Wand Documentation

Release 0.5.3

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Contents

Wand is a ctypes-based simple ImageMagick binding for Python.

```
from wand.image import Image
from wand.display import display

with Image(filename='mona-lisa.png') as img:
    print(img.size)
    for r in 1, 2, 3:
        with img.clone() as i:
            i.resize(int(i.width * r * 0.25), int(i.height * r * 0.25))
            i.rotate(90 * r)
            i.save(filename='mona-lisa-{0}.png'.format(r))
            display(i)
```

You can install it from PyPI (and it requires MagickWand library):

```
$ apt-get install libmagickwand-dev
$ pip install Wand
```

CHAPTER 1

Why just another binding?

There are already many MagickWand API bindings for Python, however they are lacking something we need:

- Pythonic and modern interfaces
- Good documentation
- Binding through `ctypes` (not C API) — we are ready to go PyPy!
- Installation using **`pip`**

CHAPTER 2

Requirements

- Python 2.6 or higher
  - CPython 2.6 or higher
  - CPython 3.3 or higher
  - PyPy 1.5 or higher
- MagickWand library
  - `libmagickwand-dev` for APT on Debian/Ubuntu
  - `imagemagick` for MacPorts/Homebrew on Mac
  - `ImageMagick-devel` for Yum on CentOS

CHAPTER 3

User's guide

3.1 What's new in Wand 0.5?

This guide doesn't cover all changes in 0.5. See also the full list of changes in *0.5 series*.

3.1.1 Numpy I/O

New in version 0.5.3.

Instances of Wand's *Image* can be created directly from a `numpy.array` object, or other objects that implements array interface protocol.

```
import numpy as np
from wand.image import Image

array = np.zeros([100, 100, 3], dtype=np.uint8)
array[:, :] = [0xff, 0x00, 0x00]

with Image.from_array(array) as img:
    print(img[0, 0])  #=> srgb(255, 0, 0)
```

You can also convert an instance of *Image* into an array.

```
import numpy as np
from wand.image import Image

with Image(filename='rose:') as img:
    array = np.array(img)
    print(array.shape)  #=> (70, 46, 3)
```

3.1.2 Resource Limits

New in version 0.5.1.

The *limits* dictionary helper allows you to define run-time policies. Doing this allows your application to process images without consuming too much system resources.

```
from wand.image import Image
from wand.resource import limits

limits['thread'] = 1  # Only allow one CPU thread for raster.
with Image(filename='input.tif') as img:
    pass
```

See *ResourceLimits* for more details.

3.1.3 Import & Extract Profiles

New in version 0.5.1.

Embedded profiles, like ICC, can be accessed via *Image.profiles* dictionary.

```
with Image(filename='photo.jpg') as photo:
    with open('color_profile.icc', 'rb') as profile:
        photo.profiles['icc'] = profile.read()
```

Hint: Each profile payload will be a raw binary blob. ImageMagick & Wand will not edit payloads, but only get, set, and delete them from an image.

See *ProfileDict* for more details.

3.1.4 Pseudo Images

New in version 0.5.0.

The *Image* constructor now accepts the `pseudo` paramater. This allows you to quickly read Pseudo-image Formats, and Built-in Patterns

Checkout *Open a Pseudo Image* for some examples.

3.1.5 ImageMagick-7 Support

New in version 0.5.0.

The release of Wand 0.5 now supports both versions of ImageMagick-6 & ImageMagick-7. ImageMagick-7 introduces some key behavior changes, and some care should go into any application that was previously written for ImageMagick-6 before upgrading system libraries.

To understand the fundamental changes, please review Porting to ImageMagick Version 7 for a more definitive overview.

Notes on Porting 6 t0 7

A few key changes worth reviewing.

HDRI by Default

Vanilla installs of ImageMagick-7 include HDRI enabled by default. Users may experiences increase depth of color, but with reduced performances during certain color manipulation routines. Max color-values should never be hard-coded, but rely on *Image.quantum_range* to ensure consistent results. It is also possible to experiences color-value underflow / overflow during arithmetic operations when upgrading.

An example of an underflow between versions:

```
# ImageMagick-6
with Image(width=1, height=1, background=Color("gray5")) as canvas:
    canvas.evaluate("subtract", canvas.quantum_range * 0.07)
    print(canvas[0, 0]) #=> srgb(0,0,0)

# ImageMagick-7
with Image(width=1, height=1, background=Color("gray5")) as canvas:
    canvas.evaluate("subtract", canvas.quantum_range * 0.07)
    print(canvas[0, 0]) #=> srgb(-1.90207%,-1.90207%,-1.90207%)
```

The majority of the image-manipulation methods are guarded against overflows by internal clamping routines, but folks working directly with *Image.evaluate()*, *Image.function()*, and *Image.composite_channel()* should take caution. Method *Image.clamp()* as been provided for this task.:

```
with Image(width=1, height=1, background=Color("gray5")) as canvas:
    canvas.evaluate("subtract", canvas.quantum_range * 0.07)
    canvas.clamp()
    print(canvas[0, 0]) #=> srgb(0,0,0)
```

Image Color-Channel Awareness

With ImageMagick-7, colors have descriptive traits, and are managed through channel-masks. An elegant solution to manage active color channels, and simplify core library functions.

Users implementing *Image.composite_channel()* should review previous solutions of composite `"copy..."` operators as the behavior may have changed.

You can play around with the effects of channel masks with `MagickSetImageChannelMask()` function. For example:

```
from wand.image import Image, CHANNELS
from wand.api import library

with Image(filename="rose:") as img:
    # Isolate only Red & Green channels
    active_mask = CHANNELS["red"] | CHANNELS["green"]
    previous_mask = library.MagickSetImageChannelMask(img.wand, active_mask)
    img.evaluate("rightshift", 1)
    # Restore previous channels
    library.MagickSetImageChannelMask(img.wand, previous_mask)
    img.save(filename="blue_rose.png")
```

Alpha Replaces Opacity & Matte

Opacity methods & enumerated value have been renamed to alpha with ImageMagick-7. Although the majority of the functionalities are the same, user are responsible for checking the library version before calling an opacity method /

enumerated value.

For example:

```
from wand.version import MAGICK_VERSION_NUMBER
from wand.image import Image

with Image(filename="wizard:") as img:
    image_type = "truecoloralpha"       # IM7 enum
    if MAGICK_VERSION_NUMBER < 0x700:   # Backwards support for IM6
        image_type = "truecolormatte"
    img.type = image_type
```

The reference documentation have been updated to note specific values available per ImageMagick versions.

Note: For "What's New in Wand 0.4", see previous announcements.

3.2 Installation

Wand itself can be installed from PyPI using **pip**:

```
$ pip install Wand
```

Wand is a Python binding of ImageMagick, so you have to install it as well:

- *Debian/Ubuntu*
- *Fedora/CentOS*
- *Mac*
- *Windows*
- *Explicitly link to specific ImageMagick*

Or you can simply install Wand and its entire dependencies using the package manager of your system (it's way convenient but the version might be outdated):

- *Debian/Ubuntu*
- *Fefora*
- *FreeBSD*

3.2.1 Install ImageMagick on Debian/Ubuntu

If you're using Linux distributions based on Debian like Ubuntu, it can be easily installed using APT:

```
$ sudo apt-get install libmagickwand-dev
```

If you need SVG, WMF, OpenEXR, DjVu, and Graphviz support you have to install `libmagickcore5-extra` as well:

```
$ sudo apt-get install libmagickcore5-extra
```

3.2.2 Install ImageMagick on Fedora/CentOS

If you're using Linux distributions based on Redhat like Fedora or CentOS, it can be installed using Yum:

```
$ yum update
$ yum install ImageMagick-devel
```

3.2.3 Install ImageMagick on Mac

You need one of Homebrew or MacPorts to install ImageMagick.

Homebrew

```
$ brew install imagemagick
```

If *seam carving* (`Image.liquid_rescale()`) is needed you have install liblqr as well:

```
$ brew install imagemagick --with-liblqr
```

MacPorts

```
$ sudo port install imagemagick
```

If your Python in not installed using MacPorts, you have to export `MAGICK_HOME` path as well. Because Python that is not installed using MacPorts doesn't look up `/opt/local`, the default path prefix of MacPorts packages.

```
$ export MAGICK_HOME=/opt/local
```

3.2.4 Install ImageMagick on Windows

You could build ImageMagick by yourself, but it requires a build tool chain like Visual Studio to compile it. The easiest way is simply downloading a prebuilt binary of ImageMagick for your architecture (`win32` or `win64`).

You can download it from the following link:

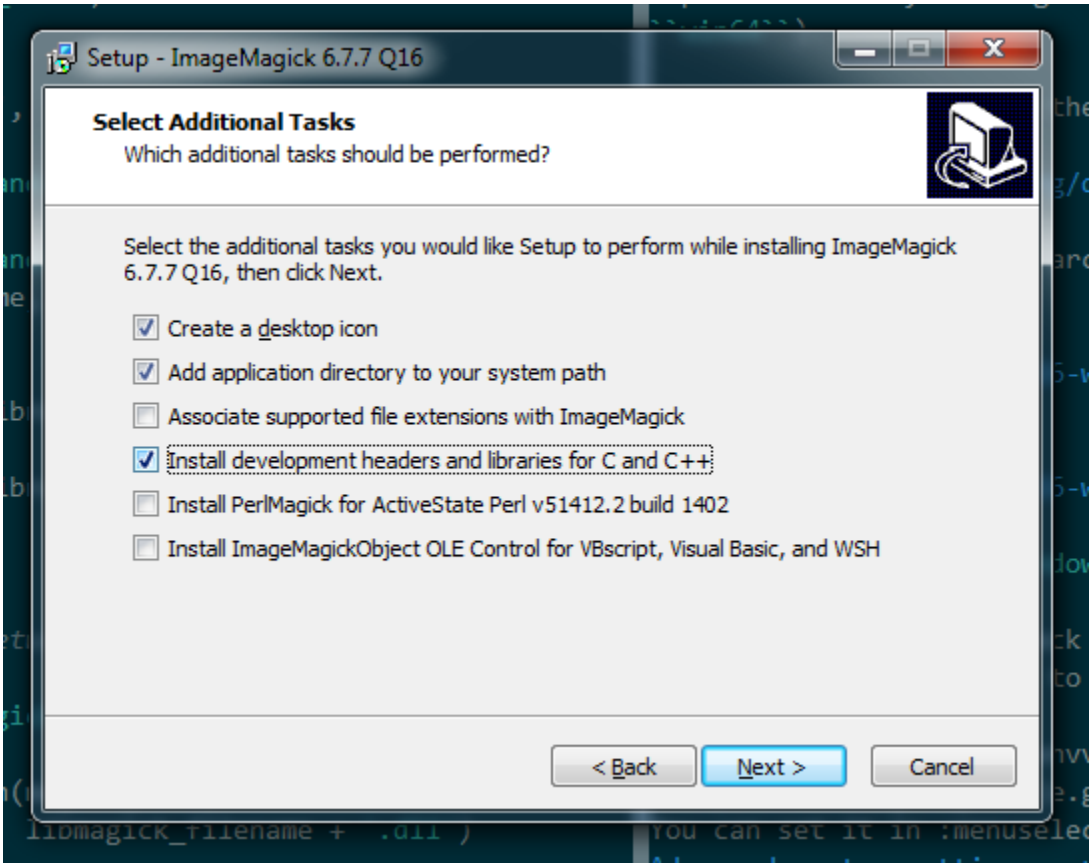
http://legacy.imagemagick.org/script/binary-releases.php#windows

Choose a binary for your architecture:

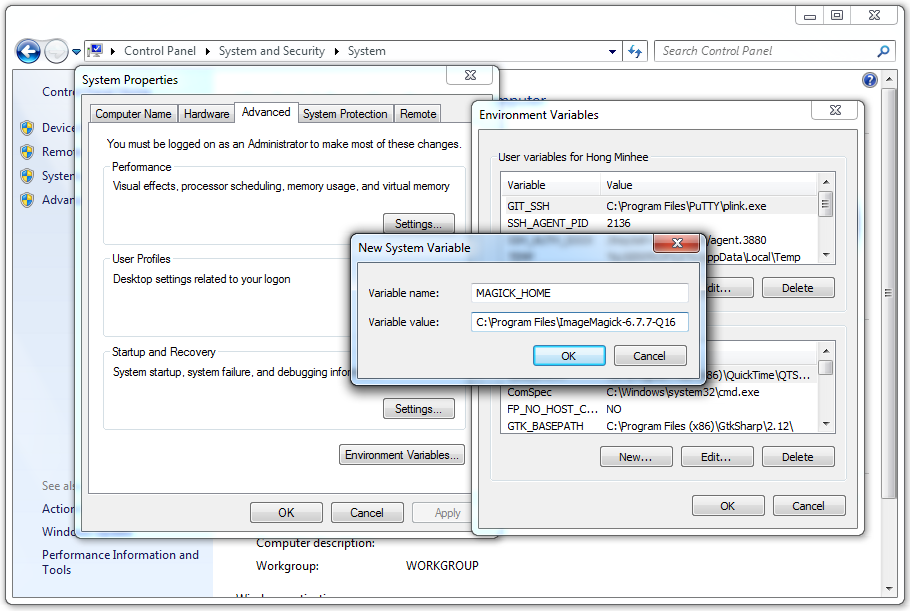
Windows 32-bit ImageMagick-6.9.x-x-Q16-x86-dll.exe

Windows 64-bit ImageMagick-6.9.x-x-Q16-x64-dll.exe

Note: Double check your Python runtime, and ensure the architectures match. A 32-bit Python runtime can not load a 64-bit dynamic library.



Note that you have to check *Install development headers and libraries for C and C++* to make Wand able to link to it.



Lastly you have to set `MAGICK_HOME` environment variable to the path of ImageMagick (e.g. `C:\Program Files\ImageMagick-6.9.3-Q16`). You can set it in *Computer* → *Properties* → *Advanced system settings* → *Advanced* → *Environment Variables*....

3.2.5 Explicitly link to specific ImageMagick

Although Wand tries searching operating system's standard library paths for a ImageMagick installation, sometimes you need to explicitly specify the path of ImageMagick installation.

In that case, you can give the path to Wand by setting `MAGICK_HOME`. Wand respects `MAGICK_HOME`, the environment variable which has been reserved by ImageMagick.

3.2.6 Install Wand on Debian/Ubuntu

Wand itself is already packaged in Debian/Ubuntu APT repository: python-wand. You can install it using **`apt-get`** command:

```
$ sudo apt-get install python-wand
```

3.2.7 Install Wand on Fedora

Wand itself is already packaged in Fedora package DB: python-wand. You can install it using **`dnf`** command:

```
$ dnf install python-wand    # Python 2
$ dnf install python3-wand   # Python 3
```

3.2.8 Install Wand on FreeBSD

Wand itself is already packaged in FreeBSD ports collection: py-wand. You can install it using **`pkg_add`** command:

```
$ pkg_add -r py-wand
```

3.3 Reading images

There are several ways to open images:

- *To open an image file*
- *To read a input stream (file-like object) that provides an image binary*
- *To read a binary string that contains image*
- *To copy an existing image object*
- *To open an empty image*

All of these operations are provided by the constructor of *`Image`* class.

3.3.1 Open an image file

The most frequently used way is just to open an image by its filename. *`Image`*'s constructor can take the parameter named `filename`:

```
from __future__ import print_function
from wand.image import Image

with Image(filename='pikachu.png') as img:
    print('width =', img.width)
    print('height =', img.height)
```

Note: It must be passed by keyword argument exactly. Because the constructor has many parameters that are exclusive to each other.

There is a keyword argument named `file` as well, but don't confuse it with `filename`. While `filename` takes a string of a filename, `file` takes a input stream (file-like object).

3.3.2 Read a input stream

If an image to open cannot be located by a filename but can be read through input stream interface (e.g. opened by `os.popen()`, contained in `StringIO`, read by `urllib2.urlopen()`), it can be read by *`Image`* constructor's `file` parameter. It takes all file-like objects which implements `read()` method:

```
from __future__ import print_function
from urllib2 import urlopen
from wand.image import Image

response = urlopen('https://stylesha.re/minhee/29998/images/100x100')
try:
    with Image(file=response) as img:
        print('format =', img.format)
        print('size =', img.size)
finally:
    response.close()
```

In the above example code, `response` object returned by `urlopen()` function has `read()` method, so it also can be used as an input stream for a downloaded image.

3.3.3 Read a blob

If you have just a binary string (`str`) of the image, you can pass it into *`Image`* constructor's `blob` parameter to read:

```
from __future__ import print_function
from wand.image import Image

with open('pikachu.png') as f:
    image_binary = f.read()

with Image(blob=image_binary) as img:
    print('width =', img.width)
    print('height =', img.height)
```

It is a way of the lowest level to read an image. There will probably not be many cases to use it.

3.3.4 Clone an image

If you have an image already and have to copy it for safe manipulation, use `clone()` method:

```
from wand.image import Image

with Image(filename='pikachu.png') as original:
    with original.clone() as converted:
        converted.format = 'png'
        # operations on a converted image...
```

For some operations like format converting or cropping, there are safe methods that return a new image of manipulated result like *convert()* or slicing operator. So the above example code can be replaced by:

```
from wand.image import Image

with Image(filename='pikachu.png') as original:
    with original.convert('png') as converted:
        # operations on a converted image...
```

3.3.5 Hint file format

When it's read from a binary string or a file object, you can explicitly give the hint which indicates file format of an image to read — optional `format` keyword is for that:

```
from wand.image import Image

with Image(blob=image_binary, format='ico') as image:
    print(image.format)
```

New in version 0.2.1: The `format` parameter to *Image* constructor.

3.3.6 Open an empty image

To open an empty image, you have to set its width and height:

```
from wand.image import Image

with Image(width=200, height=100) as img:
    img.save(filename='200x100-transparent.png')
```

Its background color will be transparent by default. You can set `background` argument as well:

```
from wand.color import Color
from wand.image import Image

with Color('red') as bg:
    with Image(width=200, height=100, background=bg) as img:
        img.save(filename='200x100-red.png')
```

New in version 0.2.2: The `width`, `height`, and `background` parameters to *Image* constructor.

3.3.7 Open a Pseudo Image

A pseudo image can refer to any of ImageMagick's internal images that are accessable through coder protocols.

```
from wand.image import Image

with Image(width=100, height=100, pseudo='plasma:') as img:
    img.save(filename='100x100-plasma.png')
```

Commun Pseudo images

- `'canvas:COLOR'`, or `'xc:COLOR'`, where *COLOR* is any valid color value string.
- `'caption:TEXT'`, where *TEXT* is a string message.
- `'gradient:START-END'`, generates a blended gradient between two colors, where both *START* and *END* are color value strings.
- `'hald:'`, creates a Higher And Lower Dimension matrix table.
- `'inline:VALUE'`, where VALUE is a data-url / base64 string value.
- `'label:TEXT'`, where *TEXT* is a string message.
- `'pattern:LABEL'`, generates a repeating pattern, where *LABEL* is the pattern name. See Built-in Patterns
- `'plasma:'`, generates a plasma fractal image.
- `'radial-gradient:'`, similar to *gradient:*, but generates a gradual blend from center of the image.
- `'tile:FILENAME'`, generates a repeating tile effect from a given images, where *FILENAME* is the path of a source image.

A list of all pseudo images can be found at https://imagemagick.org/script/formats.php#pseudo

New in version 0.5.0: The `pseudo` parameter was added to the *Image* constructor.

3.4 Writing images

You can write an *Image* object into a file or a byte string buffer (blob) as format what you want.

3.4.1 Convert images to JPEG

If you wonder what is image's format, use `format` property.

```
>>> image.format
'JPEG'
```

The `format` property is writable, so you can convert images by setting this property.

```
from wand.image import Image

with Image(filename='pikachu.png') as img:
    img.format = 'jpeg'
    # operations to a jpeg image...
```

If you want to convert an image without any changes of the original, use *convert()* method instead:

```
from wand.image import Image

with Image(filename='pikachu.png') as original:
    with original.convert('jpeg') as converted:
        # operations to a jpeg image...
        pass
```

Note: Support for some of the formats are delegated to libraries or external programs. To get a complete listing of which image formats are supported on your system, use **`identify`** command provided by ImageMagick:

```
$ identify -list format
```

3.4.2 Save to file

In order to save an image to a file, use *`save()`* method with the keyword argument `filename`:

```
from wand.image import Image

with Image(filename='pikachu.png') as img:
    img.format = 'jpeg'
    img.save(filename='pikachu.jpg')
```

Note: The image format does not effect the file being saved, to save with a given colorspace use:

```
from wand.image import Image

with Image(filename='pikachu.jpg') as img:
    img.format = 'jpeg'
    img.save(filename='PNG24:pikachu.png')
```

3.4.3 Save to stream

You can write an image into a output stream (file-like object which implements `write()` method) as well. The parameter `file` takes a such object (it also is the first positional parameter of *`save()`* method).

For example, the following code converts `pikachu.png` image into JPEG, gzips it, and then saves it to `pikachu.jpg.gz`:

```
import gzip
from wand.image import Image

gz = gzip.open('pikachu.jpg.gz')
with Image(filename='pikachu.png') as img:
    img.format = 'jpeg'
    img.save(file=gz)
gz.close()
```

3.4.4 Get binary string

Want just a binary string of the image? Use *make_blob()* method so:

```
from wand.image import Image

with image(filename='pikachu.png') as img:
    img.format = 'jpeg'
    jpeg_bin = img.make_blob()
```

There's the optional `format` parameter as well. So the above example code can be simpler:

```
from wand.image import Image

with Image(filename='pikachu.png') as img:
    jpeg_bin = img.make_blob('jpeg')
```

3.5 Resizing and cropping

Creating thumbnails (by resizing images) and cropping are most frequent works about images. This guide explains ways to deal with sizes of images.

Above all, to get the current size of the image check *width* and *height* properties:

```
>>> from urllib.request import urlopen
>>> from wand.image import Image
>>> f = urlopen('http://pbs.twimg.com/profile_images/712673855341367296/WY6aLbBV_
↪normal.jpg')
>>> with Image(file=f) as img:
...     width = img.width
...     height = img.height
...
>>> f.close()
>>> width
48
>>> height
48
```

If you want the pair of (*width*, *height*), check *size* property also.

Note: These three properties are all readonly.

3.5.1 Resize images

It scales an image into a desired size even if the desired size is larger than the original size. ImageMagick provides so many algorithms for resizing. The constant *FILTER_TYPES* contains names of filtering algorithms.

See also:

ImageMagick Resize Filters Demonstrates the results of resampling three images using the various resize filters and blur settings available in ImageMagick, and the file size of the resulting thumbnail images.

Image.resize() method takes `width` and `height` of a desired size, optional `filter` (`'undefined'` by default which means IM will try to guess best one to use) and optional `blur` (default is 1). It returns nothing but resizes itself in-place.

```
>>> img.size
(500, 600)
>>> img.resize(50, 60)
>>> img.size
(50, 60)
```

3.5.2 Sample images

Although *Image.resize()* provides many `filter` options, it's relatively slow. If speed is important for the job, you'd better use *Image.sample()* instead. It works in similar way to *Image.resize()* except it doesn't provide `filter` and `blur` options:

```
>>> img.size
(500, 600)
>>> img.sample(50, 60)
>>> img.size
(50, 60)
```

3.5.3 Crop images

To extract a sub-rectangle from an image, use the *crop()* method. It crops the image in-place. Its parameters are `left`, `top`, `right`, `bottom` in order.

```
>>> img.size
(200, 300)
>>> img.crop(10, 20, 50, 100)
>>> img.size
(40, 80)
```

It can also take keyword arguments `width` and `height`. These parameters replace `right` and `bottom`.

```
>>> img.size
(200, 300)
>>> img.crop(10, 20, width=40, height=80)
>>> img.size
(40, 80)
```

There is an another way to crop images: slicing operator. You can crop an image by `[left:right, top:bottom]` with maintaining the original:

```
>>> img.size
(300, 300)
>>> with img[10:50, 20:100] as cropped:
...     print(cropped.size)
...
(40, 80)
>>> img.size
(300, 300)
```

Specifying `gravity` along with `width` and `height` keyword arguments allows a simplified cropping alternative.

```
>>> img.size
(300, 300)
>>> img.crop(width=40, height=80, gravity='center')
>>> img.size
(40, 80)
```

3.5.4 Transform images

Use this function to crop and resize and image at the same time, using ImageMagick geometry strings. Cropping is performed first, followed by resizing.

For example, if you want to crop your image to 300x300 pixels and then scale it by 2x for a final size of 600x600 pixels, you can call:

```
img.transform('300x300', '200%')
```

Other example calls:

```
# crop top left corner
img.transform('50%')

# scale height to 100px and preserve aspect ratio
img.transform(resize='x100')

# if larger than 640x480, fit within box, preserving aspect ratio
img.transform(resize='640x480>')

# crop a 320x320 square starting at 160x160 from the top left
img.transform(crop='320+160+160')
```

See also:

ImageMagick Geometry Specifications Cropping and resizing geometry for the `transform` method are specified according to ImageMagick's geometry string format. The ImageMagick documentation provides more information about geometry strings.

3.5.5 Seam carving (also known as *content-aware resizing*)

New in version 0.3.0.

Seam carving is an algorithm for image resizing that functions by establishing a number of *seams* (paths of least importance) in an image and automatically removes seams to reduce image size or inserts seams to extend it.

In short: you can magickally resize images without distortion! See the following examples:

Original	Resized
	
Cropped	**Seam carving**
	

You can easily rescale images with seam carving using Wand: use *Image.liquid_rescale()* method:

```
>>> image = Image(filename='seam.jpg')
>>> image.size
(320, 234)
>>> with image.clone() as resize:
...     resize.resize(234, 234)
...     resize.save(filename='seam-resize.jpg')
...     resize.size
...
(234, 234)
>>> with image[:234, :] as crop:
...     crop.save(filename='seam-crop.jpg')
...     crop.size
...
```

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```
(234, 234)
>>> with image.clone() as liquid:
...     liquid.liquid_rescale(234, 234)
...     liquid.save(filename='seam-liquid.jpg')
...     liquid.size
...
(234, 234)
```

Note: It may raise *MissingDelegateError* if your ImageMagick is configured `--without-lqr` option. In this case you should recompile ImageMagick.

See also:

Seam carving — Wikipedia The article which explains what seam carving is on Wikipedia.

Note: The image `seam.jpg` used in the above example is taken by D. Sharon Pruitt and licensed under CC-BY-2.0. It can be found the original photography from Flickr.

3.6 Transformation

Note: The image `transform.jpg` used in this docs is taken by Megan Trace, and licensed under CC BY-NC 2.0. It can be found the original photography from Flickr.

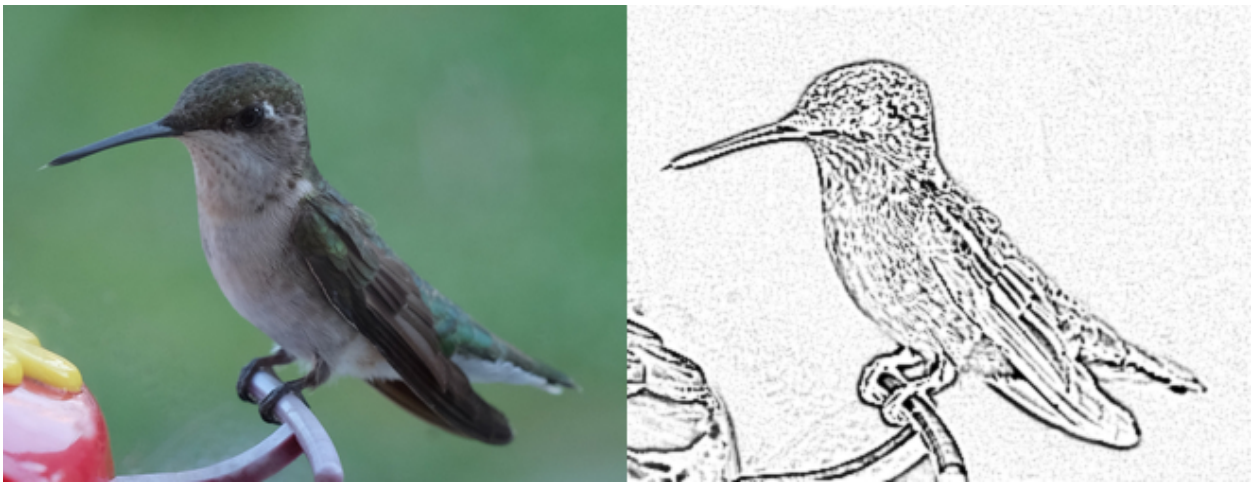
3.6.1 Charcoal

New in version 0.5.3.

One of the artistic simulations, *charcoal()* can emulate a drawing on paper.

```
from wand.image import Image

with Image(filename="hummingbird.jpg") as left:
    with left.clone() as right:
        right.charcoal(radius=1.5, sigma=0.5)
        left.extent(width=left.width*2)
        left.composite(right, top=0, left=right.width)
    left.save(filename="hummingbird-charcoal.jpg")
```



3.6.2 Despeckle

New in version 0.5.0.

Despeckling is one of the many techniques you can use to reduce noise on a given image. Also see *Enhance*.

```
from wand.image import Image

with Image(filename="hummingbird.jpg") as left:
    with left.clone() as right:
        right.despeckle()
        left.extent(width=left.width*2)
        left.composite(right, top=0, left=right.width)
    left.save(filename="hummingbird-despeckle.jpg")
```

3.6.3 Edge

New in version 0.5.0.

Detects edges on black and white images with a simple convolution filter. If used with a color image, the transformation will be applied to each color-channel.

```
from wand.image import Image

with Image(filename="hummingbird.jpg") as left:
    with left.clone() as right:
        right.transform_colorspace("gray")
        right.edge(1)
        left.extent(width=left.width*2)
        left.composite(right, top=0, left=right.width)
    left.save(filename="hummingbird-edge.jpg")
```

3.6.4 Emboss

New in version 0.5.0.

Generates a 3D effect that can be described as print reliefs. Like *Edge*, best results can be generated with grayscale image. Also see *Shade*.

```
from wand.image import Image

with Image(filename="hummingbird.jpg") as left:
    with left.clone() as right:
        right.transform_colorspace("gray")
        right.emboss(radius=3.0, sigma=1.75)
        left.extent(width=left.width*2)
        left.composite(right, top=0, left=right.width)
    left.save(filename="hummingbird-emboss.jpg")
```

3.6.5 Enhance

New in version 0.5.0.

Reduce the noise of an image by applying an auto-filter. Also see *Despeckle*.

```
from wand.image import Image

with Image(filename="hummingbird.jpg") as left:
    with left.clone() as right:
        right.enhance()
        left.extent(width=left.width*2)
        left.composite(right, top=0, left=right.width)
    left.save(filename="hummingbird-enhance.jpg")
```

3.6.6 Flip and flop

New in version 0.3.0.

You can make a mirror image by reflecting the pixels around the central x- or y-axis. For example, where the given image `transform.jpg`:

The following code flips the image using *Image.flip()* method:

```
from wand.image import Image

with Image(filename='transform.jpg') as image:
    with image.clone() as flipped:
        flipped.flip()
        flipped.save(filename='transform-flipped.jpg')
```

The image `transform-flipped.jpg` generated by the above code looks like:

As like *flip()*, *flop()* does the same thing except it doesn't make a vertical mirror image but horizontal:

```
from wand.image import Image

with Image(filename='transform.jpg') as image:
    with image.clone() as flopped:
        flopped.flop()
```

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```
        flopped.save(filename='transform-flopped.jpg')
```

The image `transform-flopped.jpg` generated by the above code looks like:

3.6.7 Noise

New in version 0.5.3.

You can add random noise to an image. This operation can be useful when applied before a blur operation to defuse an image. The types of noise can be any of the following.

- `'gaussian'`
- `'impulse'`
- `'laplacian'`
- `'multiplicative_gaussian'`
- `'poisson'`
- `'random'`
- `'uniform'`

The amount of noise can be adjusted by passing an *attenuate* kwarg where the value can be between *0.0* and *1.0*.

```
from wand.image import Image

with Image(filename="hummingbird.jpg") as left:
    with left.clone() as right:
        right.noise("laplacian", attenuate=1.0)
        left.extent(width=left.width*2)
        left.composite(right, top=0, left=right.width)
    left.save(filename="hummingbird-noise.jpg")
```

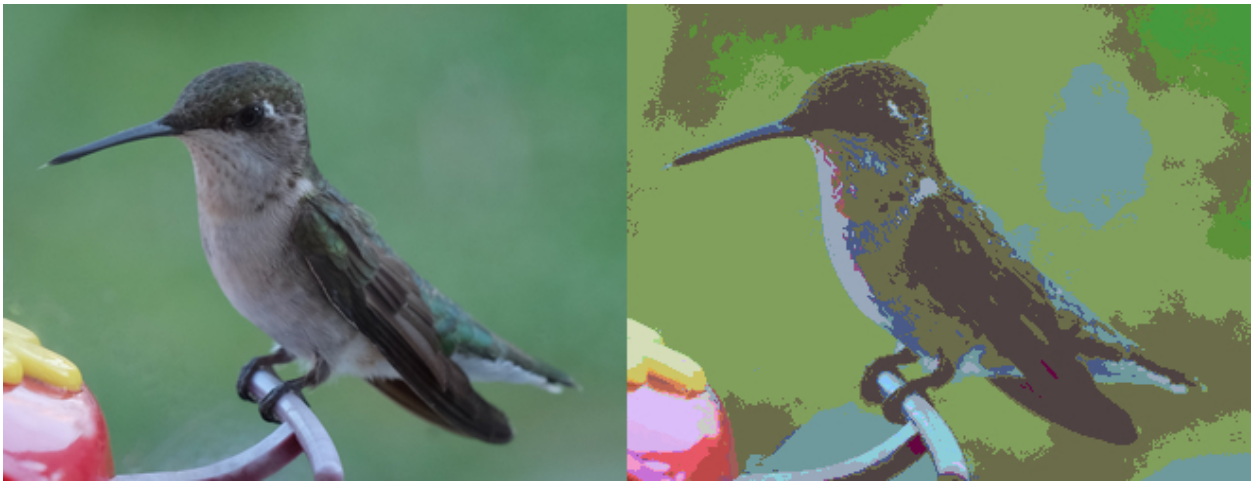
3.6.8 Remap

New in version 0.5.3.

Remap replaces all pixels with the closest matching pixel found in the *affinity* reference image.

```
from wand.image import Image

with Image(filename="hummingbird.jpg") as left:
    with left.clone() as right:
        with Image(width=100, height=1, pseudo="plasma:") as affinity:
            right.remap(affinity)
        left.extent(width=left.width*2)
        left.composite(right, top=0, left=right.width)
    left.save(filename="hummingbird-remap.jpg")
```



3.6.9 Rotation

New in version 0.1.8.

Image object provides a simple method to rotate images: *rotate()*. It takes a `degree` which can be 0 to 359. (Actually you can pass 360, 361, or more but it will be the same to 0, 1, or more respectively.)

For example, where the given image `transform.jpg`:

The below code makes the image rotated 90° to right:

```
from wand.image import Image

with Image(filename='transform.jpg') as image:
    with image.clone() as rotated:
        rotated.rotate(90)
        rotated.save(filename='transform-rotated-90.jpg')
```

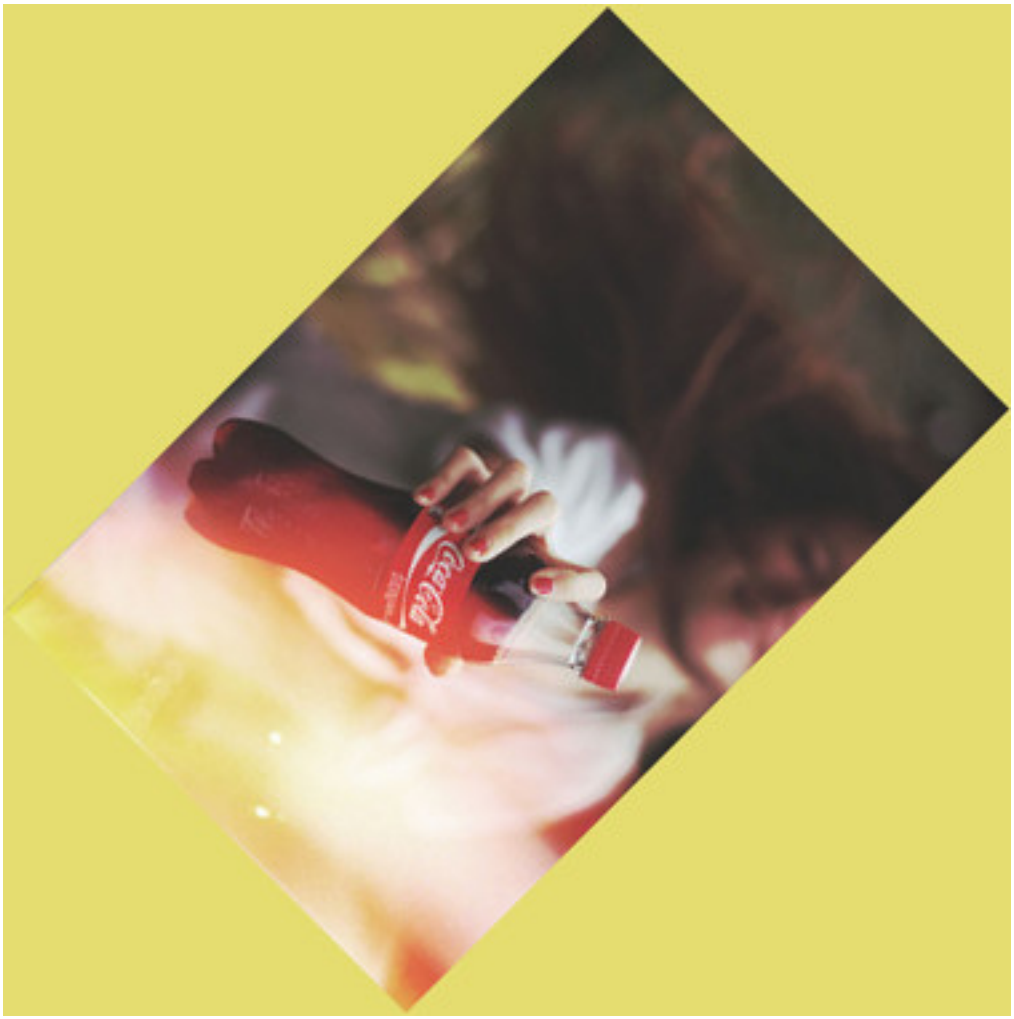
The generated image `transform-rotated-90.jpg` looks like:

If `degree` is not multiples of 90, the optional parameter `background` will help (its default is transparent):

```
from wand.color import Color
from wand.image import Image

with Image(filename='transform.jpg') as image:
    with image.clone() as rotated:
        rotated.rotate(135, background=Color('rgb(229,221,112)'))
        rotated.save(filename='transform-rotated-135.jpg')
```

The generated image `transform-rotated-135.jpg` looks like:



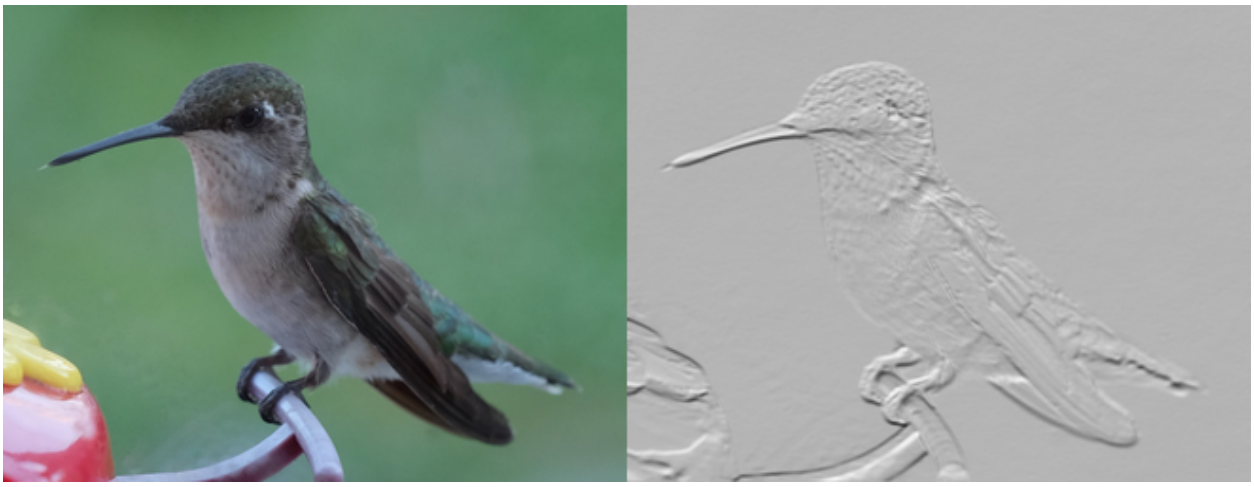
3.6.10 Shade

New in version 0.5.0.

Creates a 3D effect by simulating light from source where `aziumth` controls the X/Y angle, and `elevation` controls the Z angle. You can also determine of the resulting image should be transformed to grayscale by passing `gray` boolean.

```
from wand.image import Image

with Image(filename="hummingbird.jpg") as left:
    with left.clone() as right:
        right.shade(gray=True,
                    azimuth=286.0,
                    elevation=45.0)
        left.extent(width=left.width*2)
        left.composite(right, top=0, left=right.width)
    left.save(filename="hummingbird-shade.jpg")
```



3.6.11 Sketch

New in version 0.5.3.

Simulates an artist sketch drawing. Also see *Charcoal*.

```
from wand.image import Image

with Image(filename="hummingbird.jpg") as left:
    with left.clone() as right:
        right.transform_colorspace("gray")
        right.sketch(0.5, 0.0, 98.0)
        left.extent(width=left.width*2)
        left.composite(right, top=0, left=right.width)
    left.save(filename="hummingbird-sketch.jpg")
```

3.6.12 Spread

New in version 0.5.3.

Spread replaces each pixel with the a random pixel value found near by. The size of the area to search for a new pixel can be controlled by defining a radius.

```
from wand.image import Image

with Image(filename="hummingbird.jpg") as left:
    with left.clone() as right:
        right.spread(8.0)
        left.extent(width=left.width*2)
        left.composite(right, top=0, left=right.width)
    left.save(filename="hummingbird-spread.jpg")
```

3.6.13 Statistic

New in version 0.5.3.

Similare to *Spread*, but replaces each pixel with the result of a mathematical operation performed against neighboring pixel values.

The type of statistic operation can be any of the following.

- `'gradient'`
- `'maximum'`
- `'mean'`
- `'median'`
- `'minimum'`
- `'mode'`
- `'nonpeak'`
- `'root_mean_square'`
- `'standard_deviation'`

The size neighboring pixels to evaluate can be defined by passing `width`, and `height` kwargs.

```
from wand.image import Image

with Image(filename="hummingbird.jpg") as left:
    with left.clone() as right:
        right.statistic("median", width=8, height=5)
```

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```
        left.extent(width=left.width*2)
        left.composite(right, top=0, left=right.width)
    left.save(filename="hummingbird-statistic.jpg")
```

3.7 Colorspace

3.7.1 Image types

Every *Image* object has *type* property which identifies its colorspace. The value can be one of *IMAGE_TYPES* enumeration, and set of its available values depends on its `format` as well. For example, `'grayscale'` isn't available on JPEG.

```
>>> from wand.image import Image
>>> with Image(filename='wandtests/assets/bilevel.gif') as img:
...     img.type
...
'bilevel'
>>> with Image(filename='wandtests/assets/sasha.jpg') as img2:
...     img2.type
...
'truecolor'
```

You can change this value:

```
with Image(filename='wandtests/assets/bilevel.gif') as img:
    img.type = 'truecolor'
    img.save(filename='truecolor.gif')
```

See also:

-type — ImageMagick: command-line-Options Corresponding command-line option of **`convert`** program.

3.7.2 Enable alpha channel

You can find whether an image has alpha channel and change it to have or not to have the alpha channel using *alpha_channel* property, which is preserving a `bool` value.

```
>>> with Image(filename='wandtests/assets/sasha.jpg') as img:
...     img.alpha_channel
...
False
>>> with Image(filename='wandtests/assets/croptest.png') as img:
...     img.alpha_channel
...
True
```

It's a writable property:

```
with Image(filename='wandtests/assets/sasha.jpg') as img:
    img.alpha_channel = True
```

3.8 Color Enhancement

3.8.1 Evaluate Expression

New in version 0.4.1.

Pixel channels can be manipulated by applying an arithmetic, relational, or logical expression. See *EVALUATE_OPS* for a list of valid operations.

For example, when given image `enhancement.jpg`:

We can reduce the amount of data in the blue channel by applying the right-shift binary operator, and increase data in the right channel with left-shift operator:

```
from wand.image import Image

with Image(filename='enhancement.jpg') as img:
```

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```
    # B >> 1
    img.evaluate(operator='rightshift', value=1, channel='blue')
    # R << 1
    img.evaluate(operator='leftshift', value=1, channel='red')
```

3.8.2 Function Expression

New in version 0.4.1.

Similar to *evaluate()*, *function()* applies a multi-argument function to pixel channels. See *FUNCTION_TYPES* for a list of available function formulas.

For example, when given image `enhancement.jpg`:

We can apply a **Sinusoid** function with the following:

```
from wand.image import Image

with Image(filename='enhancement.jpg') as img:
    frequency = 3
    phase_shift = -90
    amplitude = 0.2
    bias = 0.7
    img.function('sinusoid', [frequency, phase_shift, amplitude, bias])
```

3.8.3 FX Expressions

New in version 0.4.1.

FX special effects are a powerful "micro" language to work with. Simple functions & operators offer a unique way to access & manipulate image data. The *fx()* method applies a FX expression, and generates a new *Image* instance.

For example, when given image `enhancement.jpg`:

We can create a custom DIY filter that will turn the image black & white, except colors with a hue between 195° & 252°:

```
from wand.image import Image

fx_filter='(hue > 0.55 && hue < 0.7) ? u : lightness'

with Image(filename='enhancement.jpg') as img:
     with img.fx(fx_filter) as filtered_img:
          filtered_img.save(filename='enhancement-fx.jpg')
```

3.8.4 Gamma

New in version 0.4.1.

Gamma correction allows you to adjust the luminance of an image. Resulting pixels are defined as `pixel^(1/gamma)`. The value of `gamma` is typically between 0.8 & 2.3 range, and value of 1.0 will not affect the resulting image.

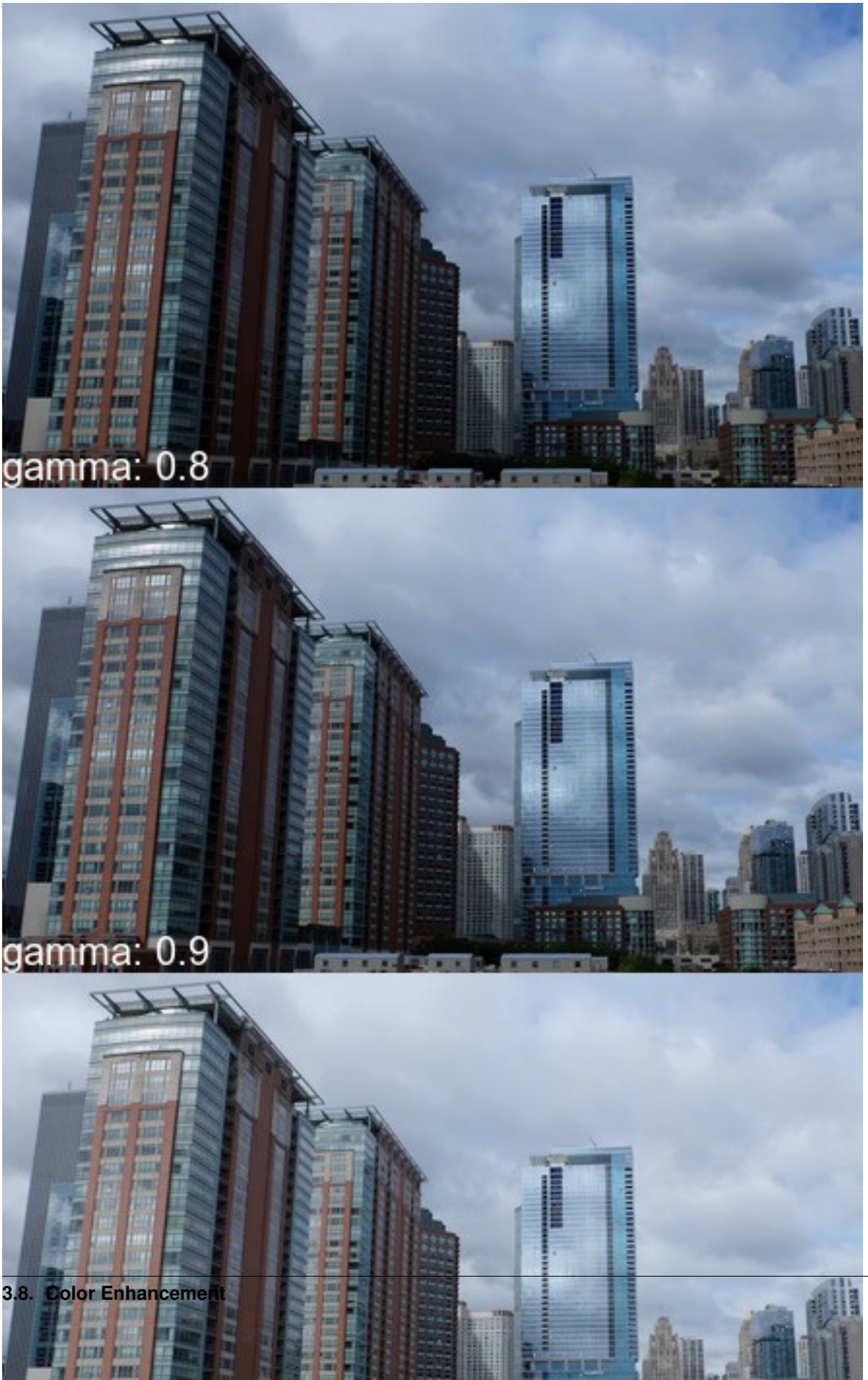
The `level()` method can also adjust `gamma` value.

For example, when given image `enhancement.jpg`:

We can step through 4 pre-configured gamma correction values with the following:

```
from wand.image import Image

with Image(filename='enhancement.jpg') as img_src:
    for Y in [0.8, 0.9, 1.33, 1.66]:
        with Image(img_src) as img_cpy:
            img_cpy.gamma(Y)
```


gamma: 0.8
gamma: 0.9

3.8.5 Level

New in version 0.4.1.

Black & white boundaries of an image can be controlled with `level()` method. Similar to the `gamma()` method, mid-point levels can be adjusted with the `gamma` keyword argument.

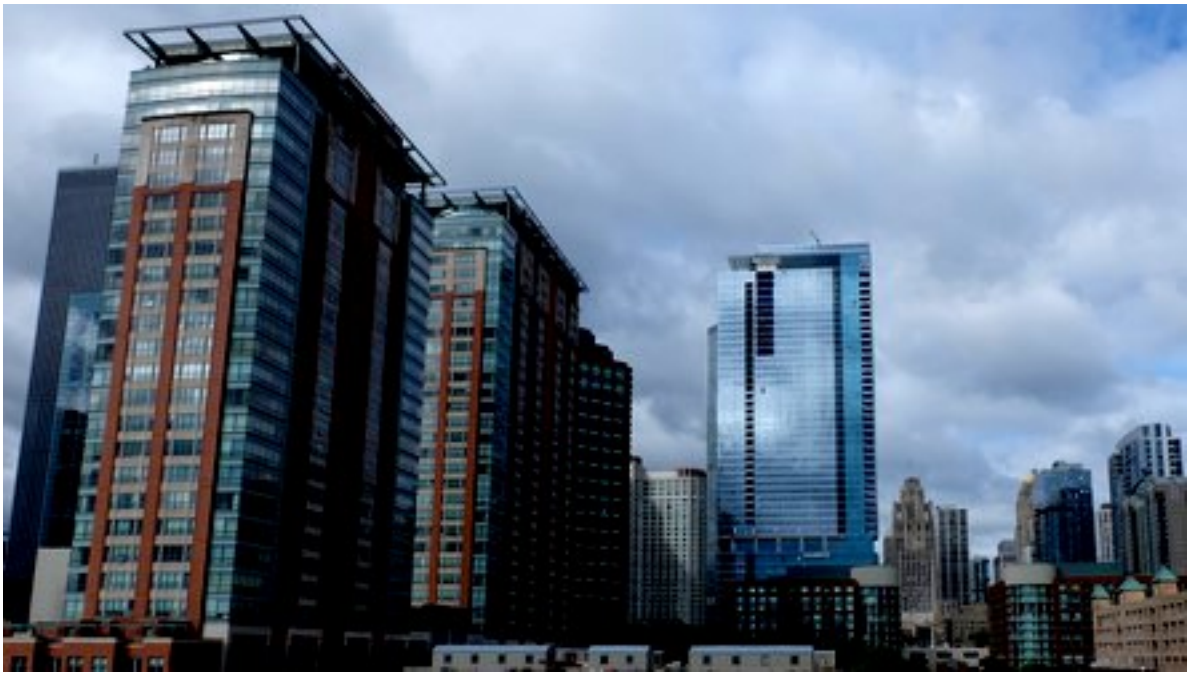
The `black` and `white` point arguments are expecting values between 0.0 & 1.0 which represent percentages.

For example, when given image `enhancement.jpg`:

We can adjust the level range between 20% & 90% with slight mid-range increase:

```
from wand.image import Image

with Image(filename='enhancement.jpg') as img:
    img.level(0.2, 0.9, gamma=1.1)
    img.save(filename='enhancement-level.jpg')
```



3.9 Distortion

ImageMagick provides several ways to distort an image by applying various transformations against user-supplied arguments. In Wand, the method *Image.distort* is used, and follows a basic function signature of:

```
with Image(...) as img:
    img.distort(method, arguments)
```

Where `method` is a string provided by *DISTORTION_METHODS*, and `arguments` is a list of doubles. Each `method` parses the `arguments` list differently. For example:

```
# Arc can have a minimum of 1 argument
img.distort('arc', (degree, ))
# Affine 3-point will require 6 arguments
points = (x1, y1, x2, y2,
          x3, y3, x4, y4,
          x5, y5, x6, y6)
img.distort('affine', points)
```

A more complete & detailed overview on distortion can be found in Distorting Images usage article by Anthony Thyssen.

3.9.1 Controlling Resulting Images

Virtual Pixels

When performing distortion on raster images, the resulting image often includes pixels that are outside original bounding raster. These regions are referred to as vertical pixels, and can be controlled by setting *Image.virtual_pixel* to any value defined in *VIRTUAL_PIXEL_METHOD*.

Virtual pixels set to `'transparent'`, `'black'`, or `'white'` are the most common, but many users prefer use the existing background color.

```
with Image(filename='rose:') as img:
    img.resize(140, 92)
    img.background_color = img[70, 46]
    img.virtual_pixel = 'background'
    img.distort('arc', (60, ))
```

Other *`virtual_pixel`* values can create special effects.

Virtual Pixel	Example
`dither`	
`edge`	
`mirror`	
`random`	
`tile`	

Matte Color

Some distortion transitions can not be calculated in the virtual-pixel space. Either being invalid, or **NaN** (not-a-number). You can define how such a pixel should be represented by setting the *`Image.matte_color`* property.

```
from wand.color import Color
from wand.image import Image

with Image(filename='rose:') as img:
    img.resize(140, 92)
    img.matte_color = Color('ORANGE')
    img.virtual_pixel = 'tile'
    args = (0, 0, 30, 60, 140, 0, 110, 60,
            0, 92, 2, 90, 140, 92, 138, 90)
    img.distort('perspective', args)
```

Rendering Size

Setting the `'distort:viewport'` artifact allows you to define the size, and offset of the resulting image:

```
img.artifacts['distort:viewport'] = '300x200+50+50'
```

Setting the `'distort:scale'` artifact will resizing the final image:

```
img.artifacts['distort:scale'] = '75%'
```

3.9.2 Scale Rotate Translate

A more common form of distortion, the method `'scale_rotate_translate'` can be controlled by the total number of arguments.

The total arguments dictate the following order.

Total Arguments	Argument Order
1	Angle
2	Scale, Angle
3	X, Y, Angle
4	X, Y, Scale, Angle
5	X, Y, ScaleX, ScaleY, Angle
6	X, Y, Scale, Angle, NewX, NewY
7	X, Y, ScaleX, ScaleY, Angle, NewX, NewY

For example...

A single argument would be treated as an angle:

```
from wand.color import Color
from wand.image import Image

```

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```
with Image(filename='rose:') as img:
    img.resize(140, 92)
    img.background_color = Color('skyblue')
    img.virtual_pixel = 'background'
    angle = 90.0
    img.distort('scale_rotate_translate', (angle,))
```

Two arguments would be treated as a scale & angle:

```
with Image(filename='rose:') as img:
    img.resize(140, 92)
    img.background_color = Color('skyblue')
    img.virtual_pixel = 'background'
    angle = 90.0
    scale = 0.5
    img.distort('scale_rotate_translate', (scale, angle,))
```

And three arguments would describe the origin of rotation:

```
with Image(filename='rose:') as img:
    img.resize(140, 92)
    img.background_color = Color('skyblue')
    img.virtual_pixel = 'background'
    x = 80
    y = 60
    angle = 90.0
    img.distort('scale_rotate_translate', (x, y, angle,))
```

. . . and so forth.

3.9.3 Perspective

Perspective distortion requires 4 pairs of points which is a total of 16 doubles. The order of the `arguments` are groups of source & destination coordinate pairs.

```
src1$_x$, src1$_y$, dst1$_x$, dst1$_y$,
src2$_x$, src2$_y$, dst2$_x$, dst2$_y$,
src3$_x$, src3$_y$, dst3$_x$, dst3$_y$,
src4$_x$, src4$_y$, dst4$_x$, dst4$_y$
```

For example:

```
from itertools import chain
from wand.color import Color
from wand.image import Image

with Image(filename='rose:') as img:
    img.resize(140, 92)
    img.background_color = Color('skyblue')
    img.virtual_pixel = 'background'
    source_points = (
        (0, 0),
        (140, 0),
        (0, 92),
        (140, 92)
    )
    destination_points = (
        (14, 4.6),
        (126.9, 9.2),
        (0, 92),
        (140, 92)
    )
    order = chain.from_iterable(zip(source_points, destination_points))
    arguments = list(chain.from_iterable(order))
    img.distort('perspective', arguments)
```

3.9.4 Affine

Affine distortion performs a shear operation. The arguments are similar to perspective, but only need a pair of 3 points, or 12 real numbers.

```
src1$_x$, src1$_y$, dst1$_x$, dst1$_y$,
src2$_x$, src2$_y$, dst2$_x$, dst2$_y$,
src3$_x$, src3$_y$, dst3$_x$, dst3$_y$
```

For example:

```
from wand.color import Color
from wand.image import Image

with Image(filename='rose:') as img:
    img.resize(140, 92)
    img.background_color = Color('skyblue')
    img.virtual_pixel = 'background'
    args = (
        10, 10, 15, 15,   # Point 1: (10, 10) => (15,  15)
        139, 0, 100, 20,  # Point 2: (139, 0) => (100, 20)
        0, 92, 50, 80     # Point 3: (0,  92) => (50,  80)
    )
    img.distort('affine', args)
```

3.9.5 Affine Projection

Affine projection is identical to *Scale Rotate Translate*, but requires exactly 6 real numbers for the distortion arguments.

`Scale$_x$, Rotate$_x$, Rotate$_y$, Scale$_y$, Translate$_x$, Translate$_y$`

For example:

```
from collections import namedtuple
from wand.color import Color
from wand.image import Image

Point = namedtuple('Point', ['x', 'y'])

with Image(filename='rose:') as img:
    img.resize(140, 92)
    img.background_color = Color('skyblue')
    img.virtual_pixel = 'background'
    rotate = Point(0.1, 0)
    scale = Point(0.7, 0.6)
    translate = Point(5, 5)
    args = (
        scale.x, rotate.x, rotate.y,
        scale.y, translate.x, translate.y
    )
    img.distort('affine_projection', args)
```

3.10 Drawing

New in version 0.3.0.

The *wand.drawing* module provides some basic drawing functions. *wand.drawing.Drawing* object buffers instructions for drawing shapes into images, and then it can draw these shapes into zero or more images.

It's also callable and takes an *Image* object:

```
from wand.drawing import Drawing
from wand.image import Image

with Drawing() as draw:
    # does something with ``draw`` object,
    # and then...
    with Image(filename='wandtests/assets/beach.jpg') as image:
        draw(image)
```

3.10.1 Arc

New in version 0.4.0.

Arcs can be drawn by using *arc()* method. You'll need to define three pairs of (x, y) coordinates. First & second pair of coordinates will be the minimum bounding rectangle, and the last pair define the starting & ending degree.

An example:

```
from wand.image import Image
from wand.drawing import Drawing
from wand.color import Color

with Drawing() as draw:
    draw.stroke_color = Color('black')
    draw.stroke_width = 2
    draw.fill_color = Color('white')
    draw.arc(( 25, 25),   # Stating point
             ( 75, 75),   # Ending point
             (135,-45))   # From bottom left around to top right
    with Image(width=100,
               height=100,
               background=Color('lightblue')) as img:
        draw.draw(img)
        img.save(filename='draw-arc.gif')
```

3.10.2 Bezier

New in version 0.4.0.

You can draw bezier curves using *bezier()* method. This method requires at least four points to determine a bezier curve. Given as a list of (x, y) coordinates. The first & last pair of coordinates are treated as start & end, and the second & third pair of coordinates act as controls.

For example:

```
from wand.image import Image
from wand.drawing import Drawing
from wand.color import Color

with Drawing() as draw:
    draw.stroke_color = Color('black')
    draw.stroke_width = 2
    draw.fill_color = Color('white')
    points = [(10,50),  # Start point
              (50,10),  # First control
              (50,90),  # Second control
              (90,50)]  # End point
    draw.bezier(points)
    with Image(width=100,
               height=100,
               background=Color('lightblue')) as image:
        draw(image)
```

Control width & color of curve with the drawing properties:

- *stroke_color*
- *stroke_width*

3.10.3 Circle

New in version 0.4.0.

You can draw circles using *circle()* method. Circles are drawn by defining two pairs of (x, y) coordinates. First coordinate for the center "`origin`" point, and a second pair for the outer `perimeter`. For example, the following code draws a circle in the middle of the `image`:

```
from wand.image import Image
from wand.drawing import Drawing
from wand.color import Color

with Drawing() as draw:
    draw.stroke_color = Color('black')
    draw.stroke_width = 2
    draw.fill_color = Color('white')
    draw.circle((50, 50), # Center point
                (25, 25)) # Perimeter point
    with Image(width=100, height=100, background=Color('lightblue')) as image:
        draw(image)
```

3.10.4 Color & Matte

New in version 0.4.0.

You can draw with colors directly on the coordinate system of an image. Define which color to set by setting *fill_color*. The behavior of *color()* is controlled by setting one of *PAINT_METHOD_TYPES* paint methods.

- 'point' alters a single pixel.
- 'replace' swaps on color for another. Threshold is influenced by fuzz.
- 'floodfill' fills area of a color influenced by fuzz.
- 'filltoborder' fills area of a color until border defined by *border_color*.
- 'reset' replaces the whole image to a single color.

Example fill all to green boarder:

```
from wand.drawing import Drawing
from wand.color import Color

with Drawing() as draw:
    draw.border_color = Color('green')
    draw.fill_color = Color('blue')
    draw.color(15, 25, 'filltoborder')
```

The *matte()* method is identical to the *color()* method above, but alters the alpha channel of the color area selected. Colors can be manipulated, but not replaced.

```
with Drawing() as draw:
    draw.fill_color = None  # or Color('none')
    draw.matte(15, 25, 'floodfill')
```

3.10.5 Composite

New in version 0.4.0.

Similar to *composite_channel()*, this *composite()* method will render a given image on top of the drawing subject image following the *COMPOSITE_OPERATORS* options. An compositing image must be given with a destination top, left, width, and height values.

```
from wand.image import Image, COMPOSITE_OPERATORS
from wand.drawing import Drawing
from wand.display import display

wizard = Image(filename='wizard:')
rose = Image(filename='rose:')

for o in COMPOSITE_OPERATORS:
  w = wizard.clone()
  r = rose.clone()
  with Drawing() as draw:
    draw.composite(operator=o, left=175, top=250,
                   width=r.width, height=r.height, image=r)
    draw(w)
    display(w)
```

3.10.6 Ellipse

New in version 0.4.0.

Ellipse can be drawn by using the *ellipse()* method. Like drawing circles, the ellipse requires a `origin` point, however, a pair of (x, y) `radius` are used in relationship to the `origin` coordinate. By default a complete "closed" ellipse is drawn. To draw a partial ellipse, provide a pair of starting & ending degrees as the third parameter.

An example of a full ellipse:

```
from wand.image import Image
from wand.drawing import Drawing
from wand.color import Color

with Drawing() as draw:
    draw.stroke_color = Color('black')
    draw.stroke_width = 2
    draw.fill_color = Color('white')
    draw.ellipse((50, 50), # Origin (center) point
                 (40, 20)) # 80px wide, and 40px tall
    with Image(width=100, height=100, background=Color('lightblue')) as image:
        draw(image)
```

Same example as above, but with a half-partial ellipse defined by the third parameter:

```
draw.ellipse((50, 50), # Origin (center) point
             (40, 20), # 80px wide, and 40px tall
             (90,-90)) # Draw half of ellipse from bottom to top
```

3.10.7 Lines

You can draw lines using *line()* method. It simply takes two (x, y) coordinates for start and end of a line. For example, the following code draws a diagonal line into the `image`:

```
draw.line((0, 0), image.size)
draw(image)
```

Or you can turn this diagonal line upside down:

```
draw.line((0, image.height), (image.width, 0))
draw(image)
```

The line color is determined by *fill_color* property, and you can change this of course. The following code draws a red diagonal line into the `image`:

```
from wand.color import Color

with Color('red') as color:
    draw.fill_color = color
    draw.line((0, 0), image.size)
    draw(image)
```

3.10.8 Paths

New in version 0.4.0.

Paths can be drawn by using any collection of path functions between *path_start()* and *path_finish()* methods. The available path functions are:

- *path_close()* draws a path from last point to first.
- *path_curve()* draws a cubic bezier curve.
- *path_curve_to_quadratic_bezier()* draws a quadratic bezier curve.
- *path_elliptic_arc()* draws an elliptical arc.
- *path_horizontal_line()* draws a horizontal line.
- *path_line()* draws a line path.
- *path_move()* adjust current point without drawing.
- *path_vertical_line()* draws a vertical line.

Each path method expects a destination point, and will draw from the current point to the new point. The destination point will become the new current point for the next applied path method. Destination points are given in the form of (`x`, `y`) coordinates to the `to` parameter, and can by relative or absolute to the current point by setting the `relative` flag. The *path_curve()* and *path_curve_to_quadratic_bezier()* expect additional `control` points, and can complement previous drawn curves by setting a `smooth` flag. When the `smooth` flag is set to `True` the first control point is assumed to be the reflection of the last defined control point.

For example:

```
from wand.image import Image
from wand.drawing import Drawing
from wand.color import Color

with Drawing() as draw:
    draw.stroke_width = 2
    draw.stroke_color = Color('black')
    draw.fill_color = Color('white')
    draw.path_start()
    # Start middle-left
    draw.path_move(to=(10, 50))
    # Curve accross top-left to center
    draw.path_curve(to=(40, 0),
                    controls=[(10, -40), (30,-40)],
                    relative=True)
    # Continue curve accross bottom-right
    draw.path_curve(to=(40, 0),
                    controls=(30, 40),
                    smooth=True,
                    relative=True)
    # Line to top-right
    draw.path_vertical_line(10)
    # Diagonal line to bottom-left
    draw.path_line(to=(10, 90))
    # Close first & last points
    draw.path_close()
    draw.path_finish()
    with Image(width=100, height=100, background=Color('lightblue')) as image:
        draw(image)
```

3.10.9 Point

New in version 0.4.0.

You can draw points by using *point()* method. It simply takes two `x`, `y` arguments for the point coordinate.

The following example will draw points following a math function across a given `image`:

```
from wand.image import Image
from wand.drawing import Drawing
from wand.color import Color
import math

with Drawing() as draw:
    for x in xrange(0, 100):
        y = math.tan(x) * 4
        draw.point(x, y + 50)
    with Image(width=100, height=100, background=Color('lightblue')) as image:
        draw(image)
```

Color of the point can be defined by setting the following property

- *fill_color*

3.10.10 Polygon

New in version 0.4.0.

Complex shapes can be created with the *polygon()* method. You can draw a polygon by given this method a list of points. Stroke line will automatically close between first & last point.

For example, the following code will draw a triangle into the `image`:

```
from wand.image import Image
from wand.drawing import Drawing
from wand.color import Color

with Drawing() as draw:
    draw.stroke_width = 2
    draw.stroke_color = Color('black')
    draw.fill_color = Color('white')
    points = [(25, 25), (75, 50), (25, 75)]
    draw.polygon(points)
    with Image(width=100, height=100, background=Color('lightblue')) as image:
        draw(image)
```

Control the fill & stroke with the following properties:

- *stroke_color*
- *stroke_dash_array*
- *stroke_dash_offset*

- *stroke_line_cap*
- *stroke_line_join*
- *stroke_miter_limit*
- *stroke_opacity*
- *stroke_width*
- *fill_color*
- *fill_opacity*
- *fill_rule*

3.10.11 Polyline

New in version 0.4.0.

Identical to *polygon()*, except *polyline()* will not close the stroke line between the first & last point.

For example, the following code will draw a two line path on the `image`:

```
from wand.image import Image
from wand.drawing import Drawing
from wand.color import Color

with Drawing() as draw:
    draw.stroke_width = 2
    draw.stroke_color = Color('black')
    draw.fill_color = Color('white')
    points = [(25, 25), (75, 50), (25, 75)]
    draw.polyline(points)
    with Image(width=100, height=100, background=Color('lightblue')) as image:
        draw(image)
```

Control the fill & stroke with the following properties:

- *stroke_color*
- *stroke_dash_array*
- *stroke_dash_offset*
- *stroke_line_cap*
- *stroke_line_join*
- *stroke_miter_limit*
- *stroke_opacity*
- *stroke_width*
- *fill_color*
- *fill_opacity*
- *fill_rule*

3.10.12 Push & Pop

New in version 0.4.0.

When working with complex vector graphics, you can use ImageMagick's internal graphic-context stack to manage different styles & operations. The methods *push()*, *push_clip_path()*, *push_defs()*, and *push_pattern()* are used to mark the beginning of a sub-routine. The clip path & pattern methods take a name based identifier argument, and can be referenced at a latter point with *clip_path*, or *set_fill_pattern_url()* / *set_stroke_pattern_url()* respectively. With stack management, *pop()* is used to mark the end of a sub-routine, and return the graphical context to its pervious state before *push()* was invoked. Methods *pop_clip_path()*, *pop_defs()*, and *pop_pattern()* exist to match there pop counterparts.

```
from wand.color import Color
from wand.image import Image
from wand.drawing import Drawing
from wand.compat import nested
from math import cos, pi, sin

with nested(Color('lightblue'),
            Color('transparent'),
            Drawing()) as (bg, fg, draw):
    draw.stroke_width = 3
    draw.fill_color = fg
    for degree in range(0, 360, 15):
        draw.push()  # Grow stack
        draw.stroke_color = Color('hsl({0}%, 100%, 50%)'.format(degree * 100 / 360))
        t = degree / 180.0 * pi
        x = 35 * cos(t) + 50
        y = 35 * sin(t) + 50
        draw.line((50, 50), (x, y))
        draw.pop()  # Restore stack
    with Image(width=100, height=100, background=Color('lightblue')) as img:
        draw(img)
```

3.10.13 Rectangles

New in version 0.3.6.

Changed in version 0.4.0.

If you want to draw rectangles use *rectangle()* method. It takes `left`/`top` coordinate, and `right`/`bottom` coordinate, or `width` and `height`. For example, the following code draws a square on the `image`:

```
draw.rectangle(left=10, top=10, right=40, bottom=40)
draw(image)
```

Or using `width` and `height` instead of `right` and `bottom`:

```
draw.rectangle(left=10, top=10, width=30, height=30)
draw(image)
```

Support for rounded corners was added in version 0.4.0. The `radius` argument sets corner rounding.

```
draw.rectangle(left=10, top=10, width=30, height=30, radius=5)
draw(image)
```

Both horizontal & vertical can be set independently with `xradius` & `yradius` respectively.

```
draw.rectangle(left=10, top=10, width=30, height=30, xradius=5, yradius=3)
draw(image)
```

Note that the stoke and the fill are determined by the following properties:

- *stroke_color*
- *stroke_dash_array*
- *stroke_dash_offset*
- *stroke_line_cap*
- *stroke_line_join*
- *stroke_miter_limit*
- *stroke_opacity*
- *stroke_width*
- *fill_color*
- *fill_opacity*
- *fill_rule*

3.10.14 Texts

Drawing object can write texts as well using its *text()* method. It takes `x` and `y` coordinates to be drawn and a string to write:

```
draw.font = 'wandtests/assets/League_Gothic.otf'
draw.font_size = 40
draw.text(image.width / 2, image.height / 2, 'Hello, world!')
draw(image)
```

As the above code shows you can adjust several settings before writing texts:

- *font*
- *font_family*
- *font_resolution*
- *font_size*
- *font_stretch*
- *font_style*
- *font_weight*
- *gravity*
- *text_alignment*
- *text_antialias*
- *text_decoration*

- *text_direction*
- *text_interline_spacing*
- *text_interword_spacing*
- *text_kerning*
- *text_under_color*

3.10.15 Word Wrapping

The *Drawing* class, by nature, doesn't implement any form of word-wrapping, and users of the `wand` library would be responsible for implementing this behavior unique to their business requirements.

ImageMagick's `caption:` coder does offer a word-wrapping solution with *Image.caption()* method, but Python's `textwrap` is a little more sophisticated.

```
from textwrap import wrap
from wand.color import Color
from wand.drawing import Drawing
from wand.image import Image


def draw_roi(contxt, roi_width, roi_height):
    """Let's draw a blue box so we can identify what
    our region of intrest is."""
    ctx.push()
    ctx.stroke_color = Color('BLUE')
    ctx.fill_color = Color('TRANSPARENT')
    ctx.rectangle(left=75, top=255, width=roi_width, height=roi_height)
    ctx.pop()


def word_wrap(image, ctx, text, roi_width, roi_height):
    """Break long text to multiple lines, and reduce point size
    until all text fits within a bounding box."""
    mutable_message = text
    iteration_attempts = 100

    def eval_metrics(txt):
        """Quick helper function to calculate width/height of text."""
        metrics = ctx.get_font_metrics(image, txt, True)
        return (metrics.text_width, metrics.text_height)

    def shrink_text():
        """Reduce point-size & restore original text"""
        ctx.font_size = ctx.font_size - 0.75
        mutable_message = text

    while ctx.font_size > 0 and iteration_attempts:
        iteration_attempts -= 1
        width, height = eval_metrics(mutable_message)
        if height > roi_height:
            shrink_text()
        elif width > roi_width:
            columns = len(mutable_message)
            while columns > 0:
```

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```
                columns -= 1
                mutable_message = '\n'.join(wrap(mutable_message, columns))
                wrapped_width, _ = eval_metrics(mutable_message)
                if wrapped_width <= roi_width:
                    break
            if columns < 1:
                shrink_text()
        else:
            break
    if iteration_attempts < 1:
        raise RuntimeError("Unable to calculate word_wrap for " + text)
    return mutable_message


message = """This is some really long sentence with the
 word "Mississippi" in it."""

ROI_SIDE = 175

with Image(filename='logo:') as img:
    with Drawing() as ctx:
        draw_roi(ctx, ROI_SIDE, ROI_SIDE)
        # Set the font style
        ctx.fill_color = Color('RED')
        ctx.font_family = 'Times New Roman'
        ctx.font_size = 32
        mutable_message = word_wrap(img,
                                    ctx,
                                    message,
                                    ROI_SIDE,
                                    ROI_SIDE)
        ctx.text(75, 275, mutable_message)
        ctx.draw(img)
        img.save(filename='draw-word-wrap.png')
```

3.11 Reading EXIF

New in version 0.3.0.

Image.metadata contains metadata of the image including EXIF. These are prefixed by `'exif:'` e.g. `'exif:ExifVersion'`, `'exif:Flash'`.

Here's a straightforward example to access EXIF of an image:

```
exif = {}
with Image(filename='wandtests/assets/beach.jpg') as image:
    exif.update((k[5:], v) for k, v in image.metadata.items()
                           if k.startswith('exif:'))
```

Note: You can't write into *Image.metadata*.

3.11.1 Image Profiles

Although wand provides a way to quickly access profile attributes through *Image.metadata*, ImageMagick is not a tag editor. Users are expected to export the profile payload, modify as needed, and import the payload back into the source image. Payload are byte-arrays, and should be treated as binary blobs.

Image profiles can be imported, extracted, and deleted with *Image.profiles* dictionary:

```
with Image(filename='wandtests/assets/beach.jpg') as image:
    # Extract EXIF payload
    if 'EXIF' in image.profiles:
        exif_binary = image.profiles['EXIF']
    # Import/replace ICC payload
    with open('color_profile.icc', 'rb') as icc:
        image.profiles['ICC'] = icc.read()
    # Remove XMP payload
    del image.profiles['XMP']
```

Note: Each write operation on any profile type requires the raster image-data to be re-encoded. On lossy formats, such encoding operations can be considered a generation loss.

3.12 Layers

3.12.1 Coalesce Layers

New in version 0.5.0.

When *reading* animations that have already been optimized, be sure to call *coalesce()* before performing any additional operations. This is especially important as the `MagickWand` internal iterator state may be pointing to the last frame read into the image stack, and with optimized images, this is usually a sub-image only holding a frame delta.

```
>>>  with Image(filename='layers-optmized.gif') as img:
...      img.coalesce()
...      # ... do work ...
```

3.12.2 Optimizing Layers

New in version 0.5.0.

A few optimization techniques exist when working with animated graphics. For example, a GIF image would have a rather large file size if every frame requires the full image to be redrawn. Let's take a look at the effects of *optimize_layers()*, and *optimize_transparency()*.

To start, we can quickly create an animated gif.

```
from wand.color import Color
from wand.image import Image

with Image(width=100, height=100, pseudo='pattern:crosshatch') as canvas:
    canvas.negate()
    for offset in range(20, 80, 10):
        with canvas.clone() as frame:
            with Drawing() as ctx:
                ctx.fill_color = Color('red')
                ctx.stroke_color = Color('black')
                ctx.circle((offset, offset), (offset+5, offset+5))
                ctx.draw(frame)
```

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```
            canvas.sequence.append(frame)
    canvas.save(filename='layers.gif')
```

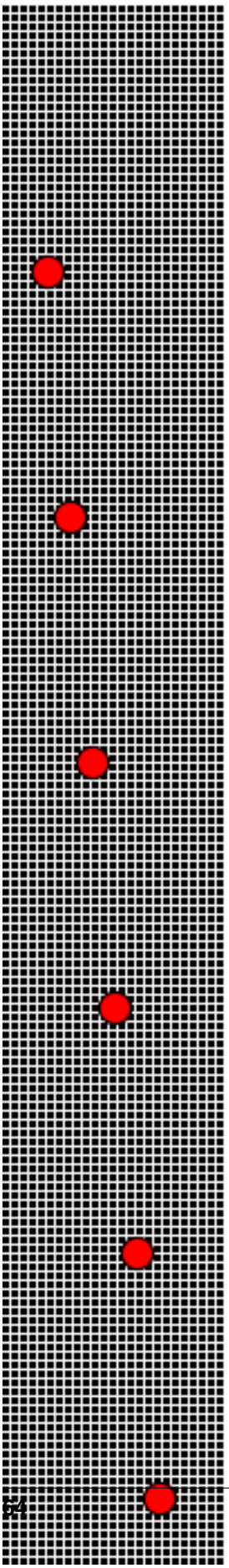
Another quick helper method to allow us to view/debug each frame.

```
def debug_layers(image, output):
    print('Debugging to file', output)
    with Image(image) as img:
        img.background_color = Color('lime')
        for index, frame in enumerate(img.sequence):
            print('Frame {0} size : {1} page: {2}'.format(index,
                                                          frame.size,
                                                          frame.page))

        img.concat(stacked=True)
        img.save(filename=output)
```

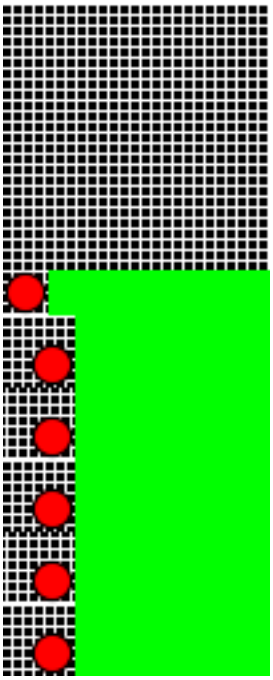
We can debug the previously created `layers.gif` by running the following:

```
>>>  with Image(filename='layers.gif') as img:
...      debug_layers(img, 'layers-expanded.png')
Debugging to file layers-expanded.png
Frame 0 size : (100, 100) page: (100, 100, 0, 0)
Frame 1 size : (100, 100) page: (100, 100, 0, 0)
Frame 2 size : (100, 100) page: (100, 100, 0, 0)
Frame 3 size : (100, 100) page: (100, 100, 0, 0)
Frame 4 size : (100, 100) page: (100, 100, 0, 0)
Frame 5 size : (100, 100) page: (100, 100, 0, 0)
Frame 6 size : (100, 100) page: (100, 100, 0, 0)
```



The moving circle is the only thing that changes between each frame, so we can optimize by having each frame only contain the delta.

```
>>>  with Image(filename='layers.gif') as img:
...      img.optimize_layers()
...      debug_layers(img, 'layers-optmized-layers.png')
Debugging to file layers-optmized-layers.png
Frame 0 size : (100, 100) page: (100, 100, 0, 0)
Frame 1 size : (17, 17) page: (100, 100, 12, 12)
Frame 2 size : (26, 27) page: (100, 100, 12, 12)
Frame 3 size : (26, 27) page: (100, 100, 23, 22)
Frame 4 size : (26, 27) page: (100, 100, 32, 32)
Frame 5 size : (26, 27) page: (100, 100, 43, 42)
Frame 6 size : (26, 27) page: (100, 100, 52, 52)
```



Notice each frame after the first has a reduce size & page x/y offset. Contacting each frame shows only the minimum bounding region covering the pixel changes across each previous frame. *Note: the lime-green background is only there for a visual cue one the website, and has not special meaning outside of "no-data here."*

3.12.3 Optimizing Transparency

New in version 0.5.0.

Following the above examples, we can also optimize by forcing pixels transparent if they are unchanged since the previous frame.

```
>>>  with Image(filename='layers.gif') as img:
...    img.optimize_transparency()
...    debug_layers(img, 'layers-optmized-transparent.png')
Debugging to file layers-optmized-transparent.png
Frame 0 size : (100, 100) page: (100, 100, 0, 0)
Frame 1 size : (100, 100) page: (100, 100, 0, 0)
Frame 2 size : (100, 100) page: (100, 100, 0, 0)
```

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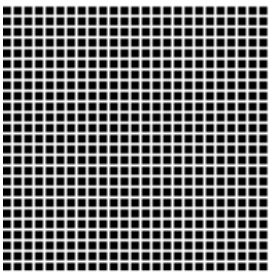
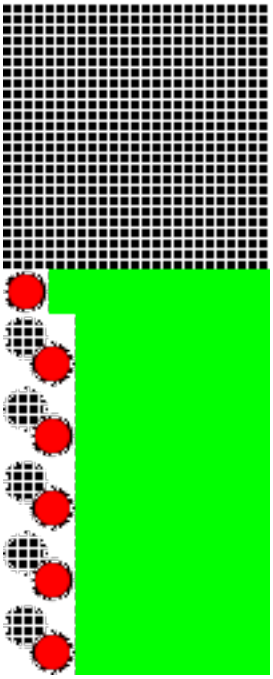
```
Frame 3 size : (100, 100) page: (100, 100, 0, 0)
Frame 4 size : (100, 100) page: (100, 100, 0, 0)
Frame 5 size : (100, 100) page: (100, 100, 0, 0)
Frame 6 size : (100, 100) page: (100, 100, 0, 0)
```



Notice both the size of each frame, and the page offset are unchanged. This technique only really saves if the subject already contains transparency color channels, and so most modern gif animations would not benefit from this method.

Naturally, applying both layer & transparency optimization will demonstrate both effects.

```
>>>  with Image(filename='layers.gif') as img:
...      img.optimize_layers()
...      img.optimize_transparency()
...      debug_layers(img, 'layers-optmized-layers-transparent.png')
Debugging to file layers-optmized-layers-transparent.png
Frame 0 size : (100, 100) page: (100, 100, 0, 0)
Frame 1 size : (17, 17) page: (100, 100, 12, 12)
Frame 2 size : (26, 27) page: (100, 100, 12, 12)
Frame 3 size : (26, 27) page: (100, 100, 23, 22)
Frame 4 size : (26, 27) page: (100, 100, 32, 32)
Frame 5 size : (26, 27) page: (100, 100, 43, 42)
Frame 6 size : (26, 27) page: (100, 100, 52, 52)
```



Note: Lime-green background added for visibility cue.

3.13 Sequence

Note: The image `sequence-animation.gif` used in this docs has been released into the public domain by its author, C6541 at Wikipedia project. This applies worldwide. (Source)

New in version 0.3.0.

Some images may actually consist of two or more images. For example, animated *image/gif* images consist of multiple frames. Some *image/ico* images have different sizes of icons.

For example, the above image `sequence-animation.gif` consists of the following frames (actually it has 60 frames, but we sample only few frames to show here):

3.13.1 `sequence` is a `Sequence`

If we *open* this image, *`Image`* object has *`sequence`*. It's a list-like object that maintain its all frames.

For example, `len()` for this returns the number of frames:

```
>>> from wand.image import Image
>>> with Image(filename='sequence-animation.gif') as image:
...     len(image.sequence)
...
60
```

You can get an item by index from *`sequence`*:

```
>>> with Image(filename='sequence-animation.gif') as image:
...     image.sequence[0]
...
<wand.sequence.SingleImage: ed84c1b (256x256)>
```

Or slice it:

```
>>> with Image(filename='sequence-animation.gif') as image:
...     image.sequence[5:10]
...
[<wand.sequence.SingleImage: 0f49491 (256x256)>,
 <wand.sequence.SingleImage: 8eba0a5 (256x256)>,
 <wand.sequence.SingleImage: 98c10fa (256x256)>,
 <wand.sequence.SingleImage: b893194 (256x256)>,
 <wand.sequence.SingleImage: 181ce21 (256x256)>]
```

3.13.2 `Image` versus `SingleImage`

Note that each item of *`sequence`* is a *`SingleImage`* instance, not *`Image`*.

`Image` is a container that directly represents *image files* like `sequence-animation.gif`, and *`SingleImage`* is a single image that represents *frames* in animations or *sizes* in *`image/ico`* files.

They both inherit *`BaseImage`*, the common abstract class. They share the most of available operations and properties like *`resize()`* and *`size`*, but some are not. For example, *`save()`* and *`mimetype`* are only provided by *`Image`*. *`delay`* and *`index`* are only available for *`SingleImage`*.

In most cases, images don't have multiple images, so it's okay if you think that *`Image`* and *`SingleImage`* are the same, but be careful when you deal with animated *`image/gif`* files or *`image/ico`* files that contain multiple icons.

3.13.3 Manipulating `SingleImage`

When working with *`sequence`*, it's important to remember that each instance of *`SingleImage`* holds a *copy* of image data from the stack. Altering the copied data will not automatically sync back to the original image-stack.

```
>>> with Image(filename='animation.gif') as image:
...     # Changes on SingleImage are invisible to `image` container.
...     image.sequence[2].negate()
...     image.save(filename='output.gif')  # Changes ignored.
```

If you intended to alter a *SingleImage*, and have changes synchronized back to the parent image-stack, use an additional with-statement context manager.

```
>>> with Image(filename='animation.gif') as image:
...     # Changes on SingleImage are sync-ed after context manager closes.
...     with image.sequence[2] as frame:
...         frame.negate()
...     image.save(filename='output.gif')  # Changes applied.
```

3.14 Resource management

See also:

***wand.resource* — Global resource management** There is the global resource to manage in MagickWand API. This module implements automatic global resource management through reference counting.

Objects Wand provides are resources to be managed. It has to be closed (destroyed) after using like file or database connection. You can deal with it using `with` very easily and explicitly:

```
with Image(filename='') as img:
    # deal with img...
```

Or you can call its *destroy()* (or *close()* if it is an *Image* instance) method manually:

```
try:
    img = Image(filename='')
    # deal with img...
finally:
    img.destroy()
```

Note: It also implements the destructor that invokes *destroy()*, and if your program runs on CPython (which does reference counting instead of ordinary garbage collection) most of resources are automatically deallocated.

However it's just depending on CPython's implementation detail of memory management, so it's not a good idea. If your program runs on PyPy (which implements garbage collector) for example, invocation time of destructors is not determined, so the program would be broken.

3.15 Running tests

Wand has unit tests and regression tests. It can be run using `setup.py` script:

```
$ python setup.py test
```

It uses pytest as its testing library. The above command will automatically install pytest as well if it's not installed yet.

Or you can manually install pytest and then use **`py.test`** command. It provides more options:

```
$ pip install pytest
$ py.test
```

3.15.1 Skipping tests

There are some time-consuming tests. You can skip these tests using `--skip-slow` option:

```
$ py.test --skip-slow
```

Be default, tests include regression testing for the PDF format. Test cases will fail if the system does not include Ghostscript binaries. You can skip PDF dependent tests with `--skip-pdf` option:

```
$ py.test --skip-pdf
```

You can run only tests you want using `-k` option.

```
$ py.test -k image
```

3.15.2 Using tox

Wand should be compatible with various Python implementations including CPython 2.6, 2.7, PyPy. tox is a testing software that helps Python packages to test on various Python implementations at a time.

It can be installed using **`pip`**:

```
$ pip install tox
```

If you type just **`tox`** at Wand directory it will be tested on multiple Python interpreters:

```
$ tox
GLOB sdist-make: /Users/emcconville/Desktop/wand/setup.py
py26 create: /Users/emcconville/Desktop/wand/.tox/py26
py26 installdeps: pytest
py26 sdist-inst: /Users/emcconville/Desktop/wand/.tox/dist/Wand-0.2.2.zip
py26 runtests: commands[0]
...
```

You can use a double `--` to pass options to pytest:

```
$ tox -- -k sequence
```

3.15.3 Continuous Integration

Travis CI automatically builds and tests every commit and pull request. The above banner image shows the current status of Wand build. You can see the detail of the current status from the following URL:

https://travis-ci.org/emcconville/wand

3.15.4 Code Coverage

Coveralls support tracking Wand's test coverage. The above banner image shows the current status of Wand coverage. You can see the details of the current status from the following URL:

https://coveralls.io/r/emcconville/wand

3.16 Roadmap

3.16.1 Very future versions

CFFI Wand will move to CFFI from ctypes.

PIL compatibility layer PIL has very long history and the most of Python projects still depend on it. We will work on PIL compatibility layer using Wand. It will provide two ways to emulate PIL:

- Module-level compatibility which can be used by changing `import`:

```
try:
    from wand.pilcompat import Image
except ImportError:
    from PIL import Image
```

- Global monkeypatcher which changes `sys.modules`:

```
from wand.pilcompat.monkey import patch; patch()
import PIL.Image  # it imports wand.pilcompat.Image module
```

CLI (`covert` command) to Wand compiler (#100) Primary interface of ImageMagick is **`convert`** command. It provides a small *parameter language*, and many answers on the Web contain code using this. The problem is that you can't simply copy-and-paste these code to utilize Wand.

This feature is to make these CLI codes possible to be used with Wand.

3.17 Wand Changelog

3.17.1 0.5 series

Version 0.5.3

Released on April 20, 2019.

- Fixed alpha channel set to "on" & "off" values for ImageMagick-7. [#404]
- Updated *`Image.composite`* & *`Image.composite_channel`* to include optional arguments for composite methods that require extra controls.
- Updated *`Image.composite`* & *`Image.composite_channel`* to include optional gravity argument.
- **Support for numpy arrays. [#65]**
  - Added *`Image.from_array`* class method.
- **Support color map / palette manipulation. [#403]**

  - Added *Image.colors* property.
  - Added *Image.color_map()* method.
  - Added *Image.cycle_color_map()* method.
- Support for `highlight` & `lowlight` has been added to *Image.compare()* method.
- Support for PEP-519 for objects implementing `__fspath__`, in *encode_filename()*.
- Added *Image.adaptive_blur()* method.
- Added *Image.adaptive_resize()* method.
- Added *Image.adaptive_sharpen()* method.
- Added *Image.adaptive_threshold()* method.
- Added *Image.black_threshold()* method.
- Added *Image.blue_shift()* method.
- Added *Image.charcoal()*
- Added *Image.color_matrix()* method.
- Added *Image.colorize()* method.
- Added *Image.fuzz* property.
- Added *Image.kurtosis* property.
- Added *Image.kurtosis_channel()* method
- Added *Image.maxima* property.
- Added *Image.mean* property.
- Added *Image.mean_channel()* method
- Added *Image.minima* property.
- Added *Image.noise()* method.
- Added *Image.range_channel()* method
- Added *Image.remap()* method.
- Added *Image.selective_blur()* method.
- Added *Image.skewness* property.
- Added *Image.sketch()* method.
- Added *Image.smush()* method.
- Added *Image.sparse_color()* method.
- Added *Image.splice()* method.
- Added *Image.spread()* method.
- Added *Image.standard_deviation* property.
- Added *Image.statistic()* method.
- Added *Image.tint()* method.

Version 0.5.2

Released on March 24, 2019.

- Import `collections.abc` explicitly. [#398 by Stefan Naumann]
- Fixed memory leak in *`HistogramDict`*. [#397]
- Fixed compression & compression quality bug. [#202 & #278]
- *`Image.read()`* will raise *`WandRuntimeError`* if `MagickReadImage()` returns `MagickFalse`, but does not emit exception. [#319]
- Added *`Image.implode()`* method.
- Added *`Image.vignette()`* method.
- Added *`Image.wave()`* method.
- Added *`Image.white_threshold()`* method.
- Added *`Image.blue_primary`* property.
- Added *`Image.green_primary`* property.
- Added *`Image.interlace_scheme`* property.
- Added *`Image.interpolate_method`* property.
- Added *`Image.red_primary`* property.
- Added *`Image.white_point`* property.

Version 0.5.1

Released on February 15, 2019.

- Added set pixel color via *Image[x, y] = Color('...')*. [#105]
- Added *`limits`* helper dictionary to allows getting / setting ImageMagick's resource-limit policies. [#97]
- Fixed segmentation violation for win32 & ImageMagick-7. [#389]
- Fixed *AssertError* by moving *`SingleImage`* sync behavior from `destroy` to context `__exit__`. [#388]
- Fixed memory leak in *`get_font_metrics`*. [#390]
- Added property setters for *`Color`* attributes.
- Added *`cyan`*, *`magenta`*, *`yellow`*, & *`black`* properties for CMYK *`Color`* instances.
- *`Color`* instance can be created from HSL values with *`from_hsl()`* class method.
- Added *`Image.compose`* property for identifying layer visibility.
- Added *`Image.profiles`* dictionary attribute. [#249]
- Moved `collections.abc` to *`wand.compat.abc`* for Python-3.8. [#394 by Tero Vuotila]
- Update *`wand.display`* to use Python3 compatible `print()` function. [#395 by Tero Vuotila]

Version 0.5.0

Released on January 1, 2019.

- Support for ImageMagick-7.
- Improved support for 32-bit systems.
- Improved support for non-Q16 libraries.
- Removed *README.rst* from setup.py's *data_files*. [#336]
- Improved *EXIF:ORIENTATION* handling. [#364 by M. Skrzypek]
- Tolerate failures while accessing wand.api. [#220 by Utkarsh Upadhyay]
- Added support for Image Artifacts through *Image.artifacts*. [#369]
- Added optional stroke color/width parameters for *Font*.
- Image layers support (#22)
  - Added *Image.coalesce()* method.
  - Added *Image.deconstruct* method.
  - Added *Image.dispose* property.
  - Added *Image.optimize_layers()* method.
  - Added *Image.optimize_transparency()* method.
- Implemented `__array_interface__()` for NumPy [#65]
- Migrated the following methods & attributes from *Image* to *BaseImage* for a more uniformed code-base.
  - *Image.compression*
  - *Image.format*
  - *Image.auto_orient()*
  - *Image.border()*
  - *Image.contrast_stretch()*
  - *Image.gamma()*
  - *Image.level()*
  - *Image.linear_stretch()*
  - *Image.normalize()*
  - *Image.strip()*
  - *Image.transpose()*
  - *Image.transverse()*
  - *Image.trim()*
- Added *Image.clut()* method.
- Added *Image.concat()* method. [#177]
- Added *Image.deskew()* method.
- Added *Image.despeckle()* method.
- Added *Image.edge()* method.

- Added *Image.emboss()* method. [#196]
- Added *Image.enhance()* method. [#132]
- Added *Image.export_pixels()* method.
- Added *Image.import_pixels()* method.
- Added *Image.morphology()* method. [#132]
- Added *Image.posterize()* method.
- Added *Image.shade()* method.
- Added *Image.shadow()* method.
- Added *Image.sharpen()* method. [#132]
- Added *Image.shave()* method.
- Added *Image.unique_colors()* method.
- Method *Drawing.draw()* now accepts *BaseImage* for folks extended classes.
- Added *Image.loop* property. [#227]
- Fixed *SingleImage.delay* property. [#153]
- Attribute *Image.font_antialias* has been deprecated in favor of *Image.antialias*. [#218]
- Fixed ordering of *COMPRESSION_TYPES* based on ImageMagick version. [#309]
- Fixed drawing on *SingleImage*. [#289]
- Fixed wrapping issue for larger offsets when using *gravity* kwarg in *Image.crop()* method. [#367]

3.17.2 0.4 series

Version 0.4.5

Released on November 12, 2018.

- Improve library searching when `MAGICK_HOME` environment variable is set. [#320 by Chase Anderson]
- Fixed misleading *TypeError: object of type 'NoneType' has no len()* during destroy routines. [#346 by Carey Metcalfe]
- Added *Image.blur()* method (`MagickBlurImage()`). [#311 by Alexander Karpinsky]
- Added *Image.extent()* method (`MagickExtentImage()`). [#233 by Jae-Myoung Yu]
- Added *Image.resample()* method (`MagickResampleImage()`). [#244 by Zio Tibia]

Version 0.4.4

Released on October 22, 2016.

- Added *BaseError*, *BaseWarning*, and *BaseFatalError*, base classes for domains. [#292]
- Fixed `TypeError` during parsing version caused by format change of ImageMagick version string (introduced by 6.9.6.2). [#310, Debian bug report #841548]
- Properly fixed again memory-leak when accessing images constructed in *Image.sequence[]*. It had still leaked memory in the case an image is not closed using `with` but manual *wand.resource.Resource.destroy()*/*wand.image.Image.close()* method call. [#237]

Version 0.4.3

Released on June 1, 2016.

- Fixed `repr()` for empty *Image* objects. [#265]
- Added *Image.compare()* method (`MagickCompareImages()`). [#238, #268 by Gyusun Yeom]
- Added *Image.page* and related properties for virtual canvas handling. [#284 by Dan Harrison]
- Added *Image.merge_layers()* method (`MagickMergeImageLayers()`). [#281 by Dan Harrison]
- Fixed `OSError` during import `libc.dylib` due to El Capitan's SIP protection. [#275 by Ramesh Dharan]

Version 0.4.2

Released on November 30, 2015.

- Fixed `ImportError` on MSYS2. [#257 by Eon Jeong]
- Added *Image.quantize()* method (`MagickQuantizeImage()`). [#152 by Kang Hyojun, #262 by Jeong YunWon]
- Added *Image.transform_colorspace()* quantize (`MagickTransformImageColorspace()`). [#152 by Adrian Jung, #262 by Jeong YunWon]
- Now ImageMagick DLL can be loaded on Windows even if its location is stored in the resitry. [#261 by Roeland Schoukens]
- Added `depth` parameter to *Image* constructor. The `depth`, `width` and `height` parameters can be used with the `filename`, `file` and `blob` parameters to load raw pixel data. [#261 by Roeland Schoukens]

Version 0.4.1

Released on August 3, 2015.

- Added *Image.auto_orient()* that fixes orientation by checking EXIF tags.
- Added *Image.transverse()* method (`MagickTransverseImage()`).
- Added *Image.transpose()* method (`MagickTransposeImage()`).
- Added *Image.evaluate()* method.
- Added *Image.frame()* method.
- Added *Image.function()* method.
- Added *Image.fx()* expression method.
- Added `gravity` options in *Image.crop()* method. [#222 by Eric McConville]
- Added *Image.matte_color* property.
- Added *Image.virtual_pixel* property.
- Added *Image.distort()* method.
- Added *Image.contrast_stretch()* method.
- Added *Image.gamma()* method.
- Added *Image.linear_stretch()* method.
- Additional support for *Image.alpha_channel*.

- Additional query functions have been added to *wand.version* API. [#120]
  - Added *configure_options()* function.
  - Added *fonts()* function.
  - Added *formats()* function.
- Additional IPython support. [#117]
  - Render RGB *Color* preview.
  - Display each frame in image *Sequence*.
- Fixed memory-leak when accessing images constructed in *Image.sequence[]*. [#237 by Eric McConville]
- Fixed Windows memory-deallocate errors on *wand.drawing* API. [#226 by Eric McConville]
- Fixed `ImportError` on FreeBSD. [#252 by Pellaeon Lin]

Version 0.4.0

Released on February 20, 2015.

See also:

whatsnew/0.4 This guide introduces what's new in Wand 0.4.

- Complete *wand.drawing* API. The whole work was done by Eric McConville. Huge thanks for his effort! [#194 by Eric McConville]
  - Added *Drawing.arc()* method (*Arc*).
  - Added *Drawing.bezier()* method (*Bezier*).
  - Added *Drawing.circle()* method (*Circle*).
  - *Color & Matte*
    - Added *wand.drawing.PAINT_METHOD_TYPES* constant.
    - Added *Drawing.color()* method.
    - Added *Drawing matte()* method.
  - Added *Drawing.composite()* method (*Composite*).
  - Added *Drawing.ellipse()* method (*Ellipse*).
  - *Paths*
    - Added *path_start()* method.
    - Added *path_finish()* method.
    - Added *path_close()* method.
    - Added *path_curve()* method.
    - Added *path_curve_to_quadratic_bezier()* method.
    - Added *path_elliptic_arc()* method.
    - Added *path_horizontal_line()* method.
    - Added *path_line()* method.
    - Added *path_move()* method.

        * Added *path_vertical_line()* method.
    - Added *Drawing.point()* method (*Point*).
    - Added *Drawing.polygon()* method (*Polygon*).
    - Added *Drawing.polyline()* method (*Polyline*).
    - *Push & Pop*
        * Added *push()* method.
        * Added *push_clip_path()* method.
        * Added *push_defs()* method.
        * Added *push_pattern()* method.
        * Added *clip_path* property.
        * Added *set_fill_pattern_url()* method.
        * Added *set_stroke_pattern_url()* method.
        * Added *pop()* method.
    - Added *Drawing.rectangle()* method (*Rectangles*).
    - Added *stroke_dash_array* property.
    - Added *stroke_dash_offset* property.
    - Added *stroke_line_cap* property.
    - Added *stroke_line_join* property.
    - Added *stroke_miter_limit* property.
    - Added *stroke_opacity* property.
    - Added *stroke_width* property.
    - Added *fill_opacity* property.
    - Added *fill_rule* property.
- Error message of *MissingDelegateError* raised by *Image.liquid_rescale()* became nicer.

3.17.3 0.3 series

Version 0.3.9

Released on December 20, 2014.

- Added `'pdf:use-cropbox'` option to *Image.options* dictionary (and `OPTIONS` constant). [#185 by Christoph Neuroth]
- Fixed a bug that exception message was `bytes` instead of `str` on Python 3.
- The `size` parameter of *Font* class becomes optional. Its default value is 0, which means *autosized*. [#191 by Cha, Hojeong]
- Fixed a bug that *Image.read()* had tried using `MagickReadImageFile()` even when the given file object has no `mode` attribute. [#205 by Stephen J. Fuhry]

Version 0.3.8

Released on August 3, 2014.

- Fixed a bug that transparent background becomes filled with white when SVG is converted to other bitmap image format like PNG. [#184]
- Added *Image.negate()* method. [#174 by Park Joon-Kyu]
- Fixed a segmentation fault on *Image.modulate()* method. [#173 by Ted Fung, #158]
- Added suggestion to install freetype also if Homebrew is used. [#141]
- Now *image/x-gif* also is determined as `animation`. [#181 by Juan-Pablo Scaletti]

Version 0.3.7

Released on March 25, 2014.

- A hotfix of debug prints made at 0.3.6.

Version 0.3.6

Released on March 23, 2014.

- Added *Drawing.rectangle()* method. *Now you can draw rectangles.* [#159]
- Added *Image.compression* property. [#171]
- Added `contextlib.nested()` function to *wand.compat* module.
- Fixed `UnicodeEncodeError` when *Drawing.text()* method gives Unicode `text` argument in Python 2. [#163]
- Now it now allows to use Wand when Python is invoked with the `-OO` flag. [#169 by Samuel Maudo]

Version 0.3.5

Released on September 13, 2013.

- Fix segmentation fault on *Image.save()* method. [#150]

Version 0.3.4

Released on September 9, 2013.

- Added *Image.modulate()* method. [#134 by Dan P. Smith]
- Added *Image.colorspace* property. [#135 by Volodymyr Kuznetsov]
- Added *Image.unsharp_mask()* method. [#136 by Volodymyr Kuznetsov]
- Added `'jpeg:sampling-factor'` option to *Image.options* dictionary (and `OPTIONS` constant). [#137 by Volodymyr Kuznetsov]
- Fixed ImageMagick shared library resolution on Arch Linux. [#139, #140 by Sergey Tereschenko]
- Added *Image.sample()* method. [#142 by Michael Allen]
- Fixed a bug that *Image.save()* preserves only one frame of the given animation when file-like object is passed. [#143, #145 by Michael Allen]

- Fixed searching of ImageMagick shared library with HDR support enabled. [#148, #149 by Lipin Dmitriy]

Version 0.3.3

Released on August 4, 2013. It's author's birthday.

- Added *Image.gaussian_blur()* method.
- Added *Drawing.stroke_color* property. [#129 by Zeray Rice]
- Added *Drawing.stroke_width* property. [#130 by Zeray Rice]
- Fixed a memory leak of *Color* class. [#127 by Wieland Morgenstern]
- Fixed a bug that *Image.save()* to stream truncates data. [#128 by Michael Allen]
- Fixed broken *display()* on Python 3. [#126]

Version 0.3.2

Released on July 11, 2013.

- Fixed incorrect encoding of filenames. [#122]
- Fixed key type of *Image.metadata* dictionary to `str` from `bytes` in Python 3.
- Fixed CentOS compatibility [#116, #124 by Pierre Vanliefland]
  - Made `DrawSetTextInterlineSpacing()` and `DrawGetTextInterlineSpacing()` optional.
  - Added exception in drawing API when trying to use `DrawSetTextInterlineSpacing()` and `DrawGetTextInterlineSpacing()` functions when they are not available.
  - Added *WandLibraryVersionError* class for library versions issues.

Version 0.3.1

Released on June 23, 2013.

- Fixed `ImportError` on Windows.

Version 0.3.0

Released on June 17, 2013.

See also:

whatsnew/0.3 This guide introduces what's new in Wand 0.3.

- Now also works on Python 2.6, 2.7, and 3.2 or higher.
- Added *wand.drawing* module. [#64 by Adrian Jung]
- Added *Drawing.get_font_metrics()* method. [#69, #71 by Cha, Hojeong]
- Added *Image.caption()* method. [#74 by Cha, Hojeong]
- Added optional `color` parameter to *Image.trim()* method.
- Added *Image.border()* method. [2496d37f75d75e9425f95dde07033217dc8afefc by Jae-Myoung Yu]

- Added `resolution` parameter to *`Image.read()`* method and the constructor of *`Image`*. [#75 by Andrey Antukh]
- Added *`Image.liquid_rescale()`* method which does seam carving. See also *Seam carving (also known as content-aware resizing)*.
- Added *`Image.metadata`* immutable mapping attribute and *`Metadata`* mapping type for it. [#56 by Michael Elovskikh]
- Added *`Image.channel_images`* immutable mapping attribute and *`ChannelImageDict`* mapping for it.
- Added *`Image.channel_depths`* immutable mapping attribute and *`ChannelDepthDict`* mapping for it.
- Added *`Image.composite_channel()`* method.
- Added *`Image.read()`* method. [#58 by Piotr Florczyk]
- Added *`Image.resolution`* property. [#58 by Piotr Florczyk]
- Added *`Image.blank()`* method. [#60 by Piotr Florczyk]
- Fixed several memory leaks. [#62 by Mitch Lindgren]
- Added *`ImageProperty`* mixin class to maintain a weak reference to the parent image.
- Ranamed `wand.image.COMPOSITE_OPS` to *`COMPOSITE_OPERATORS`*.
- Now it shows helpful error message when ImageMagick library cannot be found.
- Added IPython-specialized formatter.
- Added *`QUANTUM_DEPTH`* constant.
- Added these properties to *`Color`* class:
  - *`red_quantum`*
  - *`green_quantum`*
  - *`blue_quantum`*
  - *`alpha_quantum`*
  - *`red_int8`*
  - *`green_int8`*
  - *`blue_int8`*
  - *`alpha_int8`*
- Added *`Image.normalize()`* method. [#95 by Michael Curry]
- Added *`Image.transparent_color()`* method. [#98 by Lionel Koenig]
- Started supporting resizing and cropping of GIF images. [#88 by Bear Dong, #112 by Taeho Kim]
- Added *`Image.flip()`* method.
- Added *`Image.flop()`* method.
- Added *`Image.orientation`* property. [88574468a38015669dae903185fb328abdd717c0 by Taeho Kim]
- *`wand.resource.DestroyedResourceError`* becomes a subtype of *`wand.exceptions.WandException`*.
- *`Color`* is now hashable, so can be used as a key of dictionaries, or an element of sets. [#114 by klutzy]
- *`Color`* has *`normalized_string`* property.

- *Image* has *histogram* dictionary.
- Added optional `fuzz` parameter to *Image.trim()* method. [#113 by Evaldo Junior]

3.17.4 0.2 series

Version 0.2.4

Released on May 28, 2013.

- Fix `NameError` in *Resource.resource* setter. [#89 forwareded from Debian bug report #699064 by Jakub Wilk]
- Fix the problem of library loading for Mac with Homebrew and Arch Linux. [#102 by Roel Gerrits, #44]

Version 0.2.3

Released on January 25, 2013.

- Fixed a bug that *Image.transparentize()* method (and *Image.watermark()* method which internally uses it) didn't work.
- Fixed segmentation fault occurred when *Color.red*, *Color.green*, or *Color.blue* is accessed.
- Added *Color.alpha* property.
- Fixed a bug that format converting using *Image.format* property or *Image.convert()* method doesn't correctly work to save blob.

Version 0.2.2

Released on September 24, 2012.

- A compatibility fix for FreeBSD. [Patch by Olivier Duchateau]
- Now *Image* can be instantiated without any opening. Instead, it can take `width`/`height` and `background`. [#53 by Michael Elovskikh]
- Added *Image.transform()* method which is a convenience method accepting geometry strings to perform cropping and resizing. [#50 by Mitch Lindgren]
- Added *Image.units* property. [#45 by Piotr Florczyk]
- Now *Image.resize()* method raises a proper error when it fails for any reason. [#41 by Piotr Florczyk]
- Added *Image.type* property. [#33 by Yauhen Yakimovich, #42 by Piotr Florczyk]

Version 0.2.1

Released on August 19, 2012. Beta version.

- Added *Image.trim()* method. [#26 by Jökull Sólberg Auðunsson]
- Added *Image.depth* property. [#31 by Piotr Florczyk]
- Now *Image* can take an optional `format` hint. [#32 by Michael Elovskikh]
- Added *Image.alpha_channel* property. [#35 by Piotr Florczyk]

- The default value of *Image.resize()*'s `filter` option has changed from `'triangle'` to `'undefined'`. [#37 by Piotr Florczyk]
- Added version data of the linked ImageMagick library into *wand.version* module:
  - *MAGICK_VERSION* (`GetMagickVersion()`)
  - *MAGICK_VERSION_INFO* (`GetMagickVersion()`)
  - *MAGICK_VERSION_NUMBER* (`GetMagickVersion()`)
  - *MAGICK_RELEASE_DATE* (`GetMagickReleaseDate()`)
  - *MAGICK_RELEASE_DATE_STRING* (`GetMagickReleaseDate()`)

Version 0.2.0

Released on June 20, 2012. Alpha version.

- Added *Image.transparentize()* method. [#19 by Jeremy Axmacher]
- Added *Image.composite()* method. [#19 by Jeremy Axmacher]
- Added *Image.watermark()* method. [#19 by Jeremy Axmacher]
- Added *Image.quantum_range* property. [#19 by Jeremy Axmacher]
- Added *Image.reset_coords()* method and `reset_coords` option to *Image.rotate()* method. [#20 by Juan Pablo Scaletti]
- Added *Image.strip()* method. [#23 by Dmitry Vukolov]
- Added *Image.compression_quality* property. [#23 by Dmitry Vukolov]
- Now the current version can be found from the command line interface: `python -m wand.version`.

3.17.5 0.1 series

Version 0.1.10

Released on May 8, 2012. Still alpha version.

- So many Windows compatibility issues are fixed. [#14 by John Simon]
- Added *wand.api.libmagick*.
- Fixed a bug that raises `AttributeError` when it's trying to warn. [#16 by Tim Dettrick]
- Now it throws `ImportError` instead of `AttributeError` when the shared library fails to load. [#17 by Kieran Spear]
- Fixed the example usage on index page of the documentation. [#18 by Jeremy Axmacher]

Version 0.1.9

Released on December 23, 2011. Still alpha version.

- Now *wand.version.VERSION_INFO* becomes `tuple` and *wand.version.VERSION* becomes a string.
- Added *Image.background_color* property.

- Added == operator for *Image* type.
- Added `hash()` support of *Image* type.
- Added *Image.signature* property.
- Added *wand.display* module.
- Changed the theme of Sphinx documentation.
- Changed the start example of the documentation.

Version 0.1.8

Released on December 2, 2011. Still alpha version.

- Wrote some guide documentations: *Reading images*, *Writing images* and *Resizing and cropping*.
- Added *Image.rotate()* method for in-place rotation.
- Made *Image.crop()* to raise proper `ValueError` instead of `IndexError` for invalid width/height arguments.
- Changed the type of *Image.resize()* method's `blur` parameter from `numbers.Rational` to `numbers.Real`.
- Fixed a bug of raising `ValueError` when invalid `filter` has passed to *Image.resize()* method.

Version 0.1.7

Released on November 10, 2011. Still alpha version.

- Added *Image.mimetype* property.
- Added *Image.crop()* method for in-place crop.

Version 0.1.6

Released on October 31, 2011. Still alpha version.

- Removed a side effect of *Image.make_blob()* method that changes the image format silently.
- Added *Image.format* property.
- Added *Image.convert()* method.
- Fixed a bug about Python 2.6 compatibility.
- Use the internal representation of `PixelWand` instead of the string representaion for *Color* type.

Version 0.1.5

Released on October 28, 2011. Slightly mature alpha version.

- Now *Image* can read Python file objects by `file` keyword argument.
- Now *Image.save()* method can write into Python file objects by `file` keyword argument.
- *Image.make_blob()*'s `format` argument becomes omittable.

Version 0.1.4

Released on October 27, 2011. Hotfix of the malformed Python package.

Version 0.1.3

Released on October 27, 2011. Slightly mature alpha version.

- Pixel getter for *Image*.
- Row getter for *Image*.
- Mac compatibility.
- Windows compatibility.
- 64-bit processor compatibility.

Version 0.1.2

Released on October 16, 2011. Still alpha version.

- *Image* implements iterable interface.
- Added *wand.color* module.
- Added the abstract base class of all Wand resource objects: *wand.resource.Resource*.
- *Image* implements slicing.
- Cropping *Image* using its slicing operator.

Version 0.1.1

Released on October 4, 2011. Still alpha version.

- Now it handles errors and warnings properly and in natural way of Python.
- Added *Image.make_blob()* method.
- Added `blob` parameter into *Image* constructor.
- Added *Image.resize()* method.
- Added *Image.save()* method.
- Added *Image.clone()* method.
- Drawed the pretty logo picture (thanks to Hyojin Choi).

Version 0.1.0

Released on October 1, 2011. Very alpha version.

3.18 Talks and Presentations

3.18.1 Talks in 2012

- Lightning talk at Python Korea November 2012

CHAPTER 4

References

4.1 wand — Simple MagickWand API binding for Python

4.1.1 wand.image — Image objects

Opens and manipulates images. Image objects can be used in `with` statement, and these resources will be automatically managed (even if any error happened):

```
with Image(filename='pikachu.png') as i:
    print('width =', i.width)
    print('height =', i.height)
```

wand.image.**ALPHA_CHANNEL_TYPES = ('undefined', 'activate', 'background', 'copy', 'deactivat**

(tuple) The list of *alpha_channel* types.

- 'undefined'
- 'activate'
- 'background'
- 'copy'
- 'deactivate'
- 'discrete' - Only available in ImageMagick-7
- 'extract'
- 'off' - Only available in ImageMagick-7
- 'on' - Only available in ImageMagick-7
- 'opaque'
- 'reset' - Only available in ImageMagick-6
- 'set'

- 'shape'
- 'transparent'
- 'flatten' - Only available in ImageMagick-6
- 'remove'

See also:

ImageMagick Image Channel Describes the SetImageAlphaChannel method which can be used to modify alpha channel. Also describes AlphaChannelType

wand.image.**CHANNELS = {'all_channels': 134217727, 'alpha': 8, 'black': 32, 'blue': 4,**
(dict) The dictionary of channel types.

- 'undefined'
- 'red'
- 'gray'
- 'cyan'
- 'green'
- 'magenta'
- 'blue'
- 'yellow'
- 'alpha'
- 'opacity'
- 'black'
- 'index'
- 'composite_channels'
- 'all_channels'
- 'true_alpha'
- 'rgb_channels'
- 'gray_channels'
- 'sync_channels'
- 'default_channels'

See also:

ImageMagick Color Channels Lists the various channel types with descriptions of each

wand.image.**COLORSPACE_TYPES = ('undefined', 'rgb', 'gray', 'transparent', 'ohta', 'lab',**
(tuple) The list of colorspaces.

- 'undefined'
- 'rgb'
- 'gray'
- 'transparent'

- 'ohta'
- 'lab'
- 'xyz'
- 'ycbcr'
- 'ycc'
- 'yiq'
- 'ypbpr'
- 'yuv'
- 'cmyk'
- 'srgb'
- 'hsb'
- 'hsl'
- 'hwb'
- 'rec601luma' - Only available with ImageMagick-6
- 'rec601ycbcr'
- 'rec709luma' - Only available with ImageMagick-6
- 'rec709ycbcr'
- 'log'
- 'cmy'
- 'luv'
- 'hcl'
- 'lch'
- 'lms'
- 'lchab'
- 'lchuv'
- 'scrgb'
- 'hsi'
- 'hsv'
- 'hclp'
- 'xyy' - Only available with ImageMagick-7
- 'ydbdr'

See also:

ImageMagick Color Management Describes the ImageMagick color management operations

New in version 0.3.4.

wand.image.**COMPARE_METRICS = ('undefined', 'absolute', 'mean_absolute', 'mean_error_per_pi**
(tuple) The list of compare metric types

- 'undefined'
- 'absolute'
- 'fuzz' - Only available with ImageMagick-7
- 'mean_absolute'
- 'mean_error_per_pixel'
- 'mean_squared'
- 'normalized_cross_correlation'
- 'peak_absolute'
- 'peak_signal_to_noise_ratio'
- 'perceptual_hash'
- 'root_mean_square'

See also:

ImageMagick Compare Operations

New in version 0.4.3.

wand.image.**COMPOSITE_OPERATORS = ('undefined', 'no', 'add', 'atop', 'blend', 'bumpmap', 'cl**

(tuple) The list of composition operators

- 'undefined'
- 'no'
- 'add' - Only available with ImageMagick-6
- 'alpha' - Only available with ImageMagick-7
- 'atop'
- 'blend'
- 'blur' - Only available with ImageMagick-7
- 'bumpmap'
- 'change_mask'
- 'clear'
- 'color_burn'
- 'color_dodge'
- 'colorize'
- 'copy_black'
- 'copy_blue'
- 'copy'
- 'copy_alpha' - Only available with ImageMagick-7
- 'copy_cyan'
- 'copy_green'
- 'copy_magenta'

- `'copy_opacity'` - Only available with ImageMagick-6
- `'copy_red'`
- `'copy_yellow'`
- `'darken'`
- `'darken_intensity'` - Only available with ImageMagick-7
- `'dst_atop'`
- `'dst'`
- `'dst_in'`
- `'dst_out'`
- `'dst_over'`
- `'difference'`
- `'displace'`
- `'dissolve'`
- `'distort'` - Only available with ImageMagick-7
- `'divide'` - Only available with ImageMagick-6
- `'exclusion'`
- `'hard_light'`
- `'head_mix'` - Only available with ImageMagick-7
- `'hue'`
- `'in'`
- `'intensity'` - Only available with ImageMagick-7
- `'lighten'`
- `'lighten_intensity'` - Only available with ImageMagick-7
- `'linear_burn'` - Only available with ImageMagick-7
- `'linear_dodge'` - Only available with ImageMagick-7
- `'linear_light'`
- `'luminize'`
- `'mathematics'` - Only available with ImageMagick-7
- `'minus'` - Only available with ImageMagick-6
- `'minus_dst'` - Only available with ImageMagick-7
- `'minus_src'` - Only available with ImageMagick-7
- `'modulate'`
- `'modulate_add'` - Only available with ImageMagick-7
- `'modulate_subtract'` - Only available with ImageMagick-7
- `'multiply'`
- `'out'`

- 'over'
- 'overlay'
- 'pegtop_light' - Only available with ImageMagick-7
- 'plus'
- 'replace'
- 'saturate'
- 'screen'
- 'soft_light'
- 'src_atop'
- 'src'
- 'src_in'
- 'src_out'
- 'src_over'
- 'subtract' - Only available with ImageMagick-6
- 'threshold'
- 'vivid_light' - Only available with ImageMagick-7
- 'xor'

Changed in version 0.3.0: Renamed from COMPOSITE_OPS to *COMPOSITE_OPERATORS*.

See also:

Compositing Images **ImageMagick v6 Examples** Image composition is the technique of combining images that have, or do not have, transparency or an alpha channel. This is usually performed using the IM **composite** command. It may also be performed as either part of a larger sequence of operations or internally by other image operators.

ImageMagick Composition Operators Demonstrates the results of applying the various composition composition operators.

wand.image.**COMPRESSION_TYPES = ('undefined', 'no', 'bzip', 'dxt1', 'dxt3', 'dxt5', 'fax',**
(tuple) The list of Image.compression types.

New in version 0.3.6.

Changed in version 0.5.0: Support for ImageMagick-6 & ImageMagick-7

wand.image.**DISPOSE_TYPES = ('undefined', 'none', 'background', 'previous')**
(tuple) The list of *BaseImage.dispose* types.

New in version 0.5.0.

wand.image.**DISTORTION_METHODS = ('undefined', 'affine', 'affine_projection', 'scale_rotate_**
(tuple) The list of *BaseImage.distort()* methods.

- 'undefined'
- 'affine'
- 'affine_projection'
- 'scale_rotate_translate'

- 'perspective'
- 'perspective_projection'
- 'bilinear_forward'
- 'bilinear_reverse'
- 'polynomial'
- 'arc'
- 'polar'
- 'depolar'
- 'cylinder_2_plane'
- 'plane_2_cylinder'
- 'barrel'
- 'barrel_inverse'
- 'shepards'
- 'resize'
- 'sentinel'

New in version 0.4.1.

wand.image.**DITHER_METHODS = ('undefined', 'no', 'riemersma', 'floyd_steinberg')**
(tuple) The list of Dither methods. Used by *Image.posterize()* and *Image.remap()* methods.

- 'undefined'
- 'no'
- 'riemersma'
- 'floyd_steinberg'

New in version 0.5.0.

wand.image.**EVALUATE_OPS = ('undefined', 'add', 'and', 'divide', 'leftshift', 'max', 'min',**
(tuple) The list of evaluation operators. Used by *Image.evaluate()* method.

- 'undefined'
- 'abs'
- 'add'
- 'addmodulus'
- 'and'
- 'cosine'
- 'divide'
- 'exponential'
- 'gaussiannoise'
- 'impulsenoise'
- 'laplaciannoise'
- 'leftshift'

- 'log'
- 'max'
- 'mean'
- 'median'
- 'min'
- 'multiplicativenoise'
- 'multiply'
- 'or'
- 'poissonnoise'
- 'pow'
- 'rightshift'
- 'set'
- 'sine'
- 'subtract'
- 'sum'
- 'threshold'
- 'thresholdblack'
- 'thresholdwhite'
- 'uniformnoise'
- 'xor'

See also:

ImageMagick Image Evaluation Operators Describes the MagickEvaluateImageChannel method and lists the various evaluations operators

wand.image.**FILTER_TYPES = ('undefined', 'point', 'box', 'triangle', 'hermite', 'hanning',**
(tuple) The list of filter types. Used by *Image.resample()* and *Image.resize()* methods.

- 'undefined'
- 'point'
- 'box'
- 'triangle'
- 'hermite'
- 'hanning'
- 'hamming'
- 'blackman'
- 'gaussian'
- 'quadratic'
- 'cubic'

- 'catrom'
- 'mitchell'
- 'jinc'
- 'sinc'
- 'sincfast'
- 'kaiser'
- 'welsh'
- 'parzen'
- 'bohman'
- 'bartlett'
- 'lagrange'
- 'lanczos'
- 'lanczossharp'
- 'lanczos2'
- 'lanczos2sharp'
- 'robidoux'
- 'robidouxsharp'
- 'cosine'
- 'spline'
- 'sentinel'

See also:

ImageMagick Resize Filters Demonstrates the results of resampling images using the various resize filters and blur settings available in ImageMagick.

wand.image.**FUNCTION_TYPES = ('undefined', 'polynomial', 'sinusoid', 'arcsin', 'arctan')**
(tuple) The list of *Image.function* types.

- 'undefined'
- 'arcsin'
- 'arctan'
- 'polynomial'
- 'sinusoid'

wand.image.**GRAVITY_TYPES = ('forget', 'north_west', 'north', 'north_east', 'west', 'center**
(tuple) The list of *gravity* types.

- 'forget'
- 'north_west'
- 'north'
- 'north_east'

- 'west'
- 'center'
- 'east'
- 'south_west'
- 'south'
- 'south_east'

New in version 0.3.0.

wand.image.**IMAGE_LAYER_METHOD = ('undefined', 'coalesce', 'compareany', 'compareclear', 'co**
(tuple) The list of methods for *merge_layers()* and *compare_layers()*.

- 'undefined'
- 'coalesce'
- 'compareany' - Only used for *compare_layers()*.
- 'compareclear' - Only used for *compare_layers()*.
- 'compareoverlay' - Only used for *compare_layers()*.
- 'dispose'
- 'optimize'
- 'optimizeimage'
- 'optimizeplus'
- 'optimizetrans'
- 'removedups'
- 'removezero'
- 'composite'
- 'merge' - Only used for *merge_layers()*.
- 'flatten' - Only used for *merge_layers()*.
- 'mosaic' - Only used for *merge_layers()*.
- 'trimbounds' - Only used for *merge_layers()*.

New in version 0.4.3.

wand.image.**IMAGE_TYPES = ('undefined', 'bilevel', 'grayscale', 'grayscalematte', 'palette',**
(tuple) The list of image types

- 'undefined'
- 'bilevel'
- 'grayscale'
- 'grayscalealpha' - Only available with ImageMagick-7
- 'grayscalematte' - Only available with ImageMagick-6
- 'palette'
- 'palettealpha' - Only available with ImageMagick-7
- 'palettematte' - Only available with ImageMagick-6

- 'truecolor'
- 'truecoloralpha' - Only available with ImageMagick-7
- 'truecolormatte' - Only available with ImageMagick-6
- 'colorseparation'
- 'colorseparationalpha' - Only available with ImageMagick-7
- 'colorseparationmatte' - Only available with ImageMagick-6
- 'optimize'
- 'palettebilevelalpha' - Only available with ImageMagick-7
- 'palettebilevelmatte' - Only available with ImageMagick-6

See also:

ImageMagick Image Types Describes the MagickSetImageType method which can be used to set the type of an image

wand.image.**INTERLACE_TYPES = ('undefined', 'no', 'line', 'plane', 'partition', 'gif', 'jpeg**
(tuple) The list of interlace schemes.

- 'undefined'
- 'no'
- 'line'
- 'plane'
- 'partition'
- 'gif'
- 'jpeg'
- 'png'

New in version 0.5.2.

wand.image.**KERNEL_INFO_TYPES = ('undefined', 'unity', 'gaussian', 'dog', 'log', 'blur', 'co**
(tuple) The list of builtin kernels.

- 'undefined'
- 'unity'
- 'gaussian'
- 'dog'
- 'log'
- 'blur'
- 'comet'
- 'laplacian'
- 'sobel'
- 'frei_chen'
- 'roberts'

- 'prewitt'
- 'compass'
- 'kirsch'
- 'diamond'
- 'square'
- 'rectangle'
- 'octagon'
- 'disk'
- 'plus'
- 'cross'
- 'ring'
- 'peaks'
- 'edges'
- 'corners'
- 'diagonals'
- 'line_ends'
- 'line_junctions'
- 'ridges'
- 'convex_hull'
- 'thin_se'
- 'skeleton'
- 'chebyshev'
- 'manhattan'
- 'octagonal'
- 'euclidean'
- 'user_defined'
- 'binomial'

wand.image.**MORPHOLOGY_METHODS = ('undefined', 'convolve', 'correlate', 'erode', 'dilate',**
(tuple) The list of morphology methods.

- 'undefined'
- 'convolve'
- 'correlate'
- 'erode'
- 'dilate'
- 'erode_intensity'
- 'dilate_intensity'

- 'distance'
- 'open'
- 'close'
- 'open_intensity'
- 'close_intensity'
- 'smooth'
- 'edgein'
- 'edgeout'
- 'edge'
- 'tophat'
- 'bottom_hat'
- 'hit_and_miss'
- 'thinning'
- 'thicken'
- 'voronoi'
- 'iterative_distance'

wand.image.**NOISE_TYPES = ('undefined', 'uniform', 'gaussian', 'multiplicative_gaussian', '**
(tuple) The list of noise types used by *Image.noise()* method.

- 'undefined'
- 'uniform'
- 'gaussian'
- 'multiplicative_gaussian'
- 'impulse'
- 'laplacian'
- 'poisson'
- 'random'

New in version 0.5.3.

wand.image.**ORIENTATION_TYPES = ('undefined', 'top_left', 'top_right', 'bottom_right', 'bott**
(tuple) The list of *orientation* types.

New in version 0.3.0.

wand.image.**PIXEL_INTERPOLATE_METHODS = ('undefined', 'average', 'average9', 'average16', '**
(tuple) List of interpolate pixel methods (ImageMagick-7 only.)

- 'undefined'
- 'average'
- 'average9'
- 'average16'
- 'background'

- 'bilinear'
- 'blend'
- 'catrom'
- 'integer'
- 'mesh'
- 'nearest'
- 'spline'

New in version 0.5.0.

wand.image.**SPARSE_COLOR_METHODS = {'barycentric': 1, 'bilinear': 7, 'inverse': 19, 'manh**
(tuple) List of sparse color methods used by *Image.sparse_color()*

- 'undefined'
- 'barycentric'
- 'bilinear'
- 'shepards'
- 'voronoi'
- 'inverse'
- 'manhattan'

New in version 0.5.3.

wand.image.**STATISTIC_TYPES = ('undefined', 'gradient', 'maximum', 'mean', 'median', 'minimu**
(tuple) The list of statistic types used by *Image.statistic()*.

- 'undefined'
- 'gradient'
- 'maximum'
- 'mean'
- 'median'
- 'minimum'
- 'mode'
- 'nonpeak'
- 'root_mean_square'
- 'standard_deviation'

New in version 0.5.3.

wand.image.**STORAGE_TYPES = ('undefined', 'char', 'double', 'float', 'integer', 'long', 'qua**
(tuple) The list of pixel storage types.

- 'undefined'
- 'char'
- 'double'
- 'float'

- 'integer'
- 'long'
- 'quantum'
- 'short'

New in version 0.5.0.

wand.image.**VIRTUAL_PIXEL_METHOD = ('undefined', 'background', 'constant', 'dither', 'edge',**
(tuple) The list of *virtual_pixel* types.

- 'undefined'
- 'background'
- 'constant' - Only available with ImageMagick-6
- 'dither'
- 'edge'
- 'mirror'
- 'random'
- 'tile'
- 'transparent'
- 'mask'
- 'black'
- 'gray'
- 'white'
- 'horizontal_tile'
- 'vertical_tile'
- 'horizontal_tile_edge'
- 'vertical_tile_edge'
- 'checker_tile'

New in version 0.4.1.

wand.image.**UNIT_TYPES = ('undefined', 'pixelsperinch', 'pixelspercentimeter')**
(tuple) The list of resolution unit types.

- 'undefined'
- 'pixelsperinch'
- 'pixelspercentimeter'

See also:

ImageMagick Image Units Describes the MagickSetImageUnits method which can be used to set image units of resolution

class wand.image.**BaseImage**(*wand*)
The abstract base of *Image* (container) and *SingleImage*. That means the most of operations, defined in this abstract class, are possible for both *Image* and *SingleImage*.

New in version 0.3.0.

adaptive_blur(**args*, ***kwargs*)
Adaptively blurs the image by decreasing Gaussian as the operator approaches detected edges.

Parameters

- **radius** (numbers.Real) – size of gaussian aperture.
- **sigma** (numbers.Real) – Standard deviation of the gaussian filter.

New in version 0.5.3.

adaptive_resize(**args*, ***kwargs*)
Adaptively resize image by applying Mesh interpolation.

Parameters

- **columns** (numbers.Integral) – width of resized image.
- **rows** (numbers.Integral) – hight of resized image.

New in version 0.5.3.

adaptive_sharpen(**args*, ***kwargs*)
Adaptively sharpens the image by sharpening more intensely near image edges and less intensely far from edges.

Parameters

- **radius** (numbers.Real) – size of gaussian aperture.
- **sigma** (numbers.Real) – Standard deviation of the gaussian filter.

New in version 0.5.3.

adaptive_threshold(**args*, ***kwargs*)
Applies threshold for each pixel based on neighboring pixel values.

Parameters

- **width** (numbers.Integral) – size of neighboring pixels on the X-axis.
- **height** (numbers.Integral) – size of neighboring pixels on the Y-axis.
- **offset** (numbers.Real) – normalized number between *0.0* and *quantum_range*. Forces the pixels to black if values are below `offset`.

New in version 0.5.3.

alpha_channel
(bool) Get state of image alpha channel. It can also be used to enable/disable alpha channel, but with different behavior new, copied, or existing.

Behavior of setting *alpha_channel* is defined with the following values:

- **'activate', 'on', or True will enable an images** alpha channel. Existing alpha data is preserved.
- **'deactivate', 'off', or False will disable an images** alpha channel. Any data on the alpha will be preserved.
- **'associate' & 'disassociate' toggle alpha channel flag in** certain image-file specifications.
- 'set' enables and resets any data in an images alpha channel.
- **'opaque' enables alpha/matte channel, and forces full opaque** image.

- **'transparent' enables alpha/matte channel, and forces full** transparent image.
- **'extract' copies data in alpha channel across all other channels,** and disables alpha channel.
- **'copy' calculates the gray-scale of RGB channels,** and applies it to alpha channel.
- **'shape' is identical to 'copy', but will color the resulting** image with the value defined with *background_color*.
- 'remove' will composite *background_color* value.
- **'background' replaces full-transparent color with background** color.

New in version 0.2.1.

Changed in version 0.4.1: Support for additional setting values. However Image.alpha_channel will continue to return bool if the current alpha/matte state is enabled.

animation
(bool) Whether the image is animation or not. It doesn't only mean that the image has two or more images (frames), but all frames are even the same size. It's about image format, not content. It's False even if *image/ico* consits of two or more images of the same size.

For example, it's False for *image/jpeg*, *image/gif*, *image/ico*.

If *image/gif* has two or more frames, it's True. If *image/gif* has only one frame, it's False.

New in version 0.3.0.

Changed in version 0.3.8: Became to accept *image/x-gif* as well.

antialias
(bool) If vectors & fonts will use anti-aliasing.

Changed in version 0.5.0: Previosuly named *font_antialias*.

auto_orient(**args*, ***kwargs*)
Adjusts an image so that its orientation is suitable for viewing (i.e. top-left orientation). If available it uses MagickAutoOrientImage() (was added in ImageMagick 6.8.9+) if you have an older magick library, it will use _auto_orient() method for fallback.

New in version 0.4.1.

background_color
(*wand.color.Color*) The image background color. It can also be set to change the background color.

New in version 0.1.9.

black_threshold(**args*, ***kwargs*)
Forces all pixels above a given color as black. Leaves pixels above threshold unaltered.

Parameters **threshold** (Color) – Color to be referenced as a threshold.

New in version 0.5.3.

blue_primary
(tuple) The chromatic blue primary point for the image. With ImageMagick-6 the primary value is (x, y) coordinates; however, ImageMagick-7 has (x, y, z).

New in version 0.5.2.

blue_shift(**args*, ***kwargs*)
Mutes colors of the image by shifting blue values.

Parameters **factor** (numbers.Real) – Amount to adjust values.

New in version 0.5.3.

blur(**args*, ***kwargs*)
Blurs the image. We convolve the image with a gaussian operator of the given `radius` and standard deviation (`sigma`). For reasonable results, the `radius` should be larger than `sigma`. Use a `radius` of 0 and *`blur()`* selects a suitable `radius` for you.

Parameters

- **radius** (`numbers.Real`) – the radius of the, in pixels, not counting the center pixel
- **sigma** (`numbers.Real`) – the standard deviation of the, in pixels

New in version 0.4.5.

border(*color*, *width*, *height*, *compose='copy'*)
Surrounds the image with a border.

Parameters

- **bordercolor** – the border color pixel wand
- **width** (`numbers.Integral`) – the border width
- **height** (`numbers.Integral`) – the border height
- **compose** (`basestring`) – Use composite operator when applying frame. Only used if called with ImageMagick 7+.

New in version 0.3.0.

Changed in version 0.5.0: Added `compose` paramater, and ImageMagick 7 support.

caption(**args*, ***kwargs*)
Writes a caption `text` into the position.

Parameters

- **text** (`basestring`) – text to write
- **left** (`numbers.Integral`) – x offset in pixels
- **top** (`numbers.Integral`) – y offset in pixels
- **width** (`numbers.Integral`) – width of caption in pixels. default is *`width`* of the image
- **height** (`numbers.Integral`) – height of caption in pixels. default is *`height`* of the image
- **font** (*`wand.font.Font`*) – font to use. default is *`font`* of the image
- **gravity** (`basestring`) – text placement gravity. uses the current *`gravity`* setting of the image by default

New in version 0.3.0.

charcoal(*radius*, *sigma*)
Transform an image into a simulated charcoal drawing.

Parameters

- **radius** (`numbers.Real`) – The size of the Gaussian operator.
- **sigma** (`numbers.Real`) – The standard deviation of the Gaussian.

New in version 0.5.3.

clamp()
Restrict color values between 0 and quantum range. This is useful when applying arithmetic operations that could result in color values over/underflowing.

New in version 0.5.0.

clone()
Clones the image. It is equivalent to call *Image* with `image` parameter.

```
with img.clone() as cloned:
    # manipulate the cloned image
    pass
```

Returns the cloned new image

Return type *Image*

New in version 0.1.1.

clut(**args*, ***kwargs*)
Replace color values by referencing another image as a Color Look Up Table.

Parameters

- **image** (*wand.image.BaseImage*) – Color Look Up Table image.
- **method** (`basestring`) – Pixel Interpolate method. Only available with ImageMagick-7. See *PIXEL_INTERPOLATE_METHODS*

New in version 0.5.0.

coalesce(**args*, ***kwargs*)
Rebuilds image sequence with each frame size the same as first frame, and composites each frame atop of previous.

Note: Only affects GIF, and other formats with multiple pages/layers.

New in version 0.5.0.

color_map(*index*, *color=None*)
Get & Set a color at a palette index. If `color` is given, the color at the index location will be set & returned. Omitting the `color` argument will only return the color value at index.

Valid indexes are between `0` and total *colors* of the image.

Note: Ensure the image type is set to `'palette'` before calling the *color_map()* method. For example:

```
with Image(filename='graph.png') as img:
    img.type = 'palette'
    palette = [img.color_map(idx) for idx in range(img.colors)]
    # ...
```

Parameters

- **index** (`numbers.Integral`) – The color postion of the image palette.
- **color** (*wand.color.Color*) – Optional color to _set_ at the given index.

Returns Color at index.

Return type *wand.color.Color*

New in version 0.5.3.

color_matrix(**args*, ***kwargs*)
Adjust color values by applying a matrix transform per pixel.

Matrix should be given as 2D list, with a max size of 6x6:

```
matrix = [
    [1.0, 0.0, 0.0],
    [0.0, 1.0, 0.0],
    [0.0, 0.0, 1.0],
]
```

See color-matrix for examples.

Parameters **matrix** (collections.abc.Sequence) – 2D List of doubles.

New in version 0.5.3.

colorize(**args*, ***kwargs*)
Blends a given fill color over the image. The amount of blend is determined by the color channels given by the `alpha` argument.

Parameters

- **color** (*wand.color.Color*) – Color to paint image with.
- **alpha** (*wand.color.Color*) – Defines how to blend color.

New in version 0.5.3.

colors
(numbers.Integral) Count of unique colors used within the image. This is READ ONLY property.

New in version 0.5.3.

colorspace
(basestring) The image colorspace.

Defines image colorspace as in *COLORSPACE_TYPES* enumeration.

It may raise ValueError when the colorspace is unknown.

New in version 0.3.4.

compare(**args*, ***kwargs*)
Compares an image to a reconstructed image.

Set *fuzz* property to adjust pixel-compare thresholds.

For example:

```
from wand.image import Image

with Image(filename='input.jpg') as base:
    with Image(filename='subject.jpg') as img:
        base.fuzz = base.quantum_range * 0.20  # Threshold of 20%
        result_image, result_metric = base.compare(img)
        with result_image:
            result_image.save(filename='diff.jpg')
```

Parameters

- **image** (*wand.image.Image*) – The reference image
- **metric** (basestring) – The metric type to use for comparing.
- **highlight** (*Color* or basestring) – Set the color of the delta pixels in the resulting difference image.
- **lowlight** (*Color* or basestring) – Set the color of the similar pixels in the resulting difference image.

Returns The difference image(*wand.image.Image*), the computed distortion between the images (numbers.Integral)

Return type tuple

New in version 0.4.3.

Changed in version 0.5.3: Added support for highlight & lowlight.

compose
(basestring) The type of image compose. It's a string from *COMPOSITE_OPERATORS* list. It also can be set.

New in version 0.5.1.

composite(*image*, *left=None*, *top=None*, *operator='over'*, *arguments=None*, *gravity=None*)
Places the supplied image over the current image, with the top left corner of image at coordinates left, top of the current image. The dimensions of the current image are not changed.

Parameters

- **image** (*wand.image.Image*) – the image placed over the current image
- **left** (numbers.Integral) – the x-coordinate where *image* will be placed
- **top** (numbers.Integral) – the y-coordinate where *image* will be placed
- **operator** (basestring) – the operator that affects how the composite is applied to the image. available values can be found in the *COMPOSITE_OPERATORS* list. Default is 'over'.
- **arguments** (basestring) – Additional numbers given as a geometry string, or comma delimited values. This is needed for 'blend', 'displace', 'dissolve', and 'modulate' operators.
- **gravity** – Calculate the top & left values based on gravity value from *GRAVITY_TYPES*.

Type gravity: basestring

New in version 0.2.0.

Changed in version 0.5.3: The operator can be set, as well as additional composite arguments.

Changed in version 0.5.3: Optional gravity argument was added.

composite_channel(**args*, ***kwargs*)
Composite two images using the particular channel.

Parameters

- **channel** – the channel type. available values can be found in the *CHANNELS* mapping

- **image** (*Image*) – the composited source image. (the receiver image becomes the destination)
- **operator** (basestring) – the operator that affects how the composite is applied to the image. available values can be found in the *COMPOSITE_OPERATORS* list
- **left** (numbers.Integral) – the column offset of the composited source image
- **top** (numbers.Integral) – the row offset of the composited source image
- **arguments** (basestring) – Additional numbers given as a geometry string, or comma delimited values. This is needed for 'blend', 'displace', 'dissolve', and 'modulate' operators.
- **gravity** – Calculate the top & left values based on gravity value from *GRAVITY_TYPES*.

Type gravity: basestring

Raises **ValueError** – when the given channel or operator is invalid

New in version 0.3.0.

Changed in version 0.5.3: Support for optional composite arguments has been added.

Changed in version 0.5.3: Optional gravity argument was added.

compression

(basestring) The type of image compression. It's a string from *COMPRESSION_TYPES* list. It also can be set.

New in version 0.3.6.

Changed in version 0.5.2: Setting *compression* now sets both *image_info* and *images* in the internal image stack.

compression_quality

(numbers.Integral) Compression quality of this image.

New in version 0.2.0.

Changed in version 0.5.2: Setting *compression_quality* now sets both *image_info* and *images* in the internal image stack.

concat (**args*, ***kwargs*)

Concatenates images in stack into a single image. Left-to-right by default, top-to-bottom if stacked is True.

Parameters **stacked** (bool) – stack images in a column, or in a row (default)

New in version 0.5.0.

contrast_stretch (**args*, ***kwargs*)

Enhance contrast of image by adjusting the span of the available colors.

If only black_point is given, match the CLI behavior by assuming the white_point has the same delta percentage off the top e.g. contrast stretch of 15% is calculated as black_point = 0.15 and white_point = 0.85.

Parameters

- **black_point** (numbers.Real) – black point between 0.0 and 1.0. default is 0.0
- **white_point** (numbers.Real) – white point between 0.0 and 1.0. default value of 1.0 minus black_point

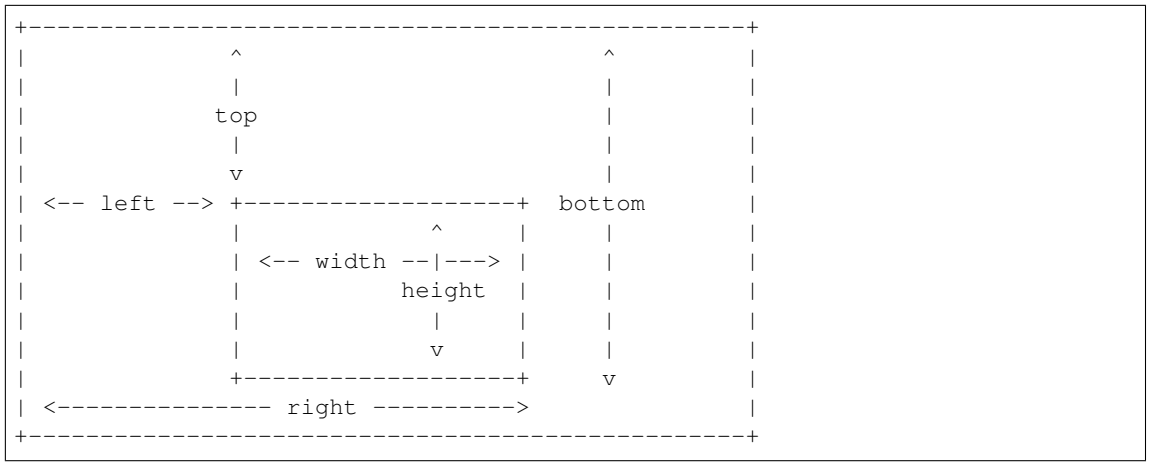
- **channel** (*CHANNELS*) – optional color channel to apply contrast stretch

Raises **ValueError** – if `channel` is not in *CHANNELS*

New in version 0.4.1.

crop(**args*, ***kwargs*)

Crops the image in-place.



Parameters

- **left** (`numbers.Integral`) – x-offset of the cropped image. default is 0
- **top** (`numbers.Integral`) – y-offset of the cropped image. default is 0
- **right** (`numbers.Integral`) – second x-offset of the cropped image. default is the *width* of the image. this parameter and `width` parameter are exclusive each other
- **bottom** (`numbers.Integral`) – second y-offset of the cropped image. default is the *height* of the image. this parameter and `height` parameter are exclusive each other
- **width** (`numbers.Integral`) – the *width* of the cropped image. default is the *width* of the image. this parameter and `right` parameter are exclusive each other
- **height** (`numbers.Integral`) – the *height* of the cropped image. default is the *height* of the image. this parameter and `bottom` parameter are exclusive each other
- **reset_coords** (`bool`) – optional flag. If set, after the rotation, the coordinate frame will be relocated to the upper-left corner of the new image. By default is *True*.
- **gravity** (*GRAVITY_TYPES*) – optional flag. If set, will calculate the `top` and `left` attributes. This requires both *width* and *height* parameters to be included.

Raises **ValueError** – when one or more arguments are invalid

---

Note: If you want to crop the image but not in-place, use slicing operator.

Changed in version 0.4.1: Added `gravity` option. Using `gravity` along with `width` & `height` to auto-adjust `left` & `top` attributes.

Changed in version 0.1.8: Made to raise `ValueError` instead of `IndexError` for invalid `width`/`height` arguments.

New in version 0.1.7.

cycle_color_map(*offset=1*)
Shift the image color-map by a given offset.

Parameters **offset** (numbers.Integral) – number of steps to rotate index by.

New in version 0.5.3.

deconstruct(**args*, ***kwargs*)
Iterates over internal image stack, and adjust each frame size to minimum bounding region of any changes from the previous frame.

New in version 0.5.0.

depth
(numbers.Integral) The depth of this image.

New in version 0.2.1.

deskew(**args*, ***kwargs*)
Attempts to remove skew artifacts common with most scanning & optical import devices.

Params threshold limit between foreground & background.

New in version 0.5.0.

despeckle(**args*, ***kwargs*)
Applies filter to reduce noise in image.

New in version 0.5.0.

dirty = None
(bool) Whether the image is changed or not.

dispose
(basestring) Controls how the image data is handled during animations. Values are from *DISPOSE_TYPES* list, and can also be set.

See also:

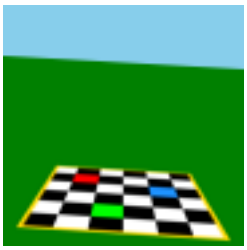
Dispose Images section in Animation Basics article.

New in version 0.5.0.

distort(**args*, ***kwargs*)
Distorts an image using various distorting methods.

```
from wand.image import Image
from wand.color import Color

with Image(filename='checks.png') as img:
    img.virtual_pixel = 'background'
    img.background_color = Color('green')
    img.matte_color = Color('skyblue')
    arguments = (0, 0, 20, 60,
                 90, 0, 70, 63,
                 0, 90, 5, 83,
                 90, 90, 85, 88)
    img.distort('perspective', arguments)
    img.save(filename='checks_perspective.png')
```



Use *virtual_pixel*, *background_color*, and *matte_color* properties to control the behavior of pixels rendered outside of the image boundaries.

Use *interpolate_method* to control how images scale-up.

Distortion viewport, and scale, can be defined by using *Image.artifacts* dictionary. For example:

```
img.artifacts['distort:viewport'] = '44x44+15+0'
img.artifacts['distort:scale'] = '10'
```

Parameters

- **method** (basestring) – Distortion method name from *DISTORTION_METHODS*
- **arguments** (collections.abc.Sequence) – List of distorting float arguments unique to distortion method
- **best_fit** (bool) – Attempt to resize resulting image fit distortion. Defaults False

New in version 0.4.1.

edge (**args*, ***kwargs*)
Applies convolution filter to detect edges.

Parameters **radius** (numbers.Real) – aperture of detection filter.

New in version 0.5.0.

emboss (**args*, ***kwargs*)
Applies convolution filter against gaussians filter.

Note: The *radius* value should be larger than *sigma* for best results.

Parameters

- **radius** (numbers.Real) – filter aperture size.
- **sigma** (numbers.Real) – standard deviation.

New in version 0.5.0.

enhance (**args*, ***kwargs*)
Applies digital filter to reduce noise.

New in version 0.5.0.

equalize (**args*, ***kwargs*)
Equalizes the image histogram

New in version 0.3.10.

evaluate (**args*, ***kwargs*)
Apply arithmetic, relational, or logical expression to an image.

Percent values must be calculated against the quantum range of the image:

```
fifty_percent = img.quantum_range * 0.5
img.evaluate(operator='set', value=fifty_percent)
```

Parameters

- **operator** (*EVALUATE_OPS*) – Type of operation to calculate
- **value** (`numbers.Real`) – Number to calculate with `operator`
- **channel** (*CHANNELS*) – Optional channel to apply operation on.

Raises

- ***TypeError*** – When `value` is not numeric.
- **ValueError** – When `operator`, or `channel` are not defined in constants.

New in version 0.4.1.

export_pixels (*x=0*, *y=0*, *width=None*, *height=None*, *channel_map='RGBA'*, *storage='char'*)
Export pixel data from a raster image to a list of values.

The `channel_map` tells ImageMagick which color channels to export, and what order they should be written as – per pixel. Valid entries for `channel_map` are:

- `'R'` - Red channel
- `'G'` - Green channel
- `'B'` - Blue channel
- `'A'` - Alpha channel (`0` is transparent)
- `'O'` - Alpha channel (`0` is opaque)
- `'C'` - Cyan channel
- `'Y'` - Yellow channel
- `'M'` - Magenta channel
- `'K'` - Black channel
- `'I'` - Intensity channel (only for grayscale)
- `'P'` - Padding

See *STORAGE_TYPES* for a list of valid `storage` options. This tells ImageMagick what type of data it should calculate & write to. For example; a storage type of `'char'` will write a 8-bit value between 0 ~ 255, a storage type of `'short'` will write a 16-bit value between 0 ~ 65535, and a `'integer'` will write a 32-bit value between 0 ~ 4294967295.

Note: By default, the entire image will be exported as `'char'` storage with each pixel mapping Red, Green, Blue, & Alpha channels.

Parameters

- **x** (numbers.Integral) – horizontal starting coordinate of raster.
- **y** (numbers.Integral) – vertical starting coordinate of raster.
- **width** (numbers.Integral) – horizontal length of raster.
- **height** (numbers.Integral) – vertical length of raster.
- **channel_map** (basestring) – a string listing the channel data format for each pixel.
- **storage** (basestring) – what data type each value should be calculated as.

Returns list of values.

Return type collections.abc.Sequence

New in version 0.5.0.

extent(**args*, ***kwargs*)
extends the image as defined by the geometry, gravity, and wand background color. Set the (x,y) offset of the geometry to move the original wand relative to the extended wand.

Parameters

- **width** (numbers.Integral) – the *width* of the extended image. default is the *width* of the image.
- **height** (numbers.Integral) – the *height* of the extended image. default is the *height* of the image.
- **x** (numbers.Integral) – the x offset of the extended image. default is 0
- **y** (numbers.Integral) – the y offset of the extended image. default is 0

New in version 0.4.5.

flip(**args*, ***kwargs*)
Creates a vertical mirror image by reflecting the pixels around the central x-axis. It manipulates the image in place.

New in version 0.3.0.

flop(**args*, ***kwargs*)
Creates a horizontal mirror image by reflecting the pixels around the central y-axis. It manipulates the image in place.

New in version 0.3.0.

font
(*wand.font.Font*) The current font options.

font_antialias
Deprecated since version 0.5.0: Use *antialias* instead.

font_path
(basestring) The path of the current font. It also can be set.

font_size
(numbers.Real) The font size. It also can be set.

format
(basestring) The image format.

If you want to convert the image format, just reset this property:

```
assert isinstance(img, wand.image.Image)
img.format = 'png'
```

It may raise ValueError when the format is unsupported.

See also:

ImageMagick Image Formats ImageMagick uses an ASCII string known as *magick* (e.g. GIF) to identify file formats, algorithms acting as formats, built-in patterns, and embedded profile types.

New in version 0.1.6.

frame(**args*, ***kwargs*)
Creates a bordered frame around image. Inner & outer bevel can simulate a 3D effect.

Parameters

- **matte** (*wand.color.Color*) – color of the frame
- **width** (numbers.Integral) – total size of frame on x-axis
- **height** (numbers.Integral) – total size of frame on y-axis
- **inner_bevel** (numbers.Real) – inset shadow length
- **outer_bevel** (numbers.Real) – outset highlight length

New in version 0.4.1.

function(**args*, ***kwargs*)
Apply an arithmetic, relational, or logical expression to an image.

Defaults entire image, but can isolate affects to single color channel by passing *CHANNELS* value to channel parameter.

Note: Support for function methods added in the following versions of ImageMagick.

- 'polynomial' >= 6.4.8-8
- 'sinusoid' >= 6.4.8-8
- 'arcsin' >= 6.5.3-1
- 'arctan' >= 6.5.3-1

Parameters

- **function** (basestring) – a string listed in *FUNCTION_TYPES*
- **arguments** (collections.abc.Sequence) – a sequence of doubles to apply against function
- **channel** (basestring) – optional *CHANNELS*, defaults all

Raises

- **ValueError** – when a `function`, or `channel` is not defined in there respected constant
- ***TypeError*** – if `arguments` is not a sequence

New in version 0.4.1.

fuzz
(`numbers.Real`) The normalized real number between `0.0` and *`quantum_range`*. This property influences the accuracy of *`compare()`*.

fx(**args*, ***kwargs*)
Manipulate each pixel of an image by given expression.

FX will preserver current wand instance, and return a new instance of *`Image`* containing affected pixels.

Defaults entire image, but can isolate affects to single color channel by passing *`CHANNELS`* value to `channel` parameter.

See also:

The anatomy of FX expressions can be found at http://www.imagemagick.org/script/fx.php

Parameters

- **expression** (`basestring`) – The entire FX expression to apply
- **channel** (*`CHANNELS`*) – Optional channel to target.

Returns A new instance of an image with expression applied

Return type *`Image`*

New in version 0.4.1.

gamma(**args*, ***kwargs*)
Gamma correct image.

Specific color channels can be correct individual. Typical values range between 0.8 and 2.3.

Parameters

- **adjustment_value** (`numbers.Real`) – value to adjust gamma level
- **channel** (`basestring`) – optional channel to apply gamma correction

Raises

- ***TypeError*** – if `gamma_point` is not a `numbers.Real`
- **ValueError** – if `channel` is not in *`CHANNELS`*

New in version 0.4.1.

gaussian_blur(**args*, ***kwargs*)
Blurs the image. We convolve the image with a gaussian operator of the given `radius` and standard deviation (`sigma`). For reasonable results, the `radius` should be larger than `sigma`. Use a `radius` of 0 and *`blur()`* selects a suitable `radius` for you.

Parameters

- **radius** (`numbers.Real`) – the radius of the, in pixels, not counting the center pixel
- **sigma** (`numbers.Real`) – the standard deviation of the, in pixels

New in version 0.3.3.

gravity
(basestring) The text placement gravity used when annotating with text. It's a string from *GRAVITY_TYPES* list. It also can be set.

green_primary
(tuple) The chromatic green primary point for the image. With ImageMagick-6 the primary value is `(x, y)` coordinates; however, ImageMagick-7 has `(x, y, z)`.

New in version 0.5.2.

hald_clut(**args*, ***kwargs*)
Replace color values by referencing a Higher And Lower Dimension (HALD) Color Look Up Table (CLUT). You can generate a HALD image by using ImageMagick's *hald:* protocol.

```
with Image(filename='rose:') as img:
    with Image(filename='hald:3') as hald:
        hald.gamma(1.367)
        img.hald_clut(hald)
```

Parameters **image** (*wand.image.BaseImage*) – The HALD color matrix.

New in version 0.5.0.

height
(numbers.Integral) The height of this image.

histogram
(*HistogramDict*) The mapping that represents the histogram. Keys are *Color* objects, and values are the number of pixels.

Tip: True-color photos can have millions of color values. If performance is more valuable than accuracy, remember to *quantize()* the image before generating a *HistogramDict*.

with Image(filename='hd_photo.jpg') as img: img.quantize(255, 'RGB', 0, False, False) hist = img.histogram

---

New in version 0.3.0.

implode(*amount=0.0*, *method='undefined'*)
Creates a "imploding" effect by pulling pixels towards the center of the image.

Parameters

- **amount** (numbers.Real) – Normalized degree of effect between *0.0* & *1.0*.
- **method** (basestring) – Which interpolate method to apply to effected pixels. See *PIXEL_INTERPOLATE_METHODS* for a list of options. Only available with ImageMagick-7.

New in version 0.5.2.

import_pixels(*x=0*, *y=0*, *width=None*, *height=None*, *channel_map='RGB'*, *storage='char'*, *data=None*)
Import pixel data from a byte-string to the image. The instance of *Image* must already be allocated with the correct size.

The channel_map tells ImageMagick which color channels to export, and what order they should be written as – per pixel. Valid entries for channel_map are:

- 'R' - Red channel

- `'G'` - Green channel
- `'B'` - Blue channel
- `'A'` - Alpha channel (`0` is transparent)
- `'O'` - Alpha channel (`0` is opaque)
- `'C'` - Cyan channel
- `'Y'` - Yellow channel
- `'M'` - Magenta channel
- `'K'` - Black channel
- `'I'` - Intensity channel (only for grayscale)
- `'P'` - Padding

See *STORAGE_TYPES* for a list of valid `storage` options. This tells ImageMagick what type of data it should calculate & write to. For example; a storage type of `'char'` will write a 8-bit value between 0 ~ 255, a storage type of `'short'` will write a 16-bit value between 0 ~ 65535, and a `'integer'` will write a 32-bit value between 0 ~ 4294967295.

Note: By default, the entire image will be exported as `'char'` storage with each pixel mapping Red, Green, Blue, & Alpha channels.

Parameters

- **x** (`numbers.Integral`) – horizontal starting coordinate of raster.
- **y** (`numbers.Integral`) – vertical starting coordinate of raster.
- **width** (`numbers.Integral`) – horizontal length of raster.
- **height** (`numbers.Integral`) – vertical length of raster.
- **channel_map** (`basestring`) – a string listing the channel data format for each pixel.
- **storage** (`basestring`) – what data type each value should be calculated as.

New in version 0.5.0.

interlace_scheme
(`basestring`) The interlace used by the image. See *INTERLACE_TYPES*.

New in version 0.5.2.

interpolate_method
(`basestring`) The interpolation method of the image. See *PIXEL_INTERPOLATE_METHODS*.

New in version 0.5.2.

kurtosis
(`numbers.Real`) The kurtosis of the image.

Tip: If you want both *kurtosis* & *skewness*, it would be faster to call *kurtosis_channel()* directly.

New in version 0.5.3.

kurtosis_channel(*channel='default_channels'*)
Calculates the kurtosis and skewness of the image.

```
from wand.image import Image

with Image(filename='input.jpg') as img:
    kurtosis, skewness = img.kurtosis_channel()
```

Parameters **channel** (basestring) – Select which color channel to evaluate. See *CHANNELS*. Default 'default_channels'.

Returns Tuple of *kurtosis* & *skewness* values.

Return type tuple

New in version 0.5.3.

level(*black=0.0*, *white=None*, *gamma=1.0*, *channel=None*)
Adjusts the levels of an image by scaling the colors falling between specified black and white points to the full available quantum range.

If only black is given, white will be adjusted inward.

Parameters

- **black** (numbers.Real) – Black point, as a percentage of the system's quantum range. Defaults to 0.
- **white** (numbers.Real) – White point, as a percentage of the system's quantum range. Defaults to 1.0.
- **gamma** (numbers.Real) – Optional gamma adjustment. Values > 1.0 lighten the image's midtones while values < 1.0 darken them.
- **channel** (*CHANNELS*) – The channel type. Available values can be found in the *CHANNELS* mapping. If None, normalize all channels.

Note: Images may not be affected if the white value is equal, or less then, the black value.

New in version 0.4.1.

linear_stretch(**args*, ***kwargs*)
Enhance saturation intensity of an image.

Parameters

- **black_point** (numbers.Real) – Black point between 0.0 and 1.0. Default 0.0
- **white_point** (numbers.Real) – White point between 0.0 and 1.0. Default 1.0

New in version 0.4.1.

liquid_rescale(**args*, ***kwargs*)
Rescales the image with seam carving, also known as image retargeting, content-aware resizing, or liquid rescaling.

Parameters

- **width** (numbers.Integral) – the width in the scaled image
- **height** (numbers.Integral) – the height in the scaled image

- **delta_x** (numbers.Real) – maximum seam transversal step. 0 means straight seams. default is 0
- **rigidity** (numbers.Real) – introduce a bias for non-straight seams. default is 0

Raises *wand.exceptions.MissingDelegateError* – when ImageMagick isn't configured `--with-lqr` option.

Note: This feature requires ImageMagick to be configured `--with-lqr` option. Or it will raise *MissingDelegateError*:

See also:

Seam carving — Wikipedia The article which explains what seam carving is on Wikipedia.

loop
(numbers.Integral) Number of frame iterations. A value of 0 will loop forever.

matte_color
(*wand.color.Color*) The color value of the matte channel. This can also be set.

New in version 0.4.1.

maxima
(numbers.Real) The maximum quantum value within the image.

Tip: If you want both *maxima* & *minima*, it would be faster to call *range_channel()* directly.

New in version 0.5.3.

mean
(numbers.Real) The mean of the image.

Tip: If you want both *mean* & *standard_deviation*, it would be faster to call *mean_channel()* directly.

New in version 0.5.3.

mean_channel(*channel='default_channels'*)
Calculates the mean and standard deviation of the image.

```
from wand.image import Image

with Image(filename='input.jpg') as img:
    mean, stddev = img.mean_channel()
```

Parameters **channel** (basestring) – Select which color channel to evaluate. See *CHANNELS*. Default `'default_channels'`.

Returns Tuple of *mean* & *standard_deviation* values.

Return type tuple

New in version 0.5.3.

merge_layers(**args*, ***kwargs*)
Composes all the image layers from the current given image onward to produce a single image of the merged layers.

The initial canvas's size depends on the given ImageLayerMethod, and is initialized using the first images background color. The images are then composited onto that image in sequence using the given composition that has been assigned to each individual image. The method must be set with a value from *IMAGE_LAYER_METHOD* that is acceptable to this operation. (See ImageMagick documentation for more details.)

Parameters **method** (basestring) – the method of selecting the size of the initial canvas.

New in version 0.4.3.

minima
(numbers.Real) The minimum quantum value within the image.

Tip: If you want both *maxima* & *minima*, it would be faster to call *range_channel()* directly.

New in version 0.5.3.

modulate(**args*, ***kwargs*)
Changes the brightness, saturation and hue of an image. We modulate the image with the given brightness, saturation and hue.

Parameters

- **brightness** (numbers.Real) – percentage of brightness
- **saturation** (numbers.Real) – percentage of saturation
- **hue** (numbers.Real) – percentage of hue rotation

Raises **ValueError** – when one or more arguments are invalid

New in version 0.3.4.

morphology(**args*, ***kwargs*)
Manipulate pixels based on the shape of neighboring pixels.

The method determines what type of effect to apply to matching kernel shapes. Common methods can be add/remove, or lighten/darken pixel values.

The kernel describes the shape of the matching neighbors. Common shapes are provided as "built-in" kernels. See :const'KERNEL_INFO_TYPES' for examples. The format for built-in kernels is:

```
label:geometry
```

Where *label* is the kernel name defined in *KERNEL_INFO_TYPES*, and *:geometry* is an optional geometry size. For example:

```
with Image(filename='rose:') as img:
    img.morphology(method='dilate', kernel='octagon:3x3')
    # or simply
    img.morphology(method='edgein', kernel='octagon')
```

Custom kernels can be applied by following a similar format:

```
geometry:args
```

Where *geometry* is the size of the custom kernel, and *args* list a comma separated list of values. For example:

```
custom_kernel='5x3:nan,1,1,1,nan 1,1,1,1,1 nan,1,1,1,nan'
with Image(filename='rose:') as img:
    img.morphology(method='dilate', kernel=custom_kernel)
```

Parameters

- **method** (basestring) – effect function to apply. See *MORPHOLOGY_METHODS* for a list of methods.
- **kernel** (basestring) – shape to evaluate surrounding pixels. See *KERNEL_INFO_TYPES* for a list of built-in shapes.
- **iterations** (numbers.Integral) – Number of times a morphology method should be applied to the image. Default 1. Use -1 for unlimited iterations until the image is unchanged by the method operator.

New in version 0.5.0.

negate (*grayscale=False*, *channel=None*)
Negate the colors in the reference image.

Parameters

- **grayscale** (bool) – if set, only negate grayscale pixels in the image.
- **channel** (basestring) – the channel type. available values can be found in the *CHANNELS* mapping. If None, negate all channels.

New in version 0.3.8.

noise (**args*, ***kwargs*)
Adds noise to image.

Parameters

- **noise_type** (basestring) – type of noise to apply. See *NOISE_TYPES*.
- **attenuate** – rate of distribution. Only available in ImageMagick-7. Default is 1.0.

New in version 0.5.3.

normalize (**args*, ***kwargs*)
Normalize color channels.

Parameters **channel** (basestring) – the channel type. available values can be found in the *CHANNELS* mapping. If None, normalize all channels.

optimize_layers (**args*, ***kwargs*)
Attempts to crop each frame to the smallest image without altering the animation.

Note: This will only affect GIF image formates.

New in version 0.5.0.

optimize_transparency (**args*, ***kwargs*)
Iterates over frames, and sets transparent values for each pixel unchanged by previous frame.

Note: This will only affect `GIF` image formates.

New in version 0.5.0.

options = None
(*OptionDict*) The mapping of internal option settings.

New in version 0.3.0.

Changed in version 0.3.4: Added `'jpeg:sampling-factor'` option.

Changed in version 0.3.9: Added `'pdf:use-cropbox'` option.

orientation
(`basestring`) The image orientation. It's a string from *ORIENTATION_TYPES* list. It also can be set.

New in version 0.3.0.

page
The dimensions and offset of this Wand's page as a 4-tuple: `(width, height, x, y)`.

Note that since it is based on the virtual canvas, it may not equal the dimensions of an image. See the ImageMagick documentation on the virtual canvas for more information.

New in version 0.4.3.

page_height
(`numbers.Integral`) The height of the page for this wand.

New in version 0.4.3.

page_width
(`numbers.Integral`) The width of the page for this wand.

New in version 0.4.3.

page_x
(`numbers.Integral`) The X-offset of the page for this wand.

New in version 0.4.3.

page_y
(`numbers.Integral`) The Y-offset of the page for this wand.

New in version 0.4.3.

posterize(**args*, ***kwargs*)
Reduce color levels per channel.

Parameters

- **levels** (`numbers.Integral`) – Number of levels per channel.
- **dither** (*basestring*) – Dither method to apply. See *DITHER_METHODS*.

New in version 0.5.0.

quantize(**args*, ***kwargs*)
quantize analyzes the colors within a sequence of images and chooses a fixed number of colors to represent the image. The goal of the algorithm is to minimize the color difference between the input and output image while minimizing the processing time.

Parameters

- **number_colors** (`numbers.Integral`) – the number of colors.

- **colorspace_type** (basestring) – colorspace_type. available value can be found in the *COLORSPACE_TYPES*
- **treedepth** (numbers.Integral) – normally, this integer value is zero or one. a zero or one tells *quantize()* to choose a optimal tree depth of log4(number_colors). a tree of this depth generally allows the best representation of the reference image with the least amount of memory and the fastest computational speed. in some cases, such as an image with low color dispersion (a few number of colors), a value other than log4(number_colors) is required. to expand the color tree completely, use a value of 8
- **dither** (bool) – a value other than zero distributes the difference between an original image and the corresponding color reduced algorithm to neighboring pixels along a Hilbert curve
- **measure_error** (bool) – a value other than zero measures the difference between the original and quantized images. this difference is the total quantization error. The error is computed by summing over all pixels in an image the distance squared in RGB space between each reference pixel value and its quantized value

New in version 0.4.2.

quantum_range
(int) The maxumim value of a color channel that is supported by the imagemagick library.

New in version 0.2.0.

range_channel(*channel='default_channels'*)
Calculate the minimum and maximum of quantum values in image.

```
from wand.image import Image

with Image(filename='input.jpg') as img:
    minima, maxima = img.range_channel()
```

Parameters **channel** (basestring) – Select which color channel to evaluate. See *CHANNELS*. Default 'default_channels'.

Returns Tuple of *minima* & *maxima* values.

Return type tuple

New in version 0.5.3.

red_primary
(tuple) The chromatic red primary point for the image. With ImageMagick-6 the primary value is (x, y) coordinates; however, ImageMagick-7 has (x, y, z).

New in version 0.5.2.

remap(**args*, ***kwargs*)
Rebuild image palette with closest color from given affinity image.

Parameters

- **affinity** (*BaseImage*) – reference image.
- **method** (basestring) – dither method. See *DITHER_METHODS*. Default is 'no' dither.

New in version 0.5.3.

resample(**args*, ***kwargs*)
Adjust the number of pixels in an image so that when displayed at the given Resolution or Density the image will still look the same size in real world terms.

Parameters

- **x_res** (numbers.Real) – the X resolution (density) in the scaled image. default is the original resolution.
- **y_res** (numbers.Real) – the Y resolution (density) in the scaled image. default is the original resolution.
- **filter** (basestring, numbers.Integral) – a filter type to use for resizing. choose one in *FILTER_TYPES*. default is 'undefined' which means IM will try to guess best one to use.
- **blur** (numbers.Real) – the blur factor where > 1 is blurry, < 1 is sharp. default is 1

New in version 0.4.5.

reset_coords()
Reset the coordinate frame of the image so to the upper-left corner is (0, 0) again (crop and rotate operations change it).

New in version 0.2.0.

resize(**args*, ***kwargs*)
Resizes the image.

Parameters

- **width** (numbers.Integral) – the width in the scaled image. default is the original width
- **height** (numbers.Integral) – the height in the scaled image. default is the original height
- **filter** (basestring, numbers.Integral) – a filter type to use for resizing. choose one in *FILTER_TYPES*. default is 'undefined' which means IM will try to guess best one to use
- **blur** (numbers.Real) – the blur factor where > 1 is blurry, < 1 is sharp. default is 1

Changed in version 0.2.1: The default value of filter has changed from 'triangle' to 'undefined' instead.

Changed in version 0.1.8: The blur parameter changed to take numbers.Real instead of numbers.Rational.

New in version 0.1.1.

resolution
(tuple) Resolution of this image.

New in version 0.3.0.

rotate(**args*, ***kwargs*)
Rotates the image right. It takes a background color for degree that isn't a multiple of 90.

Parameters

- **degree** (numbers.Real) – a degree to rotate. multiples of 360 affect nothing
- **background** (*wand.color.Color*) – an optional background color. default is transparent

- **reset_coords** (bool) – optional flag. If set, after the rotation, the coordinate frame will be relocated to the upper-left corner of the new image. By default is *True*.

New in version 0.2.0: The `reset_coords` parameter.

New in version 0.1.8.

sample(**args*, ***kwargs*)
Resizes the image by sampling the pixels. It's basically quicker than *resize()* except less quality as a tradeoff.

Parameters

- **width** (numbers.Integral) – the width in the scaled image. default is the original width
- **height** (numbers.Integral) – the height in the scaled image. default is the original height

New in version 0.3.4.

selective_blur(**args*, ***kwargs*)
Blur an image within a given threshold.

For best effects, use a value between 10% and 50% of *quantum_range*

```
from wand.image import Image

with Image(filename='photo.jpg') as img:
    # Apply 8x3 blur with a 10% threshold
    img.selective_blur(8.0, 3.0, 0.1 * img.quantum_range)
```

Parameters

- **radius** (numbers.Real) – Size of gaussian apature.
- **sigma** (numbers.Real) – Standard deviation of gaussian operator.
- **threshold** (numbers.Real) – Only pixels within contrast threshold are effected. Value should be between `0.0` and *quantum_range*.

New in version 0.5.3.

sequence = None
(collections.abc.Sequence) The list of *SingleImage*s that the image contains.

New in version 0.3.0.

shade(**args*, ***kwargs*)
Creates a 3D effect by simulating a light from an elevated angle.

Parameters

- **gray** (bool) – Isolate the effect on pixel intensity. Default is False.
- **azimuth** (numbers.Real) – Angle from x-axis.
- **elevation** (numbers.Real) – Amount of pixels from the z-axis.

New in version 0.5.0.

shadow(**args*, ***kwargs*)
Generates an image shadow.

Parameters

- **alpha** (numbers.Real) – Ratio of transparency.
- **sigma** (numbers.Real) – Standard deviation of the gaussian filter.
- **x** (numbers.Integral) – x-offset.
- **y** (numbers.Integral) – y-offset.

New in version 0.5.0.

sharpen (**args*, ***kwargs*)
Applies a gaussian effect to enhance the sharpness of an image.

Note: For best results, ensure `radius` is larger than `sigma`.

Defaults values of zero will have ImageMagick attempt to auto-select suitable values.

Parameters

- **radius** (numbers.Real) – size of gaussian aperture.
- **sigma** (numbers.Real) – Standard deviation of the gaussian filter.

New in version 0.5.0.

shave (**args*, ***kwargs*)
Remove pixels from the edges.

Parameters

- **columns** (numbers.Integral) – amount to shave off the x-axis.
- **rows** (numbers.Integral) – amount to shave off the y-axis.

New in version 0.5.0.

signature
(str) The SHA-256 message digest for the image pixel stream.

New in version 0.1.9.

size
(tuple) The pair of (*width*, *height*).

sketch (**args*, ***kwargs*)
Simulates a pencil sketch effect. For best results, `radius` value should be larger than `sigma`.

Parameters

- **radius** (numbers.Real) – size of Gaussian apature.
- **sigma** (numbers.Real) – standard deviation of the Gaussian operator.
- **angle** (numbers.Real) – direction of blur.

New in version 0.5.3.

skewness
(numbers.Real) The skewness of the image.

Tip: If you want both *kurtosis* & *skewness*, it would be faster to call *kurtosis_channel()* directly.

New in version 0.5.3.

smush (*stacked=False*, *offset=0*)
Appends all images together. Similar behavior to *concat()*, but with an optional offset between images.

Parameters

- **stacked** (bool) – If True, will join top-to-bottom. If False, join images from left-to-right (default).
- **offset** (numbers.Integral) – Minimum space (in pixels) between each join.

New in version 0.5.3.

solarize (**args*, ***kwargs*)
Simulates extreme overexposure.

Parameters **threshold** (numbers.Real) – between 0.0 and *quantum_range*.

New in version 0.5.3.

sparse_color (**args*, ***kwargs*)
Interpolates color values between points on an image.

The colors argument should be a dict mapping *Color* keys to coordinate tuples.

For example:

```
from wand.color import Color
from wand.image import Image

colors = {
    Color('RED'): (10, 50),
    Color('YELLOW'): (174, 32),
    Color('ORANGE'): (74, 123)
}
with Image(filename='input.png') as img:
    img.sparse_colors('bilinear', colors)
```

The available interpolate methods are:

- 'barycentric'
- 'bilinear'
- 'shepards'
- 'voronoi'
- 'inverse'
- 'manhattan'

You can control which color channels are effected by building a custom channel mask. For example:

```
from wand.image import Image, CHANNELS

with Image(filename='input.png') as img:
    colors = {
        img[50, 50]: (50, 50),
        img[100, 50]: (100, 50),
        img[50, 75]: (50, 75),
        img[100, 100]: (100, 100)
    }
```

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```
    # Only apply Voronoi to Red & Alpha channels
    mask = CHANNELS['red'] | CHANNELS['alpha']
    img.sparse_colors('voronoi', colors, channel_mask=mask)
```

Parameters

- **method** (basestring) – Interpolate method. See *SPARSE_COLOR_METHODS*
- **colors** (abc.Mapping { *Color*: (int, int) }) – A dictionary of *Color* keys mapped to an (x, y) coordinate tuple.
- **channel_mask** (numbers.Integral) – Isolate specific color channels to apply interpolation. Default to RGB channels.

New in version 0.5.3.

splice(**args*, ***kwargs*)

Partitions image by splicing a width x height rectangle at (x, y) offset coordinate. The space inserted will be replaced by the *background_color* value.

Parameters

- **width** (numbers.Integral) – number of pixel columns.
- **height** (numbers.Integral) – number of pixel rows.
- **x** (numbers.Integral) – offset on the X-axis.
- **y** (numbers.Integral) – offset on the Y-axis.

New in version 0.5.3.

spread(**args*, ***kwargs*)

Randomly displace pixels within a defined radius.

Parameters

- **radius** (numbers.Real) – Distance a pixel can be displaced from source.
- **method** – Interpolation method. Only available with ImageMagick-7. See *PIXEL_INTERPOLATE_METHODS*.

standard_deviation

(numbers.Real) The standard deviation of the image.

Tip: If you want both *mean* & *standard_deviation*, it would be faster to call *mean_channel()* directly.

New in version 0.5.3.

statistic(**args*, ***kwargs*)

Replace each pixel with the statistic results from neighboring pixel values. The width & height defines the size, or apature, of the neighboring pixels.

Parameters

- **stat** (basestring) – The type of statistic to calculate. See *STATISTIC_TYPES*.
- **width** (numbers.Integral) – The size of neighboring pixels on the X-axis.
- **height** (numbers.Integral) – The size of neighboring pixels on the Y-axis.

strip()
Strips an image of all profiles and comments.

New in version 0.2.0.

threshold(**args*, ***kwargs*)
Changes the value of individual pixels based on the intensity of each pixel compared to threshold. The result is a high-contrast, two color image. It manipulates the image in place.

Parameters

- **threshold** (numbers.Real) – threshold as a factor of quantum
- **channel** (basestring) – the channel type. available values can be found in the *CHANNELS* mapping. If None, threshold all channels.

New in version 0.3.10.

tint(**args*, ***kwargs*)
Applies a color vector to each pixel in the image.

Parameters

- **color** (*Color*) – Color to calculate midtone.
- **alpha** (*Color*) – Determine how to blend.

New in version 0.5.3.

transform(**args*, ***kwargs*)
Transforms the image using MagickTransformImage(), which is a convenience function accepting geometry strings to perform cropping and resizing. Cropping is performed first, followed by resizing. Either or both arguments may be omitted or given an empty string, in which case the corresponding action will not be performed. Geometry specification strings are defined as follows:

A geometry string consists of a size followed by an optional offset. The size is specified by one of the options below, where **bold** terms are replaced with appropriate integer values:

scale% Height and width both scaled by specified percentage

scale-x%xscale-y% Height and width individually scaled by specified percentages. Only one % symbol is needed.

width Width given, height automagically selected to preserve aspect ratio.

xheight Height given, width automagically selected to preserve aspect ratio.

widthxheight Maximum values of width and height given; aspect ratio preserved.

widthxheight! Width and height emphatically given; original aspect ratio ignored.

widthxheight> Shrinks images with dimension(s) larger than the corresponding width and/or height dimension(s).

widthxheight< Enlarges images with dimensions smaller than the corresponding width and/or height dimension(s).

area@ Resize image to have the specified area in pixels. Aspect ratio is preserved.

The offset, which only applies to the cropping geometry string, is given by {+-}**x**{+-}**y**, that is, one plus or minus sign followed by an **x** offset, followed by another plus or minus sign, followed by a **y** offset. Offsets are in pixels from the upper left corner of the image. Negative offsets will cause the corresponding number of pixels to be removed from the right or bottom edge of the image, meaning the cropped size will be the computed size minus the absolute value of the offset.

For example, if you want to crop your image to 300x300 pixels and then scale it by 2x for a final size of 600x600 pixels, you can call:

```
image.transform('300x300', '200%')
```

This method is a fairly thin wrapper for the C API, and does not perform any additional checking of the parameters except insofar as verifying that they are of the correct type. Thus, like the C API function, the method is very permissive in terms of what it accepts for geometry strings; unrecognized strings and trailing characters will be ignored rather than raising an error.

Parameters

- **crop** (basestring) – A geometry string defining a subregion of the image to crop to
- **resize** (basestring) – A geometry string defining the final size of the image

See also:

ImageMagick Geometry Specifications Cropping and resizing geometry for the `transform` method are specified according to ImageMagick's geometry string format. The ImageMagick documentation provides more information about geometry strings.

New in version 0.2.2.

Changed in version 0.5.0: Will call *crop()* followed by *resize()* in the event that `MagickTransformImage()` is not available.

transform_colorspace(**args*, ***kwargs*)

Transform image's colorspace.

Parameters **colorspace_type** (basestring) – colorspace_type. available value can be found in the *COLORSPACE_TYPES*

New in version 0.4.2.

transparent_color(**args*, ***kwargs*)

Makes the color `color` a transparent color with a tolerance of fuzz. The `alpha` parameter specify the transparency level and the parameter `fuzz` specify the tolerance.

Parameters

- **color** (*wand.color.Color*) – The color that should be made transparent on the image, color object
- **alpha** (numbers.Real) – the level of transparency: 1.0 is fully opaque and 0.0 is fully transparent.
- **fuzz** (numbers.Integral) – By default target must match a particular pixel color exactly. However, in many cases two colors may differ by a small amount. The fuzz member of image defines how much tolerance is acceptable to consider two colors as the same. For example, set fuzz to 10 and the color red at intensities of 100 and 102 respectively are now interpreted as the same color for the color.
- **invert** (bool) – Boolean to tell to paint the inverse selection.

New in version 0.3.0.

transparentize(**args*, ***kwargs*)

Makes the image transparent by subtracting some percentage of the black color channel. The `transparency` parameter specifies the percentage.

Parameters **transparency** (numbers.Real) – the percentage fade that should be performed on the image, from 0.0 to 1.0

New in version 0.2.0.

transpose(**args*, ***kwargs*)
Creates a vertical mirror image by reflecting the pixels around the central x-axis while rotating them 90-degrees.

New in version 0.4.1.

transverse(**args*, ***kwargs*)
Creates a horizontal mirror image by reflecting the pixels around the central y-axis while rotating them 270-degrees.

New in version 0.4.1.

trim(**args*, ***kwargs*)
Remove solid border from image. Uses top left pixel as a guide by default, or you can also specify the `color` to remove.

Parameters

- **color** (*Color*) – the border color to remove. if it's omitted top left pixel is used by default
- **fuzz** (`numbers.Integral`) – Defines how much tolerance is acceptable to consider two colors as the same.

Changed in version 0.5.2: The `color` parameter may except color-compliant strings.

Changed in version 0.3.0: Optional `color` and `fuzz` parameters.

New in version 0.2.1.

type
(`basestring`) The image type.

Defines image type as in *IMAGE_TYPES* enumeration.

It may raise `ValueError` when the type is unknown.

New in version 0.2.2.

unique_colors(**args*, ***kwargs*)
Discards all duplicate pixels, and rebuilds the image as a single row.

New in version 0.5.0.

units
(`basestring`) The resolution units of this image.

unsharp_mask(**args*, ***kwargs*)
Sharpens the image using unsharp mask filter. We convolve the image with a Gaussian operator of the given `radius` and standard deviation (`sigma`). For reasonable results, `radius` should be larger than `sigma`. Use a radius of 0 and *unsharp_mask()* selects a suitable radius for you.

Parameters

- **radius** (`numbers.Real`) – the radius of the Gaussian, in pixels, not counting the center pixel
- **sigma** (`numbers.Real`) – the standard deviation of the Gaussian, in pixels
- **amount** (`numbers.Real`) – the percentage of the difference between the original and the blur image that is added back into the original
- **threshold** (`numbers.Real`) – the threshold in pixels needed to apply the diffence amount

New in version 0.3.4.

vignette (**args*, ***kwargs*)
Creates a soft vignette style effect on the image.

Parameters

- **radius** (numbers.Real) – the radius of the Gaussian blur effect.
- **sigma** (numbers.Real) – the standard deviation of the Gaussian effect.
- **x** (numbers.Integral) – Width of the oval effect.
- **y** (numbers.Integral) – Height of the oval effect.

New in version 0.5.2.

virtual_pixel
(basestring) The virtual pixel of image. This can also be set with a value from *VIRTUAL_PIXEL_METHOD* ... versionadded:: 0.4.1

wand
Internal pointer to the MagickWand instance. It may raise *ClosedImageError* when the instance has destroyed already.

watermark (**args*, ***kwargs*)
Transparentized the supplied image and places it over the current image, with the top left corner of image at coordinates left, top of the current image. The dimensions of the current image are not changed.

Parameters

- **image** (*wand.image.Image*) – the image placed over the current image
- **transparency** (numbers.Real) – the percentage fade that should be performed on the image, from 0.0 to 1.0
- **left** (numbers.Integral) – the x-coordinate where *image* will be placed
- **top** (numbers.Integral) – the y-coordinate where *image* will be placed

New in version 0.2.0.

wave (**args*, ***kwargs*)
Creates a ripple effect within the image.

Parameters

- **amplitude** (numbers.Real) – height of wave form.
- **wave_length** (numbers.Real) – width of wave form.
- **method** (basestring) – pixel interpolation method. Only available with ImageMagick-7. See *PIXEL_INTERPOLATE_METHODS*

New in version 0.5.2.

white_point
(tuple) The chromatic white point for the image. With ImageMagick-6 the primary value is (x, y) coordinates; however, ImageMagick-7 has (x, y, z).

New in version 0.5.2.

white_threshold (**args*, ***kwargs*)
Forces all pixels above a given color as white. Leaves pixels below threshold unaltered.

Parameters **threshold** (Color) – Color to be referenced as a threshold.

New in version 0.5.2.

width
(numbers.Integral) The width of this image.

class wand.image.**ChannelDepthDict**(*image*)
The mapping table of channels to their depth.

Parameters **image** (*Image*) – an image instance

Note: You don't have to use this by yourself. Use *Image.channel_depths* property instead.

New in version 0.3.0.

class wand.image.**ChannelImageDict**(*image*)
The mapping table of separated images of the particular channel from the image.

Parameters **image** (*Image*) – an image instance

Note: You don't have to use this by yourself. Use *Image.channel_images* property instead.

New in version 0.3.0.

exception wand.image.**ClosedImageError**
An error that rises when some code tries access to an already closed image.

class wand.image.**HistogramDict**(*image*)
Specialized mapping object to represent color histogram. Keys are colors, and values are the number of pixels.

Parameters **image** (*BaseImage*) – the image to get its histogram

New in version 0.3.0.

class wand.image.**Image**(*image=None*, *blob=None*, *file=None*, *filename=None*, *format=None*, *width=None*, *height=None*, *depth=None*, *background=None*, *resolution=None*, *pseudo=None*)
An image object.

Parameters

- **image** (*Image*) – makes an exact copy of the image
- **blob** (bytes) – opens an image of the blob byte array
- **file** (*file object*) – opens an image of the file object
- **filename** (basestring) – opens an image of the filename string
- **format** (basestring) – forces filename to buffer. format to help ImageMagick detect the file format. Used only in blob or file cases
- **width** (numbers.Integral) – the width of new blank image or an image loaded from raw data.
- **height** (numbers.Integral) – the height of new blank image or an image loaded from raw data.
- **depth** (numbers.Integral) – the depth used when loading raw data.
- **background** (*wand.color.Color*) – an optional background color. default is transparent

- **resolution** (collections.abc.Sequence, numbers.Integral) – set a resolution value (dpi), useful for vectorial formats (like pdf)

New in version 0.1.5: The `file` parameter.

New in version 0.1.1: The `blob` parameter.

New in version 0.2.1: The `format` parameter.

New in version 0.2.2: The `width`, `height`, `background` parameters.

New in version 0.3.0: The `resolution` parameter.

New in version 0.4.2: The `depth` parameter.

Changed in version 0.4.2: The `depth`, `width` and `height` parameters can be used with the `filename`, `file` and `blob` parameters to load raw pixel data.

New in version 0.5.0: The `pseudo` parameter.

[left:right, top:bottom]

Crops the image by its `left`, `right`, `top` and `bottom`, and then returns the cropped one.

```
with img[100:200, 150:300] as cropped:
    # manipulated the cropped image
    pass
```

Like other subscriptable objects, default is 0 or its width/height:

```
img[:, :]        #--> just clone
img[:100, 200:]  #--> equivalent to img[0:100, 200:img.height]
```

Negative integers count from the end (width/height):

```
img[-70:-50, -20:-10]
#--> equivalent to img[width-70:width-50, height-20:height-10]
```

Returns the cropped image

Rtype *Image*

New in version 0.1.2.

artifacts = None

(*ArtifactTree*) A dict mapping to image artifacts. Similar to *metadata*, but used to alter behavior of various internal operations.

New in version 0.5.0.

blank(*width*, *height*, *background=None*)

Creates blank image.

Parameters

- **width** (numbers.Integral) – the width of new blank image.
- **height** (numbers.Integral) – the height of new blank image.
- **background** (*wand.color.Color*) – an optional background color. default is transparent

Returns blank image

Return type *Image*

New in version 0.3.0.

channel_depths = None
(*ChannelDepthDict*) The mapping of channels to their depth. Read only.

New in version 0.3.0.

channel_images = None
(*ChannelImageDict*) The mapping of separated channels from the image.

```
with image.channel_images['red'] as red_image:
    display(red_image)
```

clear()
Clears resources associated with the image, leaving the image blank, and ready to be used with new image.

New in version 0.3.0.

close()
Closes the image explicitly. If you use the image object in `with` statement, it was called implicitly so don't have to call it.

Note: It has the same functionality of *destroy()* method.

compare_layers(*method*)
Generates new images showing the delta pixels between layers. Similar pixels are converted to transparent. Useful for debugging complex animations.

```
with img.compare_layers('compareany') as delta:
    delta.save(filename='framediff_%02d.png')
```

Note: May not work as expected if animations are already optimized.

Parameters **method** (`basestring`) – Can be `'compareany'`, `'compareclear'`, or `'compareoverlay'`

Returns new image stack.

Return type *Image*

New in version 0.5.0.

convert(*format*)
Converts the image format with the original image maintained. It returns a converted image instance which is new.

```
with img.convert('png') as converted:
    converted.save(filename='converted.png')
```

Parameters **format** (`basestring`) – image format to convert to

Returns a converted image

Return type *Image*

Raises **ValueError** – when the given `format` is unsupported

New in version 0.1.6.

destroy()
Manually remove *SingleImage*'s in the *Sequence*, allowing it to be properly garbage collected after using a `with Image()` context manager.

classmethod from_array(*array*, *channel_map=None*, *storage=None*)
Create an image instance from a `numpy` array, or any other datatype that implements __array_interface__ protocol.

```
import numpy
from wand.image import Image

matrix = numpy.random.rand(100, 100, 3)
with Image.from_array(matrix) as img:
    img.save(filename='noise.png')
```

Use the optional `channel_map` & `storage` arguments to specify the order of color channels & data size. If `channel_map` is omitted, this method will will guess `"RGB"`, `"I"`, or `"CMYK"` based on array shape. If `storage` is omitted, this method will reference the array's `typestr` value, and raise a `ValueError` if storage-type can not be mapped.

Float values must be normalized between *0.0* and *1.0*, and signed integers should be converted to unsigned values between *0* and max value of type.

Instances of *Image* can also be exported to numpy arrays:

```
with Image(filename='rose:') as img:
    matrix = numpy.array(img)
```

Parameters

- **array** (`numpy.array`) – Numpy array of pixel values.
- **channel_map** (`basestring`) – Color channel layout.
- **storage** (`basestring`) – Datatype per pixel part.

Returns New instance of an image.

Return type *Image*

New in version 0.5.3.

make_blob(*format=None*)
Makes the binary string of the image.

Parameters **format** (`basestring`) – the image format to write e.g. `'png'`, `'jpeg'`. it is omittable

Returns a blob (bytes) string

Return type `bytes`

Raises **ValueError** – when `format` is invalid

Changed in version 0.1.6: Removed a side effect that changes the image `format` silently.

New in version 0.1.5: The `format` parameter became optional.

New in version 0.1.1.

metadata = None
(*Metadata*) The metadata mapping of the image. Read only.

New in version 0.3.0.

mimetype
(basestring) The MIME type of the image e.g. 'image/jpeg', 'image/png'.

New in version 0.1.7.

profiles = None
(*ProfileDict*) The mapping of image profiles.

New in version 0.5.1.

pseudo(*width*, *height*, *pseudo='xc:'*)
Creates a new image from ImageMagick's internal protocol coders.

Parameters

- **width** (numbers.Integral) – Total columns of the new image.
- **height** (numbers.Integral) – Total rows of the new image.
- **pseudo** (basestring) – The protocol & arguments for the pseudo image.

New in version 0.5.0.

read(*file=None*, *filename=None*, *blob=None*, *resolution=None*)
Read new image into Image() object.

Parameters

- **blob** (bytes) – reads an image from the blob byte array
- **file** (*file object*) – reads an image from the file object
- **filename** (basestring) – reads an image from the filename string
- **resolution** (collections.abc.Sequence, numbers.Integral) – set a resolution value (DPI), useful for vectorial formats (like PDF)

New in version 0.3.0.

save(*file=None*, *filename=None*)
Saves the image into the file or filename. It takes only one argument at a time.

Parameters

- **file** (*file object*) – a file object to write to
- **filename** (basestring) – a filename string to write to

New in version 0.1.5: The file parameter.

New in version 0.1.1.

class wand.image.**ImageProperty**(*image*)
The mixin class to maintain a weak reference to the parent *Image* object.

New in version 0.3.0.

image
(*Image*) The parent image.

It ensures that the parent *Image*, which is held in a weak reference, still exists. Returns the dereferenced *Image* if it does exist, or raises a *ClosedImageError* otherwise.

Exc *ClosedImageError* when the parent Image has been destroyed

class wand.image.**Iterator**(*image=None*, *iterator=None*)

Row iterator for *Image*. It shouldn't be instantiated directly; instead, it can be acquired through *Image* instance:

```
assert isinstance(image, wand.image.Image)
iterator = iter(image)
```

It doesn't iterate every pixel, but rows. For example:

```
for row in image:
    for col in row:
        assert isinstance(col, wand.color.Color)
        print(col)
```

Every row is a collections.abc.Sequence which consists of one or more *wand.color.Color* values.

Parameters **image** (*Image*) – the image to get an iterator

New in version 0.1.3.

clone()

Clones the same iterator.

class wand.image.**Metadata**(*image*)

Class that implements dict-like read-only access to image metadata like EXIF or IPTC headers. Most WRITE encoders will ignore properties assigned here.

Parameters **image** (*Image*) – an image instance

Note: You don't have to use this by yourself. Use *Image.metadata* property instead.

New in version 0.3.0.

class wand.image.**OptionDict**(*image*)

Free-form mutable mapping of global internal settings.

New in version 0.3.0.

Changed in version 0.5.0: Remove key check to OPTIONS. Image properties are specific to vendor, and this library should not attempt to manage the 100+ options in a whitelist.

wand.image.**manipulative**(*function*)

Mark the operation manipulating itself instead of returning new one.

class wand.image.**ArtifactTree**(*image*)

Splay tree to map image artifacts. Values defined here are intended to be used elseware, and will not be written to the encoded image.

For example:

```
# Omit timestamp from PNG file headers.
with Image(filename='input.png') as img:
    img.artifacts['png:exclude-chunks'] = 'tIME'
    img.save(filename='output.png')
```

Parameters **image** (*Image*) – an image instance

Note: You don't have to use this by yourself. Use *Image.artifacts* property instead.

New in version 0.5.0.

class wand.image.**ProfileDict**(*image*)
The mapping table of embedded image profiles.

Use this to get, set, and delete whole profile payloads on an image. Each payload is a raw binary string.

For example:

```
with Image(filename='photo.jpg') as img:
    # Extract EXIF
    with open('exif.bin', 'wb') as payload:
        payload.write(img.profiles['exif'])
    # Import ICC
    with open('color_profile.icc', 'rb') as payload:
        img.profiles['icc'] = payload.read()
    # Remove XMP
    del imp.profiles['xmp']
```

See also:

Embedded Image Profiles for a list of supported profiles.

New in version 0.5.1.

4.1.2 wand.color — Colors

New in version 0.1.2.

class wand.color.**Color**(*string=None*, *raw=None*)
Color value.

Unlike any other objects in Wand, its resource management can be implicit when it used outside of `with` block. In these case, its resource are allocated for every operation which requires a resource and destroyed immediately. Of course it is inefficient when the operations are much, so to avoid it, you should use color objects inside of `with` block explicitly e.g.:

```
red_count = 0
with Color('#f00') as red:
    with Image(filename='image.png') as img:
        for row in img:
            for col in row:
                if col == red:
                    red_count += 1
```

Parameters **string** (basestring) – a color name string e.g. `'rgb(255, 255, 255)'`, `'#fff'`, `'white'`. see ImageMagick Color Names doc also

Changed in version 0.3.0: *Color* objects become hashable.

Changed in version 0.5.1: Color channel properties can now be set.

Changed in version 0.5.1: Added *cyan*, *magenta*, *yellow*, & *black* properties for CMYK *Color* instances.

Changed in version 0.5.1: Method *Color.from_hsl()* can create a RGB color from `hue`, `saturation`, & `lightness` values.

See also:

ImageMagick Color Names The color can then be given as a color name (there is a limited but large set of these; see below) or it can be given as a set of numbers (in decimal or hexadecimal), each corresponding to a channel in an RGB or RGBA color model. HSL, HSLA, HSB, HSBA, CMYK, or CMYKA color models may also be specified. These topics are briefly described in the sections below.

== (other)
Equality operator.

Param other a color another one

Type color *Color*

Returns `True` only if two images equal.

Rtype `bool`

alpha
(`numbers.Real`) Alpha value, from 0.0 to 1.0.

alpha_int8
(`numbers.Integral`) Alpha value as 8bit integer which is a common style. From 0 to 255.

New in version 0.3.0.

alpha_quantum
(`numbers.Integral`) Alpha value. Scale depends on *QUANTUM_DEPTH*.

New in version 0.3.0.

black
(`numbers.Real`) Black, or `'K'`, color channel in CMYK colorspace. Unused by RGB colorspace.

New in version 0.5.1.

black_int8
(`numbers.Integral`) Black value as 8bit integer which is a common style. From 0 to 255.

New in version 0.5.1.

black_quantum
(`numbers.Integral`) Black. Scale depends on *QUANTUM_DEPTH*.

New in version 0.5.1.

blue
(`numbers.Real`) Blue, from 0.0 to 1.0.

blue_int8
(`numbers.Integral`) Blue as 8bit integer which is a common style. From 0 to 255.

New in version 0.3.0.

blue_quantum
(`numbers.Integral`) Blue. Scale depends on *QUANTUM_DEPTH*.

New in version 0.3.0.

static c_equals(*a*, *b*)
Raw level version of equality test function for two pixels.

Parameters

- **a** (ctypes.c_void_p) – a pointer to PixelWand to compare
- **b** (ctypes.c_void_p) – a pointer to PixelWand to compare

Returns True only if two pixels equal

Return type bool

Note: It's only for internal use. Don't use it directly. Use == operator of *Color* instead.

---

cyan
(numbers.Real) Cyan color channel in CMYK colorspace. Unused by RGB colorspace.

New in version 0.5.1.

cyan_int8
(numbers.Integral) Cyan value as 8bit integer which is a common style. From 0 to 255.

New in version 0.5.1.

cyan_quantum
(numbers.Integral) Cyan. Scale depends on *QUANTUM_DEPTH*.

New in version 0.5.1.

dirty = None
(bool) Whether the color has changed or not.

classmethod from_hsl(*hue=0.0*, *saturation=0.0*, *lightness=0.0*)
Creates a RGB color from HSL values. The hue, saturation, and lightness must be normalized between 0.0 & 1.0.

```
h=0.75  # 270 Degrees
s=1.0   # 100 Percent
l=0.5   # 50 Percent
with Color.from_hsl(hue=h, saturation=s, lightness=l) as color:
    print(color)  #=> srgb(128,0,255)
```

Parameters

- **hue** (numbers.Real) – a normalized double between 0.0 & 1.0.
- **saturation** (numbers.Real) – a normalized double between 0.0 & 1.0.
- **lightness** (numbers.Real) – a normalized double between 0.0 & 1.0.

Return type *Color*

New in version 0.5.1.

green
(numbers.Real) Green, from 0.0 to 1.0.

green_int8
(numbers.Integral) Green as 8bit integer which is a common style. From 0 to 255.

New in version 0.3.0.

green_quantum
(numbers.Integral) Green. Scale depends on *QUANTUM_DEPTH*.

New in version 0.3.0.

hsl()
Calculate the HSL color values from the RGB color.

Returns Tuple containing three normalized doubles, between 0.0 & 1.0, representing `hue`, `saturation`, and `lightness`.

Return type `collections.Sequence`

New in version 0.5.1.

magenta
(`numbers.Real`) Magenta color channel in CMYK colorspace. Unused by RGB colorspace.

New in version 0.5.1.

magenta_int8
(`numbers.Integral`) Magenta value as 8bit integer which is a common style. From 0 to 255.

New in version 0.5.1.

normalized_string
(`basestring`) The normalized string representation of the color. The same color is always represented to the same string.

New in version 0.3.0.

red
(`numbers.Real`) Red, from 0.0 to 1.0.

red_int8
(`numbers.Integral`) Red as 8bit integer which is a common style. From 0 to 255.

New in version 0.3.0.

red_quantum
(`numbers.Integral`) Red. Scale depends on *QUANTUM_DEPTH*.

New in version 0.3.0.

string
(`basestring`) The string representation of the color.

yellow
(`numbers.Real`) Yellow color channel in CMYK colorspace. Unused by RGB colorspace.

New in version 0.5.1.

yellow_int8
(`numbers.Integral`) Yellow as 8bit integer which is a common style. From 0 to 255.

New in version 0.5.1.

yellow_quantum
(`numbers.Integral`) Yellow. Scale depends on *QUANTUM_DEPTH*.

New in version 0.5.1.

wand.color.**scale_quantum_to_int8**(*quantum*)
Straightforward port of `ScaleQuantumToChar()` inline function.

Parameters **quantum** (`numbers.Integral`) – quantum value

Returns 8bit integer of the given `quantum` value

Return type `numbers.Integral`

New in version 0.3.0.

Changed in version 0.5.0: Added HDRI support

4.1.3 wand.font — Fonts

New in version 0.3.0.

Font is an object which takes the *path* of font file, *size*, *color*, and whether to use *antialias*ing. If you want to use font by its name rather than the file path, use TTFQuery package. The font path resolution by its name is a very complicated problem to achieve.

See also:

TTFQuery — Find and Extract Information from TTF Files TTFQuery builds on the FontTools-TTX package to allow the Python programmer to accomplish a number of tasks:

- query the system to find installed fonts
- retrieve metadata about any TTF font file
  - this includes the glyph outlines (shape) of individual code-points, which allows for rendering the glyphs in 3D (such as is done in OpenGLContext)
- lookup/find fonts by:
  - abstract family type
  - proper font name
- build simple metadata registries for run-time font matching

class wand.font.**Font**

Font struct which is a subtype of `tuple`.

Parameters

- **path** (`str`, `basestring`) – the path of the font file
- **size** (`numbers.Real`) – the size of typeface. 0 by default which means *autosized*
- **color** (*Color*) – the color of typeface. black by default
- **antialias** (`bool`) – whether to use antialiasing. `True` by default
- **stroke_color** (*Color*) – optional color to outline typeface.
- **stroke_width** (`numbers.Real`) – optional thickness of typeface outline.

Changed in version 0.3.9: The `size` parameter becomes optional. Its default value is 0, which means *autosized*.

Changed in version 0.5.0: Added `stroke_color` & `stoke_width` paramaters.

antialias

(`bool`) Whether to apply antialiasing (`True`) or not (`False`).

color

(*wand.color.Color*) The font color.

path

(`basestring`) The path of font file.

size

(`numbers.Real`) The font size in pixels.

stroke_color
(*wand.color.Color*) The stroke color.

stroke_width
(numbers.Real) The width of the stroke line.

4.1.4 wand.drawing — Drawings

The module provides some vector drawing functions.

New in version 0.3.0.

wand.drawing.**CLIP_PATH_UNITS = ('undefined_path_units', 'user_space', 'user_space_on_use',**
(collections.abc.Sequence) The list of clip path units

- 'undefined_path_units'
- 'user_space'
- 'user_space_on_use'
- 'object_bounding_box'

wand.drawing.**FILL_RULE_TYPES = ('undefined', 'evenodd', 'nonzero')**
(collections.abc.Sequence) The list of fill-rule types.

- 'undefined'
- 'evenodd'
- 'nonzero'

wand.drawing.**FONT_METRICS_ATTRIBUTES = ('character_width', 'character_height', 'ascender',**
(collections.abc.Sequence) The attribute names of font metrics.

wand.drawing.**GRAVITY_TYPES = ('forget', 'north_west', 'north', 'north_east', 'west', 'cente**
(collections.abc.Sequence) The list of text gravity types.

- 'forget'
- 'north_west'
- 'north'
- 'north_east'
- 'west'
- 'center'
- 'east'
- 'south_west'
- 'south'
- 'south_east'
- 'static'

wand.drawing.**LINE_CAP_TYPES = ('undefined', 'butt', 'round', 'square')**
(collections.abc.Sequence) The list of LineCap types

- 'undefined;
- 'butt'

- 'round'
- 'square'

wand.drawing.**LINE_JOIN_TYPES = ('undefined', 'miter', 'round', 'bevel')**
(collections.abc.Sequence) The list of LineJoin types

- 'undefined'
- 'miter'
- 'round'
- 'bevel'

wand.drawing.**PAINT_METHOD_TYPES = ('undefined', 'point', 'replace', 'floodfill', 'filltobo**
(collections.abc.Sequence) The list of paint method types.

- 'undefined'
- 'point'
- 'replace'
- 'floodfill'
- 'filltoborder'
- 'reset'

wand.drawing.**STRETCH_TYPES = ('undefined', 'normal', 'ultra_condensed', 'extra_condensed',**
(collections.abc.Sequence) The list of stretch types for fonts

- 'undefined;
- 'normal'
- 'ultra_condensed'
- 'extra_condensed'
- 'condensed'
- 'semi_condensed'
- 'semi_expanded'
- 'expanded'
- 'extra_expanded'
- 'ultra_expanded'
- 'any'

wand.drawing.**STYLE_TYPES = ('undefined', 'normal', 'italic', 'oblique', 'any')**
(collections.abc.Sequence) The list of style types for fonts

- 'undefined;
- 'normal'
- 'italic'
- 'oblique'
- 'any'

wand.drawing.**TEXT_ALIGN_TYPES = ('undefined', 'left', 'center', 'right')**
(collections.abc.Sequence) The list of text align types.

- 'undefined'
- 'left'
- 'center'
- 'right'

wand.drawing.**TEXT_DECORATION_TYPES = ('undefined', 'no', 'underline', 'overline', 'line_thr**
(collections.abc.Sequence) The list of text decoration types.

- 'undefined'
- 'no'
- 'underline'
- 'overline'
- 'line_through'

wand.drawing.**TEXT_DIRECTION_TYPES = ('undefined', 'right_to_left', 'left_to_right')**
(collections.abc.Sequence) The list of text direction types.

- 'undefined'
- 'right_to_left'
- 'left_to_right'

class wand.drawing.**Drawing**(*drawing=None*)
Drawing object. It maintains several vector drawing instructions and can get drawn into zero or more *Image* objects by calling it.

For example, the following code draws a diagonal line to the image:

```
with Drawing() as draw:
    draw.line((0, 0), image.size)
    draw(image)
```

Parameters **drawing** (*Drawing*) – an optional drawing object to clone. use *clone()* method rather than this parameter

New in version 0.3.0.

affine(*matrix*)
Adjusts the current affine transformation matrix with the specified affine transformation matrix. Note that the current affine transform is adjusted rather than replaced.

```
                                  | sx  rx  0 |
| x', y', 1 |  =  | x, y, 1 |  *  | ry  sy  0 |
                                  | tx  ty  1 |
```

Parameters **matrix** (collections.abc.Sequence) – a list of Real to define affine matrix [sx, rx, ry, sy, tx, ty]

New in version 0.4.0.

alpha(*x=None*, *y=None*, *paint_method='undefined'*)
Paints on the image's opacity channel in order to set effected pixels to transparent.

To influence the opacity of pixels. The available methods are:

- 'undefined'
- 'point'
- 'replace'
- 'floodfill'
- 'filltoborder'
- 'reset'

Note: This method replaces *matte()* in ImageMagick version 7. An AttributeError will be raised if attempting to call on a library without DrawAlpha support.

New in version 0.5.0.

arc(*start*, *end*, *degree*)
Draws a arc using the current *stroke_color*, *stroke_width*, and *fill_color*.

Parameters

- **start** (Sequence) – (Real, numbers.Real) pair which represents starting x and y of the arc
- **end** (Sequence) – (Real, numbers.Real) pair which represents ending x and y of the arc
- **degree** (Sequence) – (Real, numbers.Real) pair which represents starting degree, and ending degree

New in version 0.4.0.

bezier(*points=None*)
Draws a bezier curve through a set of points on the image, using the specified array of coordinates.

At least four points should be given to complete a bezier path. The first & forth point being the start & end point, and the second & third point controlling the direction & curve.

Example bezier on image

```
with Drawing() as draw:
    points = [(40,10), # Start point
              (20,50), # First control
              (90,10), # Second control
              (70,40)] # End point
    draw.stroke_color = Color('#000')
    draw.fill_color = Color('#fff')
    draw.bezier(points)
    draw.draw(image)
```

Parameters **points** (list) – list of x,y tuples

New in version 0.4.0.

border_color
(*Color*) the current border color. It also can be set. This attribute controls the behavior of *color()* during 'filltoborder' operation.

New in version 0.4.0.

circle(*origin*, *perimeter*)
Draws a circle from `origin` to `perimeter`

Parameters

- **origin** (`collections.abc.Sequence`) – (`Real`, `numbers.Real`) pair which represents origin x and y of circle
- **perimeter** (`collections.abc.Sequence`) – (`Real`, `numbers.Real`) pair which represents perimeter x and y of circle

New in version 0.4.0.

clip_path
(`basestring`) The current clip path. It also can be set.

New in version 0.4.0.

clip_rule
(`basestring`) The current clip rule. It also can be set. It's a string value from *FILL_RULE_TYPES* list.

New in version 0.4.0.

clip_units
(`basestring`) The current clip units. It also can be set. It's a string value from *CLIP_PATH_UNITS* list.

New in version 0.4.0.

clone()
Copies a drawing object.

Returns a duplication

Return type *Drawing*

color(*x=None*, *y=None*, *paint_method='undefined'*)
Draws a color on the image using current fill color, starting at specified position & method.

Available methods in *wand.drawing.PAINT_METHOD_TYPES*:

- `'undefined'`
- `'point'`
- `'replace'`
- `'floodfill'`
- `'filltoborder'`
- `'reset'`

New in version 0.4.0.

comment(*message=None*)
Adds a comment to the vector stream.

Parameters **message** (`basestring`) – the comment to set.

New in version 0.4.0.

composite(*operator*, *left*, *top*, *width*, *height*, *image*)
Composites an image onto the current image, using the specified composition operator, specified position, and at the specified size.

Parameters

- **operator** – the operator that affects how the composite is applied to the image. available values can be found in the COMPOSITE_OPERATORS list
- **type** – COMPOSITE_OPERATORS
- **left** (numbers.Real) – the column offset of the composited drawing source
- **top** (numbers.Real) – the row offset of the composited drawing source
- **width** (numbers.Real) – the total columns to include in the composited source
- **height** (numbers.Real) – the total rows to include in the composited source

New in version 0.4.0.

draw(*image*)

Renders the current drawing into the image. You can simply call *Drawing* instance rather than calling this method. That means the following code which calls *Drawing* object itself:

```
drawing(image)
```

is equivalent to the following code which calls *draw()* method:

```
drawing.draw(image)
```

Parameters **image** (*BaseImage*) – the image to be drawn

ellipse(*origin*, *radius*, *rotation=(0, 360)*)

Draws a ellipse at origin with independent x & y radius. Ellipse can be partial by setting start & end rotation.

Parameters

- **origin** (collections.abc.Sequence) – (Real, numbers.Real) pair which represents origin x and y of circle
- **radius** (collections.abc.Sequence) – (Real, numbers.Real) pair which represents radius x and radius y of circle
- **rotation** (collections.abc.Sequence) – (Real, numbers.Real) pair which represents start and end of ellipse. Default (0,360)

New in version 0.4.0.

fill_color

(*Color*) The current color to fill. It also can be set.

fill_opacity

(Real) The current fill opacity. It also can be set.

New in version 0.4.0.

fill_rule

(basestring) The current fill rule. It can also be set. It's a string value from *FILL_RULE_TYPES* list.

New in version 0.4.0.

font

(basestring) The current font name. It also can be set.

font_family
(basestring) The current font family. It also can be set.

New in version 0.4.0.

font_resolution
(Sequence) The current font resolution. It also can be set.

New in version 0.4.0.

font_size
(numbers.Real) The font size. It also can be set.

font_stretch
(basestring) The current font stretch variation. It also can be set, but will only apply if the font-family or encoder supports the stretch type.

New in version 0.4.0.

font_style
(basestring) The current font style. It also can be set, but will only apply if the font-family supports the style.

New in version 0.4.0.

font_weight
(Integral) The current font weight. It also can be set.

New in version 0.4.0.

get_font_metrics(*image*, *text*, *multiline=False*)
Queries font metrics from the given text.

Parameters

- **image** (*BaseImage*) – the image to be drawn
- **text** (basestring) – the text string for get font metrics.
- **multiline** (*boolean*) – text is multiline or not

gravity
(basestring) The text placement gravity used when annotating with text. It's a string from *GRAVITY_TYPES* list. It also can be set.

line(*start*, *end*)
Draws a line start to end.

Parameters

- **start** (collections.abc.Sequence) – (Integral, numbers.Integral) pair which represents starting x and y of the line
- **end** (collections.abc.Sequence) – (Integral, numbers.Integral) pair which represents ending x and y of the line

matte(*x=None*, *y=None*, *paint_method='undefined'*)
Paints on the image's opacity channel in order to set effected pixels to transparent.

To influence the opacity of pixels. The available methods are:

- 'undefined'
- 'point'
- 'replace'

- `'floodfill'`
- `'filltoborder'`
- `'reset'`

Note: This method has been replace by *`alpha()`* in ImageMagick version 7. An `AttributeError` will be raised if attempting to call on a library without `DrawMatte` support.

New in version 0.4.0.

opacity
(`Real`) returns the opacity used when drawing with the fill or stroke color or texture. Fully opaque is 1.0. This method only affects vector graphics, and is experimental. To set the opacity of a drawing, use *`Drawing.fill_opacity`* & *`Drawing.stroke_opacity`*

New in version 0.4.0.

path_close()
Adds a path element to the current path which closes the current subpath by drawing a straight line from the current point to the current subpath's most recent starting point.

New in version 0.4.0.

path_curve(*to=None*, *controls=None*, *smooth=False*, *relative=False*)
Draws a cubic Bezier curve from the current point to given `to` (x,y) coordinate using `controls` points at the beginning and the end of the curve. If `smooth` is set to True, only one `controls` is expected and the previous control is used, else two pair of coordinates are expected to define the control points. The `to` coordinate then becomes the new current point.

Parameters

- **to** (`collections.abc.Sequence`) – (`Real`, `numbers.Real`) pair which represents coordinates to draw to
- **controls** (`collections.abc.Sequence`) – (`Real`, `numbers.Real`) coordinate to used to influence curve
- **smooth** (`bool`) – `bool` assume last defined control coordinate
- **relative** (`bool`) – treat given coordinates as relative to current point

New in version 0.4.0.

path_curve_to_quadratic_bezier(*to=None*, *control=None*, *smooth=False*, *relative=False*)
Draws a quadratic Bezier curve from the current point to given `to` coordinate. The control point is assumed to be the reflection of the control point on the previous command if `smooth` is True, else a pair of `control` coordinates must be given. Each coordinates can be relative, or absolute, to the current point by setting the `relative` flag. The `to` coordinate then becomes the new current point, and the `control` coordinate will be assumed when called again when `smooth` is set to true.

Parameters

- **to** (`collections.abc.Sequence`) – (`Real`, `numbers.Real`) pair which represents coordinates to draw to
- **control** (`collections.abc.Sequence`) – (`Real`, `numbers.Real`) coordinate to used to influence curve
- **smooth** (`bool`) – assume last defined control coordinate
- **relative** (`bool`) – treat given coordinates as relative to current point

New in version 0.4.0.

path_elliptic_arc(*to=None*, *radius=None*, *rotation=0.0*, *large_arc=False*, *clockwise=False*, *relative=False*)

Draws an elliptical arc from the current point to given `to` coordinates. The `to` coordinates can be relative, or absolute, to the current point by setting the `relative` flag. The size and orientation of the ellipse are defined by two radii (rx, ry) in `radius` and an `rotation` parameters, which indicates how the ellipse as a whole is rotated relative to the current coordinate system. The center of the ellipse is calculated automagically to satisfy the constraints imposed by the other parameters. `large_arc` and `clockwise` contribute to the automatic calculations and help determine how the arc is drawn. If `large_arc` is True then draw the larger of the available arcs. If `clockwise` is true, then draw the arc matching a clock-wise rotation.

Parameters

- **to** (`collections.abc.Sequence`) – (`Real`, `numbers.Real`) pair which represents coordinates to draw to
- **radius** (`collections.abc.Sequence`) – (`Real`, `numbers.Real`) pair which represents the radii of the ellipse to draw
- **rotate** (`Real`) – degree to rotate ellipse on x-axis
- **large_arc** (`bool`) – draw largest available arc
- **clockwise** (`bool`) – draw arc path clockwise from start to target
- **relative** (`bool`) – treat given coordinates as relative to current point

New in version 0.4.0.

path_finish()

Terminates the current path.

New in version 0.4.0.

path_horizontal_line(*x=None*, *relative=False*)

Draws a horizontal line path from the current point to the target point. Given `x` parameter can be relative, or absolute, to the current point by setting the `relative` flag. The target point then becomes the new current point.

Parameters

- **x** (`Real`) – `Real` x-axis point to draw to.
- **relative** (`bool`) – `bool` treat given point as relative to current point

New in version 0.4.0.

path_line(*to=None*, *relative=False*)

Draws a line path from the current point to the given `to` coordinate. The `to` coordinates can be relative, or absolute, to the current point by setting the `relative` flag. The coordinate then becomes the new current point.

Parameters

- **to** (`collections.abc.Sequence`) – (`Real`, `numbers.Real`) pair which represents coordinates to draw to.
- **relative** (`bool`) – `bool` treat given coordinates as relative to current point

New in version 0.4.0.

path_move(*to=None*, *relative=False*)
Starts a new sub-path at the given coordinates. Given `to` parameter can be relative, or absolute, by setting the `relative` flag.

Parameters

- **to** (`collections.abc.Sequence`) – (`Real`, `numbers.Real`) pair which represents coordinates to draw to.
- **relative** (`bool`) – `bool` treat given coordinates as relative to current point

New in version 0.4.0.

path_start()
Declares the start of a path drawing list which is terminated by a matching *path_finish()* command. All other *path_** commands must be enclosed between a *path_start()* and a *path_finish()* command. This is because path drawing commands are subordinate commands and they do not function by themselves.

New in version 0.4.0.

path_vertical_line(*y=None*, *relative=False*)
Draws a vertical line path from the current point to the target point. Given `y` parameter can be relative, or absolute, to the current point by setting the `relative` flag. The target point then becomes the new current point.

Parameters

- **y** (`Real`) – `Real` y-axis point to draw to.
- **relative** (`bool`) – `bool` treat given point as relative to current point

New in version 0.4.0.

point(*x*, *y*)
Draws a point at given `x` and `y`

Parameters

- **x** (`Real`) – `Real` x of point
- **y** (`Real`) – `Real` y of point

New in version 0.4.0.

polygon(*points=None*)
Draws a polygon using the current `stoke_color`, *stroke_width*, and *fill_color*, using the specified array of coordinates.

Example polygon on `image`

```
with Drawing() as draw:
    points = [(40,10), (20,50), (90,10), (70,40)]
    draw.polygon(points)
    draw.draw(image)
```

Parameters **points** (`list`) – list of x,y tuples

New in version 0.4.0.

polyline(*points=None*)
Draws a polyline using the current `stoke_color`, *stroke_width*, and *fill_color*, using the specified array of coordinates.

Identical to *polygon*, but without closed stroke line.

Parameters **points** (list) – list of x,y tuples

New in version 0.4.0.

pop()
Pop destroys the current tip of the drawing context stack, and restores the parent style context. See *push()* method for an example.

Note: Popping the graphical context stack will not erase, or alter, any previously executed drawing commands.

Returns success of pop operation.

Return type *bool*

New in version 0.4.0.

pop_clip_path()
Terminates a clip path definition.

New in version 0.4.0.

pop_defs()
Terminates a definition list.

New in version 0.4.0.

pop_pattern()
Terminates a pattern definition.

New in version 0.4.0.

push()
Grows the current drawing context stack by one, and inherits the previous style attributes. Use *Drawing.pop* to return to restore previous style attributes.

This is useful for drawing shapes with diffrent styles without repeatedly setting the similar *fill_color* & *stroke_color* properties.

For example:

```
with Drawing() as ctx:
    ctx.fill_color = Color('GREEN')
    ctx.stroke_color = Color('ORANGE')
    ctx.push()
    ctx.fill_color = Color('RED')
    ctx.text(x1, y1, 'this is RED with ORANGE outline')
    ctx.push()
    ctx.stroke_color = Color('BLACK')
    ctx.text(x2, y2, 'this is RED with BLACK outline')
    ctx.pop()
    ctx.pop()
    ctx.text(x3, y3, 'this is GREEN with ORANGE outline')
```

Which translate to the following MVG:

```
push graphic-context
    fill "GREEN"
    stroke "ORANGE"
    push graphic-context
        fill "RED"
        text x1,y1 "this is RED with ORANGE outline"
        push graphic-context
            stroke "BLACK"
            text x2,y2 "this is RED with BLACK outline"
        pop graphic-context
    pop graphic-context
    text x3,y3 "this is GREEN with ORANGE outline"
pop graphic-context
```

Note: Pushing graphical context does not reset any previously drawn artifacts.

Returns success of push operation.

Return type *bool*

New in version 0.4.0.

push_clip_path(*clip_mask_id*)

Starts a clip path definition which is comprised of any number of drawing commands and terminated by a *Drawing.pop_clip_path* command.

Parameters **clip_mask_id** (basestring) – string identifier to associate with the clip path.

New in version 0.4.0.

push_defs()

Indicates that commands up to a terminating *Drawing.pop_defs* command create named elements (e.g. clip-paths, textures, etc.) which may safely be processed earlier for the sake of efficiency.

New in version 0.4.0.

push_pattern(*pattern_id*, *left*, *top*, *width*, *height*)

Indicates that subsequent commands up to a *Drawing.pop_pattern* command comprise the definition of a named pattern. The pattern space is assigned top left corner coordinates, a width and height, and becomes its own drawing space. Anything which can be drawn may be used in a pattern definition. Named patterns may be used as stroke or brush definitions.

Parameters

- **pattern_id** (basestring) – a unique identifier for the pattern.
- **left** (numbers.Real) – x ordinate of top left corner.
- **top** (numbers.Real) – y ordinate of top left corner.
- **width** (numbers.Real) – width of pattern space.
- **height** (numbers.Real) – height of pattern space.

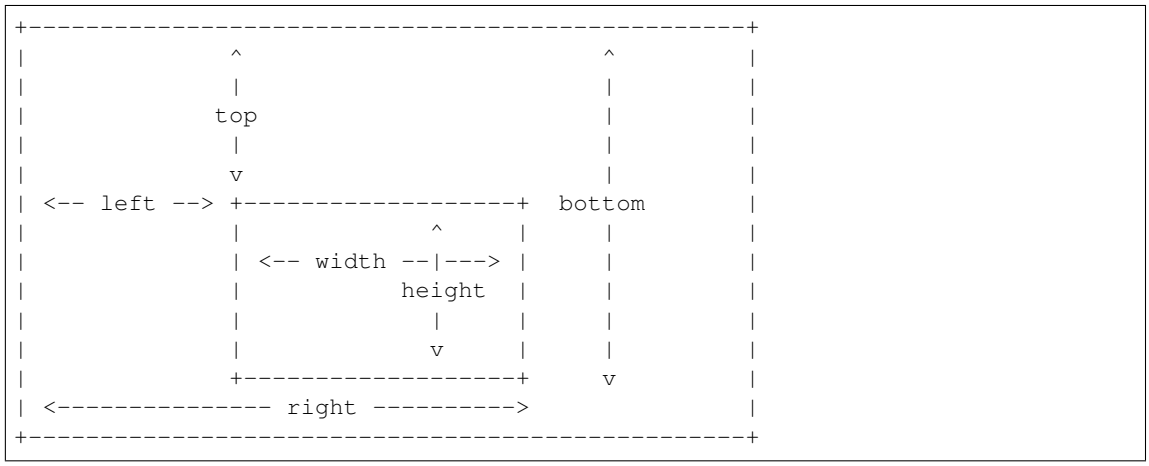
Returns success of push operation

Return type *bool*

New in version 0.4.0.

rectangle(*left=None*, *top=None*, *right=None*, *bottom=None*, *width=None*, *height=None*, *radius=None*, *xradius=None*, *yradius=None*)

Draws a rectangle using the current *stroke_color*, *stroke_width*, and *fill_color*.



Parameters

- **left** (numbers.Real) – x-offset of the rectangle to draw
- **top** (numbers.Real) – y-offset of the rectangle to draw
- **right** (numbers.Real) – second x-offset of the rectangle to draw. this parameter and `width` parameter are exclusive each other
- **bottom** (numbers.Real) – second y-offset of the rectangle to draw. this parameter and `height` parameter are exclusive each other
- **width** (numbers.Real) – the `width` of the rectangle to draw. this parameter and `right` parameter are exclusive each other
- **height** (numbers.Real) – the `height` of the rectangle to draw. this parameter and `bottom` parameter are exclusive each other
- **radius** (numbers.Real) – the corner rounding. this is a short-cut for setting both `xradius`, and `yradius`
- **xradius** (numbers.Real) – the `xradius` corner in horizontal direction.
- **yradius** (numbers.Real) – the `yradius` corner in vertical direction.

New in version 0.3.6.

Changed in version 0.4.0: Radius keywords added to create rounded rectangle.

rotate(*degree*)

Applies the specified rotation to the current coordinate space.

Parameters **degree** (Real) – degree to rotate

New in version 0.4.0.

scale(*x=None*, *y=None*)

Adjusts the scaling factor to apply in the horizontal and vertical directions to the current coordinate space.

Parameters

- **x** (Real) – Horizontal scale factor
- **y** (Real) – Vertical scale factor

New in version 0.4.0.

set_fill_pattern_url(*url*)
Sets the URL to use as a fill pattern for filling objects. Only local URLs ("#identifier") are supported at this time. These local URLs are normally created by defining a named fill pattern with Drawing.push_pattern & Drawing.pop_pattern.

Parameters **url** (basestring) – URL to use to obtain fill pattern.

New in version 0.4.0.

set_stroke_pattern_url(*url*)
Sets the pattern used for stroking object outlines. Only local URLs ("#identifier") are supported at this time. These local URLs are normally created by defining a named stroke pattern with Drawing.push_pattern & Drawing.pop_pattern.

Parameters **url** (basestring) – URL to use to obtain stroke pattern.

New in version 0.4.0.

skew(*x=None*, *y=None*)
Skews the current coordinate system in the horizontal direction if x is given, and vertical direction if y is given.

Parameters

- **x** (Real) – Skew horizontal direction
- **y** (Real) – Skew vertical direction

New in version 0.4.0.

stroke_antialias
(bool) Controls whether stroked outlines are antialiased. Stroked outlines are antialiased by default. When antialiasing is disabled stroked pixels are thresholded to determine if the stroke color or underlying canvas color should be used.

It also can be set.

New in version 0.4.0.

stroke_color
(*Color*) The current color of stroke. It also can be set.

New in version 0.3.3.

stroke_dash_array
(Sequence) - (numbers.Real) An array representing the pattern of dashes & gaps used to stroke paths. It also can be set.

New in version 0.4.0.

stroke_dash_offset
(numbers.Real) The stroke dash offset. It also can be set.

New in version 0.4.0.

stroke_line_cap
(basestring) The stroke line cap. It also can be set.

New in version 0.4.0.

stroke_line_join
(basestring) The stroke line join. It also can be set.

New in version 0.4.0.

stroke_miter_limit
(Integral) The current miter limit. It also can be set.

New in version 0.4.0.

stroke_opacity
(Real) The current stroke opacity. It also can be set.

New in version 0.4.0.

stroke_width
(numbers.Real) The stroke width. It also can be set.

New in version 0.3.3.

text(*x*, *y*, *body*)
Writes a text body into (x, y).

Parameters

- **x** (numbers.Integral) – the left offset where to start writing a text
- **y** (numbers.Integral) – the baseline where to start writing text
- **body** (basestring) – the body string to write

text_alignment
(basestring) The current text alignment setting. It's a string value from *TEXT_ALIGN_TYPES* list. It also can be set.

text_antialias
(bool) The boolean value which represents whether antialiasing is used for text rendering. It also can be set to True or False to switch the setting.

text_decoration
(basestring) The text decoration setting, a string from *TEXT_DECORATION_TYPES* list. It also can be set.

text_direction
(basestring) The text direction setting. a string from *TEXT_DIRECTION_TYPES* list. It also can be set.

text_encoding
(basestring) The internally used text encoding setting. Although it also can be set, but it's not encouraged.

text_interline_spacing
(numbers.Real) The setting of the text line spacing. It also can be set.

text_interword_spacing
(numbers.Real) The setting of the word spacing. It also can be set.

text_kerning
(numbers.Real) The setting of the text kerning. It also can be set.

text_under_color
(*Color*) The color of a background rectangle to place under text annotations. It also can be set.

translate(*x=None*, *y=None*)
Applies a translation to the current coordinate system which moves the coordinate system origin to the specified coordinate.

Parameters

- **x** (Real) – Skew horizontal direction

- **y** (Real) – Skew vertical direction

New in version 0.4.0.

vector_graphics
(basestring) The XML text of the Vector Graphics. It also can be set. The drawing-wand XML is experimental, and subject to change.

Setting this property to None will reset all vector graphic properties to the default state.

New in version 0.4.0.

viewbox(*left*, *top*, *right*, *bottom*)
Viewbox sets the overall canvas size to be recorded with the drawing vector data. Usually this will be specified using the same size as the canvas image. When the vector data is saved to SVG or MVG formats, the viewbox is use to specify the size of the canvas image that a viewer will render the vector data on.

Parameters

- **left** (Integral) – the left most point of the viewbox.
- **top** (Integral) – the top most point of the viewbox.
- **right** (Integral) – the right most point of the viewbox.
- **bottom** (Integral) – the bottom most point of the viewbox.

New in version 0.4.0.

class wand.drawing.**FontMetrics**(*character_width*, *character_height*, *ascender*, *descender*, *text_width*, *text_height*, *maximum_horizontal_advance*, *x1*, *y1*, *x2*, *y2*, *x*, *y*)
The tuple subtype which consists of font metrics data.

ascender
Alias for field number 2

character_height
Alias for field number 1

character_width
Alias for field number 0

descender
Alias for field number 3

maximum_horizontal_advance
Alias for field number 6

text_height
Alias for field number 5

text_width
Alias for field number 4

x
Alias for field number 11

x1
Alias for field number 7

x2
Alias for field number 9

y
Alias for field number 12

y1
Alias for field number 8

y2
Alias for field number 10

4.1.5 wand.sequence — Sequences

New in version 0.3.0.

class wand.sequence.**Sequence**(*image*)
The list-like object that contains every *SingleImage* in the *Image* container. It implements collections.abc.Sequence protocol.

New in version 0.3.0.

append(*image*)
S.append(object) – append object to the end of the sequence

current_index
(numbers.Integral) The current index of its internal iterator.

Note: It's only for internal use.

extend(*images*, *offset=None*)
S.extend(iterable) – extend sequence by appending elements from the iterable

index_context(***kwds*)
Scoped setter of *current_index*. Should be used for with statement e.g.:

```
with image.sequence.index_context(3):
    print(image.size)
```

Note: It's only for internal use.

insert(*index*, *image*)
S.insert(index, object) – insert object before index

class wand.sequence.**SingleImage**(*wand*, *container*, *c_original_resource*)
Each single image in *Image* container. For example, it can be a frame of GIF animation.

Note that all changes on single images are invisible to their containers unless they are altered a with ... context manager.

with Image(filename='animation.gif') as container:

with container.sequence[0] as frame: frame.negate()

New in version 0.3.0.

Changed in version 0.5.1: Only sync changes of a *SingleImage* when exiting a with ... context. Not when parent *Image* closes.

container = None
(*wand.image.Image*) The container image.

delay
(numbers.Integral) The delay to pause before display the next image (in the *sequence* of its *container*). It's hundredths of a second.

index
(numbers.Integral) The index of the single image in the *container* image.

4.1.6 wand.resource — Global resource management

There is the global resource to manage in MagickWand API. This module implements automatic global resource management through reference counting.

wand.resource.**genesis**()
Instantiates the MagickWand API.

> **Warning:** Don't call this function directly. Use *increment_refcount()* and *decrement_refcount()* functions instead.

wand.resource.**terminus**()
Cleans up the MagickWand API.

> **Warning:** Don't call this function directly. Use *increment_refcount()* and *decrement_refcount()* functions instead.

wand.resource.**increment_refcount**()
Increments the reference_count and instantiates the MagickWand API if it is the first use.

wand.resource.**decrement_refcount**()
Decrements the reference_count and cleans up the MagickWand API if it will be no more used.

wand.resource.**limits = <wand.resource.ResourceLimits object>**
(*ResourceLimits*) Helper to get & set Magick Resource Limits.

New in version 0.5.1.

class wand.resource.**Resource**
Abstract base class for MagickWand object that requires resource management. Its all subclasses manage the resource semiautomatically and support with statement as well:

```
with Resource() as resource:
    # use the resource...
    pass
```

It doesn't implement constructor by itself, so subclasses should implement it. Every constructor should assign the pointer of its resource data into *resource* attribute inside of with *allocate()* context. For example:

```
class Pizza(Resource):
    '''My pizza yummy.'''

    def __init__(self):
        with self.allocate():
            self.resource = library.NewPizza()
```

New in version 0.1.2.

allocate(***kwds*)
Allocates the memory for the resource explicitly. Its subclasses should assign the created resource into *resource* attribute inside of this context. For example:

```
with resource.allocate():
    resource.resource = library.NewResource()
```

c_clear_exception = NotImplemented
(ctypes.CFUNCTYPE) The ctypes function that clears an exception of the *resource*.

Note: It is an abstract attribute that has to be implemented in the subclass.

c_destroy_resource = NotImplemented
(ctypes.CFUNCTYPE) The ctypes function that destroys the *resource*.

Note: It is an abstract attribute that has to be implemented in the subclass.

c_get_exception = NotImplemented
(ctypes.CFUNCTYPE) The ctypes function that gets an exception from the *resource*.

Note: It is an abstract attribute that has to be implemented in the subclass.

c_is_resource = NotImplemented
(ctypes.CFUNCTYPE) The ctypes predicate function that returns whether the given pointer (that contains a resource data usuaully) is a valid resource.

Note: It is an abstract attribute that has to be implemented in the subclass.

destroy()
Cleans up the resource explicitly. If you use the resource in with statement, it was called implicitly so have not to call it.

get_exception()
Gets a current exception instance.

Returns a current exception. it can be None as well if any errors aren't occurred

Return type *wand.exceptions.WandException*

raise_exception(*stacklevel=1*)
Raises an exception or warning if it has occurred.

resource
Internal pointer to the resource instance. It may raise *DestroyedResourceError* when the resource has destroyed already.

class wand.resource.**ResourceLimits**
Wrapper for MagickCore resource limits. Useful for dynamically reducing system resources before attempting risky, or slow running, *Image* operations.

For example:

```
from wand.image import Image
from wand.resource import limits

# Use 100MB of ram before writing temp data to disk.
limits['memory'] = 1024 * 1024 * 100
# Reject images larger than 1000x1000.
limits['width'] = 1000
limits['height'] = 1000

# Debug resources used.
with Image(filename='user.jpg') as img:
    print('Using {0} of {1} memory'.format(limits.resource('memory'),
                                           limits['memory']))

# Dump list of all limits.
for label in limits:
    print('{0} => {1}'.format(label, limits[label]))
```

Available resource keys:

- `'area'` - Maximum *width * height* of a pixel cache before writing to disk.
- `'disk'` - Maximum bytes used by pixel cache on disk before exception is thrown.
- `'file'` - Maximum cache files opened at any given time.
- `'height'` - Maximum height of image before exception is thrown.
- `'list_length'` - Maximum images in sequence. Only available with recent version of ImageMagick.
- `'map'` - Maximum memory map in bytes to allocated for pixel cache before using disk.
- `'memory'` - Maximum bytes to allocated for pixel cache before using disk.
- `'thread'` - Maximum parallel task sub-routines can spawn - if using OpenMP.
- `'throttle'` - Total milliseconds to yield to CPU - if possible.
- `'time'` - Maximum seconds before exception is thrown.
- `'width'` - Maximum width of image before exception is thrown.

New in version 0.5.1.

get_resource_limit(*resource*)
Get the current limit for the resource type.

Parameters **resource** (`basestring`) – Resource type.

Return type `numeric.Integral`

New in version 0.5.1.

resource(*resource*)
Get the current value for the resource type.

Parameters **resource** (`basestring`) – Resource type.

Return type `numeric.Integral`

New in version 0.5.1.

set_resource_limit(*resource*, *limit*)
Sets a new limit for resource type.

Note: The new limit value must be equal to, or less then, the maximum limit defined by the `policy.xml`. Any values set outside normal bounds will be ignored silently.

Parameters

- **resource** (`basestring`) – Resource type.
- **limit** (`numeric.Integral`) – New limit value.

New in version 0.5.1.

exception `wand.resource.`**DestroyedResourceError**
An error that rises when some code tries access to an already destroyed resource.

Changed in version 0.3.0: It becomes a subtype of *wand.exceptions.WandException*.

`wand.resource.`**safe_copy**(*ptr*)
Safely cast memory address to char pointer, convert to python string, and immediately free resources.

Parameters **ptr** (`ctypes.c_void_p`) – The memory address to convert to text string.

Returns `tuple` (`ctypes.c_void_p`, `str`)

New in version 0.5.3.

4.1.7 wand.exceptions — Errors and warnings

This module maps MagickWand API's errors and warnings to Python's native exceptions and warnings. You can catch all MagickWand errors using Python's natural way to catch errors.

See also:

ImageMagick Exceptions

New in version 0.1.1.

exception `wand.exceptions.`**BaseError**
Bases: *wand.exceptions.WandException*

Base class for Wand-related errors.

New in version 0.4.4.

exception `wand.exceptions.`**BaseFatalError**
Bases: *wand.exceptions.WandException*

Base class for Wand-related fatal errors.

New in version 0.4.4.

exception `wand.exceptions.`**BaseWarning**
Bases: *wand.exceptions.WandException*, `exceptions.Warning`

Base class for Wand-related warnings.

New in version 0.4.4.

exception `wand.exceptions.`**BlobError**
Bases: *wand.exceptions.BaseError*, `exceptions.IOError`

A binary large object could not be allocated, read, or written.

exception wand.exceptions.**BlobFatalError**
Bases: *wand.exceptions.BaseFatalError*, exceptions.IOError

A binary large object could not be allocated, read, or written.

exception wand.exceptions.**BlobWarning**
Bases: *wand.exceptions.BaseWarning*, exceptions.IOError

A binary large object could not be allocated, read, or written.

wand.exceptions.**CODE_MAP = [(<class 'wand.exceptions.BaseWarning'>, 'Warning'), (<class 'wa**
(list) The list of (base_class, suffix) pairs (for each code). It would be zipped with *DOMAIN_MAP* pairs' last element.

exception wand.exceptions.**CacheError**
Bases: *wand.exceptions.BaseError*

Pixels could not be read or written to the pixel cache.

exception wand.exceptions.**CacheFatalError**
Bases: *wand.exceptions.BaseFatalError*

Pixels could not be read or written to the pixel cache.

exception wand.exceptions.**CacheWarning**
Bases: *wand.exceptions.BaseWarning*

Pixels could not be read or written to the pixel cache.

exception wand.exceptions.**CoderError**
Bases: *wand.exceptions.BaseError*

There was a problem with an image coder.

exception wand.exceptions.**CoderFatalError**
Bases: *wand.exceptions.BaseFatalError*

There was a problem with an image coder.

exception wand.exceptions.**CoderWarning**
Bases: *wand.exceptions.BaseWarning*

There was a problem with an image coder.

exception wand.exceptions.**ConfigureError**
Bases: *wand.exceptions.BaseError*

There was a problem getting a configuration file.

exception wand.exceptions.**ConfigureFatalError**
Bases: *wand.exceptions.BaseFatalError*

There was a problem getting a configuration file.

exception wand.exceptions.**ConfigureWarning**
Bases: *wand.exceptions.BaseWarning*

There was a problem getting a configuration file.

exception wand.exceptions.**CorruptImageError**
Bases: *wand.exceptions.BaseError*, exceptions.ValueError

The image file may be corrupt.

exception wand.exceptions.**CorruptImageFatalError**
Bases: *wand.exceptions.BaseFatalError*, exceptions.ValueError

The image file may be corrupt.

exception wand.exceptions.**CorruptImageWarning**
Bases: *wand.exceptions.BaseWarning*, exceptions.ValueError

The image file may be corrupt.

wand.exceptions.**DOMAIN_MAP = [('ResourceLimit', 'A program resource is exhausted e.g. not e**
(list) A list of error/warning domains, these descriptions and codes. The form of elements is like: (domain name, description, codes).

exception wand.exceptions.**DelegateError**
Bases: *wand.exceptions.BaseError*

An ImageMagick delegate failed to complete.

exception wand.exceptions.**DelegateFatalError**
Bases: *wand.exceptions.BaseFatalError*

An ImageMagick delegate failed to complete.

exception wand.exceptions.**DelegateWarning**
Bases: *wand.exceptions.BaseWarning*

An ImageMagick delegate failed to complete.

exception wand.exceptions.**DrawError**
Bases: *wand.exceptions.BaseError*

A drawing operation failed.

exception wand.exceptions.**DrawFatalError**
Bases: *wand.exceptions.BaseFatalError*

A drawing operation failed.

exception wand.exceptions.**DrawWarning**
Bases: *wand.exceptions.BaseWarning*

A drawing operation failed.

exception wand.exceptions.**FileOpenError**
Bases: *wand.exceptions.BaseError*, exceptions.IOError

The image file could not be opened for reading or writing.

exception wand.exceptions.**FileOpenFatalError**
Bases: *wand.exceptions.BaseFatalError*, exceptions.IOError

The image file could not be opened for reading or writing.

exception wand.exceptions.**FileOpenWarning**
Bases: *wand.exceptions.BaseWarning*, exceptions.IOError

The image file could not be opened for reading or writing.

exception wand.exceptions.**ImageError**
Bases: *wand.exceptions.BaseError*

The operation could not complete due to an incompatible image.

exception wand.exceptions.**ImageFatalError**
Bases: *wand.exceptions.BaseFatalError*

The operation could not complete due to an incompatible image.

exception wand.exceptions.**ImageWarning**
Bases: *wand.exceptions.BaseWarning*

The operation could not complete due to an incompatible image.

exception wand.exceptions.**MissingDelegateError**
Bases: *wand.exceptions.BaseError*, exceptions.ImportError

The image type can not be read or written because the appropriate; delegate is missing.

exception wand.exceptions.**MissingDelegateFatalError**
Bases: *wand.exceptions.BaseFatalError*, exceptions.ImportError

The image type can not be read or written because the appropriate; delegate is missing.

exception wand.exceptions.**MissingDelegateWarning**
Bases: *wand.exceptions.BaseWarning*, exceptions.ImportError

The image type can not be read or written because the appropriate; delegate is missing.

exception wand.exceptions.**ModuleError**
Bases: *wand.exceptions.BaseError*

There was a problem with an image module.

exception wand.exceptions.**ModuleFatalError**
Bases: *wand.exceptions.BaseFatalError*

There was a problem with an image module.

exception wand.exceptions.**ModuleWarning**
Bases: *wand.exceptions.BaseWarning*

There was a problem with an image module.

exception wand.exceptions.**MonitorError**
Bases: *wand.exceptions.BaseError*

There was a problem activating the progress monitor.

exception wand.exceptions.**MonitorFatalError**
Bases: *wand.exceptions.BaseFatalError*

There was a problem activating the progress monitor.

exception wand.exceptions.**MonitorWarning**
Bases: *wand.exceptions.BaseWarning*

There was a problem activating the progress monitor.

exception wand.exceptions.**OptionError**
Bases: *wand.exceptions.BaseError*

A command-line option was malformed.

exception wand.exceptions.**OptionFatalError**
Bases: *wand.exceptions.BaseFatalError*

A command-line option was malformed.

exception wand.exceptions.**OptionWarning**
Bases: *wand.exceptions.BaseWarning*

A command-line option was malformed.

exception wand.exceptions.**PolicyError**
Bases: *wand.exceptions.BaseError*

A policy denies access to a delegate, coder, filter, path, or resource.

exception wand.exceptions.**PolicyFatalError**
Bases: *wand.exceptions.BaseFatalError*

A policy denies access to a delegate, coder, filter, path, or resource.

exception wand.exceptions.**PolicyWarning**
Bases: *wand.exceptions.BaseWarning*

A policy denies access to a delegate, coder, filter, path, or resource.

exception wand.exceptions.**RandomError**
Bases: *wand.exceptions.BaseError*

There is a problem generating a true or pseudo-random number.

exception wand.exceptions.**RandomFatalError**
Bases: *wand.exceptions.BaseFatalError*

There is a problem generating a true or pseudo-random number.

exception wand.exceptions.**RandomWarning**
Bases: *wand.exceptions.BaseWarning*

There is a problem generating a true or pseudo-random number.

exception wand.exceptions.**RegistryError**
Bases: *wand.exceptions.BaseError*

There was a problem getting or setting the registry.

exception wand.exceptions.**RegistryFatalError**
Bases: *wand.exceptions.BaseFatalError*

There was a problem getting or setting the registry.

exception wand.exceptions.**RegistryWarning**
Bases: *wand.exceptions.BaseWarning*

There was a problem getting or setting the registry.

exception wand.exceptions.**ResourceLimitError**
Bases: *wand.exceptions.BaseError*, exceptions.MemoryError

A program resource is exhausted e.g. not enough memory.

exception wand.exceptions.**ResourceLimitFatalError**
Bases: *wand.exceptions.BaseFatalError*, exceptions.MemoryError

A program resource is exhausted e.g. not enough memory.

exception wand.exceptions.**ResourceLimitWarning**
Bases: *wand.exceptions.BaseWarning*, exceptions.MemoryError

A program resource is exhausted e.g. not enough memory.

exception wand.exceptions.**StreamError**
Bases: *wand.exceptions.BaseError*, exceptions.IOError

There was a problem reading or writing from a stream.

exception wand.exceptions.**StreamFatalError**
Bases: *wand.exceptions.BaseFatalError*, exceptions.IOError

There was a problem reading or writing from a stream.

exception wand.exceptions.**StreamWarning**
Bases: *wand.exceptions.BaseWarning*, exceptions.IOError

There was a problem reading or writing from a stream.

wand.exceptions.**TYPE_MAP = {300: <class 'wand.exceptions.ResourceLimitWarning'>, 305: <cl**
(dict) The dictionary of (code, exc_type).

exception wand.exceptions.**TypeError**
Bases: *wand.exceptions.BaseError*

A font is unavailable; a substitution may have occurred.

exception wand.exceptions.**TypeFatalError**
Bases: *wand.exceptions.BaseFatalError*

A font is unavailable; a substitution may have occurred.

exception wand.exceptions.**TypeWarning**
Bases: *wand.exceptions.BaseWarning*

A font is unavailable; a substitution may have occurred.

exception wand.exceptions.**WandError**
Bases: *wand.exceptions.BaseError*

There was a problem specific to the MagickWand API.

exception wand.exceptions.**WandException**
Bases: exceptions.Exception

All Wand-related exceptions are derived from this class.

exception wand.exceptions.**WandFatalError**
Bases: *wand.exceptions.BaseFatalError*

There was a problem specific to the MagickWand API.

exception wand.exceptions.**WandLibraryVersionError**
Bases: *wand.exceptions.WandException*

Base class for Wand-related ImageMagick version errors.

New in version 0.3.2.

exception wand.exceptions.**WandRuntimeError**
Bases: *wand.exceptions.WandException*, exceptions.RuntimeError

Generic class for Wand-related runtime errors.

New in version 0.5.2.

exception wand.exceptions.**WandWarning**
Bases: *wand.exceptions.BaseWarning*

There was a problem specific to the MagickWand API.

exception wand.exceptions.**XServerError**
Bases: *wand.exceptions.BaseError*

An X resource is unavailable.

exception wand.exceptions.**XServerFatalError**
Bases: *wand.exceptions.BaseFatalError*

An X resource is unavailable.

exception wand.exceptions.**XServerWarning**
Bases: *wand.exceptions.BaseWarning*

An X resource is unavailable.

4.1.8 wand.api — Low-level interfaces

Changed in version 0.1.10: Changed to throw `ImportError` instead of `AttributeError` when the shared library fails to load.

class wand.api.**AffineMatrix**

class wand.api.**MagickPixelPacket**

wand.api.**library**
(ctypes.CDLL) The MagickWand library.

wand.api.**libc**
(ctypes.CDLL) The C standard library.

wand.api.**libmagick**
(ctypes.CDLL) The ImageMagick library. It is the same with *library* on platforms other than Windows.

New in version 0.1.10.

wand.api.**load_library**()
Loads the MagickWand library.

Returns the MagickWand library and the ImageMagick library

Return type ctypes.CDLL

class wand.api.**PixelInfo**

class wand.api.**PointInfo**

4.1.9 wand.compat — Compatibility layer

This module provides several subtle things to support multiple Python versions (2.6, 2.7, 3.3+) and VM implementations (CPython, PyPy).

wand.compat.**PY3 = False**
(bool) Whether it is Python 3.x or not.

wand.compat.**abc = <module 'collections' from '/home/docs/.pyenv/versions/2.7.14/lib/python2**
(module) Module containing abstract base classes. collections in Python 2 and collections.abc in Python 3.

wand.compat.**binary**(*string*, *var=None*)
Makes `string` to `str` in Python 2. Makes `string` to `bytes` in Python 3.

Parameters

- **string** (bytes, str, unicode) – a string to cast it to *binary_type*
- **var** (str) – an optional variable name to be used for error message

wand.compat.**binary_type**
alias of __builtin__.str

wand.compat.**encode_filename**(*filename*)
If filename is a *text_type*, encode it to *binary_type* according to filesystem's default encoding.

Changed in version 0.5.3: Added support for PEP-519 https://github.com/emcconville/wand/pull/339

wand.compat.**file_types = (<class 'io.RawIOBase'>, <type 'file'>)**
(type, tuple) Types for file objects that have fileno().

wand.compat.**nested**(**args*, ***kwds*)
Combine multiple context managers into a single nested context manager.

This function has been deprecated in favour of the multiple manager form of the with statement.

The one advantage of this function over the multiple manager form of the with statement is that argument unpacking allows it to be used with a variable number of context managers as follows:

with nested(*managers): do_something()

wand.compat.**string_type**
alias of __builtin__.basestring

wand.compat.**text**(*string*)
Makes string to str in Python 3. Does nothing in Python 2.

Parameters **string** (bytes, str, unicode) – a string to cast it to *text_type*

wand.compat.**text_type**
alias of __builtin__.unicode

class wand.compat.**xrange**(*stop*) → xrange object
xrange(start, stop[, step]) -> xrange object

Like range(), but instead of returning a list, returns an object that generates the numbers in the range on demand. For looping, this is slightly faster than range() and more memory efficient.

4.1.10 wand.display — Displaying images

The *display()* functions shows you the image. It is useful for debugging.

If you are in Mac, the image will be opened by your default image application (**Preview.app** usually).

If you are in Windows, the image will be opened by **imdisplay.exe**, or your default image application (**Windows Photo Viewer** usually) if **imdisplay.exe** is unavailable.

You can use it from CLI also. Execute *wand.display* module through python -m option:

```
$ python -m wand.display wandtests/assets/mona-lisa.jpg
```

New in version 0.1.9.

wand.display.**display**(*image*, *server_name=':0'*)
Displays the passed image.

Parameters

- **image** (*Image*) – an image to display

- **server_name** (str) – X11 server name to use. it is ignored and not used for Mac. default is ':0'

4.1.11 wand.version — Version data

You can find the current version in the command line interface:

```
$ python -m wand.version
0.5.3
$ python -m wand.version --verbose
Wand 0.5.3
ImageMagick 6.7.7-6 2012-06-03 Q16 http://www.imagemagick.org
$ python -m wand.version --config | grep CC | cut -d : -f 2
gcc -std=gnu99 -std=gnu99
$ python -m wand.version --fonts | grep Helvetica
Helvetica
Helvetica-Bold
Helvetica-Light
Helvetica-Narrow
Helvetica-Oblique
$ python -m wand.version --formats | grep CMYK
CMYK
CMYKA
```

New in version 0.2.0: The command line interface.

New in version 0.2.2: The `--verbose`/`-v` option which also prints ImageMagick library version for CLI.

New in version 0.4.1: The `--fonts`, `--formats`, & `--config` option allows printing additional information about ImageMagick library.

wand.version.**VERSION = '0.5.3'**
(basestring) The version string e.g. '0.1.2'.

Changed in version 0.1.9: Becomes string. (It was tuple before.)

wand.version.**VERSION_INFO = (0, 5, 3)**
(tuple) The version tuple e.g. (0, 1, 2).

Changed in version 0.1.9: Becomes tuple. (It was string before.)

wand.version.**MAGICK_VERSION = None**
(basestring) The version string of the linked ImageMagick library. The exactly same string to the result of GetMagickVersion() function.

Example:

```
'ImageMagick 6.7.7-6 2012-06-03 Q16 http://www.imagemagick.org'
```

New in version 0.2.1.

wand.version.**MAGICK_VERSION_FEATURES = 'Cipher DPC Modules OpenMP '**
(basestring) A string of all features enabled. This value is identical to what is returned by GetMagickFeatures()

New in version 0.5.0.

wand.version.**MAGICK_VERSION_INFO = None**
(tuple) The version tuple e.g. (6, 7, 7, 6) of *MAGICK_VERSION*.

New in version 0.2.1.

wand.version.**MAGICK_VERSION_NUMBER = None**
(numbers.Integral) The version number of the linked ImageMagick library.

New in version 0.2.1.

wand.version.**MAGICK_RELEASE_DATE = None**
(datetime.date) The release date of the linked ImageMagick library. Equivalent to the result of GetMagickReleaseDate() function.

New in version 0.2.1.

wand.version.**MAGICK_RELEASE_DATE_STRING = None**
(basestring) The date string e.g. '2012-06-03' of *MAGICK_RELEASE_DATE_STRING*. This value is the exactly same string to the result of GetMagickReleaseDate() function.

New in version 0.2.1.

wand.version.**MAGICK_HDRI = None**
(bool) True if ImageMagick is compiled for High Dynamic Range Image.

wand.version.**QUANTUM_DEPTH = None**
(numbers.Integral) The quantum depth configuration of the linked ImageMagick library. One of 8, 16, 32, or 64.

New in version 0.3.0.

wand.version.**QUANTUM_RANGE = None**
(numbers.Integral) The quantum range configuration of the linked ImageMagick library.

New in version 0.5.0.

wand.version.**configure_options**(*pattern='*'*)
Queries ImageMagick library for configurations options given at compile-time.

Example: Find where the ImageMagick documents are installed:

```
>>> from wand.version import configure_options
>>> configure_options('DOC*')
{'DOCUMENTATION_PATH': '/usr/local/share/doc/ImageMagick-6'}
```

Parameters **pattern** (basestring) – A term to filter queries against. Supports wildcard '*' characters. Default patterns '*' for all options.

Returns Directory of configuration options matching given pattern

Return type collections.defaultdict

wand.version.**fonts**(*pattern='*'*)
Queries ImageMagick library for available fonts.

Available fonts can be configured by defining *types.xml*, *type-ghostscript.xml*, or *type-windows.xml*. Use *wand.version.configure_options()* to locate system search path, and resources article for defining xml file.

Example: List all bold Helvetica fonts:

```
>>> from wand.version import fonts
>>> fonts('*Helvetica*Bold*')
['Helvetica-Bold', 'Helvetica-Bold-Oblique', 'Helvetica-BoldOblique',
 'Helvetica-Narrow-Bold', 'Helvetica-Narrow-BoldOblique']
```

Parameters **pattern** (basestring) – A term to filter queries against. Supports wildcard '*' characters. Default patterns '*' for all options.

Returns Sequence of matching fonts

Return type `collections.Sequence`

`wand.version.`**`formats`**(*pattern='*'*)

Queries ImageMagick library for supported formats.

Example: List supported PNG formats:

```
>>> from wand.version import formats
>>> formats('PNG*')
['PNG', 'PNG00', 'PNG8', 'PNG24', 'PNG32', 'PNG48', 'PNG64']
```

Parameters **`pattern`** (`basestring`) – A term to filter formats against. Supports wildcards '*' characters. Default pattern '*' for all formats.

Returns Sequence of matching formats

Return type `collections.Sequence`

CHAPTER 5

Troubleshooting

5.1 Mailing list

Wand has the list for users. If you want to subscribe the list, just send a mail to:

wand@librelist.com

The list archive provided by Librelist is synchronized every hour.

5.2 Stack Overflow

There's a Stack Overflow tag for Wand:

http://stackoverflow.com/questions/tagged/wand

Freely ask questions about Wand including troubleshooting. Thanks for sindikat's contribution.

5.3 Documentation

The documentation for Wand is hosted by ReadTheDocs.org. The nightly development docs can be found under the latest version, and the most recent release under stable. Previous & maintenance releases are also available.

CHAPTER 6

Open source

Wand is an open source software initially written by Hong Minhee (for StyleShare), and is currently maintained by E. McConville. See also the complete list of contributors as well. The source code is distributed under MIT license and you can find it at GitHub repository. Check out now:

```
$ git clone git://github.com/emcconville/wand.git
```

If you find a bug, please notify to our issue tracker. Pull requests are always welcome!

We discuss about Wand's development on IRC. Come #wand channel on freenode network.

Check out *Wand Changelog* also.

CHAPTER 7

Indices and tables

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