
- "x300" – *Resize height to 300 keep aspect ratio*
- "50%x20%" – *Resize width to 50 percent and height to 20 percent of original*
- "500x300+10+20" – *Crop image to 500 by 300 at position 10,20*

**See Also**

Other image: _index_, analysis, animation, attributes, color, composite, device, edges, editing, effects, fx, morphology, ocr, options, painting, segmentation, transform, video

**Examples**

```r
# Specify a point
logo <- image_read("logo:")
image_annotate(logo, "Some text", location = geometry_point(100, 200), size = 24)

# Specify image area
image_crop(logo, geometry_area(300, 300), repage = FALSE)
image_crop(logo, geometry_area(300, 300, 100, 100), repage = FALSE)

# Specify image size
image_resize(logo, geometry_size_pixels(300))
image_resize(logo, geometry_size_pixels(height = 300))
image_resize(logo, geometry_size_pixels(300, 300, preserve_aspect = FALSE))

# resize relative to current size
image_resize(logo, geometry_size_percent(50))
image_resize(logo, geometry_size_percent(50, 20))
```
**image_ggplot**  
*Image to ggplot*

**Description**

Create a `ggplot` with axes set to pixel coordinates and plot the raster image on it using `ggplot2::annotation_raster`. See examples for how to plot an image onto an existing `ggplot`.

**Usage**

```r
image_ggplot(image, interpolate = FALSE)
```

**Arguments**

- `image`: magick image object returned by `image_read()` or `image_graph()`
- `interpolate`: passed to `ggplot2::annotation_raster`

**Examples**

```r
# Plot with base R
plot(logo)

# Plot image with ggplot2
library(ggplot2)
myplot <- image_ggplot(logo)
myplot + ggtitle("Test plot")

# Show that coordinates are reversed:
myplot + theme_classic()

# Or add to plot as annotation
image <- image_fill(logo, 'none')
raster <- as.raster(image)
myplot <- qplot(mpg, wt, data = mtcars)
myplot + annotation_raster(raster, 25, 35, 3, 5)

# Or overplot image using grid
library(grid)
qplot(speed, dist, data = cars, geom = c("point", "smooth"))
grid.raster(image)
```
Apply a morphology method. This is a very flexible function which can be used to apply any morphology method with custom parameters. See imagemagick website for examples.

Usage

image_morphology(image, method = "convolve", kernel = "Gaussian", iterations = 1, opts = list())

image_convolve(image, kernel = "Gaussian", iterations = 1, scaling = NULL, bias = NULL)

Arguments

- **image**: magick image object returned by image_read() or image_graph()
- **method**: a string with a valid method from morphology_types()
- **kernel**: either a square matrix or a string. The string can either be a parameterized kerneltype such as: "DoG:0,0,2" or "Diamond" or it can contain a custom matrix (see examples)
- **iterations**: number of iterations
- **opts**: a named list or character vector with custom attributes
- **scaling**: string with kernel scaling. The special flag "!" automatically scales to full dynamic range, for example: "50%!
- **bias**: output bias string, for example "50%"

See Also

Other image: _index_, analysis, animation, attributes, color, composite, device, edges, editing, effects, fx, geometry, ocr, options, painting, segmentation, transform, video

Examples

#example from IM website:
if(magick_config()$version > "6.8.8"){
  pixel <- image_blank(1, 1, 'white') %>% image_border('black', '5x5')

  # See the effect of Dilate method
  pixel %>% image_scale('800%')
  pixel %>% image_morphology('Dilate', "Diamond") %>% image_scale('800%')

  # These produce the same output:
  pixel %>% image_morphology('Dilate', "Diamond", iter = 3) %>% image_scale('800%')
# Octagonal Convex Hull
man %>%
  image_morphology('Close', 'Diamond') %>%
  image_morphology('Thicken', 'ConvexHull', iterations = -1)

# Thinning down to a Skeleton
man %>%
  image_morphology('Thinning', 'Skeleton', iterations = -1)

# Specify custom kernel matrix usingn a string:
img <- demo_image("test_mag.gif")
i <- image_convolve(img, kernel = '4x5:
    0 -1 0 0
  -1 1 -1 0
  -1 1 -1 0
  -1 1 +1 -1
    0 -1 -1 0 ', bias = "50%")
}

---

**Description**

Extract text from an image using the **tesseract** package.

**Usage**

```r
image_ocr(image, language = "eng", HOCR = FALSE, ...)
image_ocr_data(image, language = "eng", ...)
```
Arguments

image magick image object returned by `image_read()` or `image_graph()`
language passed to `tesseract`. To install additional languages see instructions in `tesseract_download()`.
HOCR if TRUE return results as HOCR xml instead of plain text
... additional parameters passed to `tesseract`

Details

To use this function you need to `tesseract` first:

```r
install.packages("tesseract")
```

Best results are obtained if you set the correct language in `tesseract`. To install additional languages see instructions in `tesseract_download()`.

See Also

Other image: `_index_`, `analysis`, `animation`, `attributes`, `color`, `composite`, `device`, `edges`, `editing`, `effects`, `fx`, `geometry`, `morphology`, `options`, `painting`, `segmentation`, `transform`, `video`

Examples

```r
if(require("tesseract")){
  img <- image_read("http://jeroen.github.io/images/testocr.png")
  image_ocr(img)
  image_ocr_data(img)
}
```

<table>
<thead>
<tr>
<th>options</th>
<th>Magick Options</th>
</tr>
</thead>
</table>

Description

List option types and values supported in your version of ImageMagick. For descriptions see `ImageMagick Enumerations`.

Usage

`magick_options()`

`option_types()`

`filter_types()`

`metric_types()`
image_fill(image, color, point = '+1+1', fuzz = 0, refcolor = NULL)

describe((image, text, gravity = "northwest", location = '+0+0',

References
ImageMagick Manual: Enumerations

See Also
Other image: _index_, analysis, animation, attributes, color, composite, device, edges, editing, effects, fx, geometry, morphology, ocr, painting, segmentation, transform, video
painting

degrees = 0, size = 10, font = "", style = "normal",
weight = 400, kerning = 0, decoration = NULL, color = NULL,
strokecolor = NULL, boxcolor = NULL)

Arguments

- **image**: magick image object returned by `image_read()` or `image_graph()`
- **color**: a valid color string such as "navyblue" or "#000080". Use "none" for transparency.
- **point**: a geometry_point string indicating the starting point of the flood-fill
- **fuzz**: relative color distance (value between 0 and 100) to be considered similar in the filling algorithm
- **refcolor**: if set, fuzz color distance will be measured against this color, not the color of the starting point. Any color (within fuzz color distance of the given refcolor), connected to starting point will be replaced with the color. If the pixel at the starting point does not itself match the given refcolor (according to fuzz) then no action will be taken.
- **text**: character vector of length equal to 'image' or length 1
- **gravity**: string with gravity value from `gravity_types`.
- **location**: geometry string with location relative to gravity
- **degrees**: rotates text around center point
- **size**: font-size in pixels
- **font**: string with font family such as "sans", "mono", "serif", "Times", "Helvetica", "Trebuchet", "Georgia", "Palatino" or "Comic Sans".
- **style**: value of `style_types` for example "italic"
- **weight**: thickness of the font, 400 is normal and 700 is bold.
- **kerning**: increases or decreases whitespace between letters
- **decoration**: value of `decoration_types` for example "underline"
- **strokecolor**: a color string adds a stroke (border around the text)
- **boxcolor**: a color string for background color that annotation text is rendered on.

Details

Note that more sophisticated drawing mechanisms are available via the graphics device using `image_draw`.

Setting a font, weight, style only works if your imagemagick is compiled with fontconfig support.

See Also

Other image: `_index_`, `analysis`, `animation`, `attributes`, `color`, `composite`, `device`, `edges`, `editing`, `effects`, `fx`, `geometry`, `morphology`, `ocr`, `options`, `segmentation`, `transform`, `video`
Examples

```r
logo <- image_read("logo:")
logo <- image_background(logo, 'white')
image_fill(logo, "pink", point = "+450+400")
image_fill(logo, "pink", point = "+450+400", fuzz = 25)
# Add some text to an image
image_annotate(logo, "This is a test")
image_annotate(logo, "CONFIDENTIAL", size = 50, color = "red", boxcolor = "pink",
degrees = 30, location = "+100+100")

# Setting fonts requires fontconfig support (and that you have the font)
image_annotate(logo, "The quick brown fox", font = "monospace", size = 50)
```

---

**segmentation**

### Image Segmentation

**Description**

Basic image segmentation like connected components labelling, blob extraction and fuzzy c-means

**Usage**

- `image_connect(image, connectivity = 4)`
- `image_split(image, keep_color = TRUE)`
- `image_fuzzycmeans(image, min_pixels = 1, smoothing = 1.5)`

**Arguments**

- `image` magick image object returned by `image_read()` or `image_graph()`
- `connectivity` number neighbor colors which are considered part of a unique object
- `keep_color` if TRUE the output images retain the color of the input pixel. If FALSE all matching pixels are set black to retain only the image mask.
- `min_pixels` the minimum number of pixels contained in a hexahedra before it can be considered valid (expressed as a percentage)
- `smoothing` the smoothing threshold which eliminates noise in the second derivative of the histogram (higher values gives smoother second derivative)

**Details**

- `image_connect` Connect adjacent pixels with the same pixel intensities to do blob extraction
- `image_split` Splits the image according to pixel intensities
- `image_fuzzycmeans` Fuzzy c-means segmentation of the histogram of color components

`image_connect` performs blob extraction by scanning the image, pixel-by-pixel from top-left to bottom-right where regions of adjacent pixels which share the same set of intensity values get combined.
thresholding

See Also

Other image: _index_, analysis, animation, attributes, color, composite, device, edges, editing, effects, fx, geometry, morphology, ocr, options, painting, transform, video

Examples

# Split an image by color
img <- image_quantize(logo, 4)
layers <- image_split(img)
layers

# This returns the original image
image_flatten(layers)

# From the IM website
objects <- image_convert(demo_image("objects.gif"), colorspace = "Gray")
objects

# Split image in blobs of connected pixel levels
if(magick_config()$version > "6.9.0"){
  objects %>%
    image_connect(connectivity = 4) %>%
    image_split()
}

# Fuzzy c-means
image_fuzzycmeans(logo)

logo %>
  image_convert(colorspace = "HCL") %>
  image_fuzzycmeans(smoothing = 5)
}

thresholding

Image thresholding

Description

Thresholding an image can be used for simple and straightforward image segmentation. The function image_threshold() allows to do black and white thresholding whereas image_lat() performs local adaptive thresholding.

Usage

image_threshold(image, type = c("black", "white"), threshold = "50%",
 channel = NULL)

image_lat(image, geometry = "10x10+5%")
Arguments

- **image**: magick image object returned by `image_read()` or `image_graph()`
- **type**: type of thresholding, either one of lat, black or white (see details below)
- **threshold**: pixel intensity threshold percentage for black or white thresholding
- **channel**: a value of `channel_types()` specifying which channel(s) to set
- **geometry**: pixel window plus offset for LAT algorithm

Details

- `image_threshold(type = "black")`: Forces all pixels below the threshold into black while leaving all pixels at or above the threshold unchanged
- `image_threshold(type = "white")`: Forces all pixels above the threshold into white while leaving all pixels at or below the threshold unchanged
- `image_lat()`: Local Adaptive Thresholding. Looks in a box (width x height) around the pixel neighborhood if the pixel value is bigger than the average minus an offset.

Examples

```r
test <- image_convert(logo, colorspace = "Gray")
image_threshold(test, type = "black", threshold = "50%")
image_threshold(test, type = "white", threshold = "50%")

# Turn image into BW
test %>%
  image_threshold(type = "white", threshold = "50%") %>%
  image_threshold(type = "black", threshold = "50%")

# adaptive thresholding
image_lat(test, geometry = "10x10+5%")
```

---

**Image Transform**

**Description**

Basic transformations like rotate, resize, crop and flip. The `geometry` syntax is used to specify sizes and areas.

**Usage**

- `image_trim(image, fuzz = 0)`
- `image_chop(image, geometry)`
- `image_rotate(image, degrees)`
transform

image_resize(image, geometry = NULL, filter = NULL)
image_scale(image, geometry = NULL)
image_sample(image, geometry = NULL)
image_crop(image, geometry = NULL, gravity = NULL, repage = TRUE)
image_extent(image, geometry, gravity = "center", color = "none")
image_flip(image)
image_flop(image)
image_deskew(image, threshold = 40)
image_page(image, pagesize = NULL, density = NULL)
image_repage(image)
image_orient(image, orientation = NULL)
image_shear(image, geometry = "10x10", color = "none")

Arguments

image magick image object returned by image_read() or image_graph()
fuzz relative color distance (value between 0 and 100) to be considered similar in the
filling algorithm
geometry a geometry string specifying area (for cropping) or size (for resizing).
degrees value between 0 and 360 for how many degrees to rotate
filter string with filter type from: filter_types
gravity string with gravity value from gravity_types.
repage resize the canvas to the cropped area
color a valid color string such as "navyblue" or "#000080". Use "none" for trans-
pparency.
threshold straightens an image. A threshold of 40 works for most images.
pagesize geometry string with preferred size and location of an image canvas
density geometry string with vertical and horizontal resolution in pixels of the image.
Specifies an image density when decoding a Postscript or PDF.
orientation string to set image orientation one of the orientation_types. If NULL it applies
auto-orientation which tries to infer the correct orientation from the Exif data.

Details

For details see Magick++ STL documentation. Short descriptions:
• `image_trim` removes edges that are the background color from the image.
• `image_chop` removes vertical or horizontal subregion of image.
• `image_crop` cuts out a subregion of original image
• `image_rotate` rotates and increases size of canvas to fit rotated image.
• `image_deskew` auto rotate to correct skewed images
• `image_resize` resizes using custom `filterType`
• `image_scale` and `image_sample` resize using simple ratio and pixel sampling algorithm.
• `image_flip` and `image_flop` invert image vertically and horizontally

The most powerful resize function is `image_resize` which allows for setting a custom resize filter. Output of `image_scale` is similar to `image_resize(img, filter = "point")`.

For resize operations it holds that if no geometry is specified, all frames are rescaled to match the top frame.

**See Also**

Other image: `_index_`, `analysis`, `animation`, `attributes`, `color`, `composite`, `device`, `edges`, `editing`, `effects`, `fx`, `geometry`, `morphology`, `ocr`, `options`, `painting`, `segmentation`, `video`

**Examples**

```r
logo <- image_read("logo:"
logo <- image_scale(logo, "400")
image_trim(logo)
image_chop(logo, "100x20")
image_rotate(logo, 45)
# Small image
rose <- image_convert(image_read("rose:"), "png")

# Resize to 400 width or height:
image_resize(rose, "400x")
image_resize(rose, "x400")

# Resize keeping ratio
image_resize(rose, "400x400")

# Resize, force size losing ratio
image_resize(rose, "400x400!")

# Different filters
image_resize(rose, "400x", filter = "Triangle")
image_resize(rose, "400x", filter = "Point")
# simple pixel resize
image_scale(rose, "400x")
image_sample(rose, "400x")
image_crop(logo, "400x400+200+200")
image_extent(rose, "200x200", color = 'pink')
image_flip(logo)
image_flop(logo)
```
if(magick_config()$version > "6.8.6")
    image_orient(logo)
    image_shear(logo, "10x10")

---

**video**  
*Write Video*

---

**Description**

High quality video / gif exporter based on external packages *gifski* and *av*.

**Usage**

```r
image_write_video(image, path = NULL, framerate = 10, ...)
```

```r
image_write_gif(image, path = NULL, delay = 1/10, ...)
```

**Arguments**

- `image` magick image object returned by *image_read()* or *image_graph()*
- `path` filename of the output gif or video. This is also the return value.
- `framerate` frames per second, passed to *av_encode_video*
- `...` additional parameters passed to *av_encode_video* and *gifski*.
- `delay` duration of each frame in seconds (inverse of framerate)

**Details**

This requires an image with multiple frames. The GIF exporter accomplishes the same thing as *image_animate* but much faster and with better quality.

**See Also**

Other image: *_index_, analysis, animation, attributes, color, composite, device, edges, editing, effects, fx, geometry, morphology, ocr, options, painting, segmentation, transform*
### Example Images

Description

Example images included with ImageMagick:

Details

- **logo**: ImageMagick Logo, 640x480
- **wizard**: ImageMagick Wizard, 480x640
- **rose**: Picture of a rose, 70x46
- **granite**: Granite texture pattern, 128x128

### Magick Image Processing

Description

The **magick** package for graphics and image processing in R. Important resources:

- **R introduction vignette**: getting started
- **Magick++ API and Magick++ STL** detailed descriptions of methods and parameters

Details

Documentation is split into the following pages:

- **analysis** - metrics and calculations: compare, fft
- **animation** - manipulate or combine multiple frames: animate, morph, mosaic, montage, average, append, apply
- **attributes** - image properties: comment, info
- **color** - contrast, brightness, colors: modulate, quantize, map, transparent, background, colorize, contrast, normalize, enhance, equalize, median
- **composite** - advanced joining: composite, border, frame
- **device** - creating graphics and drawing on images
- **editing** - basic image IO: read, write, convert, join, display, brose
- **effects** - fun effects: despecle, reducenoise, noise, blur, charcoal, edge, oilpaint, emboss, implode, negate
- **geometry** - specify points, areas and sizes using geometry syntax
- **ocr** - extract text from image using **tesseract** package
- **options** - list option types and values supported in your version of ImageMagick
- **painting** - flood fill and annotating text
- **transform** - shape operations: trim, chop, rotate, resize, scale, sample crop, flip, flop, deskew, page
See Also

Other image: analysis, animation, attributes, color, composite, device, edges, editing, effects, fx, geometry, morphology, ocr, options, painting, segmentation, transform, video
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