# term-img

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CHAPTER

ONE

# INSTALLATION

## 1.1 Requirements

- Operating System: Unix / Linux / MacOS X / Windows (partial support, see the *FAQs*)
- Python >= 3.7
- A terminal emulator with full Unicode support and ANSI 24-bit color support
  - Plans are in place to support a wider variety of terminal emulators, whether not meeting or surpassing these requirements (see *Planned Features*).

## 1.2 Steps

The latest **stable** version can be installed from PyPI using `pip`:

```
pip install term-image
```

The **development** version can be installed thus: Clone the repository, then navigate into the project directory in a terminal and run:

```
pip install .
```

## 1.3 Supported Terminal Emulators

Some terminals emulators that have been tested to meet all major requirements are:

- **libvte**-based terminal emulators such as:
  - Gnome Terminal
  - Terminator
  - Tilix
- Kitty
- Alacritty
- Windows Terminal
- Termux (on Android)

Other terminals that only support 256 colors but meet other requirements include: - xterm, uxterm *(256 colors)*

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**Note:** If you've tested `term-img` on any other terminal emulator that meets all requirements, please mention the name in a new thread under this discussion.

Also, if you're having an issue with terminal support, you may report or view information about it in the discussion linked above.

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See here for information about terminal colors and a list of potentially supported terminal emulators.

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**Note:** Some terminal emulators support 24-bit color codes but have a 256-color pallete. This will limit color reproduction.

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CHAPTER

TWO

# LIBRARY DOCUMENTATION

## 2.1 Tutorial

This is a basic introduction to using the library. Please refer to the *Reference* for detailed description of the features and functionality provided by the library.

For this tutorial we'll be using the image below:

The image has a resolution of **288x288 pixels**.

**Note:** All the samples in this tutorial occured in a terminal window of **255 columns by 70 lines**.

### 2.1.1 Creating an instance

If the file is stored on your local filesystem:

```
from term_img.image import TermImage

image = TermImage.from_file("python.png")
```

You can also use a URL if you don't have the file stored locally:

```
from term_img.image import TermImage

image = TermImage.from_url("https://raw.githubusercontent.com/AnonymouX47/term-img/docs/
↪source/resources/python.png")
```

The library can also be used with PIL images:

```
from PIL import Image
from term_img.image import TermImage

img = Image.open("python.png")
image = TermImage(img)
```

### 2.1.2 Rendering an image

Rendering an image is simply the process of converting it (per-frame for *animated* images) into text (a string).

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**Hint:** To display the rendered output in the following steps, just print the output string with `print()`.

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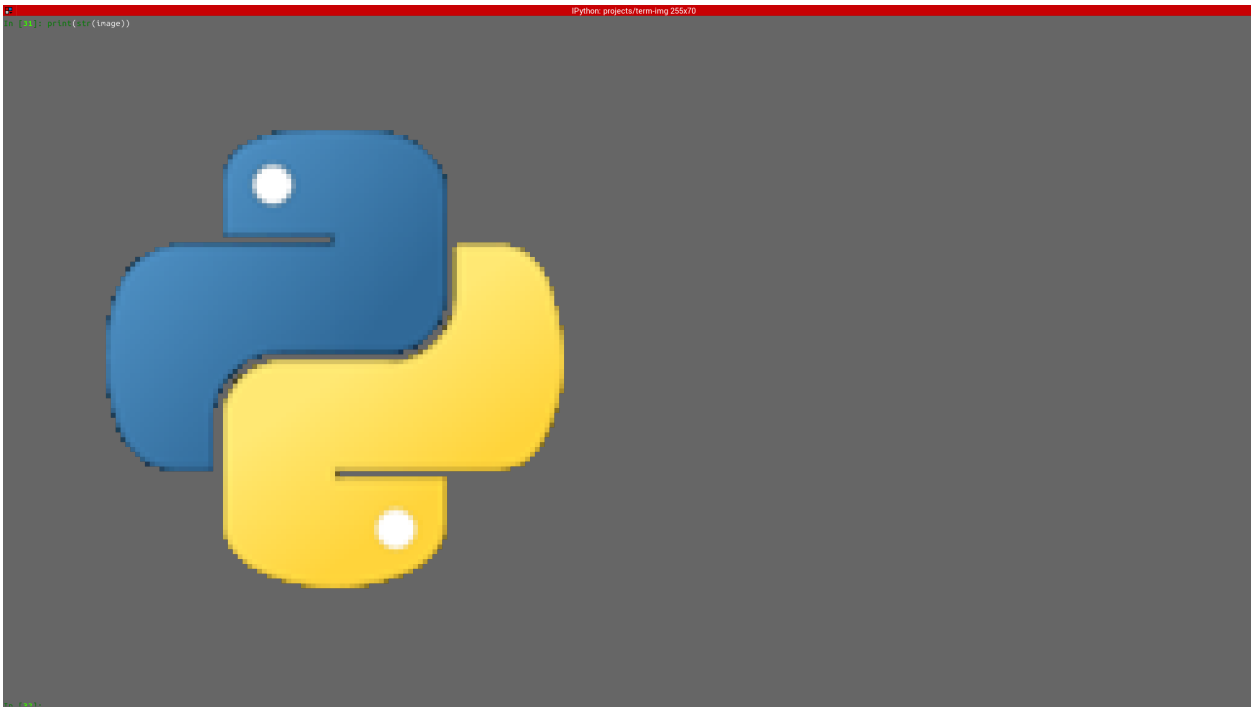
There are two ways to render an image:

#### 1. Unformatted

```
str(image)
```

Renders the image without *padding/alignment* and with transparency enabled

The result should look like:



### 2. Formatted

---

**Note:** To see the effect of *alignment* in the steps below, please scale the image down using:

```
image.scale = 0.75
```

This simply sets the x-axis and y-axis *scales* of the image to `0.75`. We'll see more about this *later*.

---

Below are examples of formatted rendering:

```
format(image, "|200.^70#ffffff")
```

Renders the image with:

- **center** *horizontal alignment*
- a *padding width* of **200** columns
- **top** *vertical alignment*
- a *padding height* of **70** lines
- transparent background replaced with a **white** (`#ffffff`) background

---

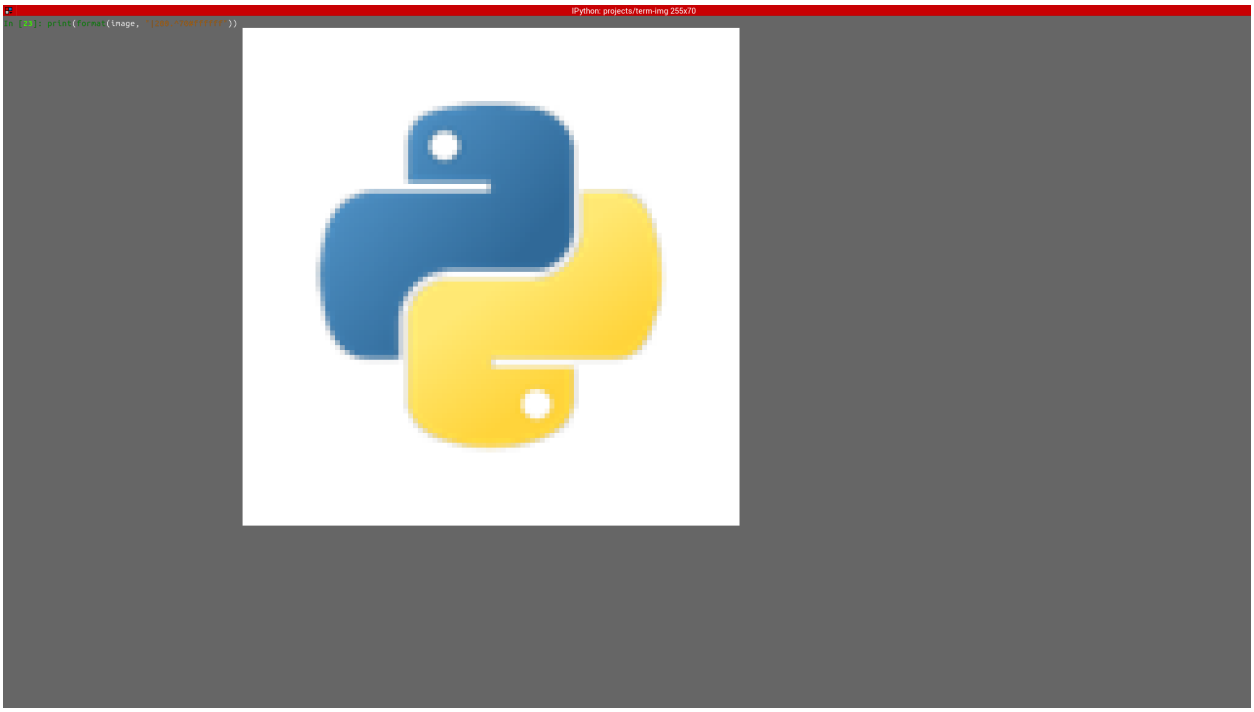
**Note:** If you get an error while trying the step above, saying something like "padding width larger than…", either:

- reduce the width (200) to something that'll fit into your terminal window, or
- increase the size of the terminlal window

You might use your own *terminal height* instead of **70**.

---

The result should look like:

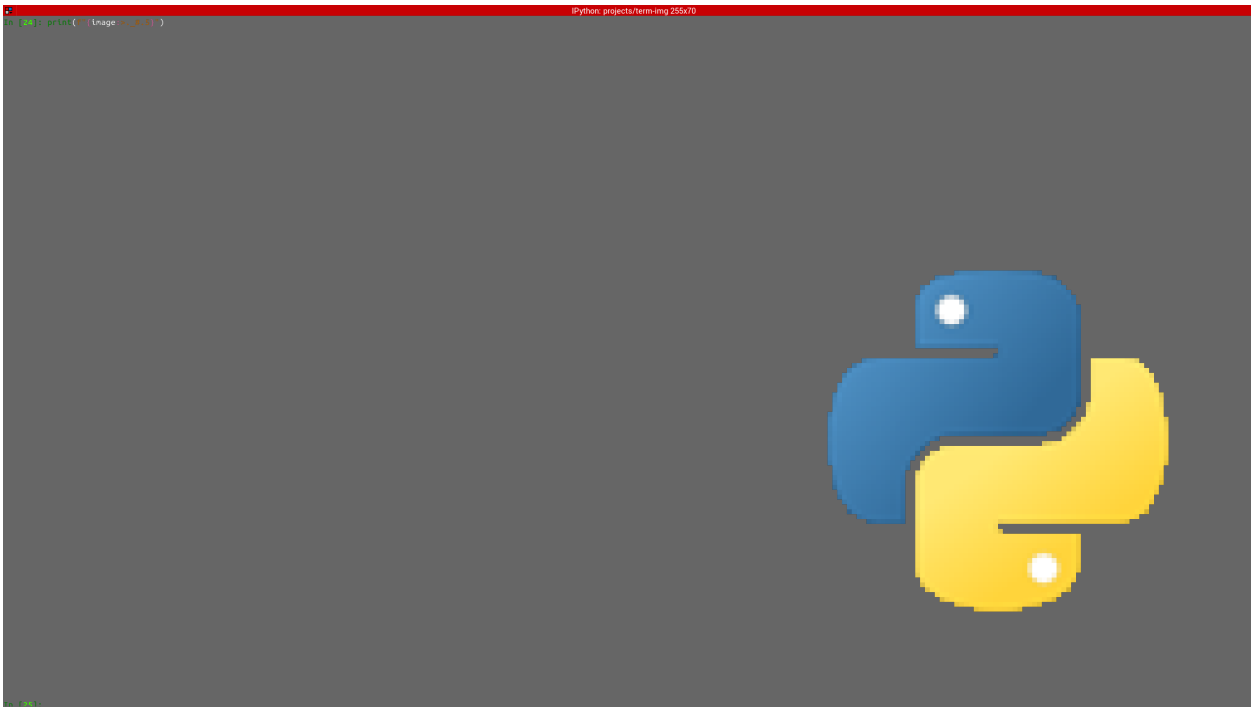


```
f"{image:>._#.5}"
```

Renders the image with:

- **right** *horizontal alignment*
- **automatic** *padding width* (the current *terminal width* minus *horizontal allowance*)
- **bottom** *vertical alignment*
- **automatic** *padding height* (the current *terminal height* minus *vertical allowance*)
- transparent background with **0.5** *alpha threshold*

The result should look like:



```
"{:1.1#}".format(image)
```

Renders the image with:

- **center** *horizontal alignment* (default)
- **no** horizontal *padding*, since 1 must be less than or equal to the image *width*
- **middle** *vertical alignment* (default)
- **no** vertical *padding*, since 1 is less than or equal to the image *height*
- transparency **disabled** (uses the image's default background color)

The result should look like:

You should also have a look at the complete *Image Format Specification*.

### 2.1.3 Drawing/Displaying an image to/in the terminal

There are two ways to draw an image to the terminal screen:

1. The *draw()* method

   ```
   image.draw()
   ```

   **NOTE:** *TermImage.draw()* has various parameters for *alignment*/*padding*, transparency and animation control.

2. Using `print()` with an image render output (i.e printing the rendered string)

   ```
   print(image)  # Uses str()
   ```

   OR

   ```
   print(f"{image:>200.^70#ffffff}")  # Uses format()
   ```

---

**Note:**

- For *animated* images, only the former animates the output, the latter only draws the **current** frame (see *TermImage.seek()* and *TermImage.tell()*).
- Also, the former performs size validation to see if the image will fit into the terminal, while the latter doesn't.

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**Important:** All the examples above use automatic *sizing* and default *scale*.

---

### 2.1.4 Image render size

The *render size* of an image is the dimension with which an image is rendered.
The *render size* can be retrieved via the *size*, *width* and *height* properties.

The *render size* of an image can be in either of two states:

1. Set

   The size is said the be *set* when the image has a fixed size.
   In this state, the `size` property is a `tuple` of integers, the `width` and `height` properties are integers.

2. Unset

   The size is said to be *unset* when the image doesn't have a fixed size.
   In this case, the size with which the image is rendered is automatically calculated (based on the current *term:`terminal size*) whenever the image is to be rendered.
   In this state, the `size`, `width` and `height` properties are `None`.

The *render size* of an image can be set when creating the instance by passing valid values to **either** the *width* **or** the *height* **keyword-only** parameter.
For whichever axis is given, the other axis is calculated **proportionally**.

---

**Note:**

1. The arguments can only be given **by keyword**.
2. If neither is given, the size is *unset*.
3. All methods of instantiation accept these arguments.

---

For example:

```
>>> image = Termimage.from_file("python.png")  # Unset
>>> image.size is None
True
>>> image = TermImage.from_file("python.png", width=60)  # width is given
>>> image.size
(60, 60)
>>> image.height
60
>>> image = TermImage.from_file("python.png", height=56)  # height is given
>>> image.size
(56, 56)
>>> image.width
56
```

No size validation is performed i.e the resulting size might not fit into the terminal window

```
>>> image = TermImage.from_file("python.png", height=136)  # (terminal_height - 2) * 2; Will fit, OK
>>> image.size
(136, 136)
>>> image = TermImage.from_file("python.png", height=1000)  # Will not fit, also OK
>>> image.size
(1000, 1000)
```

An exception is raised when both *width* and *height* are given.

```
>>> image = TermImage.from_file("python.png", width=100, height=100)
Traceback (most recent call last):
  .
  .
  .
ValueError: Cannot specify both width and height
```

The *width* and *height* properties are used to set the *render size* of an image after instantiation.

```
>>> image = Termimage.from_file("python.png")  # Unset
>>> image.size is None
True
>>> image.width = 56
>>> image.size
(56, 56)
>>> image.height
56
>>> image.height = 136
>>> image.size
(136, 136)
>>> image.width
136
>>> image.width = 200  # Even though the terminal can't contain the resulting height, the size is still set
```

Setting `width` or `height` to `None` sets the size to that automatically calculated based on the current *terminal size*.

```
>>> image = Termimage.from_file("python.png")  # Unset
>>> image.size is None
True
>>> image.width = None
>>> image.size
(136, 136)
>>> image.width = 56
>>> image.size
(56, 56)
>>> image.height = None
>>> image.size
(136, 136)
```

**Note:** An exception is raised if the terminal size is too small to calculate a size.

The *size* property can only be set to one value, `None` and doing this *unsets* the *render size*.

```
>>> image = Termimage.from_file("python.png", width=100)
>>> image.size
(100, 100)
>>> image.size = None
>>> image.size is image.width is image.height is None
True
```

**Important:**

1. The currently set *font ratio* is also taken into consideration when calculating or validating sizes.
2. The *height* is actually **about twice the number of lines** that'll be used to draw the image, assuming the y-axis *scale* is `1.0` (we'll get to that).
3. There is a **default** 2-line *vertical allowance*, to allow for shell prompts or the likes.

Therefore, **by default**, only `terminal_height - 2` lines are available i.e the maximum height is `(terminal_height - 2) * 2`.

**Hint:** See *`TermImage.set_size()`* for advanced sizing control.

### 2.1.5 Image render scale

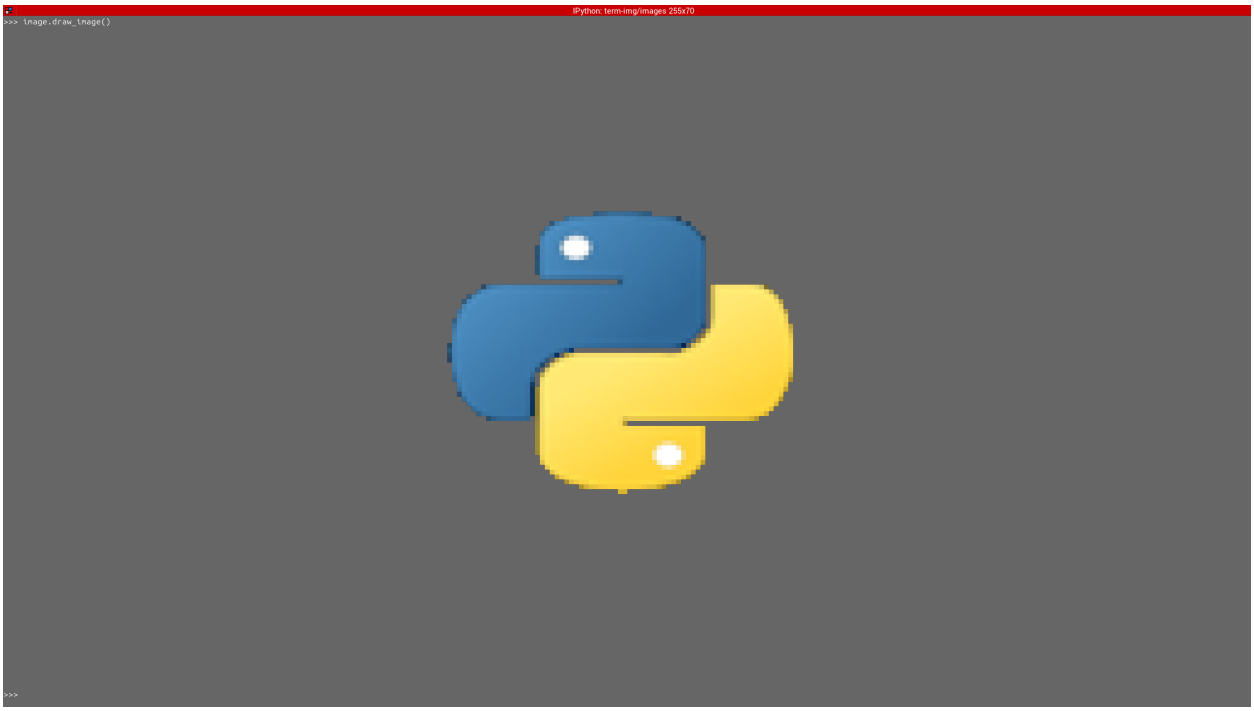
The *render scale* of an image is the **fraction** of the *render size* that'll actually be used to render the image.
A valid scale value is a `float` in the range `0 < x <= 1` i.e greater than zero and less than or equal to one.

The *render scale* can be retrieved via the properties *`scale`*, *`scale_x`* and *`scale_y`*.

The scale can be set at instantiation by passing a value to the *scale* **keyword-only** paramter.

```
>>> image = Termimage.from_file("python.png", scale=(0.75, 0.6))
>>> image.scale
>>> (0.75, 0.6)
```

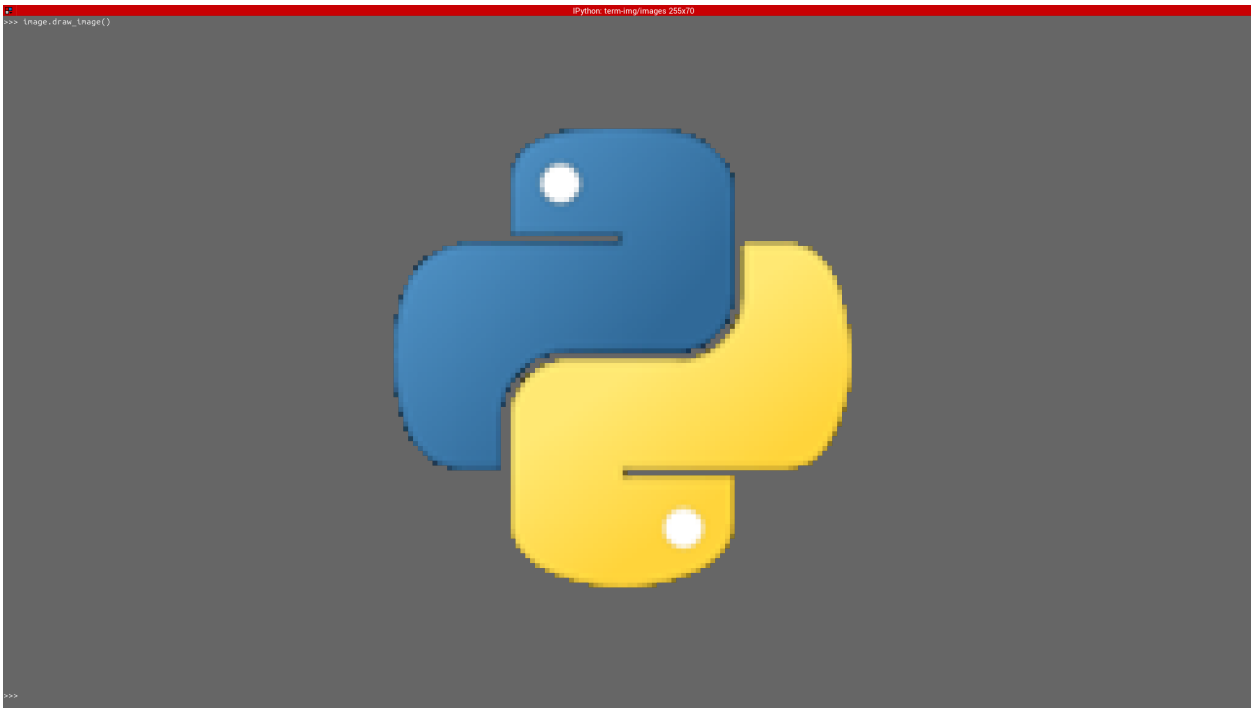
The rendered result (using `image.draw()`) should look like:




If the *scale* argument is ommited, the default scale `(1.0, 1.0)` is used.

```
>>> image = Termimage.from_file("python.png")
>>> image.scale
>>> (1.0, 1.0)
```

The rendered result (using `image.draw()`) should look like:



The properties *scale*, *scale_x* and *scale_y* are used to set the *render scale* of an image after instantiation.

`scale` accepts a tuple of two scale values or a single scale value.
`scale_x` and `scale_y` each accept a single scale value.

```
>>> image = Termimage.from_file("python.png")
>>> image.scale = (.3, .56756)
>>> image.scale
(0.3, 0.56756)
>>> image.scale = .5
>>> image.scale
(0.5, 0.5)
>>> image.scale_x = .75
>>> image.scale
(0.75, 0.5)
>>> image.scale_y = 1.
>>> image.scale
(0.75, 1.0)
```

Finally, to explore more of the library's features and functionality, check out the *Reference* section.

## 2.2 Reference

### 2.2.1 Core Library Definitions

The `term_img.image` module defines the following:

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**Note:** It's allowed to set properties for *animated* images on non-animated ones, the values are simply ignored.

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**class** `term_img.image.`**TermImage**(*image*, *, *width=None*, *height=None*, *scale=(1.0, 1.0)*)

Bases: `object`

Text-printable image

**Parameters**

- **image** (*Image.Image*) – Source image.
- **width** (*Optional[int]*) – The width to render the image with.
- **height** (*Optional[int]*) – The height to render the image with.
- **scale** (*Tuple[float, float]*) – The image render scale on respective axes.

**Raises**

- **TypeError** – An argument is of an inappropriate type.
- **ValueError** – An argument has an unexpected/invalid value.

Propagates exceptions raised by *set_size()*, if *width* or *height* is given.

---

**Note:**

- *width* is not neccesarily the exact number of columns that'll be used to render the image. That is influenced by the currently set *font ratio*.
- *height* is **2 times** the number of lines that'll be used in the terminal.
- If neither is given or both are `None`, the size is automatically determined when the image is to be *rendered*, such that it can fit within the terminal.
- The *size* is multiplied by the *scale* on each axis respectively before the image is *rendered*.

---

**property closed**
Instance finalization status

**property frame_duration**
Duration (in seconds) of a single frame for *animated* images

Setting this on non-animated images is simply ignored, no exception is raised.

**property height**
Image *render height*

`None` when `render size` is *unset*.

Settable values:

- `None`: Sets the render size to the automatically calculated one.
- A positive `int`: Sets the render height to the given value and the width proprtionally.

The image is actually *rendered* using half this number of lines

**property is_animated**
`True` if the image is *animated*. Otherwise, `False`.

**property original_size**
Original image size in pixels

**property n_frames: int**
The number of frames in the image

**property rendered_height**
The number of lines that the drawn image will occupy in a terminal

**property rendered_size: Tuple[int, int]**
The number of columns and lines (respectively) that the drawn image will occupy in a terminal

**property rendered_width**
The number of columns that the drawn image will occupy in a terminal

**property scale**
Image *render scale*

Settable values are:

- A *scale value*; sets both axes.
- A `tuple` of two *scale values*; sets `(x, y)` respectively.

A scale value is a `float` in the range **0.0 < value <= 1.0**.

**property scale_x**
x-axis *render scale*

A scale value is a `float` in the range **0.0 < x <= 1.0**.

**property scale_y**
y-ayis *render scale*

A scale value is a `float` in the range **0.0 < y <= 1.0**.

**property size**
Image *render size*

`None` when render size is unset.

Setting this to `None` *unsets* the *render size* (so that it's automatically calculated whenever the image is *rendered*) and resets the recognized advanced sizing options to their defaults.

**property source**
The *source* from which the instance was initialized

Can be a PIL image, file path or URL.

**property width**
Image *render width*

`None` when *`render size`* is *unset*.

Settable values:

- `None`: Sets the render size to the automatically calculated one.
- A positive `int`: Sets the render width to the given value and the height proportionally.

**close**()
Finalizes the instance and releases external resources.

- In most cases, it's not neccesary to explicity call this method, as it's automatically called when the instance is garbage-collected.
- This method can be safely called mutiple times.
- If the instance was initialized with a PIL image, the PIL image is never finalized.

**Return type** None

**draw**(*h_align=None*, *pad_width=None*, *v_align=None*, *pad_height=None*, *alpha=0.1568627450980392*, ***, *scroll=False*, *animate=True*, *repeat=- 1*, *cached=100*, *check_size=True*)
Draws/Displays an image in the terminal.

**Parameters**

- **h_align** (*Optional[str]*) – Horizontal alignment ("left" / "<", "center" / "|" or "right" / ">"). Default: center.
- **pad_width** (*Optional[int]*) – Number of columns within which to align the image.
  - Excess columns are filled with spaces.
  - default: terminal width.
- **v_align** (*Optional[str]*) – Vertical alignment ("top"/"^", "middle"/"-" or "bottom"/"_"). Default: middle.
- **pad_height** (*Optional[int]*) – Number of lines within which to align the image.
  - Excess lines are filled with spaces.
  - default: terminal height, with a 2-line allowance.
- **alpha** (*Optional[float]*) – Transparency setting.

  - If `None`, transparency is disabled (uses the image's default background color).
  - If a `float` (**0.0 <= x < 1.0**), specifies the alpha ratio **above** which pixels are taken as *opaque*.
  - If a string, specifies a **hex color** with which transparent background should be replaced.
- **scroll** (*bool*) – Only applies to non-animations. If `True`:
  - and the *render size* is set, allows the image's *rendered height* to be greater than the *available terminal height*.
  - and the *render size* is *unset*, the image is drawn to fit the terminal width.
- **animate** (*bool*) – If `False`, disable animation i.e draw only the current frame of an animated image.
- **repeat** (*int*) – The number of times to go over all frames of an animated image. A negative value implies infinite repetition.
- **cached** (*Union[bool, int]*) – Determines if *rendered* frames of an animated image will be cached (for speed up of subsequent renders of the same frame) or not.
  - If `bool`, it directly sets if the frames will be cached or not.
  - If `int`, caching is enabled only if the framecount of the image is less than or equal to the given number.
- **check_size** (*bool*) – If `False`, does not perform size validation for non-animations.

**Raises**

- **TypeError** – An argument is of an inappropriate type.
- **ValueError** – An argument is of an appropriate type but has an unexpected/invalid value.
- **ValueError** – *Render size* or *scale* too small.
- ***term_img.exceptions.InvalidSize*** – The image's *rendered size* can not fit into the *available terminal size*.

**Return type** None

- Animations, **by default**, are infinitely looped and can be terminated with `Ctrl-C` (`SIGINT`), raising `KeyboardInterrupt`.
- If *set_size()* was previously used to set the *render size* (directly or not), the last values of its *fit_to_width*, *h_allow* and *v_allow* parameters are taken into consideration, with *fit_to_width* applying to only non-animations.
- If the render size was set with the *fit_to_width* paramter of *set_size()* set to `True`, then setting *scroll* is unnecessary.
- *animate*, *repeat* and *cached* apply to *animated* images only. They are simply ignored for non-animated images.
- For animations (i.e animated images with *animate* set to `True`):
  - *Render size* and *padding height* are always validated, if set.
  - *scroll* is taken as `False` when render size is *unset*.

**classmethod from_file**(*filepath*, ***kwargs*)

Creates a *TermImage* instance from an image file.

**Parameters**

- **filepath** (*str*) – Relative/Absolute path to an image file.
- **kwargs** (*Union[int, None, Tuple[float, float]]*) – Same keyword arguments as the class constructor.

**Returns** A new *TermImage* instance.

**Raises**

- **TypeError** – *filepath* is not a string.
- **FileNotFoundError** – The given path does not exist.
- **IsADirectoryError** – Propagated from from `PIL.Image.open()`.
- **UnidentifiedImageError** – Propagated from from `PIL.Image.open()`.

**Return type** *term_img.image.TermImage*

Also Propagates exceptions raised or propagated by the class constructor.

**classmethod from_url**(*url*, ***kwargs*)

Creates a *TermImage* instance from an image URL.

**Parameters**

- **url** (*str*) – URL of an image file.
- **kwargs** (*Union[int, None, Tuple[float, float]]*) – Same keyword arguments as the class constructor.

**Returns** A new *TermImage* instance.

**Raises**

- **TypeError** – *url* is not a string.
- **ValueError** – The URL is invalid.
- ***term_img.exceptions.URLNotFoundError*** – The URL does not exist.
- **PIL.UnidentifiedImageError** – Propagated from `PIL.Image.open()`.

**Return type** *term_img.image.TermImage*

Also propagates connection-related exceptions from `requests.get()` and exceptions raised or propagated by the class constructor.

---

**Note:** This method creates a temporary image file, but only after a successful initialization.

Proper clean-up is guaranteed except maybe in very rare cases.

To ensure 100% guarantee of clean-up, use the object as a *context manager*.

---

**seek**(*pos*)

Changes current image frame.

**Parameters** **pos** (*int*) – New frame number.

**Raises**

- **TypeError** – An argument is of an inappropriate type.
- **ValueError** – An argument has an unexpected/invalid value but of an appropriate type.

**Return type** None

Frame numbers start from 0 (zero).

**set_size**(*width=None*, *height=None*, *h_allow=0*, *v_allow=2*, ***, *maxsize=None*, *fit_to_width=False*, *fit_to_height=False*)

Sets the *render size* with advanced control.

**Parameters**

- **width** (*Optional[int]*) – *Render width* to use.
- **height** (*Optional[int]*) – *Render height* to use.
- **h_allow** (*int*) – Horizontal allowance i.e minimum number of columns to leave unused.
- **v_allow** (*int*) – Vertical allowance i.e minimum number of lines to leave unused.
- **maxsize** (*Optional[Tuple[int, int]]*) – If given `(cols, lines)`, it's used instead of the terminal size.
- **fit_to_width** (*bool*) – Only used with **automatic sizing**. See description below.
- **fit_to_height** (*bool*) – Only used with **automatic sizing**. See description below.

**Raises**

- **TypeError** – An argument is of an inappropriate type.
- **ValueError** – An argument is of an appropriate type but has an unexpected/invalid value.
- **ValueError** – Both *width* and *height* are specified.
- **ValueError** – *fit_to_width* or *fit_to_height* is `True` when *width*, *height* or *maxsize* is given.
- **ValueError** – The *available size* is too small for automatic sizing.
- ***term_img.exceptions.InvalidSize*** – The resulting *render size* is too small.
- ***term_img.exceptions.InvalidSize*** – *maxsize* is given and the resulting *rendered size* will not fit into it.

**Return type** None

If neither *width* nor *height* is given or anyone given is `None`, **automatic sizing** applies. In such a case, if:

- both *fit_to_width* and *fit_to_height* are `False`, the size is set to fit **within** the *available terminal size* (or *maxsize*, if given).
- *fit_to_width* is `True`, the size is set such that the *rendered width* is exactly the *available terminal width* (assuming the horizontal *render scale* equals 1), regardless of the *font ratio*.
- *fit_to_height* is `True`, the size is set such that the *rendered height* is exactly the *available terminal height* (assuming the vertical *render scale* equals 1), regardless of the *font ratio*.

---

**Important:**

1. *fit_to_width* and *fit_to_height* are mutually exclusive. Only one can be `True` at a time.
2. Neither *fit_to_width* nor *fit_to_height* may be `True` when *width*, *height* or *maxsize* is given.
3. Be careful when setting *fit_to_height* to `True` as it might result in the image's *rendered width* being larger than the terminal width (or maxsize[0]) because *draw()* will (by default) raise *term_img.exceptions.InvalidSize* if such is the case.

---

*Vertical allowance* does not apply when *fit_to_width* is `True`.

*horizontal allowance* does not apply when *fit_to_height* is `True`.

*Allowance*s are ignored when *maxsize* is given.

*fit_to_width* might be set to `True` to set the *render size* for vertically-oriented images (i.e images with height > width) such that the drawn image spans more columns but the terminal window has to be scrolled to view the entire image.

Image formatting and all size validation recognize and respect the values of the *fit_to_width*, *h_allow* and *v_allow* parameters, until the size is re-set or *unset*.

*fit_to_height* is only provided for completeness, it should probably be used only when the image will not be drawn to the current terminal. The value of this parameter is **not** recognized by any other method or operation.

---

**Note:** The size is checked to fit in only when *maxsize* is given because *draw()* is generally not the means of drawing such an image and all rendering methods don't perform any sort of render size validation.

---

`tell()`

Returns the current image frame number.

**Return type** int

`class term_img.image.ImageIterator(`*image*, *repeat=- 1*, *format=''*, *cached=100*`)`

Bases: `object`

Effeciently iterate over *rendered* frames of an *animated* image

**Parameters**

- **image** (`TermImage`) – Animated image.
- **repeat** (*int*) – The number of times to go over the entire image. A negative value implies infinite repetition.
- **format** (*str*) – The *format specification* to be used to format the rendered frames (default: auto).
- **cached** (*Union[bool, int]*) – Determines if the *rendered* frames will be cached (for speed up of subsequent renders) or not.
  - If `bool`, it directly sets if the frames will be cached or not.
  - If `int`, caching is enabled only if the framecount of the image is less than or equal to the given number.

- If *repeat* equals `1`, caching is disabled.
- The iterator has immediate response to changes in the image *render size* and *scale*.
- If the *render size* is *unset*, it's automatically calculated per frame.
- The current frame number reflects on the underlying image during iteration.
- After the iterator is exhausted, the underlying image is set to frame *0*.

`close()`

Closes the iterator and releases resources used.

Does not reset the frame number of the underlying image.

> **Note:** This methods is automatically called when the iterator is exhausted or garbage-collected.

#### Context Management Protocol Support

`TermImage` instances are context managers i.e they can be used with the `with` statement as in:

```
with TermImage.from_url(url) as image:
    ...
```

Using an instance as a context manager more surely guarantees **object finalization** (i.e clean-up/release of resources), especially for instances with URL sources (see *`TermImage.from_url()`*).

#### Iteration Support

*Animated* `TermImage` instances are iterable i.e they can be used with the `for` statement (and other means of iteration such as unpacking) as in:

```
for frame in TermImage.from_file("animated.gif"):
    ...
```

Subsequent frames of the image are yielded on subsequent iterations.

**Note:**

- `iter(anim_image)` returns an *`ImageIterator`* instance with a repeat count of *1*, hence caching is disabled.
- The frames are unformatted and transparency is enabled i.e as returned by `str(image)`.

For more extensive or custom iteration, use *`ImageIterator`* directly.

### 2.2.2 Custom Exceptions

The `term_img.exceptions` module defines the following:

**exception** `term_img.exceptions.`**TermImageException**
Bases: `Exception`

Package exception baseclass

**exception** `term_img.exceptions.`**URLNotFoundError**
Bases: `FileNotFoundError`, *`term_img.exceptions.TermImageException`*

Raised for 404 errors

**exception** `term_img.exceptions.`**InvalidSize**
Bases: `ValueError`, *`term_img.exceptions.TermImageException`*

Raised when the given/set image render size is larger than the terminal size

### 2.2.3 Top-Level Functions

`term_img.get_font_ratio()`
Return the set libray-wide *font ratio*

**Return type** float

`term_img.set_font_ratio(ratio)`
Set the library-wide font ratio

**Parameters** `ratio` (*float*) – The aspect ratio of your terminal's font i.e *width / height* of a single character cell.

**Return type** None

This value is taken into consideration when rendering images in order for images drawn to the terminal to have a proper perceived scale.

If you can't determine this value from your terminal's configuration, you might have to try different values till you get a good fit. Normally, this value should be between 0 and 1, but not too close to either.

### 2.2.4 Image Format Specification

```
[h_align] [width] [ . [v_align] [height] ] [ # [threshold | bgcolor] ]
```

**Note:**

- The spaces are only for clarity and not included in the syntax.
- Fields within `[ ]` are optional.
- `|` implies mutual exclusivity.
- If the `.` is present, then at least one of `v_align` and `height` must be present.
- `width` and `height` are in units of columns and lines repectively.
- If the *padding width* or *padding height* is less than or equal to the image's *rendered width* or *rendered height* respectively, the padding has **no effect**.

- `h_align`: This can be one of:
  - `<` → left
  - `|` → center
  - `>` → right
  - *absent* → center
- `width`: Integer padding width (default: *terminal width* minus *horizontal allowance*)
  - Must not be greater than the *terminal width*.
- `v_align`: This can be one of:
  - `^` → top

  - `-` → middle
  - `_` → bottom
  - *absent* → middle
- `height`: Integer padding height (default: *terminal height* minus *vertical allowance*)
  - Must not be greater than the *terminal height* for *animated* images.
- `#`: Transparency setting:
  - If absent, transparency is enabled.
  - `threshold`: Alpha ratio above which pixels are taken as opaque e.g `.0`, `.325043`, `.99999`. The value must be in the range **0.0 <= threshold < 1.0**.
  - `bgcolor`: Hex color with which transparent background should be replaced e.g `ffffff`, `7faa52`.
  - If neither `threshold` nor `bgcolor` is present, but `#` is present, transparency is disabled (uses the image's default background color).

See *Formatted rendering* for examples.

## 2.3 Known Issues

1. Drawing of images and animations doesn't work completely well with `cmd` and `powershell` (tested in Windows Terminal).
   - **Description**: Some lines of the image seem to extend beyond the number of columns that it should normally occupy by about one or two columns. This behaviour causes animations to go bizzare.
   - **Comment**: First of all, the issue is inherent to these shells and neither a fault of this library nor the Windows Terminal, as drawing images and animations works properly with WSL within Windows Terminal.
   - **Solution**: A workaround is to leave some **horizontal allowance** of **at least two columns** to ensure the image never reaches the right edge of the terminal. This can be achieved in the library by using the *h_allow* parameter of *`TermImage.set_size()`*.

## 2.4 Planned Features

- Performance improvements
- Support for terminal graphics protocols (See #22)
- More text-based render styles
  - Greyscale rendering (Good for 256-color terminals)
  - ASCII-based rendering (Support for terminals without unicode or 24-bit color support)
  - Black and white rendering
- Support for open file objects and `Pathlike` objects
- Determination of frame duration per frame during animations and image iteration
- Image source type property
- Framing formatting option
- Jumping to a specified frame during image iteration

- Image zoom and pan functionalities
- Addition of urwid widgets for displaying images
- etc…

CHAPTER

THREE

# IMAGE VIEWER

## 3.1 Text-based User Interface

The TUI is developed using urwid.

### 3.1.1 UI Components

The UI consists of various areas which are each composed using one or more widgets.
The components of the UI might change depending on the current *context* and some *actions*.

The following are the key components that make up the UI.

- **Banner**:
  - At the top of the UI.
  - Fixed height of 4 lines.
  - Contains the project title with a surrounding color fill and a line-box decoration.
  - Hidden in full image views.
- **Viewer**:
  - Immediately below the title banner.
  - Consists of two sub-components (described below) arranged horizontally: * Menu * View
- **Menu**:
  - Sub-component of the *viewer* to the left.
  - Fixed width of 20 columns.
  - Contains a list of image and directory entries which can be scrolled through.
  - Used to scroll through images in a directory and navigate back and forth through directories, among other actions.
- **View**:
  - Sub-component of the *viewer* to the right.
  - Images are displayed in here.
  - The content can be one of these two, depending on the type of item currently selected in the *menu*: * An image: When the item selected in the menu is an image. * An image grid: When the item selected in the menu is a directory.

  - The *view* component can also be used to scroll through images.
- **Notification Bar**:
  - Immediately above the *Action/Key Bar*.
  - Notifications about various events are displayed here.
  - Hidden in full image views.
  - Hidden in all views, in QUIET mode (`--quiet`).
- **Action/Key Bar**:
  - Contains a list of *actions* in the current *context*.
  - Each action has the symbol of the assigned key beside its name.
  - If the actions are too much to be listed on one line, the bar can be expanded/collapsed using the key indicated at the far right.
- **Overlays**:
  - These are used for various purposes such as help menu, confirmations, etc.
  - They are shown only when certain actions are triggered.
- **Info Bar**:
  - Used for debugging.
  - This is a 1-line bar immediately above the action/key bar.
  - Only shows (in all views) when the `--debug` option is specified.

Full/Maximized image views consist of only the *view* and *action/key bar* components.

### 3.1.2 Contexts

A context is simply a set of *actions*.

The active context might change due to one of these:

- Triggering certain *actions*.
- Change of *viewer* sub-component (i.e *menu* or *view*) in focus.
- Type of menu entry selected.
- An overlay is shown.

The active context determines which actions are available and displayed in the *action/key bar* at the bottom of the UI.

The following are the contexts available:

- **global**: The actions in this context are available when any other context is active, with a few exceptions.
- **menu**: This context is active when the *menu* UI component is in focus and non-empty.
- **image**: This context is active if the *view* UI component is in focus and was switched to (from the *menu*) while an image entry was selected.
- **image-grid**: This context is active if the *view* UI component is in focus and was switched to (from the *menu*) while a directory entry was selected.
- **full-image**: This context is active when an image entry is maximized from the `image` context (using the `Maximize` action) or from the `menu` context using the `Open` action.

- **full-grid-image**: This context is active when an image grid cell is maximized from the `image-grid` context (using the `Open` action).
- **confirmation**: This context is active only when specific actions that require confirmation are triggered e.g the `Delete` action in some contexts.
- **overlay**: This context is active only when an overlay UI component (e.g the help menu) is shown.

### 3.1.3 Actions

An action is a single entry in a *context*, it represents a functionality available in that context.
An action has the following defining properties:

- **name**: The name of the action.
- **key**: The key/combination used to trigger the action.
- **symbol**: A string used to represent the *key*.
- **description**: A brief description of what the action does.
- **visibility**: Determines if the action is displayed in the *action/key bar* or not.
- **state**: Determines if the action is enabled or not. * If an action is disabled, pressing its *key* will trigger the terminal bell.

---

**Note:** All contexts and their actions (with default properties) are defined in `_context_keys` in the `term_img.config` sub-module.

---

## 3.2 Configuration

The configuration is divided into the following categories:

- Options
- Keys

The configuration is stored in the JSON format in a file located at `~/.term_img/config.json`.

### 3.2.1 Config Options

These are fields whose values control various behaviours of the viewer.
Any option with a "[*]" after its description will be used only when the corresponding command-line option is either not specified or has an invalid value.

They are as follows:

**anim cache** The maximum frame count of an image for which frames will be cached during animation. [*]

- Type: integer
- Valid values: x > `0`

**cell width** The initial width of (no of columns for) grid cells, in the TUI.

- Type: integer
- Valid values: `30` <= x <= `50` and x is even

**checkers** Maximum number of subprocesses for checking directory sources.

- Type: null or integer
- Valid values: `null` or x >= `0`

If `null`, the number of subprocesses is automatically determined based on the amount of logical processors available. CPU affinity is also taken into account on supported platforms.
If `0` (zero), directory sources are checked within the main process.

**font ratio** The *font ratio*. [*]

- Type: float
- Valid values: x > `0.0`

**getters** Number of threads for downloading images from URL sources.

- Type: integer
- Valid values: x > `0`

**grid renderers** Number of subprocesses for rendering grid cells.

- Type: integer
- Valid values: x > `0`

If `0` (zero), grid cells are rendered by a thread of the main process.

**log file** The file to which logs are written. [*]

- Type: string
- Valid values: An absolute path to a writable file.

If the file doesn't exist the parent directory must be writable, so the file can created.
If the file exists, it is appended to, not overwritten.
See *Logging*.

**max notifications** The maximum number of TUI notifications that can show at a time.

- Type: integer
- Valid values: x >= `0`

Adjusts the height of the *notification bar*.

**max pixels** The maximum amount of pixels in images to be displayed in the TUI. [*]

- Type: integer
- Valid values: x > `0`

Any image having more pixels than the specified value will be:

- skipped, in CLI mode, if `--max-pixels-cli` is specified.
- replaced, in TUI mode, with a placeholder when displayed but can still be forced to display or viewed externally.

Note that increasing this should not have any effect on general performance (i.e navigation, etc) but the larger an image is, the more the time and memory it'll take to render it. Thus, a large image might delay the rendering of other images to be rendered immediately after it.

**Attention:** The `version` field is not a config option, it's used for config file updates and should not be tampered with.

### 3.2.2 Key Config

The key assigned to every *action* can be modified in the config file.

The `"keys"` field in the configuration holds a mapping containing fields each mapping a *context* to a mapping of *actions* to their properties.

The format of the `"keys"` mapping is thus:

```
{
   "<context>": {
      "<action>": [
         "<key>",
         "<symbol>"
      ],

      ...
   },

   ...
}
```

*'...' means continuous repitition of the format occurs.*

*action* is the name of the action. **It should not be modified**.
Any or both of *key* and *symbol* can be changed. Both must be valid Python strings, hence Unicode characters are supported.

**Hint:** If using a Unicode character that occupies multiple columns in *symbol*, then add spaces after it as required to cover-up for the extra columns.

**Note:** The `navigation` field is not actually a *context*, instead it's the universal navigation controls configuration from which navigation *actions* in actual *contexts* are updated.

**Attention:**

1. Keys used in `navigation` or `global` contexts cannot be used in any other context.
2. All keys in a context must be unique.
3. If a key is invalid or already used, the default is tried as a fallback but if that fails (because it's already used), the session is terminated.

Here is a config with Vim-style (majorly navigation) keybindings.
*Remember to rename the file to* `config.json`.

Below is a list of all **valid** values for *key*:

```
" "
"!"
"""
"#"
"$"
"%"
"&"
"'"
"("
")"
"*"
"+"
","
"-"
"."
"/"
"0"
"1"
"2"
"3"
"4"
"5"
"6"
"7"
"8"
"9"
":"
";"
"<"
"="
">"
"?"
```

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```
"@"
"["
"\\"
"]"
"^"
"_"
"`"
"A"
"a"
"ctrl a"
"B"
"b"
"ctrl b"
"C"
"c"
"D"
"d"
"ctrl d"
"E"
"e"
"ctrl e"
"F"
"f"
"ctrl f"
"G"
"g"
"ctrl g"
"H"
"h"
"ctrl h"
"I"
"i"
"ctrl i"
"J"
"j"
"ctrl j"
"K"
"k"
"ctrl k"
"L"
"l"
"ctrl l"
"M"
"m"
"ctrl m"
"N"
"n"
"ctrl n"
"O"
"o"
"ctrl o"
"P"
```

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```
"p"
"ctrl p"
"Q"
"q"
"ctrl q"
"R"
"r"
"ctrl r"
"S"
"s"
"ctrl s"
"T"
"t"
"ctrl t"
"U"
"u"
"ctrl u"
"V"
"v"
"ctrl v"
"W"
"w"
"ctrl w"
"X"
"x"
"ctrl x"
"Y"
"y"
"ctrl y"
"Z"
"z"
"{"
"|"
"}"
"~"
"f1"
"ctrl f1"
"shift f1"
"shift ctrl f1"
"f2"
"ctrl f2"
"shift f2"
"shift ctrl f2"
"f3"
"ctrl f3"
"shift f3"
"shift ctrl f3"
"f4"
"ctrl f4"
"shift f4"
"shift ctrl f4"
"f5"
```

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(continued from previous page)

```
"ctrl f5"
"shift f5"
"shift ctrl f5"
"f6"
"ctrl f6"
"shift f6"
"shift ctrl f6"
"f7"
"ctrl f7"
"shift f7"
"shift ctrl f7"
"f8"
"ctrl f8"
"shift f8"
"shift ctrl f8"
"f9"
"ctrl f9"
"shift f9"
"shift ctrl f9"
"up"
"ctrl up"
"shift up"
"shift ctrl up"
"end"
"ctrl end"
"shift end"
"shift ctrl end"
"esc"
"f10"
"ctrl f10"
"shift f10"
"shift ctrl f10"
"f11"
"ctrl f11"
"shift f11"
"shift ctrl f11"
"f12"
"ctrl f12"
"shift f12"
"shift ctrl f12"
"tab"
"down"
"ctrl down"
"shift down"
"shift ctrl down"
"home"
"ctrl home"
"shift home"
"shift ctrl home"
"left"
"ctrl left"
"shift left"
```

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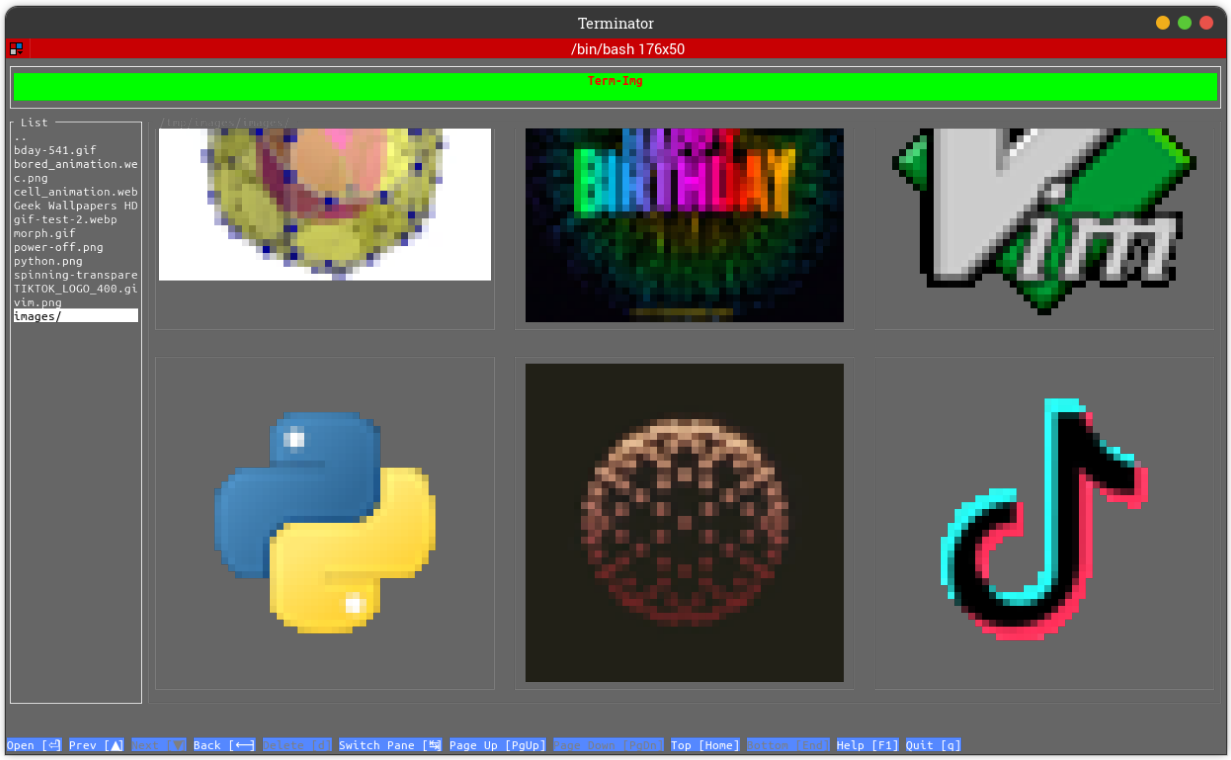
```
"shift ctrl left"
"enter"
"right"
"ctrl right"
"shift right"
"shift ctrl right"
"delete"
"ctrl delete"
"shift delete"
"shift ctrl delete"
"insert"
"backspace"
"page up"
"ctrl page up"
"page down"
"ctrl page down"
```

Any values other than these will be flagged as invalid and the default will be used instead (if possible) for that session.

The package comes with a standalone in-terminal image viewer based on the library.

The image viewer is started from the command line using either the `term-img` command (only works if the Python scripts directory is on `PATH`) or `python -m term_img`.
*Take note of the "-" (hyphen) versus "_" (underscore).*



## 3.3 Image sources

The viewer accepts the following kinds of sources:

- An image file on a local filesystem.
- A directory on a local filesystem.
- An Image URL.

Any other thing given as a *source* is simply reported as invalid.

## 3.4 Modes

The viewer can be used in two modes:

1. **CLI mode**

   In this mode, images are directly printed to standard output.
   This mode is used whenever there is only a single image source or when the `--cli` option is specified.

2. **TUI mode**

   In this mode, a Terminal/Text-based User Interface is launched, within which images and directories can be browsed and viewed in different ways.
   This mode is used whenever there are multiple image sources or at least one directory source, or when the `--tui` option is specified.

## 3.5 Usage

Run `term-img` with the `--help` option to see the usage info and help text.
All arguments and options are described there.

Note that some options are only applicable to a specific mode. If used with the other mode, they're simply ignored.

Some options have a `[N]` (where *N* is a number) behind their description, it indicates that the option has a footnote attached.
All footnotes are at the bottom of the help text.

## 3.6 Notifications

Notifications are event reports meant to be brought to the immediate knowledge of the user.
Notifications have two possible destinations:

- Standard output/error stream: This is used while the TUI is **not** launched.
- TUI *notification bar*: This is used while the TUI is launched.

Notifications sent to the TUI's *notification bar* automatically disappear after 5 seconds.

## 3.7 Logging

Logs are more detailed event reports meant for troubleshooting and debugging purporses.

**Logs are written to a file on a local filesystem. The default log file is `~/.term_img/term_img.log` but a different file can be spec**

- for all sessions, using the *log file* config option
- per session, using the `--log` command-line option

A log entry has the following format:

```
(<pid>) (<date> <time>) <process>: <thread>: [<level>] <module>: <function>: <message>
```

- *pid*: The process ID of the term-img session.
- *date* and *time*: Current system date and time in the format `%d-%m-%Y %H:%M:%S`.
- *process* and *thread*: The names of the python process and thread that produced the log record.
  - Only present when the *logging level* is set to `DEBUG` (either by `--debug` or `--log-level=DEBUG`).
- *level*: The level of the log entry, this indicates it's importance.
- *module*: The package sub-module from which it originated.
- *function*: The function from which it originated.
  - Only present when running on **Python 3.8+** and *logging level* is set to `DEBUG` (either by `--debug` or `--log-level=DEBUG`).
- *message*: The actual report describing the event that occured.

---

**Note:**

- Certain logs and some extra info are only provided when *logging level* is set to `DEBUG`.
- Log files are **appended to**, so it's safe use the same file for multiple sessions.
- Log files are rotated upon reaching a size of **1MiB**.
  - Only the current and immediate previous log file are kept.
- The Process ID of the `term-img` instance preceeds every log entry, so this can be used to distinguish and track logs from different sessions running simultaneously while using the same log file.

---

## 3.8 Known Issues

1. The TUI is not supported on Windows
2. Drawing of images and animations doesn't work completely well with `cmd` and `powershell` (tested in Windows Terminal). See *Known Issues* for details.
    - In the viewer's CLI mode, use the `--h-allow` option to specify a horizontal allowance.

## 3.9 Planned Features

- Performance improvements
- STDIN source
- Open in external viewer
- Pattern-based file and directory exclusion
- Minimum and maximum file size
- Optionally skipping symlinks
- Distinguished color for symlinked entries in the list view
- Full grid view
- Grid cells for directory entries
- Interactive CLI mode
- Slideshow
- Zoom/Pan
- Sorting options
- Find in iist view
- Filter in list and grid views
- Alpha backaground adjustment per image
- Frame duration adjustment per animated image
- Copy:
    - Image data
    - File/Directory name
    - Full path
    - Parent directory path
- Theme customization
- Config menu
- Overlay support for `Image` widgets
- etc…

CHAPTER

FOUR

# FAQS

**Why?**

- Why not?
- To improve and extend the capabilities of CLI and TUI applications.
- Terminals emulators have been an always will be!

**What about Windows support?**

- Firstly, only the new Windows Terminal seems to have proper ANSI support and mordern terminal emulator features.
- The library and the viewer's CLI mode currently work (with a few quirks) on Windows (i.e using `cmd` or `powershell`) if the other requirements are satisfied but can't guarantee it'll always be so.
  - Drawing images and animations doesn't work completely well in `cmd` and `powershell`. See *Known Issues*.
- The TUI doesn't work due to the lack of fcntl on Windows, which is used by urwid.
- If stuck on Windows and want to use all features, you could use WSL + Windows Terminal.

**Why are colours not properly reproduced?**

- Some terminals support 24-bit colors but have a **256-color pallete**. This limits color reproduction.

**Why do images look out-of-scale in my terminal?**

- Simply adjust your *font ratio* setting appropriately.

**Why is the TUI unresponsive or slow in drawing images?**

- Drawing (not rendering) speed is **enteirly** dependent on the terminal emulator itself.
- Some terminal emulators block upon input, so rapidly repeated input could cause the terminal to be unresponsive.

CHAPTER

FIVE

# GLOSSARY

Below are definitions of terms used across the library's public interface, exception messages, CLI help text and the documentation.

**Note:** For contributors, these terms are also used in the source code, as variable names, in comments, docstrings, etc.

**alignment** The position to place a rendered image within its padding.

**allowance** The amount of space to be left un-used in a given maximum size.

**alpha threshold** Alpha ratio/value above which a pixel is taken as **opaque**.

**animated** Having multiple frames.

The frames of an animated image are generally meant to be displayed in rapid succession, to give the effect of animation.

**available height** The remainder after vertical allowance is subtracted from the maximum amount of lines.

**available size** The remainder after *allowances* are subtracted from the maximum size.

**available width** The remainder after horizontal allowance is subtracted from the maximum amount of columns.

**font ratio** The **aspect ratio** of a terminal's font i.e the ratio of **width to height** of a single **character cell** on the terminal.

See also: *get_font_ratio()* and *set_font_ratio()*.

**horizontal alignment** The position to place a rendered image within its *padding width*.

**horizontal allowance** The amount of **columns** to be left un-used in a given maximum amount of columns.

**padding**

**padding width** Amount of columns within which to fit an image. Excess columns on either or both sides of the image (depending on the *horizontal alignment*) will be filled with spaces.

**padding height** Amount of columns within which to fit an image. Excess columns on either or both sides of the image (depending on the *vertical alignment*) will be filled with spaces.

**pixel ratio** It is equvalent to the *font ratio* multiplied by 2, since there are two pixels (arranged vertically) in one character cell.

**render**

**rendered** To convert image pixel data into a **string** (optionally including escape sequences to produce colour and transparency).

**render height** The real **vertical** dimension (in pixels) with which an image is rendered.

**render size** The real dimension (in pixels) with which an image is rendered.

**render width** The real **horizontal** dimension (in pixels) with which an image is rendered.

**rendered height** The amount of **lines** that'll be occupied by a rendered image **when drawn onto a terminal screen**.

**rendered size** The amount of space (columns and lines) that'll be occupied by a rendered image **when drawn onto a terminal screen**.

This is determined by the *render size* and *scale* of an image and the global *font ratio*.

**rendered width** The amount of **columns** that'll be occupied by a rendered image **when drawn onto a terminal screen**.

**scale**

**render scale** The fraction of an image's *render size* that'll actually be used to *render* it.

See also: *Image render scale*.

**source** The resource from which an image is derived.

**terminal height** The amount of lines on a terminal screen at a time i.e without scrolling.

**terminal size** The amount of columns and lines on a terminal screen at a time i.e without scrolling.

**terminal width** The amount of columns on a terminal screen at a time.

**vertical alignment** The position to place a rendered image within its *padding height*.

**vertical allowance** The amount of **lines** to be left un-used in a given maximum amount of lines.

CHAPTER

SIX

# INDICES AND TABLES

- *Glossary*
- genindex
- modindex
- search

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# INDEX

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