PyPlot.jl Documentation

Release 0.0.0

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July 10, 2013

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PyPlot.jl is a simple raphics solution for Julia, by wrapping the `pyplot` module of matplotlib.

CHAPTER

ONE

OVERVIEW

Function	**Description**
acorr	Plot the autocorrelation of *x*.
annotate	Create an annotation: a piece of text referring to a data point.
arrow	Add an arrow to the axes.
autoscale	Autoscale the axis view to the data (toggle).
axes	Add an axes to the figure.
axhline	Add a horizontal line across the axis.
axhspan	Add a horizontal span (rectangle) across the axis.
axis	Set or get the axis properties.:: >>> axis() returns the current axes limits `[xmin, xmax, ymin, ymax]`.:: >>
axvline	Add a vertical line across the axes.
axvspan	Add a vertical span (rectangle) across the axes.
bar	Make a bar plot.
barbs	Plot a 2-D field of barbs.
barh	Make a horizontal bar plot.
box	Turn the axes box on or off.
boxplot	Make a box and whisker plot.
broken_barh	Plot horizontal bars.
cla	Clear the current axes.
clabel	Label a contour plot.
clf	Clear the current figure.
clim	Set the color limits of the current image.
close	Close a figure window.
cohere	Plot the coherence between *x* and *y*.
colorbar	Add a colorbar to a plot.
contour	Plot contours.
contourf	Plot contours.
csd	Plot cross-spectral density.
delaxes	Remove an axes from the current figure.
draw	Redraw the current figure.
errorbar	Plot an errorbar graph.
figimage	Adds a non-resampled image to the figure.
figlegend	Place a legend in the figure.
figtext	Add text to figure.
figure	Create a new figure.
fill	Plot filled polygons.
fill_between	Make filled polygons between two curves.
fill_betweenx	Make filled polygons between two horizontal curves.

Function	Description
findobj	Find artist objects.
gca	Return the current axis instance.
gcf	Return a reference to the current figure.
gci	Get the current colorable artist.
get_figlabels	Return a list of existing figure labels.
get_fignums	Return a list of existing figure numbers.
grid	Turn the axes grids on or off.
hexbin	Make a hexagonal binning plot.
hist	Plot a histogram.
hist2d	Make a 2D histogram plot.
hlines	Plot horizontal lines.
hold	Set the hold state.
imread	Read an image from a file into an array.
imsave	Save an array as in image file.
imshow	Display an image on the axes.
ioff	Turn interactive mode off.
ion	Turn interactive mode on.
ishold	Return the hold status of the current axes.
isinteractive	Return status of interactive mode.
legend	Place a legend on the current axes.
locator_params	Control behavior of tick locators.
loglog	Make a plot with log scaling on both the *x* and *y* axis.
margins	Set or retrieve autoscaling margins.
matshow	Display an array as a matrix in a new figure window.
minorticks_off	Remove minor ticks from the current plot.
minorticks_on	Display minor ticks on the current plot.
over	Call a function with hold(True).
pause	Pause for *interval* seconds.
pcolor	Create a pseudocolor plot of a 2-D array.
pcolormesh	Plot a quadrilateral mesh.
pie	Plot a pie chart.
plot	Plot lines and/or markers to the `Axes`.
plot_date	Plot with data with dates.
plotfile	Plot the data in in a file.
polar	Make a polar plot.
psd	Plot the power spectral density.
quiver	Plot a 2-D field of arrows.
quiverkey	Add a key to a quiver plot.
rc	Set the current rc params.
rcdefaults	Restore the default rc params.
rgrids	Get or set the radial gridlines on a polar plot.
savefig	Save the current figure.
sca	Set the current Axes instance to *ax*.
scatter	Make a scatter plot.
sci	Set the current image.
semilogx	Make a plot with log scaling on the *x* axis.
semilogy	Make a plot with log scaling on the *y* axis.
set_cmap	Set the default colormap.
setp	Set a property on an artist object.

Function	Description
show	Display a figure.
specgram	Plot a spectrogram.
spy	Plot the sparsity pattern on a 2-D array.
stackplot	Draws a stacked area plot.
stem	Create a stem plot.
step	Make a step plot.
streamplot	Draws streamlines of a vector flow.
subplot	Return a subplot axes positioned by the given grid definition.
subplot2grid	Create a subplot in a grid.
subplot_tool	Launch a subplot tool window for a figure.
subplots	Create a figure with a set of subplots already made.
subplots_adjust	Tune the subplot layout.
suptitle	Add a centered title to the figure.
switch_backend	Switch the default backend.
table	Add a table to the current axes.
text	Add text to the axes.
thetagrids	Get or set the theta locations of the gridlines in a polar plot.
tick_params	Change the appearance of ticks and tick labels.
ticklabel_format	Change the *~matplotlib.ticker.ScalarFormatter* used by default for linear axes.
tight_layout	Automatically adjust subplot parameters to give specified padding.
title	Set the title of the current axis.
tricontour	Draw contours on an unstructured triangular grid.
tricontourf	Draw contours on an unstructured triangular grid.
tripcolor	Create a pseudocolor plot of an unstructured triangular grid.
triplot	Draw a unstructured triangular grid as lines and/or markers.
twinx	Make a second axes that shares the x-axis.
twiny	Make a second axes that shares the y-axis.
vlines	Plot vertical lines.
xcorr	Plot the cross correlation between x and y.
xlabel	Set the x axis label of the current axis.
xlim	Get or set the x limits of the current axes.
xscale	Set the scaling of the x-axis.
xticks	Get or set the x-limits of the current tick locations and labels.
ylabel	Set the y axis label of the current axis.
ylim	Get or set the y-limits of the current axes.
yscale	Set the scaling of the y-axis.
yticks	Get or set the y-limits of the current tick locations and labels.

CHAPTER

TWO

FUNCTIONS

annotate (*s*, *xy*, *xytext=None*, *xycoords="data"*, *textcoords="data"*, *arrowprops=None*, *kwargs...*)

Create an annotation: a piece of text referring to a data point.

Keyword arguments:

Annotate the *x*, *y* point *xy* with text *s* at *x*, *y* location *xytext*. (If *xytext* = *None*, defaults to *xy*, and if *textcoords* = *None*, defaults to *xycoords*).

arrowprops, if not *None*, is a dictionary of line properties (see `matplotlib.lines.Line2D`) for the arrow that connects annotation to the point.

If the dictionary has a key *arrowstyle*, a FancyArrowPatch instance is created with the given dictionary and is drawn. Otherwise, a YAArow patch instance is created and drawn. Valid keys for YAArow are

Key	Description
width	the width of the arrow in points
frac	the fraction of the arrow length occupied by the head
head-width	the width of the base of the arrow head in points
shrink	oftentimes it is convenient to have the arrowtip and base a bit away from the text and point being annotated. If *d* is the distance between the text and annotated point, shrink will shorten the arrow so the tip and base are shink percent of the distance *d* away from the endpoints. ie, `shrink=0.05 is 5%`
?	any key for `matplotlib.patches.polygon`

Valid keys for FancyArrowPatch are

Key	Description
arrowstyle	the arrow style
connectionstyle	the connection style
relpos	default is (0.5, 0.5)
patchA	default is bounding box of the text
patchB	default is None
shrinkA	default is 2 points
shrinkB	default is 2 points
mutation_scale	default is text size (in points)
mutation_aspect	default is 1.
?	any key for `matplotlib.patches.PathPatch`

xycoords and *textcoords* are strings that indicate the coordinates of *xy* and *xytext*.

Property	Description
'figure points'	points from the lower left corner of the figure
'figure pixels'	pixels from the lower left corner of the figure
'figure fraction'	0,0 is lower left of figure and 1,1 is upper, right
'axes points'	points from lower left corner of axes
'axes pixels'	pixels from lower left corner of axes
'axes fraction'	0,1 is lower left of axes and 1,1 is upper right
'data'	use the coordinate system of the object being annotated (default)
'offset points'	Specify an offset (in points) from the *xy* value
'polar'	you can specify *theta*, *r* for the annotation, even in cartesian plots. Note that if you are using a polar axes, you do not need to specify polar for the coordinate system since that is the native "data" coordinate system.

If a 'points' or 'pixels' option is specified, values will be added to the bottom-left and if negative, values will be subtracted from the top-right. Eg:

```
# 10 points to the right of the left border of the axes and
# 5 points below the top border
xy=(10,-5), xycoords='axes points'
```

The *annotation_clip* attribute contols the visibility of the annotation when it goes outside the axes area. If True, the annotation will only be drawn when the *xy* is inside the axes. If False, the annotation will always be drawn regardless of its position. The default is *None*, which behave as True only if *xycoords* is"data".

Additional kwargs are Text properties:

> agg_filter: unknown alpha: float (0.0 transparent through 1.0 opaque) animated: [True | False] axes: an `Axes` instance backgroundcolor: any matplotlib color bbox: rectangle prop dict clip_box: a `matplotlib.transforms.Bbox` instance clip_on: [True | False] clip_path: [(`Path`, `Transform`) | `Patch` | None] color: any matplotlib color contains: a callable function family or fontfamily or fontname or name: [FONTNAME | 'serif' | 'sans-serif' | 'cursive' | 'fantasy' | 'monospace'] figure: a `matplotlib.figure.Figure` instance fontproperties or font_properties: a `matplotlib.font_manager.FontProperties` instance gid: an id string horizontalalignment or ha: ['center' | 'right' | 'left'] label: string or anything printable with '%s' conversion. linespacing: float (multiple of font size) lod: [True | False] multialignment: ['left' | 'right' | 'center'] path_effects: unknown picker: [None|float|boolean|callable] position: (x,y) rasterized: [True | False | None] rotation: [angle in degrees | 'vertical' | 'horizontal'] rotation_mode: unknown size or fontsize: [size in points | 'xx-small' | 'x-small' | 'small' | 'medium' | 'large' | 'x-large' | 'xx-large'] snap: unknown stretch or fontstretch: [a numeric value in range 0-1000 | 'ultra-condensed' | 'extra-condensed' | 'condensed' | 'semi-condensed' | 'normal' | 'semi-expanded' | 'expanded' | 'extra-expanded' | 'ultra-expanded'] style or fontstyle: ['normal' | 'italic' | 'oblique'] text: string or anything printable with '%s' conversion. transform: `Transform` instance url: a url string variant or fontvariant: ['normal' | 'small-caps'] verticalalignment or va or ma: ['center' | 'top' | 'bottom' | 'baseline'] visible: [True | False] weight or fontweight: [a numeric value in range 0-1000 | 'ultralight' | 'light' | 'normal' | 'regular' | 'book' | 'medium' | 'roman' | 'semibold' | 'demibold' | 'demi' | 'bold' | 'heavy' | 'extra bold' | 'black'] x: float y: float zorder: any number

arrow (*x*, *y*, *dx*, *dy*, *kwargs...*)
Add an arrow to the axes.

Draws arrow on specified axis from (*x*, *y*) to (*x* + *dx*, *y* + *dy*). Uses FancyArrow patch to construct the arrow.

Optional kwargs control the arrow construction and properties:

Constructor arguments

***width*: float (default: 0.001)** width of full arrow tail

***length_includes_head*: [True | False] (default: False)** True if head is to be counted in calculating the length.

***head_width*: float or None (default: 3*width)** total width of the full arrow head

***head_length*: float or None (default: 1.5 * head_width)** length of arrow head

***shape*: ['full', 'left', 'right'] (default: 'full')** draw the left-half, right-half, or full arrow

***overhang*: float (default: 0)** fraction that the arrow is swept back (0 overhang means triangular shape). Can be negative or greater than one.

***head_starts_at_zero*: [True | False] (default: False)** if True, the head starts being drawn at coordinate 0 instead of ending at coordinate 0.

Other valid kwargs (inherited from `Patch`) are: agg_filter: unknown alpha: float or None animated: [True | False] antialiased or aa: [True | False] or None for default axes: an `Axes` instance clip_box: a `matplotlib.transforms.Bbox` instance clip_on: [True | False] clip_path: [(`Path`, `Transform`) | `Patch` | None] color: matplotlib color spec contains: a callable function edgecolor or ec: mpl color spec, or None for default, or 'none' for no color facecolor or fc: mpl color spec, or None for default, or 'none' for no color figure: a `matplotlib.figure.Figure` instance fill: [True | False] gid: an id string hatch: ['/' | '\' | '|' | '-' | '+' | 'x' | 'o' | 'O' | '.' | '*'] label: string or anything printable with '%s' conversion. linestyle or ls: ['solid' | 'dashed' | 'dashdot' | 'dotted'] linewidth or lw: float or None for default lod: [True | False] path_effects: unknown picker: [None|float|boolean|callable] rasterized: [True | False | None] snap: unknown transform: `Transform` instance url: a url string visible: [True | False] zorder: any number

Additional kwargs: hold = [True|False] overrides default hold state

`autoscale`()

Autoscale the axis view to the data (toggle).

Convenience method for simple axis view autoscaling. It turns autoscaling on or off, and then, if autoscaling for either axis is on, it performs the autoscaling on the specified axis or axes.

***enable*: [True | False | None]** True (default) turns autoscaling on, False turns it off. None leaves the autoscaling state unchanged.

***axis*: ['x' | 'y' | 'both']** which axis to operate on; default is 'both'

***tight*: [True | False | None]** If True, set view limits to data limits; if False, let the locator and margins expand the view limits; if None, use tight scaling if the only artist is an image, otherwise treat *tight* as False. The *tight* setting is retained for future autoscaling until it is explicitly changed.

`autumn`()

set the default colormap to autumn and apply to current image if any. See help(colormaps) for more information

`axes`()

Add an axes to the figure.

The axes is added at position *rect* specified by:

- `axes()` by itself creates a default full `subplot(111)` window axis.
- `axes(rect, axisbg='w')` where *rect* = [left, bottom, width, height] in normalized (0, 1) units. *axisbg* is the background color for the axis, default white.

- `axes(h)` where *h* is an axes instance makes *h* the current axis. An `Axes` instance is returned.

kwarg	Accepts	Desctiption
axisbg	color	the axes background color
frameon	[True|False]	display the frame?
sharex	otherax	current axes shares xaxis attribute with otherax
sharey	otherax	current axes shares yaxis attribute with otherax
polar	[True|False]	use a polar axes?

axhline(*y=0*, *xmin=0*, *xmax=1*, *kwargs...*)
Add a horizontal line across the axis.

Draw a horizontal line at *y* from *xmin* to *xmax*. With the default values of *xmin* = 0 and *xmax* = 1, this line will always span the horizontal extent of the axes, regardless of the xlim settings, even if you change them, eg. with the `set_xlim()` command. That is, the horizontal extent is in axes coords: 0=left, 0.5=middle, 1.0=right but the *y* location is in data coordinates.

Return value is the `Line2D` instance. kwargs are the same as kwargs to plot, and can be used to control the line properties. Eg.,

- draw a thick red hline at *y* = 0 that spans the xrange:

```
>>> axhline(linewidth=4, color='r')
```

- draw a default hline at *y* = 1 that spans the xrange:

```
>>> axhline(y=1)
```

- draw a default hline at *y* = .5 that spans the the middle half of the xrange:

```
>>> axhline(y=.5, xmin=0.25, xmax=0.75)
```

Valid kwargs are `Line2D` properties, with the exception of 'transform':

agg_filter: unknown alpha: float (0.0 transparent through 1.0 opaque) animated: [True | False] antialiased or aa: [True | False] axes: an `Axes` instance clip_box: a `matplotlib.transforms.Bbox` instance clip_on: [True | False] clip_path: [(`Path`, `Transform`) | `Patch` | None] color or c: any matplotlib color contains: a callable function dash_capstyle: ['butt' | 'round' | 'projecting'] dash_joinstyle: ['miter' | 'round' | 'bevel'] dashes: sequence of on/off ink in points data: 2D array (rows are x, y) or two 1D arrays drawstyle: ['default' | 'steps' | 'steps-pre' | 'steps-mid' | 'steps-post'] figure: a `matplotlib.figure.Figure` instance fillstyle: ['full' | 'left' | 'right' | 'bottom' | 'top' | 'none'] gid: an id string label: string or anything printable with '%s' conversion. linestyle or ls: [`'-'` | `'--'` | `'-.'` | `':'` | `'None'` | `' '` | `''`] and any drawstyle in combination with a linestyle, e.g. `'steps--'`. linewidth or lw: float value in points lod: [True | False] marker: [`7` | `4` | `5` | `6` | `'o'` | `'D'` | `'h'` | `'H'` | `'_'` | `''` | `'None'` | `None` | `' '` | `'8'` | `'p'` | `','` | `'+'` | `'.'` | `'s'` | `'*'` | `'d'` | `3` | `0` | `1` | `2` | `'1'` | `'3'` | `'4'` | `'2'` | `'v'` | `'<'` | `'>'` | `'^'` | `'|'` | `'x'` | `'$...$'` | *tuple* | *Nx2 array*] markeredgecolor or mec: any matplotlib color markeredgewidth or mew: float value in points markerfacecolor or mfc: any matplotlib color markerfacecoloralt or mfcalt: any matplotlib color markersize or ms: float markevery: None | integer | (startind, stride) picker: float distance in points or callable pick function `fn(artist, event)` pickradius: float distance in points rasterized: [True | False | None] snap: unknown solid_capstyle: ['butt' | 'round' | 'projecting'] solid_joinstyle: ['miter' | 'round' | 'bevel'] transform: a `matplotlib.transforms.Transform` instance url: a url string visible: [True | False] xdata: 1D array ydata: 1D array zorder: any number

Additional kwargs: hold = [True|False] overrides default hold state

axhspan(*ymin*, *ymax*, *xmin=0*, *xmax=1*, *kwargs...*)
Add a horizontal span (rectangle) across the axis.

y coords are in data units and *x* coords are in axes (relative 0-1) units.

Draw a horizontal span (rectangle) from *ymin* to *ymax*. With the default values of *xmin* = 0 and *xmax* = 1, this always spans the xrange, regardless of the xlim settings, even if you change them, eg. with the `set_xlim()` command. That is, the horizontal extent is in axes coords: 0=left, 0.5=middle, 1.0=right but the *y* location is in data coordinates.

Return value is a `matplotlib.patches.Polygon` instance.

Examples:

- draw a gray rectangle from *y* = 0.25-0.75 that spans the horizontal extent of the axes:

```
>>> axhspan(0.25, 0.75, facecolor='0.5', alpha=0.5)
```

Valid kwargs are `Polygon` properties:

agg_filter: unknown alpha: float or None animated: [True | False] antialiased or aa: [True | False] or None for default axes: an `Axes` instance clip_box: a `matplotlib.transforms.Bbox` instance clip_on: [True | False] clip_path: [(`Path`, `Transform`) | `Patch` | None] color: matplotlib color spec contains: a callable function edgecolor or ec: mpl color spec, or None for default, or 'none' for no color facecolor or fc: mpl color spec, or None for default, or 'none' for no color figure: a `matplotlib.figure.Figure` instance fill: [True | False] gid: an id string hatch: ['/' | '\' | '|' | '-' | '+' | 'x' | 'o' | 'O' | '.' | '*'] label: string or anything printable with '%s' conversion. linestyle or ls: ['solid' | 'dashed' | 'dashdot' | 'dotted'] linewidth or lw: float or None for default lod: [True | False] path_effects: unknown picker: [None|float|boolean|callable] rasterized: [True | False | None] snap: unknown transform: `Transform` instance url: a url string visible: [True | False] zorder: any number

Additional kwargs: hold = [True|False] overrides default hold state

axis()

Set or get the axis properties.:

```
>>> axis()
```

returns the current axes limits `[xmin, xmax, ymin, ymax]`.:

```
>>> axis(v)
```

sets the min and max of the x and y axes, with `v = [xmin, xmax, ymin, ymax]`.:

```
>>> axis('off')
```

turns off the axis lines and labels.:

```
>>> axis('equal')
```

changes limits of *x* or *y* axis so that equal increments of *x* and *y* have the same length; a circle is circular.:

```
>>> axis('scaled')
```

achieves the same result by changing the dimensions of the plot box instead of the axis data limits.:

```
>>> axis('tight')
```

changes *x* and *y* axis limits such that all data is shown. If all data is already shown, it will move it to the center of the figure without modifying (*xmax* - *xmin*) or (*ymax* - *ymin*). Note this is slightly different than in MATLAB.:

```
>>> axis('image')
```

is 'scaled' with the axis limits equal to the data limits.:

```
>>> axis('auto')
```

and:

```
>>> axis('normal')
```

are deprecated. They restore default behavior; axis limits are automatically scaled to make the data fit comfortably within the plot box.

if `len(*v)==0`, you can pass in *xmin*, *xmax*, *ymin*, *ymax* as kwargs selectively to alter just those limits without changing the others.

The xmin, xmax, ymin, ymax tuple is returned

See Also:

`xlim()`, `ylim()` For setting the x- and y-limits individually.

`axvline`(*x=0*, *ymin=0*, *ymax=1*, *kwargs...*)

Add a vertical line across the axes.

Draw a vertical line at *x* from *ymin* to *ymax*. With the default values of *ymin* = 0 and *ymax* = 1, this line will always span the vertical extent of the axes, regardless of the ylim settings, even if you change them, eg. with the `set_ylim()` command. That is, the vertical extent is in axes coords: 0=bottom, 0.5=middle, 1.0=top but the *x* location is in data coordinates.

Return value is the `Line2D` instance. kwargs are the same as kwargs to plot, and can be used to control the line properties. Eg.,

- draw a thick red vline at *x* = 0 that spans the yrange:

```
>>> axvline(linewidth=4, color='r')
```

- draw a default vline at *x* = 1 that spans the yrange:

```
>>> axvline(x=1)
```

- draw a default vline at *x* = .5 that spans the the middle half of the yrange:

```
>>> axvline(x=.5, ymin=0.25, ymax=0.75)
```

Valid kwargs are `Line2D` properties, with the exception of 'transform':

agg_filter: unknown alpha: float (0.0 transparent through 1.0 opaque) animated: [True | False] antialiased or aa: [True | False] axes: an `Axes` instance clip_box: a `matplotlib.transforms.Bbox` instance clip_on: [True | False] clip_path: [(`Path`, `Transform`) | `Patch` | None] color or c: any matplotlib color contains: a callable function dash_capstyle: ['butt' | 'round' | 'projecting'] dash_joinstyle: ['miter' | 'round' | 'bevel'] dashes: sequence of on/off ink in points data: 2D array (rows are x, y) or two 1D arrays drawstyle: ['default' | 'steps' | 'steps-pre' | 'steps-mid' | 'steps-post'] figure: a `matplotlib.figure.Figure` instance fillstyle: ['full' | 'left' | 'right' | 'bottom' | 'top' | 'none'] gid: an id string label: string or anything printable with '%s' conversion. linestyle or ls: [`'-'` | `'--'` | `'-.'` | `':'` | `'None'` | `' '` | `''`] and any drawstyle in combination with a linestyle, e.g. `'steps--'`. linewidth or lw: float value in points lod: [True | False] marker: [`7` | `4` | `5` | `6` | `'o'` | `'D'` | `'h'` | `'H'` | `'_'` | `''` | `'None'` | `None` | `' '` | `'8'` | `'p'` | `','` | `'+'` | `'.'` | `'s'` | `'*'` | `'d'` | `3` | `0` | `1` | `2` | `'1'` | `'3'` | `'4'` | `'2'` | `'v'` | `'<'` | `'>'` | `'^'` | `'|'` | `'x'` | `'$...$'` | *tuple* | *Nx2 array*] markeredgecolor or mec: any matplotlib color markeredgewidth or mew: float value in points markerfacecolor or mfc: any matplotlib color markerfacecoloralt or mfcalt: any matplotlib color markersize or ms: float markevery: None | integer | (startind, stride) picker: float distance in points or callable pick function `fn(artist, event)` pickradius: float distance in points rasterized: [True | False | None] snap:

unknown solid_capstyle: ['butt' | 'round' | 'projecting'] solid_joinstyle: ['miter' | 'round' | 'bevel'] transform: a `matplotlib.transforms.Transform` instance url: a url string visible: [True | False] xdata: 1D array ydata: 1D array zorder: any number

Additional kwargs: hold = [True|False] overrides default hold state

axvspan (*xmin*, *xmax*, *ymin=0*, *ymax=1*, *kwargs...*)

Add a vertical span (rectangle) across the axes.

x coords are in data units and *y* coords are in axes (relative 0-1) units.

Draw a vertical span (rectangle) from *xmin* to *xmax*. With the default values of *ymin* = 0 and *ymax* = 1, this always spans the yrange, regardless of the ylim settings, even if you change them, eg. with the `set_ylim()` command. That is, the vertical extent is in axes coords: 0=bottom, 0.5=middle, 1.0=top but the *y* location is in data coordinates.

Return value is the `matplotlib.patches.Polygon` instance.

Examples:

- draw a vertical green translucent rectangle from x=1.25 to 1.55 that spans the yrange of the axes:

```
>>> axvspan(1.25, 1.55, facecolor='g', alpha=0.5)
```

Valid kwargs are `Polygon` properties:

agg_filter: unknown alpha: float or None animated: [True | False] antialiased or aa: [True | False] or None for default axes: an `Axes` instance clip_box: a `matplotlib.transforms.Bbox` instance clip_on: [True | False] clip_path: [(`Path`, `Transform`) | `Patch` | None] color: matplotlib color spec contains: a callable function edgecolor or ec: mpl color spec, or None for default, or 'none' for no color facecolor or fc: mpl color spec, or None for default, or 'none' for no color figure: a `matplotlib.figure.Figure` instance fill: [True | False] gid: an id string hatch: ['/' | '\' | '|' | '-' | '+' | 'x' | 'o' | 'O' | '.' | '*'] label: string or anything printable with '%s' conversion. linestyle or ls: ['solid' | 'dashed' | 'dashdot' | 'dotted'] linewidth or lw: float or None for default lod: [True | False] path_effects: unknown picker: [None|float|boolean|callable] rasterized: [True | False | None] snap: unknown transform: `Transform` instance url: a url string visible: [True | False] zorder: any number

Additional kwargs: hold = [True|False] overrides default hold state

bar (*left*, *height*, *width=0.8*, *bottom=0*, *kwargs...*)

Make a bar plot.

Make a bar plot with rectangles bounded by:

left*, *left* + *width*, *bottom*, *bottom* + *height (left, right, bottom and top edges)

left, *height*, *width*, and *bottom* can be either scalars or sequences

Return value is a list of `matplotlib.patches.Rectangle` instances.

Required arguments:

Argument	Description
left	the x coordinates of the left sides of the bars
height	the heights of the bars

Optional keyword arguments:

Keyword	Description
width	the widths of the bars
bottom	the y coordinates of the bottom edges of the bars
color	the colors of the bars
edgecolor	the colors of the bar edges
linewidth	width of bar edges; None means use default linewidth; 0 means don't draw edges.
xerr	if not None, will be used to generate errorbars on the bar chart
yerr	if not None, will be used to generate errorbars on the bar chart
ecolor	specifies the color of any errorbar
capsize	(default 3) determines the length in points of the error bar caps
error_kw	dictionary of kwargs to be passed to errorbar method. *ecolor* and *capsize* may be specified here rather than as independent kwargs.
align	'edge' (default) | 'center'
orientation	'vertical' | 'horizontal'
log	[False|True] False (default) leaves the orientation axis as-is; True sets it to log scale

For vertical bars, *align* = 'edge' aligns bars by their left edges in left, while *align* = 'center' interprets these values as the *x* coordinates of the bar centers. For horizontal bars, *align* = 'edge' aligns bars by their bottom edges in bottom, while *align* = 'center' interprets these values as the *y* coordinates of the bar centers.

The optional arguments *color*, *edgecolor*, *linewidth*, *xerr*, and *yerr* can be either scalars or sequences of length equal to the number of bars. This enables you to use bar as the basis for stacked bar charts, or candlestick plots. Detail: *xerr* and *yerr* are passed directly to `errorbar()`, so they can also have shape 2xN for independent specification of lower and upper errors.

Other optional kwargs:

> agg_filter: unknown alpha: float or None animated: [True | False] antialiased or aa: [True | False] or None for default axes: an `Axes` instance clip_box: a `matplotlib.transforms.Bbox` instance clip_on: [True | False] clip_path: [(`Path`, `Transform`) | `Patch` | None] color: matplotlib color spec contains: a callable function edgecolor or ec: mpl color spec, or None for default, or 'none' for no color facecolor or fc: mpl color spec, or None for default, or 'none' for no color figure: a `matplotlib.figure.Figure` instance fill: [True | False] gid: an id string hatch: ['/' | '\' | '|' | '-' | '+' | 'x' | 'o' | 'O' | '.' | '*'] label: string or anything printable with '%s' conversion. linestyle or ls: ['solid' | 'dashed' | 'dashdot' | 'dotted'] linewidth or lw: float or None for default lod: [True | False] path_effects: unknown picker: [None|float|boolean|callable] rasterized: [True | False | None] snap: unknown transform: `Transform` instance url: a url string visible: [True | False] zorder: any number

Additional kwargs: hold = [True|False] overrides default hold state

barbs (*args...*, *kwargs...*)

Plot a 2-D field of barbs.

Call signatures:

```
barb(U, V, kw...)
barb(U, V, C, kw...)
barb(X, Y, U, V, kw...)
barb(X, Y, U, V, C, kw...)
```

Arguments:

> ***X*, *Y*:** The x and y coordinates of the barb locations (default is head of barb; see *pivot* kwarg)
>
> ***U*, *V*:** Give the x and y components of the barb shaft

***C*: ** An optional array used to map colors to the barbs

All arguments may be 1-D or 2-D arrays or sequences. If *X* and *Y* are absent, they will be generated as a uniform grid. If *U* and *V* are 2-D arrays but *X* and *Y* are 1-D, and if `len(X)` and `len(Y)` match the column and row dimensions of *U*, then *X* and *Y* will be expanded with `numpy.meshgrid()`.

U, *V*, *C* may be masked arrays, but masked *X*, *Y* are not supported at present.

Keyword arguments:

***length*: ** Length of the barb in points; the other parts of the barb are scaled against this. Default is 9

***pivot*: ['tip' | 'middle']** The part of the arrow that is at the grid point; the arrow rotates about this point, hence the name *pivot*. Default is 'tip'

***barbcolor*: [color | color sequence]** Specifies the color all parts of the barb except any flags. This parameter is analagous to the *edgecolor* parameter for polygons, which can be used instead. However this parameter will override facecolor.

***flagcolor*: [color | color sequence]** Specifies the color of any flags on the barb. This parameter is analagous to the *facecolor* parameter for polygons, which can be used instead. However this parameter will override facecolor. If this is not set (and *C* has not either) then *flagcolor* will be set to match *barbcolor* so that the barb has a uniform color. If *C* has been set, *flagcolor* has no effect.

***sizes*: ** A dictionary of coefficients specifying the ratio of a given feature to the length of the barb. Only those values one wishes to override need to be included. These features include:

- 'spacing' - space between features (flags, full/half barbs)
- 'height' - height (distance from shaft to top) of a flag or full barb
- 'width' - width of a flag, twice the width of a full barb
- 'emptybarb' - radius of the circle used for low magnitudes

***fill_empty*: ** A flag on whether the empty barbs (circles) that are drawn should be filled with the flag color. If they are not filled, they will be drawn such that no color is applied to the center. Default is False

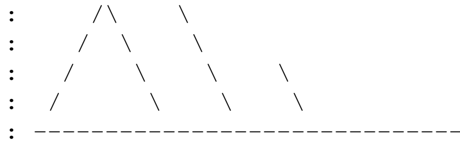
***rounding*: ** A flag to indicate whether the vector magnitude should be rounded when allocating barb components. If True, the magnitude is rounded to the nearest multiple of the half-barb increment. If False, the magnitude is simply truncated to the next lowest multiple. Default is True

***barb_increments*: ** A dictionary of increments specifying values to associate with different parts of the barb. Only those values one wishes to override need to be included.

- 'half' - half barbs (Default is 5)
- 'full' - full barbs (Default is 10)
- 'flag' - flags (default is 50)

***flip_barb*: ** Either a single boolean flag or an array of booleans. Single boolean indicates whether the lines and flags should point opposite to normal for all barbs. An array (which should be the same size as the other data arrays) indicates whether to flip for each individual barb. Normal behavior is for the barbs and lines to point right (comes from wind barbs having these features point towards low pressure in the Northern Hemisphere.) Default is False

Barbs are traditionally used in meteorology as a way to plot the speed and direction of wind observations, but can technically be used to plot any two dimensional vector quantity. As opposed to arrows, which give vector magnitude by the length of the arrow, the barbs give more quantitative information about the vector magnitude by putting slanted lines or a triangle for various increments in magnitude, as show schematically below:



The largest increment is given by a triangle (or "flag"). After those come full lines (barbs). The smallest increment is a half line. There is only, of course, ever at most 1 half line. If the magnitude is small and only needs a single half-line and no full lines or triangles, the half-line is offset from the end of the barb so that it can be easily distinguished from barbs with a single full line. The magnitude for the barb shown above would nominally be 65, using the standard increments of 50, 10, and 5.

linewidths and edgecolors can be used to customize the barb. Additional `PolyCollection` keyword arguments:

> agg_filter: unknown alpha: float or None animated: [True | False] antialiased or antialiaseds: Boolean or sequence of booleans array: unknown axes: an `Axes` instance clim: a length 2 sequence of floats clip_box: a `matplotlib.transforms.Bbox` instance clip_on: [True | False] clip_path: [(`Path`, `Transform`) | `Patch` | None] cmap: a colormap or registered colormap name color: matplotlib color arg or sequence of rgba tuples colorbar: unknown contains: a callable function edgecolor or edgecolors: matplotlib color arg or sequence of rgba tuples facecolor or facecolors: matplotlib color arg or sequence of rgba tuples figure: a `matplotlib.figure.Figure` instance gid: an id string hatch: ['/' | '\' | '|' | '-' | '+' | 'x' | 'o' | 'O' | '.' | '*'] label: string or anything printable with '%s' conversion. linestyle or linestyles or dashes: ['solid' | 'dashed', 'dashdot', 'dotted' | (offset, on-off-dash-seq)] linewidth or lw or linewidths: float or sequence of floats lod: [True | False] norm: unknown offset_position: unknown offsets: float or sequence of floats paths: unknown picker: [None|float|boolean|callable] pickradius: unknown rasterized: [True | False | None] snap: unknown transform: `Transform` instance url: a url string urls: unknown visible: [True | False] zorder: any number

Additional kwargs: hold = [True|False] overrides default hold state

barh (*bottom*, *width*, *height=0.8*, *left=0*, *kwargs...*)

Make a horizontal bar plot.

Make a horizontal bar plot with rectangles bounded by:

> ***left*, *left* + *width*, *bottom*, *bottom* + *height*** (left, right, bottom and top edges)

bottom, *width*, *height*, and *left* can be either scalars or sequences

Required arguments:

Argument	Description
bottom	the vertical positions of the bottom edges of the bars
width	the lengths of the bars

Optional keyword arguments:

Keyword	Description
height	the heights (thicknesses) of the bars
left	the x coordinates of the left edges of the bars
color	the colors of the bars
edgecolor	the colors of the bar edges
linewidth	width of bar edges; None means use default linewidth; 0 means don't draw edges.
xerr	if not None, will be used to generate errorbars on the bar chart
yerr	if not None, will be used to generate errorbars on the bar chart
ecolor	specifies the color of any errorbar
capsize	(default 3) determines the length in points of the error bar caps
align	'edge' (default) | 'center'
log	[False|True] False (default) leaves the horizontal axis as-is; True sets it to log scale

Setting *align* = 'edge' aligns bars by their bottom edges in bottom, while *align* = 'center' interprets these values as the *y* coordinates of the bar centers.

The optional arguments *color*, *edgecolor*, *linewidth*, *xerr*, and *yerr* can be either scalars or sequences of length equal to the number of bars. This enables you to use barh as the basis for stacked bar charts, or candlestick plots.

other optional kwargs:

> agg_filter: unknown alpha: float or None animated: [True | False] antialiased or aa: [True | False] or None for default axes: an `Axes` instance clip_box: a `matplotlib.transforms.Bbox` instance clip_on: [True | False] clip_path: [(`Path`, `Transform`) | `Patch` | None] color: matplotlib color spec contains: a callable function edgecolor or ec: mpl color spec, or None for default, or 'none' for no color facecolor or fc: mpl color spec, or None for default, or 'none' for no color figure: a `matplotlib.figure.Figure` instance fill: [True | False] gid: an id string hatch: ['/' | '\' | '|' | '-' | '+' | 'x' | 'o' | 'O' | '.' | '*'] label: string or anything printable with '%s' conversion. linestyle or ls: ['solid' | 'dashed' | 'dashdot' | 'dotted'] linewidth or lw: float or None for default lod: [True | False] path_effects: unknown picker: [None|float|boolean|callable] rasterized: [True | False | None] snap: unknown transform: `Transform` instance url: a url string visible: [True | False] zorder: any number

Additional kwargs: hold = [True|False] overrides default hold state

bone()

set the default colormap to bone and apply to current image if any. See help(colormaps) for more information

box()

Turn the axes box on or off. *on* may be a boolean or a string, 'on' or 'off'.

If *on* is *None*, toggle state.

boxplot(*x*, *notch=False*, *sym='+'*, *vert=True*, *whis=1.5*, *positions=None*, *widths=None*, *patch_artist=False*, *bootstrap=None*, *usermedians=None*, *conf_intervals=None*)

Make a box and whisker plot.

Make a box and whisker plot for each column of *x* or each vector in sequence *x*. The box extends from the lower to upper quartile values of the data, with a line at the median. The whiskers extend from the box to show the range of the data. Flier points are those past the end of the whiskers.

Function Arguments:

***x* :** Array or a sequence of vectors.

notch [[False (default) | True]] If False (default), produces a rectangular box plot. If True, will produce a notched box plot

sym [[default 'b+']] The default symbol for flier points. Enter an empty string ('') if you don't want to show fliers.

vert [[False | True (default)]] If True (default), makes the boxes vertical. If False, makes horizontal boxes.

whis [[default 1.5]] Defines the length of the whiskers as a function of the inner quartile range. They extend to the most extreme data point within (`whis*(75%-25%)`) data range.

bootstrap [[*None* (default) | integer]] Specifies whether to bootstrap the confidence intervals around the median for notched boxplots. If bootstrap==None, no bootstrapping is performed, and notches are calculated using a Gaussian-based asymptotic approximation (see McGill, R., Tukey, J.W., and Larsen, W.A., 1978, and Kendall and Stuart, 1967). Otherwise, bootstrap specifies the number of times to bootstrap the median to determine it's 95% confidence intervals. Values between 1000 and 10000 are recommended.

usermedians [[default None]] An array or sequence whose first dimension (or length) is compatible with *x*. This overrides the medians computed by matplotlib for each element of *usermedians* that is not None. When an element of *usermedians* == None, the median will be computed directly as normal.

conf_intervals [[default None]] Array or sequence whose first dimension (or length) is compatible with *x* and whose second dimension is 2. When the current element of *conf_intervals* is not None, the notch locations computed by matplotlib are overridden (assuming notch is True). When an element of *conf_intervals* is None, boxplot compute notches the method specified by the other kwargs (e.g. *bootstrap*).

positions [[default 1,2,...,n]] Sets the horizontal positions of the boxes. The ticks and limits are automatically set to match the positions.

widths [[default 0.5]] Either a scalar or a vector and sets the width of each box. The default is 0.5, or `0.15*(distance between extreme positions)` if that is smaller.

patch_artist [[False (default) | True]] If False produces boxes with the Line2D artist If True produces boxes with the Patch artist

Returns a dictionary mapping each component of the boxplot to a list of the `matplotlib.lines.Line2D` instances created. That dictionary has the following keys (assuming vertical boxplots):

- boxes: the main body of the boxplot showing the quartiles and the median's confidence intervals if enabled.
- medians: horizonal lines at the median of each box.
- whiskers: the vertical lines extending to the most extreme, n-outlier data points.
- caps: the horizontal lines at the ends of the whiskers.
- fliers: points representing data that extend beyone the whiskers (outliers).

Additional kwargs: hold = [True|False] overrides default hold state

broken_barh (*self*, *xranges*, *yrange*, *kwargs...*)

Plot horizontal bars.

A collection of horizontal bars spanning *yrange* with a sequence of *xranges*.

Required arguments:

Argument	Description
xranges	sequence of (*xmin*, *xwidth*)
yrange	sequence of (*ymin*, *ywidth*)

kwargs are `matplotlib.collections.BrokenBarHCollection` properties:

agg_filter: unknown alpha: float or None animated: [True | False] antialiased or antialiaseds: Boolean or sequence of booleans array: unknown axes: an `Axes` instance clim: a length 2 sequence of floats clip_box: a `matplotlib.transforms.Bbox` instance clip_on: [True | False] clip_path:

[(`Path`, `Transform`) | `Patch` | None] cmap: a colormap or registered colormap name color: matplotlib color arg or sequence of rgba tuples colorbar: unknown contains: a callable function edgecolor or edgecolors: matplotlib color arg or sequence of rgba tuples facecolor or facecolors: matplotlib color arg or sequence of rgba tuples figure: a `matplotlib.figure.Figure` instance gid: an id string hatch: ['/' | '\' | '|' | '-' | '+' | 'x' | 'o' | 'O' | '.' | '*'] label: string or anything printable with '%s' conversion. linestyle or linestyles or dashes: ['solid' | 'dashed', 'dashdot', 'dotted' | (offset, on-off-dash-seq)] linewidth or lw or linewidths: float or sequence of floats lod: [True | False] norm: unknown offset_position: unknown offsets: float or sequence of floats paths: unknown picker: [None|float|boolean|callable] pickradius: unknown rasterized: [True | False | None] snap: unknown transform: `Transform` instance url: a url string urls: unknown visible: [True | False] zorder: any number

these can either be a single argument, ie:

```
facecolors = 'black'
```

or a sequence of arguments for the various bars, ie:

```
facecolors = ('black', 'red', 'green')
```

Additional kwargs: hold = [True|False] overrides default hold state

cla()
Clear the current axes.

clabel(*cs*, *kwargs...*)
Label a contour plot.

Adds labels to line contours in *cs*, where *cs* is a `ContourSet` object returned by contour.

```
clabel(cs, v, kwargs...)
```

only labels contours listed in *v*.

Optional keyword arguments:

fontsize: size in points or relative size eg 'smaller', 'x-large'

colors:

- if *None*, the color of each label matches the color of the corresponding contour
- if one string color, e.g. *colors* = 'r' or *colors* = 'red', all labels will be plotted in this color
- if a tuple of matplotlib color args (string, float, rgb, etc), different labels will be plotted in different colors in the order specified

inline: controls whether the underlying contour is removed or not. Default is *True*.

inline_spacing: space in pixels to leave on each side of label when placing inline. Defaults to 5. This spacing will be exact for labels at locations where the contour is straight, less so for labels on curved contours.

fmt: a format string for the label. Default is '%1.3f' Alternatively, this can be a dictionary matching contour levels with arbitrary strings to use for each contour level (i.e., fmt[level]=string), or it can be any callable, such as a `Formatter` instance, that returns a string when called with a numeric contour level.

manual: if *True*, contour labels will be placed manually using mouse clicks. Click the first button near a contour to add a label, click the second button (or potentially both mouse buttons at once) to finish adding labels. The third button can be used to remove the last label added, but only if labels are not inline. Alternatively, the keyboard can be used to select label locations (enter to

end label placement, delete or backspace act like the third mouse button, and any other key will select a label location).

manual can be an iterable object of x,y tuples. Contour labels will be created as if mouse is clicked at each x,y positions.

***rightside_up*:** if *True* (default), label rotations will always be plus or minus 90 degrees from level.

***use_clabeltext*:** if *True* (default is False), ClabelText class (instead of matplotlib.Text) is used to create labels. ClabelText recalculates rotation angles of texts during the drawing time, therefore this can be used if aspect of the axes changes.

Additional kwargs: hold = [True|False] overrides default hold state

clf()

Clear the current figure.

clim()

Set the color limits of the current image.

To apply clim to all axes images do:

```
clim(0, 0.5)
```

If either *vmin* or *vmax* is None, the image min/max respectively will be used for color scaling.

If you want to set the clim of multiple images, use, for example:

```
for im in gca().get_images():
    im.set_clim(0, 0.05)
```

close()

Close a figure window.

`close()` by itself closes the current figure

`close(h)` where *h* is a `Figure` instance, closes that figure

`close(num)` closes figure number *num*

`close(name)` where *name* is a string, closes figure with that label

`close('all')` closes all the figure windows

cohere(*x*, *y*, *NFFT=256*, *Fs=2*, *Fc=0*, *detrend = mlab.detrend_none*, *window = mlab.window_hanning*, *noverlap=0*, *pad_to=None*, *sides='default'*, *scale_by_freq=None*, *kwargs...*)

Plot the coherence between *x* and *y*.

Plot the coherence between *x* and *y*. Coherence is the normalized cross spectral density:

Keyword arguments:

***NFFT*: integer** The number of data points used in each block for the FFT. Must be even; a power 2 is most efficient. The default value is 256. This should *NOT* be used to get zero padding, or the scaling of the result will be incorrect. Use *pad_to* for this instead.

***Fs*: scalar** The sampling frequency (samples per time unit). It is used to calculate the Fourier frequencies, freqs, in cycles per time unit. The default value is 2.

***detrend*: callable** The function applied to each segment before fft-ing, designed to remove the mean or linear trend. Unlike in MATLAB, where the *detrend* parameter is a vector, in matplotlib is it a function. The `pylab` module defines `detrend_none()`, `detrend_mean()`, and `detrend_linear()`, but you can use a custom function as well.

***window*: callable or ndarray** A function or a vector of length *NFFT*. To create window vectors see `window_hanning()`, `window_none()`, `numpy.blackman()`, `numpy.hamming()`, `numpy.bartlett()`, `scipy.signal()`, `scipy.signal.get_window()`, etc. The default is `window_hanning()`. If a function is passed as the argument, it must take a data segment as an argument and return the windowed version of the segment.

***pad_to*: integer** The number of points to which the data segment is padded when performing the FFT. This can be different from *NFFT*, which specifies the number of data points used. While not increasing the actual resolution of the psd (the minimum distance between resolvable peaks), this can give more points in the plot, allowing for more detail. This corresponds to the *n* parameter in the call to fft(). The default is None, which sets *pad_to* equal to *NFFT*

***sides*: ['default' | 'onesided' | 'twosided']** Specifies which sides of the PSD to return. Default gives the default behavior, which returns one-sided for real data and both for complex data. 'onesided' forces the return of a one-sided PSD, while 'twosided' forces two-sided.

***scale_by_freq*: boolean** Specifies whether the resulting density values should be scaled by the scaling frequency, which gives density in units of Hz^-1. This allows for integration over the returned frequency values. The default is True for MATLAB compatibility.

***noverlap*: integer** The number of points of overlap between blocks. The default value is 0 (no overlap).

***Fc*: integer** The center frequency of *x* (defaults to 0), which offsets the x extents of the plot to reflect the frequency range used when a signal is acquired and then filtered and downsampled to baseband.

The return value is a tuple (Cxy, f), where f are the frequencies of the coherence vector.

kwargs are applied to the lines.

References:

- Bendat & Piersol – Random Data: Analysis and Measurement Procedures, John Wiley & Sons (1986)

kwargs control the `Line2D` properties of the coherence plot:

agg_filter: unknown alpha: float (0.0 transparent through 1.0 opaque) animated: [True | False] antialiased or aa: [True | False] axes: an `Axes` instance clip_box: a `matplotlib.transforms.Bbox` instance clip_on: [True | False] clip_path: [(`Path`, `Transform`) | `Patch` | None] color or c: any matplotlib color contains: a callable function dash_capstyle: ['butt' | 'round' | 'projecting'] dash_joinstyle: ['miter' | 'round' | 'bevel'] dashes: sequence of on/off ink in points data: 2D array (rows are x, y) or two 1D arrays drawstyle: ['default' | 'steps' | 'steps-pre' | 'steps-mid' | 'steps-post'] figure: a `matplotlib.figure.Figure` instance fillstyle: ['full' | 'left' | 'right' | 'bottom' | 'top' | 'none'] gid: an id string label: string or anything printable with '%s' conversion. linestyle or ls: [`'-'` | `'--'` | `'-.'` | `':'` | `'None'` | `' '` | `''`] and any drawstyle in combination with a linestyle, e.g. `'steps--'`. linewidth or lw: float value in points lod: [True | False] marker: [`7` | `4` | `5` | `6` | `'o'` | `'D'` | `'h'` | `'H'` | `'_'` | `''` | `'None'` | `None` | `' '` | `'8'` | `'p'` | `','` | `'+'` | `'.'` | `'s'` | `'*'` | `'d'` | `3` | `0` | `1` | `2` | `'1'` | `'3'` | `'4'` | `'2'` | `'v'` | `'<'` | `'>'` | `'^'` | `'|'` | `'x'` | `'$...$'` | *tuple* | *Nx2 array*] markeredgecolor or mec: any matplotlib color markeredgewidth or mew: float value in points markerfacecolor or mfc: any matplotlib color markerfacecoloralt or mfcalt: any matplotlib color markersize or ms: float markevery: None | integer | (startind, stride) picker: float distance in points or callable pick function `fn(artist, event)` pickradius: float distance in points rasterized: [True | False | None] snap: unknown solid_capstyle: ['butt' | 'round' | 'projecting'] solid_joinstyle: ['miter' | 'round' | 'bevel'] transform: a `matplotlib.transforms.Transform` instance url: a url string visible: [True | False] xdata: 1D array ydata: 1D array zorder: any number

Additional kwargs: hold = [True|False] overrides default hold state

colorbar (*args...*, *kwargs...*)

Add a colorbar to a plot.

Function signatures for the `pyplot` interface; all but the first are also method signatures for the `colorbar()` method:

```
colorbar(kwargs...)
colorbar(mappable, kwargs...)
colorbar(mappable, cax=cax, kwargs...)
colorbar(mappable, ax=ax, kwargs...)
```

arguments:

mappable the `Image`, `ContourSet`, etc. to which the colorbar applies; this argument is mandatory for the `colorbar()` method but optional for the `colorbar()` function, which sets the default to the current image.

keyword arguments:

cax None | axes object into which the colorbar will be drawn

ax None | parent axes object from which space for a new colorbar axes will be stolen

use_gridspec False | If *cax* is None, a new *cax* is created as an instance of Axes. If *ax* is an instance of Subplot and *use_gridspec* is True, *cax* is created as an instance of Subplot using the grid_spec module.

Additional keyword arguments are of two kinds:

axes properties:

Property	Description
orientation	vertical or horizontal
fraction	0.15; fraction of original axes to use for colorbar
pad	0.05 if vertical, 0.15 if horizontal; fraction of original axes between colorbar and new image axes
shrink	1.0; fraction by which to shrink the colorbar
aspect	20; ratio of long to short dimensions
anchor	(0.0, 0.5) if vertical; (0.5, 1.0) if horizontal; the anchor point of the colorbar axes
panchor	(1.0, 0.5) if vertical; (0.5, 0.0) if horizontal; the anchor point of the colorbar parent axes

colorbar properties:

Property	Description
extend	['neither' | 'both' | 'min' | 'max'] If not 'neither', make pointed end(s) for out-of- range values. These are set for a given colormap using the colormap set_under and set_over methods.
extendfrac	[*None* | 'auto' | length | lengths] If set to *None*, both the minimum and maximum triangular colorbar extensions with have a length of 5% of the interior colorbar length (this is the default setting). If set to 'auto', makes the triangular colorbar extensions the same lengths as the interior boxes (when *spacing* is set to 'uniform') or the same lengths as the respective adjacent interior boxes (when *spacing* is set to 'proportional'). If a scalar, indicates the length of both the minimum and maximum triangular colorbar extensions as a fraction of the interior colorbar length. A two-element sequence of fractions may also be given, indicating the lengths of the minimum and maximum colorbar extensions respectively as a fraction of the interior colorbar length.
spacing	['uniform' | 'proportional'] Uniform spacing gives each discrete color the same space; proportional makes the space proportional to the data interval.
ticks	[None | list of ticks | Locator object] If None, ticks are determined automatically from the input.
format	[None | format string | Formatter object] If None, the `ScalarFormatter` is used. If a format string is given, e.g. '%.3f', that is used. An alternative `Formatter` object may be given instead.
drawedges	[False | True] If true, draw lines at color boundaries.

The following will probably be useful only in the context of indexed colors (that is, when the mappable has norm=NoNorm()), or other unusual circumstances.

Property	Description
boundaries	None or a sequence
values	None or a sequence which must be of length 1 less than the sequence of *boundaries*. For each region delimited by adjacent entries in *boundaries*, the color mapped to the corresponding value in values will be used.

If *mappable* is a `ContourSet`, its *extend* kwarg is included automatically.

Note that the *shrink* kwarg provides a simple way to keep a vertical colorbar, for example, from being taller than the axes of the mappable to which the colorbar is attached; but it is a manual method requiring some trial and error. If the colorbar is too tall (or a horizontal colorbar is too wide) use a smaller value of *shrink*.

For more precise control, you can manually specify the positions of the axes objects in which the mappable and the colorbar are drawn. In this case, do not use any of the axes properties kwargs.

It is known that some vector graphics viewer (svg and pdf) renders white gaps between segments of the colorbar. This is due to bugs in the viewers not matplotlib. As a workaround the colorbar can be rendered with overlapping segments:

```
cbar = colorbar()
cbar.solids.set_edgecolor("face")
draw()
```

However this has negative consequences in other circumstances. Particularly with semi transparent images (alpha < 1) and colorbar extensions and is not enabled by default see (issue #1188).

colormaps()

Matplotlib provides a number of colormaps, and others can be added using `register_cmap()`. This function documents the built-in colormaps, and will also return a list of all registered colormaps if called.

You can set the colormap for an image, pcolor, scatter, etc, using a keyword argument:

```
imshow(X, cmap=cm.hot)
```

or using the `set_cmap()` function:

```
imshow(X)
pyplot.set_cmap('hot')
pyplot.set_cmap('jet')
```

In interactive mode, `set_cmap()` will update the colormap post-hoc, allowing you to see which one works best for your data.

All built-in colormaps can be reversed by appending `_r`: For instance, `gray_r` is the reverse of `gray`.

There are several common color schemes used in visualization:

Sequential schemes for unipolar data that progresses from low to high

Diverging schemes for bipolar data that emphasizes positive or negative deviations from a central value

Cyclic schemes meant for plotting values that wrap around at the endpoints, such as phase angle, wind direction, or time of day

Qualitative schemes for nominal data that has no inherent ordering, where color is used only to distinguish categories

The base colormaps are (with the exception of *spectral*) derived from those of the same name provided with Matlab:

Colormap	Description
autumn	sequential linearly-increasing shades of red-orange-yellow
bone	sequential increasing black-white color map with a tinge of blue, to emulate X-ray film
cool	linearly-decreasing shades of cyan-magenta
copper	sequential increasing shades of black-copper
flag	repetitive red-white-blue-black pattern (not cyclic at endpoints)
gray	sequential linearly-increasing black-to-white grayscale
hot	sequential black-red-yellow-white, to emulate blackbody radiation from an object at increasing temperatures
hsv	cyclic red-yellow-green-cyan-blue-magenta-red, formed by changing the hue component in the HSV color space
jet	a spectral map with dark endpoints, blue-cyan-yellow-red; based on a fluid-jet simulation by NCSA [1]
pink	sequential increasing pastel black-pink-white, meant for sepia tone colorization of photographs
prism	repetitive red-yellow-green-blue-purple-...-green pattern (not cyclic at endpoints)
spring	linearly-increasing shades of magenta-yellow
summer	sequential linearly-increasing shades of green-yellow
winter	linearly-increasing shades of blue-green
spectral	black-purple-blue-green-yellow-red-white spectrum

[1] Rainbow colormaps, `jet` in particular, are considered a poor choice for scientific visualization by many researchers: Rainbow Color Map (Still) Considered Harmful

For the above list only, you can also set the colormap using the corresponding pylab shortcut interface function, similar to Matlab:

```
imshow(X)
hot()
jet()
```

The next set of palettes are from the Yorick scientific visualisation package, an evolution of the GIST package, both by David H. Munro:

Colormap	Description
gist_earth	mapmaker's colors from dark blue deep ocean to green lowlands to brown highlands to white mountains
gist_heat	sequential increasing black-red-orange-white, to emulate blackbody radiation from an iron bar as it grows hotter
gist_ncar	pseudo-spectral black-blue-green-yellow-red-purple-white colormap from National Center for Atmospheric Research [2]
gist_rainbow	runs through the colors in spectral order from red to violet at full saturation (like *hsv* but not cyclic)
gist_stern	"Stern special" color table from Interactive Data Language software

The following colormaps are based on the ColorBrewer color specifications and designs developed by Cynthia Brewer:

ColorBrewer Diverging (luminance is highest at the midpoint, and decreases towards differently-colored end-points):

Colormap	Description
BrBG	brown, white, blue-green
PiYG	pink, white, yellow-green
PRGn	purple, white, green
PuOr	orange, white, purple
RdBu	red, white, blue
RdGy	red, white, gray
RdYlBu	red, yellow, blue
RdYlGn	red, yellow, green
Spectral	red, orange, yellow, green, blue

ColorBrewer Sequential (luminance decreases monotonically):

[2] Resembles "BkBlAqGrYeOrReViWh200" from NCAR Command Language. See Color Table Gallery

Colormap	Description
Blues	white to dark blue
BuGn	white, light blue, dark green
BuPu	white, light blue, dark purple
GnBu	white, light green, dark blue
Greens	white to dark green
Greys	white to black (not linear)
Oranges	white, orange, dark brown
OrRd	white, orange, dark red
PuBu	white, light purple, dark blue
PuBuGn	white, light purple, dark green
PuRd	white, light purple, dark red
Purples	white to dark purple
RdPu	white, pink, dark purple
Reds	white to dark red
YlGn	light yellow, dark green
YlGnBu	light yellow, light green, dark blue
YlOrBr	light yellow, orange, dark brown
YlOrRd	light yellow, orange, dark red

ColorBrewer Qualitative:

(For plotting nominal data, `ListedColormap` should be used, not `LinearSegmentedColormap`. Different sets of colors are recommended for different numbers of categories. These continuous versions of the qualitative schemes may be removed or converted in the future.)

- Accent
- Dark2
- Paired
- Pastel1
- Pastel2
- Set1
- Set2
- Set3

Other miscellaneous schemes:

Colormap	Description
afmhot	sequential black-orange-yellow-white blackbody spectrum, commonly used in atomic force microscopy
brg	blue-red-green
bwr	diverging blue-white-red
coolwarm	diverging blue-gray-red, meant to avoid issues with 3D shading, color blindness, and ordering of colors [3]
CMRmap	"Default colormaps on color images often reproduce to confusing grayscale images. The proposed colormap maintains an aesthetically pleasing color image that automatically reproduces to a monotonic grayscale with discrete, quantifiable saturation levels." [4]
cubehelix	Unlike most other color schemes cubehelix was designed by D.A. Green to be monotonically increasing in terms of perceived brightness. Also, when printed on a black and white postscript printer, the scheme results in a greyscale with monotonically increasing brightness. This color scheme is named cubehelix because the r,g,b values produced can be visualised as a squashed helix around the diagonal in the r,g,b color cube.
gnuplot	gnuplot's traditional pm3d scheme (black-blue-red-yellow)
gnuplot2	sequential color printable as gray (black-blue-violet-yellow-white)
ocean	green-blue-white
rainbow	spectral purple-blue-green-yellow-orange-red colormap with diverging luminance
seismic	diverging blue-white-red
terrain	mapmaker's colors, blue-green-yellow-brown-white, originally from IGOR Pro

The following colormaps are redundant and may be removed in future versions. It's recommended to use *gray* or *gray_r* instead, which produce identical output:

Colormap	Description
gist_gray	identical to *gray*
gist_yarg	identical to *gray_r*
binary	identical to *gray_r*

colors()

This is a do-nothing function to provide you with help on how matplotlib handles colors.

Commands which take color arguments can use several formats to specify the colors. For the basic builtin colors, you can use a single letter

Alias	Color
'b'	blue
'g'	green
'r'	red
'c'	cyan
'm'	magenta
'y'	yellow
'k'	black
'w'	white

[3] See Diverging Color Maps for Scientific Visualization by Kenneth Moreland.
[4] See A Color Map for Effective Black-and-White Rendering of Color-Scale Images by Carey Rappaport

For a greater range of colors, you have two options. You can specify the color using an html hex string, as in:

```
color = '#eeefff'
```

or you can pass an R,G,B tuple, where each of R,G,B are in the range [0,1].

You can also use any legal html name for a color, for example:

```
color = 'red'
color = 'burlywood'
color = 'chartreuse'
```

The example below creates a subplot with a dark slate gray background:

```
subplot(111, axisbg=(0.1843, 0.3098, 0.3098))
```

Here is an example that creates a pale turqoise title:

```
title('Is this the best color?', color='#afeeee')
```

connect ()

Connect event with string *s* to *func*. The signature of *func* is:

```
def func(event)
```

where event is a `matplotlib.backend_bases.Event`. The following events are recognized

- 'button_press_event'
- 'button_release_event'
- 'draw_event'
- 'key_press_event'
- 'key_release_event'
- 'motion_notify_event'
- 'pick_event'
- 'resize_event'
- 'scroll_event'
- 'figure_enter_event',
- 'figure_leave_event',
- 'axes_enter_event',
- 'axes_leave_event'
- 'close_event'

For the location events (button and key press/release), if the mouse is over the axes, the variable `event.inaxes` will be set to the `Axes` the event occurs is over, and additionally, the variables `event.xdata` and `event.ydata` will be defined. This is the mouse location in data coords. See `KeyEvent` and `MouseEvent` for more info.

Return value is a connection id that can be used with `mpl_disconnect()`.

Example usage:

```
def on_press(event):
    print('you pressed', event.button, event.xdata, event.ydata)

cid = canvas.mpl_connect('button_press_event', on_press)
```

contour()

Plot contours.

`contour()` and `contourf()` draw contour lines and filled contours, respectively. Except as noted, function signatures and return values are the same for both versions.

`contourf()` differs from the MATLAB version in that it does not draw the polygon edges. To draw edges, add line contours with calls to `contour()`.

Call signatures:

```
contour(Z)
```

make a contour plot of an array *Z*. The level values are chosen automatically.

```
contour(X,Y,Z)
```

X, *Y* specify the (x, y) coordinates of the surface

```
contour(Z,N)
contour(X,Y,Z,N)
```

contour *N* automatically-chosen levels.

```
contour(Z,V)
contour(X,Y,Z,V)
```

draw contour lines at the values specified in sequence *V*

```
contourf(..., V)
```

fill the `len(V)-1` regions between the values in *V*

```
contour(Z, kwargs...)
```

Use keyword args to control colors, linewidth, origin, cmap ... see below for more details.

X and *Y* must both be 2-D with the same shape as *Z*, or they must both be 1-D such that `len(X)` is the number of columns in *Z* and `len(Y)` is the number of rows in *Z*.

`C = contour(...)` returns a `QuadContourSet` object.

Optional keyword arguments:

***colors*: [*None* | string | (mpl_colors)]** If *None*, the colormap specified by cmap will be used.

If a string, like 'r' or 'red', all levels will be plotted in this color.

If a tuple of matplotlib color args (string, float, rgb, etc), different levels will be plotted in different colors in the order specified.

***alpha*: float** The alpha blending value

***cmap*: [*None* | Colormap]** A cm `Colormap` instance or *None*. If *cmap* is *None* and *colors* is *None*, a default Colormap is used.

***norm*: [*None* | Normalize]** A `matplotlib.colors.Normalize` instance for scaling data values to colors. If *norm* is *None* and *colors* is *None*, the default linear scaling is used.

***vmin*, *vmax*: [*None* | scalar]** If not *None*, either or both of these values will be supplied to the `matplotlib.colors.Normalize` instance, overriding the default color scaling based on *levels*.

***levels*: [level0, level1, ..., leveln]** A list of floating point numbers indicating the level curves to draw; eg to draw just the zero contour pass `levels=[0]`

***origin*: [*None* | 'upper' | 'lower' | 'image']** If *None*, the first value of *Z* will correspond to the lower left corner, location (0,0). If 'image', the rc value for `image.origin` will be used.

This keyword is not active if *X* and *Y* are specified in the call to contour.

extent: [*None* | (x0,x1,y0,y1)]

If *origin* is not *None*, then *extent* is interpreted as in `matplotlib.pyplot.imshow()`: it gives the outer pixel boundaries. In this case, the position of Z[0,0] is the center of the pixel, not a corner. If *origin* is *None*, then (*x0*, *y0*) is the position of Z[0,0], and (*x1*, *y1*) is the position of Z[-1,-1].

This keyword is not active if *X* and *Y* are specified in the call to contour.

***locator*: [*None* | ticker.Locator subclass]** If *locator* is *None*, the default `MaxNLocator` is used. The locator is used to determine the contour levels if they are not given explicitly via the *V* argument.

***extend*: ['neither' | 'both' | 'min' | 'max']** Unless this is 'neither', contour levels are automatically added to one or both ends of the range so that all data are included. These added ranges are then mapped to the special colormap values which default to the ends of the colormap range, but can be set via `matplotlib.colors.Colormap.set_under()` and `matplotlib.colors.Colormap.set_over()` methods.

***xunits*, *yunits*: [*None* | registered units]** Override axis units by specifying an instance of a `matplotlib.units.ConversionInterface`.

***antialiased*: [*True* | *False*]** enable antialiasing, overriding the defaults. For filled contours, the default is *True*. For line contours, it is taken from rcParams['lines.antialiased'].

contour-only keyword arguments:

***linewidths*: [*None* | number | tuple of numbers]** If *linewidths* is *None*, the default width in `lines.linewidth` in `matplotlibrc` is used.

If a number, all levels will be plotted with this linewidth.

If a tuple, different levels will be plotted with different linewidths in the order specified

***linestyles*: [*None* | 'solid' | 'dashed' | 'dashdot' | 'dotted']** If *linestyles* is *None*, the default is 'solid' unless the lines are monochrome. In that case, negative contours will take their linestyle from the `matplotlibrc` `contour.negative_linestyle` setting.

linestyles can also be an iterable of the above strings specifying a set of linestyles to be used. If this iterable is shorter than the number of contour levels it will be repeated as necessary.

contourf-only keyword arguments:

***nchunk*: [0 | integer]** If 0, no subdivision of the domain. Specify a positive integer to divide the domain into subdomains of roughly *nchunk* by *nchunk* points. This may never actually be advantageous, so this option may be removed. Chunking introduces artifacts at the chunk boundaries unless *antialiased* is *False*.

***hatches*:** A list of cross hatch patterns to use on the filled areas. If None, no hatching will be added to the contour. Hatching is supported in the PostScript, PDF, SVG and Agg backends only.

Note: contourf fills intervals that are closed at the top; that is, for boundaries *z1* and *z2*, the filled region is:

```
z1 < z <= z2
```

There is one exception: if the lowest boundary coincides with the minimum value of the *z* array, then that minimum value will be included in the lowest interval.

Additional kwargs: hold = [True|False] overrides default hold state

contourf()

Plot contours.

`contour()` and `contourf()` draw contour lines and filled contours, respectively. Except as noted, function signatures and return values are the same for both versions.

`contourf()` differs from the MATLAB version in that it does not draw the polygon edges. To draw edges, add line contours with calls to `contour()`.

Call signatures:

```
contour(Z)
```

make a contour plot of an array *Z*. The level values are chosen automatically.

```
contour(X,Y,Z)
```

X, *Y* specify the (x, y) coordinates of the surface

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contour(Z,N)
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```

contour *N* automatically-chosen levels.

```
contour(Z,V)
contour(X,Y,Z,V)
```

draw contour lines at the values specified in sequence *V*

```
contourf(..., V)
```

fill the `len(V)-1` regions between the values in *V*

```
contour(Z, kwargs...)
```

Use keyword args to control colors, linewidth, origin, cmap ... see below for more details.

X and *Y* must both be 2-D with the same shape as *Z*, or they must both be 1-D such that `len(X)` is the number of columns in *Z* and `len(Y)` is the number of rows in *Z*.

`C = contour(...)` returns a `QuadContourSet` object.

Optional keyword arguments:

***colors*: [*None* | string | (mpl_colors)]** If *None*, the colormap specified by cmap will be used.

If a string, like 'r' or 'red', all levels will be plotted in this color.

If a tuple of matplotlib color args (string, float, rgb, etc), different levels will be plotted in different colors in the order specified.

***alpha*: float** The alpha blending value

***cmap*: [*None* | Colormap]** A cm `Colormap` instance or *None*. If *cmap* is *None* and *colors* is *None*, a default Colormap is used.

***norm*: [*None* | Normalize]** A `matplotlib.colors.Normalize` instance for scaling data values to colors. If *norm* is *None* and *colors* is *None*, the default linear scaling is used.

***vmin*, *vmax*: [*None* | scalar]** If not *None*, either or both of these values will be supplied to the `matplotlib.colors.Normalize` instance, overriding the default color scaling based on *levels*.

***levels*: [level0, level1, ..., leveln]** A list of floating point numbers indicating the level curves to draw; eg to draw just the zero contour pass `levels=[0]`

***origin*: [*None* | 'upper' | 'lower' | 'image']** If *None*, the first value of *Z* will correspond to the lower left corner, location (0,0). If 'image', the rc value for `image.origin` will be used.

This keyword is not active if *X* and *Y* are specified in the call to contour.

extent: [*None* | (x0,x1,y0,y1)]

If *origin* is not *None*, then *extent* is interpreted as in `matplotlib.pyplot.imshow()`: it gives the outer pixel boundaries. In this case, the position of Z[0,0] is the center of the pixel, not a corner. If *origin* is *None*, then (*x0*, *y0*) is the position of Z[0,0], and (*x1*, *y1*) is the position of Z[-1,-1].

This keyword is not active if *X* and *Y* are specified in the call to contour.

***locator*: [*None* | ticker.Locator subclass]** If *locator* is *None*, the default `MaxNLocator` is used. The locator is used to determine the contour levels if they are not given explicitly via the *V* argument.

***extend*: ['neither' | 'both' | 'min' | 'max']** Unless this is 'neither', contour levels are automatically added to one or both ends of the range so that all data are included. These added ranges are then mapped to the special colormap values which default to the ends of the colormap range, but can be set via `matplotlib.colors.Colormap.set_under()` and `matplotlib.colors.Colormap.set_over()` methods.

***xunits*, *yunits*: [*None* | registered units]** Override axis units by specifying an instance of a `matplotlib.units.ConversionInterface`.

***antialiased*: [*True* | *False*]** enable antialiasing, overriding the defaults. For filled contours, the default is *True*. For line contours, it is taken from rcParams['lines.antialiased'].

contour-only keyword arguments:

***linewidths*: [*None* | number | tuple of numbers]** If *linewidths* is *None*, the default width in `lines.linewidth` in `matplotlibrc` is used.

If a number, all levels will be plotted with this linewidth.

If a tuple, different levels will be plotted with different linewidths in the order specified

***linestyles*: [*None* | 'solid' | 'dashed' | 'dashdot' | 'dotted']** If *linestyles* is *None*, the default is 'solid' unless the lines are monochrome. In that case, negative contours will take their linestyle from the `matplotlibrc` `contour.negative_linestyle` setting.

linestyles can also be an iterable of the above strings specifying a set of linestyles to be used. If this iterable is shorter than the number of contour levels it will be repeated as necessary.

contourf-only keyword arguments:

***nchunk*: [0 | integer]** If 0, no subdivision of the domain. Specify a positive integer to divide the domain into subdomains of roughly *nchunk* by *nchunk* points. This may never actually be advantageous, so this option may be removed. Chunking introduces artifacts at the chunk boundaries unless *antialiased* is *False*.

***hatches*:** A list of cross hatch patterns to use on the filled areas. If None, no hatching will be added to the contour. Hatching is supported in the PostScript, PDF, SVG and Agg backends only.

Note: contourf fills intervals that are closed at the top; that is, for boundaries *z1* and *z2*, the filled region is:

```
z1 < z <= z2
```

There is one exception: if the lowest boundary coincides with the minimum value of the *z* array, then that minimum value will be included in the lowest interval.

Additional kwargs: hold = [True|False] overrides default hold state

cool()
set the default colormap to cool and apply to current image if any. See help(colormaps) for more information

copper()
set the default colormap to copper and apply to current image if any. See help(colormaps) for more information

csd(*x*, *y*, *NFFT=256*, *Fs=2*, *Fc=0*, *detrend=mlab.detrend_none*, *window=mlab.window_hanning*, *noverlap=0*, *pad_to=None*, *sides='default'*, *scale_by_freq=None*, *kwargs...*)
Plot cross-spectral density.

The cross spectral density P_{xy} by Welch's average periodogram method. The vectors *x* and *y* are divided into *NFFT* length segments. Each segment is detrended by function *detrend* and windowed by function *window*. The product of the direct FFTs of *x* and *y* are averaged over each segment to compute P_{xy}, with a scaling to correct for power loss due to windowing.

Keyword arguments:

***NFFT*: integer** The number of data points used in each block for the FFT. Must be even; a power 2 is most efficient. The default value is 256. This should *NOT* be used to get zero padding, or the scaling of the result will be incorrect. Use *pad_to* for this instead.

***Fs*: scalar** The sampling frequency (samples per time unit). It is used to calculate the Fourier frequencies, freqs, in cycles per time unit. The default value is 2.

***detrend*: callable** The function applied to each segment before fft-ing, designed to remove the mean or linear trend. Unlike in MATLAB, where the *detrend* parameter is a vector, in matplotlib is it a function. The `pylab` module defines `detrend_none()`, `detrend_mean()`, and `detrend_linear()`, but you can use a custom function as well.

***window*: callable or ndarray** A function or a vector of length *NFFT*. To create window vectors see `window_hanning()`, `window_none()`, `numpy.blackman()`, `numpy.hamming()`, `numpy.bartlett()`, `scipy.signal()`, `scipy.signal.get_window()`, etc. The default is `window_hanning()`. If a function is passed as the argument, it must take a data segment as an argument and return the windowed version of the segment.

***pad_to*: integer** The number of points to which the data segment is padded when performing the FFT. This can be different from *NFFT*, which specifies the number of data points used. While not increasing the actual resolution of the psd (the minimum distance between resolvable peaks), this can give more points in the plot, allowing for more detail. This corresponds to the *n* parameter in the call to fft(). The default is None, which sets *pad_to* equal to *NFFT*

***sides*: ['default' | 'onesided' | 'twosided']** Specifies which sides of the PSD to return. Default gives the default behavior, which returns one-sided for real data and both for complex data. 'onesided' forces the return of a one-sided PSD, while 'twosided' forces two-sided.

***scale_by_freq*: boolean** Specifies whether the resulting density values should be scaled by the scaling frequency, which gives density in units of Hz^-1. This allows for integration over the returned frequency values. The default is True for MATLAB compatibility.

***noverlap*: integer** The number of points of overlap between blocks. The default value is 0 (no overlap).

***Fc*: integer** The center frequency of *x* (defaults to 0), which offsets the x extents of the plot to reflect the frequency range used when a signal is acquired and then filtered and downsampled to baseband.

References: Bendat & Piersol – Random Data: Analysis and Measurement Procedures, John Wiley & Sons (1986)

kwargs control the Line2D properties:

agg_filter: unknown alpha: float (0.0 transparent through 1.0 opaque) animated: [True | False] antialiased or aa: [True | False] axes: an `Axes` instance clip_box: a `matplotlib.transforms.Bbox` instance clip_on: [True | False] clip_path: [(`Path`, `Transform`) | `Patch` | None] color or c: any matplotlib color contains: a callable function dash_capstyle: ['butt' | 'round' | 'projecting'] dash_joinstyle: ['miter' | 'round' | 'bevel'] dashes: sequence of on/off ink in points data: 2D array (rows are x, y) or two 1D arrays drawstyle: ['default' | 'steps' | 'steps-pre' | 'steps-mid' | 'steps-post'] figure: a `matplotlib.figure.Figure` instance fillstyle: ['full' | 'left' | 'right' | 'bottom' | 'top' | 'none'] gid: an id string label: string or anything printable with '%s' conversion. linestyle or ls: [`'-'` | `'--'` | `'-.'` | `':'` | `'None'` | `' '` | `''`] and any drawstyle in combination with a linestyle, e.g. `'steps--'`. linewidth or lw: float value in points lod: [True | False] marker: [`7` | `4` | `5` | `6` | `'o'` | `'D'` | `'h'` | `'H'` | `'_'` | `''` | `'None'` | `None` | `' '` | `'8'` | `'p'` | `','` | `'+'` | `'.'` | `'s'` | `'*'` | `'d'` | `3` | `0` | `1` | `2` | `'1'` | `'3'` | `'4'` | `'2'` | `'v'` | `'<'` | `'>'` | `'^'` | `'|'` | `'x'` | `'$...$'` | *tuple* | *Nx2 array*] markeredgecolor or mec: any matplotlib color markeredgewidth or mew: float value in points markerfacecolor or mfc: any matplotlib color markerfacecoloralt or mfcalt: any matplotlib color markersize or ms: float markevery: None | integer | (startind, stride) picker: float distance in points or callable pick function `fn(artist, event)` pickradius: float distance in points rasterized: [True | False | None] snap: unknown solid_capstyle: ['butt' | 'round' | 'projecting'] solid_joinstyle: ['miter' | 'round' | 'bevel'] transform: a `matplotlib.transforms.Transform` instance url: a url string visible: [True | False] xdata: 1D array ydata: 1D array zorder: any number

Additional kwargs: hold = [True|False] overrides default hold state

dedent()

Remove excess indentation from docstring *s*.

Discards any leading blank lines, then removes up to n whitespace characters from each line, where n is the number of leading whitespace characters in the first line. It differs from textwrap.dedent in its deletion of leading blank lines and its use of the first non-blank line to determine the indentation.

It is also faster in most cases.

delaxes()

Remove an axes from the current figure. If *ax* doesn't exist, an error will be raised.

`delaxes()`: delete the current axes

disconnect()

Disconnect callback id cid

Example usage:

```
cid = canvas.mpl_connect('button_press_event', on_press)
#...later
canvas.mpl_disconnect(cid)
```

draw()

Redraw the current figure.

This is used in interactive mode to update a figure that has been altered using one or more plot object method calls; it is not needed if figure modification is done entirely with pyplot functions, if a sequence of modifications ends with a pyplot function, or if matplotlib is in non-interactive mode and the sequence of modifications ends with `show()` or `savefig()`.

A more object-oriented alternative, given any `Figure` instance, `fig`, that was created using a `pyplot` function, is:

```
fig.canvas.draw()
```

draw_if_interactive()

Is called after every pylab drawing command

errorbar(*x*, *y*, *yerr=None*, *xerr=None*, *fmt='-'*, *ecolor=None*, *elinewidth=None*, *capsize=3*, *barsabove=False*, *lolims=False*, *uplims=False*, *xlolims=False*, *xuplims=False*, *errorevery=1*, *capthick=None*)

Plot an errorbar graph.

Plot *x* versus *y* with error deltas in *yerr* and *xerr*. Vertical errorbars are plotted if *yerr* is not *None*. Horizontal errorbars are plotted if *xerr* is not *None*.

x, *y*, *xerr*, and *yerr* can all be scalars, which plots a single error bar at *x*, *y*.

Optional keyword arguments:

***xerr/yerr*: [scalar | N, Nx1, or 2xN array-like]** If a scalar number, len(N) array-like object, or an Nx1 array-like object, errorbars are drawn at +/-value relative to the data.

If a sequence of shape 2xN, errorbars are drawn at -row1 and +row2 relative to the data.

***fmt*: '-'** The plot format symbol. If *fmt* is *None*, only the errorbars are plotted. This is used for adding errorbars to a bar plot, for example.

***ecolor*: [*None* | mpl color]** A matplotlib color arg which gives the color the errorbar lines; if *None*, use the marker color.

***elinewidth*: scalar** The linewidth of the errorbar lines. If *None*, use the linewidth.

***capsize*: scalar** The length of the error bar caps in points

***capthick*: scalar** An alias kwarg to *markeredgewidth* (a.k.a. - *mew*). This setting is a more sensible name for the property that controls the thickness of the error bar cap in points. For backwards compatibility, if *mew* or *markeredgewidth* are given, then they will over-ride *capthick*. This may change in future releases.

***barsabove*: [*True* | *False*]** if *True*, will plot the errorbars above the plot symbols. Default is below.

***lolims / uplims / xlolims / xuplims*: [*False* | *True*]** These arguments can be used to indicate that a value gives only upper/lower limits. In that case a caret symbol is used to indicate this. lims-arguments may be of the same type as *xerr* and *yerr*.

***errorevery*: positive integer** subsamples the errorbars. Eg if everyerror=5, errorbars for every 5-th datapoint will be plotted. The data plot itself still shows all data points.

All other keyword arguments are passed on to the plot command for the markers. For example, this code makes big red squares with thick green edges:

```
x,y,yerr = rand(3,10)
errorbar(x, y, yerr, marker='s',
         mfc='red', mec='green', ms=20, mew=4)
```

where *mfc*, *mec*, *ms* and *mew* are aliases for the longer property names, *markerfacecolor*, *markeredgecolor*, *markersize* and *markeredgewith*.

valid kwargs for the marker properties are

> agg_filter: unknown alpha: float (0.0 transparent through 1.0 opaque) animated: [True | False] antialiased or aa: [True | False] axes: an `Axes` instance clip_box: a `matplotlib.transforms.Bbox` instance clip_on: [True | False] clip_path: [(`Path`, `Transform`) | `Patch` | None] color or c: any matplotlib color contains: a callable function dash_capstyle: ['butt' | 'round' | 'projecting'] dash_joinstyle: ['miter' | 'round' | 'bevel'] dashes: sequence of on/off ink in points data: 2D array (rows are x, y) or two 1D arrays drawstyle: ['default' | 'steps' | 'steps-pre' | 'steps-mid' | 'steps-post'] figure: a `matplotlib.figure.Figure` instance fillstyle: ['full' | 'left' | 'right' | 'bottom' | 'top' | 'none'] gid: an id string label: string or anything printable with '%s' conversion. linestyle or ls: [`'-'` | `'--'` | `'-.'` | `':'` | `'None'` | `' '` | `''`] and any drawstyle in combination with a linestyle, e.g. `'steps--'`. linewidth or lw: float value in points lod: [True | False] marker: [`7` | `4` | `5` | `6` | `'o'` | `'D'` | `'h'` | `'H'` | `'_'` | `''` | `'None'` | `None` | `' '` | `'8'` | `'p'` | `','` | `'+'` | `'.'` | `'s'` | `'*'` | `'d'` | `3` | `0` | `1` | `2` | `'1'` | `'3'` | `'4'` | `'2'` | `'v'` | `'<'` | `'>'` | `'^'` | `'|'` | `'x'` | `'$...$'` | *tuple* | *Nx2 array*] markeredgecolor or mec: any matplotlib color markeredgewidth or mew: float value in points markerfacecolor or mfc: any matplotlib color markerfacecoloralt or mfcalt: any matplotlib color markersize or ms: float markevery: None | integer | (startind, stride) picker: float distance in points or callable pick function `fn(artist, event)` pickradius: float distance in points rasterized: [True | False | None] snap: unknown solid_capstyle: ['butt' | 'round' | 'projecting'] solid_joinstyle: ['miter' | 'round' | 'bevel'] transform: a `matplotlib.transforms.Transform` instance url: a url string visible: [True | False] xdata: 1D array ydata: 1D array zorder: any number

Returns (*plotline*, *caplines*, *barlinecols*):

> ***plotline*: `Line2D` instance** *x*, *y* plot markers and/or line
>
> ***caplines*: list of error bar cap** `Line2D` instances
>
> ***barlinecols*: list of** `LineCollection` instances for the horizontal and vertical error ranges.

Additional kwargs: hold = [True|False] overrides default hold state

`figaspect`()

Create a figure with specified aspect ratio. If *arg* is a number, use that aspect ratio. If *arg* is an array, figaspect will determine the width and height for a figure that would fit array preserving aspect ratio. The figure width, height in inches are returned. Be sure to create an axes with equal with and height, eg

Example usage:

```
# make a figure twice as tall as it is wide
w, h = figaspect(2.)
fig = Figure(figsize=(w,h))
ax = fig.add_axes([0.1, 0.1, 0.8, 0.8])
ax.imshow(A, kwargs...)


# make a figure with the proper aspect for an array
A = rand(5,3)
w, h = figaspect(A)
fig = Figure(figsize=(w,h))
ax = fig.add_axes([0.1, 0.1, 0.8, 0.8])
ax.imshow(A, kwargs...)
```

Thanks to Fernando Perez for this function

`figimage`(*X*, *kwargs...*)

Adds a non-resampled image to the figure.

adds a non-resampled array *X* to the figure.

```
figimage(X, xo, yo)
```

with pixel offsets *xo*, *yo*,

X must be a float array:

- If *X* is MxN, assume luminance (grayscale)
- If *X* is MxNx3, assume RGB
- If *X* is MxNx4, assume RGBA

Optional keyword arguments:

Keyword	Description
xo or yo	An integer, the *x* and *y* image offset in pixels
cmap	a `matplotlib.colors.Colormap` instance, eg cm.jet. If *None*, default to the rc `image.cmap` value
norm	a `matplotlib.colors.Normalize` instance. The default is normalization(). This scales luminance -> 0-1
vmin|vmax	are used to scale a luminance image to 0-1. If either is *None*, the min and max of the luminance values will be used. Note if you pass a norm instance, the settings for *vmin* and *vmax* will be ignored.
alpha	the alpha blending value, default is *None*
origin	['upper' | 'lower'] Indicates where the [0,0] index of the array is in the upper left or lower left corner of the axes. Defaults to the rc image.origin value

figimage complements the axes image (`imshow()`) which will be resampled to fit the current axes. If you want a resampled image to fill the entire figure, you can define an `Axes` with size [0,1,0,1].

An `matplotlib.image.FigureImage` instance is returned.

Additional kwargs are Artist kwargs passed on to :class:'~matplotlib.image.FigureImage'Addition kwargs: hold = [True|False] overrides default hold state

figlegend()

Place a legend in the figure.

labels a sequence of strings

handles a sequence of `Line2D` or `Patch` instances

loc can be a string or an integer specifying the legend location

A `matplotlib.legend.Legend` instance is returned.

Example:

```
figlegend( (line1, line2, line3),
           ('label1', 'label2', 'label3'),
           'upper right' )
```

See Also:

`legend()`

fignum_exists()

Return *True* if figure *num* exists.

text(*x*, *y*, *s*, *fontdict=None*, *kwargs...*)

Add text to figure.

Add text to figure at location *x*, *y* (relative 0-1 coords). See `text()` for the meaning of the other arguments.

kwargs control the `Text` properties:

agg_filter: unknown alpha: float (0.0 transparent through 1.0 opaque) animated: [True | False] axes: an `Axes` instance backgroundcolor: any matplotlib color bbox: rectangle prop dict clip_box: a `matplotlib.transforms.Bbox` instance clip_on: [True | False] clip_path: [(`Path`, `Transform`) | `Patch` | None] color: any matplotlib color contains: a callable function family or fontfamily or fontname or name: [FONTNAME | 'serif' | 'sans-serif' | 'cursive' | 'fantasy' | 'monospace'] figure: a `matplotlib.figure.Figure` instance fontproperties or font_properties: a `matplotlib.font_manager.FontProperties` instance gid: an id string horizontalalignment or ha: ['center' | 'right' | 'left'] label: string or anything printable with '%s' conversion. linespacing: float (multiple of font size) lod: [True | False] multialignment: ['left' | 'right' | 'center'] path_effects: unknown picker: [None|float|boolean|callable] position: (x,y) rasterized: [True | False | None] rotation: [angle in degrees | 'vertical' | 'horizontal'] rotation_mode: unknown size or fontsize: [size in points | 'xx-small' | 'x-small' | 'small' | 'medium' | 'large' | 'x-large' | 'xx-large'] snap: unknown stretch or fontstretch: [a numeric value in range 0-1000 | 'ultra-condensed' | 'extra-condensed' | 'condensed' | 'semi-condensed' | 'normal' | 'semi-expanded' | 'expanded' | 'extra-expanded' | 'ultra-expanded'] style or fontstyle: ['normal' | 'italic' | 'oblique'] text: string or anything printable with '%s' conversion. transform: `Transform` instance url: a url string variant or fontvariant: ['normal' | 'small-caps'] verticalalignment or va or ma: ['center' | 'top' | 'bottom' | 'baseline'] visible: [True | False] weight or fontweight: [a numeric value in range 0-1000 | 'ultralight' | 'light' | 'normal' | 'regular' | 'book' | 'medium' | 'roman' | 'semibold' | 'demibold' | 'demi' | 'bold' | 'heavy' | 'extra bold' | 'black'] x: float y: float zorder: any number

figure()

Create a new figure.

call signature:

```
figure(num=None, figsize=(8, 6), dpi=80, facecolor='w', edgecolor='k')
```

Create a new figure and return a `matplotlib.figure.Figure` instance. If *num* = *None*, the figure number will be incremented and a new figure will be created. The returned figure objects have a *number* attribute holding this number.

If *num* is an integer, and `figure(num)` already exists, make it active and return a reference to it. If `figure(num)` does not exist it will be created. Numbering starts at 1, MATLAB style:

```
figure(1)
```

The same applies if *num* is a string. In this case *num* will be used as an explicit figure label:

```
figure("today")
```

and in windowed backends, the window title will be set to this figure label.

If you are creating many figures, make sure you explicitly call "close" on the figures you are not using, because this will enable pylab to properly clean up the memory.

Optional keyword arguments:

Keyword	Description
figsize	width x height in inches; defaults to rc figure.figsize
dpi	resolution; defaults to rc figure.dpi
facecolor	the background color; defaults to rc figure.facecolor
edgecolor	the border color; defaults to rc figure.edgecolor

rcParams defines the default values, which can be modified in the matplotlibrc file

FigureClass is a `Figure` or derived class that will be passed on to `new_figure_manager()` in the backends which allows you to hook custom Figure classes into the pylab interface. Additional kwargs will be passed on to your figure init function.

fill (*args...*, *kwargs...*)
Plot filled polygons.

args is a variable length argument, allowing for multiple *x*, *y* pairs with an optional color format string; see `plot()` for details on the argument parsing. For example, to plot a polygon with vertices at *x*, *y* in blue.:

```
ax.fill(x,y, 'b' )
```

An arbitrary number of *x*, *y*, *color* groups can be specified:

```
ax.fill(x1, y1, 'g', x2, y2, 'r')
```

Return value is a list of `Patch` instances that were added.

The same color strings that `plot()` supports are supported by the fill format string.

If you would like to fill below a curve, eg. shade a region between 0 and *y* along *x*, use `fill_between()`

The *closed* kwarg will close the polygon when *True* (default).

kwargs control the `Polygon` properties:

> agg_filter: unknown alpha: float or None animated: [True | False] antialiased or aa: [True | False] or None for default axes: an `Axes` instance clip_box: a `matplotlib.transforms.Bbox` instance clip_on: [True | False] clip_path: [(`Path`, `Transform`) | `Patch` | None] color: matplotlib color spec contains: a callable function edgecolor or ec: mpl color spec, or None for default, or 'none' for no color facecolor or fc: mpl color spec, or None for default, or 'none' for no color figure: a `matplotlib.figure.Figure` instance fill: [True | False] gid: an id string hatch: ['/' | '\' | '|' | '-' | '+' | 'x' | 'o' | 'O' | '.' | '*'] label: string or anything printable with '%s' conversion. linestyle or ls: ['solid' | 'dashed' | 'dashdot' | 'dotted'] linewidth or lw: float or None for default lod: [True | False] path_effects: unknown picker: [None|float|boolean|callable] rasterized: [True | False | None] snap: unknown transform: `Transform` instance url: a url string visible: [True | False] zorder: any number

Additional kwargs: hold = [True|False] overrides default hold state

fill_between (*x*, *y1*, *y2=0*, *where=None*, *kwargs...*)
Make filled polygons between two curves.

Create a `PolyCollection` filling the regions between *y1* and *y2* where `where==True`

> ***x*** **:** An N-length array of the x data
>
> ***y1*** **:** An N-length array (or scalar) of the y data
>
> ***y2*** **:** An N-length array (or scalar) of the y data
>
> ***where*** **:** If *None*, default to fill between everywhere. If not *None*, it is an N-length numpy boolean array and the fill will only happen over the regions where `where==True`.
>
> ***interpolate*** **:** If *True*, interpolate between the two lines to find the precise point of intersection. Otherwise, the start and end points of the filled region will only occur on explicit values in the *x* array.
>
> ***kwargs*** **:** Keyword args passed on to the `PolyCollection`.

kwargs control the `Polygon` properties:

> agg_filter: unknown alpha: float or None animated: [True | False] antialiased or antialiaseds: Boolean or sequence of booleans array: unknown axes: an `Axes` instance clim: a length 2 sequence of

floats clip_box: a `matplotlib.transforms.Bbox` instance clip_on: [True | False] clip_path: [(`Path`, `Transform`) | `Patch` | None] cmap: a colormap or registered colormap name color: matplotlib color arg or sequence of rgba tuples colorbar: unknown contains: a callable function edgecolor or edgecolors: matplotlib color arg or sequence of rgba tuples facecolor or facecolors: matplotlib color arg or sequence of rgba tuples figure: a `matplotlib.figure.Figure` instance gid: an id string hatch: ['/' | '\' | '|' | '-' | '+' | 'x' | 'o' | 'O' | '.' | '*'] label: string or anything printable with '%s' conversion. linestyle or linestyles or dashes: ['solid' | 'dashed', 'dashdot', 'dotted' | (offset, on-off-dash-seq)] linewidth or lw or linewidths: float or sequence of floats lod: [True | False] norm: unknown offset_position: unknown offsets: float or sequence of floats paths: unknown picker: [None|float|boolean|callable] pickradius: unknown rasterized: [True | False | None] snap: unknown transform: `Transform` instance url: a url string urls: unknown visible: [True | False] zorder: any number

`fill_betweenx`(*y*, *x1*, *x2=0*, *where=None*, *kwargs...*)

Make filled polygons between two horizontal curves.

Create a `PolyCollection` filling the regions between *x1* and *x2* where `where==True`

y **:** An N-length array of the y data

x1 **:** An N-length array (or scalar) of the x data

x2 **:** An N-length array (or scalar) of the x data

where **:** If *None*, default to fill between everywhere. If not *None*, it is a N length numpy boolean array and the fill will only happen over the regions where `where==True`

kwargs **:** keyword args passed on to the `PolyCollection`

kwargs control the `Polygon` properties:

agg_filter: unknown alpha: float or None animated: [True | False] antialiased or antialiaseds: Boolean or sequence of booleans array: unknown axes: an `Axes` instance clim: a length 2 sequence of floats clip_box: a `matplotlib.transforms.Bbox` instance clip_on: [True | False] clip_path: [(`Path`, `Transform`) | `Patch` | None] cmap: a colormap or registered colormap name color: matplotlib color arg or sequence of rgba tuples colorbar: unknown contains: a callable function edgecolor or edgecolors: matplotlib color arg or sequence of rgba tuples facecolor or facecolors: matplotlib color arg or sequence of rgba tuples figure: a `matplotlib.figure.Figure` instance gid: an id string hatch: ['/' | '\' | '|' | '-' | '+' | 'x' | 'o' | 'O' | '.' | '*'] label: string or anything printable with '%s' conversion. linestyle or linestyles or dashes: ['solid' | 'dashed', 'dashdot', 'dotted' | (offset, on-off-dash-seq)] linewidth or lw or linewidths: float or sequence of floats lod: [True | False] norm: unknown offset_position: unknown offsets: float or sequence of floats paths: unknown picker: [None|float|boolean|callable] pickradius: unknown rasterized: [True | False | None] snap: unknown transform: `Transform` instance url: a url string urls: unknown visible: [True | False] zorder: any number

Additional kwargs: hold = [True|False] overrides default hold state

`findobj`(*o=gcf()*, *match=None*, *include_self=True*)

Find artist objects.

Recursively find all :class:matplotlib.artist.Artist instances contained in self.

match can be

- None: return all objects contained in artist.
- function with signature `boolean = match(artist)` used to filter matches
- class instance: eg Line2D. Only return artists of class type.

If *include_self* is True (default), include self in the list to be checked for a match.

flag()
set the default colormap to flag and apply to current image if any. See help(colormaps) for more information

gca()
Return the current axis instance. This can be used to control axis properties either using set or the `Axes` methods, for example, setting the xaxis range:

```
plot(t,s)
set(gca(), 'xlim', [0,10])
```

or:

```
plot(t,s)
a = gca()
a.set_xlim([0,10])
```

gcf()
Return a reference to the current figure.

gci()
Get the current colorable artist. Specifically, returns the current `ScalarMappable` instance (image or patch collection), or *None* if no images or patch collections have been defined. The commands `imshow()` and `figimage()` create `Image` instances, and the commands `pcolor()` and `scatter()` create `Collection` instances. The current image is an attribute of the current axes, or the nearest earlier axes in the current figure that contains an image.

get()
Return the value of object's property. *property* is an optional string for the property you want to return

Example usage:

```
getp(obj)  # get all the object properties
getp(obj, 'linestyle')  # get the linestyle property
```

obj is a `Artist` instance, eg `Line2D` or an instance of a `Axes` or `matplotlib.text.Text`. If the *property* is 'somename', this function returns

obj.get_somename()

`getp()` can be used to query all the gettable properties with `getp(obj)`. Many properties have aliases for shorter typing, e.g. 'lw' is an alias for 'linewidth'. In the output, aliases and full property names will be listed as:

property or alias = value

e.g.:

linewidth or lw = 2

get_backend()
Returns the current backend.

get_cmap()
Get a colormap instance, defaulting to rc values if *name* is None.

Colormaps added with `register_cmap()` take precedence over builtin colormaps.

If *name* is a `colors.Colormap` instance, it will be returned.

If *lut* is not None it must be an integer giving the number of entries desired in the lookup table, and *name* must be a standard mpl colormap name with a corresponding data dictionary in *datad*.

get_current_fig_manager()
None

get_figlabels()
Return a list of existing figure labels.

get_fignums()
Return a list of existing figure numbers.

get_plot_commands()
Get a sorted list of all of the plotting commands.

get_scale_docs()
Helper function for generating docstrings related to scales.

get_scale_names()
None

getp()
Return the value of object's property. *property* is an optional string for the property you want to return

Example usage:

```
getp(obj)  # get all the object properties
getp(obj, 'linestyle')  # get the linestyle property
```

obj is a `Artist` instance, eg `Line2D` or an instance of a `Axes` or `matplotlib.text.Text`. If the *property* is 'somename', this function returns

obj.get_somename()

`getp()` can be used to query all the gettable properties with `getp(obj)`. Many properties have aliases for shorter typing, e.g. 'lw' is an alias for 'linewidth'. In the output, aliases and full property names will be listed as:

property or alias = value

e.g.:

linewidth or lw = 2

ginput(*self*, *n=1*, *timeout=30*, *show_clicks=True*, *mouse_add=1*, *mouse_pop=3*, *mouse_stop=2*)
Blocking call to interact with the figure.

This will wait for *n* clicks from the user and return a list of the coordinates of each click.

If *timeout* is zero or negative, does not timeout.

If *n* is zero or negative, accumulate clicks until a middle click (or potentially both mouse buttons at once) terminates the input.

Right clicking cancels last input.

The buttons used for the various actions (adding points, removing points, terminating the inputs) can be overriden via the arguments *mouse_add*, *mouse_pop* and *mouse_stop*, that give the associated mouse button: 1 for left, 2 for middle, 3 for right.

The keyboard can also be used to select points in case your mouse does not have one or more of the buttons. The delete and backspace keys act like right clicking (i.e., remove last point), the enter key terminates input and any other key (not already used by the window manager) selects a point.

gray()
set the default colormap to gray and apply to current image if any. See help(colormaps) for more information

grid(*self*, *b=None*, *which='major'*, *axis='both'*, *kwargs...*)
Turn the axes grids on or off.

Set the axes grids on or off; *b* is a boolean. (For MATLAB compatibility, *b* may also be a string, 'on' or 'off'.)

If *b* is *None* and `len(kwargs)==0`, toggle the grid state. If *kwargs* are supplied, it is assumed that you want a grid and *b* is thus set to *True*.

which can be 'major' (default), 'minor', or 'both' to control whether major tick grids, minor tick grids, or both are affected.

axis can be 'both' (default), 'x', or 'y' to control which set of gridlines are drawn.

kwargs are used to set the grid line properties, eg:

```
ax.grid(color='r', linestyle='-', linewidth=2)
```

Valid `Line2D` kwargs are

> agg_filter: unknown alpha: float (0.0 transparent through 1.0 opaque) animated: [True | False] antialiased or aa: [True | False] axes: an `Axes` instance clip_box: a `matplotlib.transforms.Bbox` instance clip_on: [True | False] clip_path: [(`Path`, `Transform`) | `Patch` | None] color or c: any matplotlib color contains: a callable function dash_capstyle: ['butt' | 'round' | 'projecting'] dash_joinstyle: ['miter' | 'round' | 'bevel'] dashes: sequence of on/off ink in points data: 2D array (rows are x, y) or two 1D arrays drawstyle: ['default' | 'steps' | 'steps-pre' | 'steps-mid' | 'steps-post'] figure: a `matplotlib.figure.Figure` instance fillstyle: ['full' | 'left' | 'right' | 'bottom' | 'top' | 'none'] gid: an id string label: string or anything printable with '%s' conversion. linestyle or ls: [`'-'` | `'--'` | `'-.'` | `':'` | `'None'` | `' '` | `''`] and any drawstyle in combination with a linestyle, e.g. `'steps--'`. linewidth or lw: float value in points lod: [True | False] marker: [`7` | `4` | `5` | `6` | `'o'` | `'D'` | `'h'` | `'H'` | `'_'` | `''` | `'None'` | `None` | `' '` | `'8'` | `'p'` | `','` | `'+'` | `'.'` | `'s'` | `'*'` | `'d'` | `3` | `0` | `1` | `2` | `'1'` | `'3'` | `'4'` | `'2'` | `'v'` | `'<'` | `'>'` | `'^'` | `'|'` | `'x'` | `'$...$'` | *tuple* | *Nx2 array*] markeredgecolor or mec: any matplotlib color markeredgewidth or mew: float value in points markerfacecolor or mfc: any matplotlib color markerfacecoloralt or mfcalt: any matplotlib color markersize or ms: float markevery: None | integer | (startind, stride) picker: float distance in points or callable pick function `fn(artist, event)` pickradius: float distance in points rasterized: [True | False | None] snap: unknown solid_capstyle: ['butt' | 'round' | 'projecting'] solid_joinstyle: ['miter' | 'round' | 'bevel'] transform: a `matplotlib.transforms.Transform` instance url: a url string visible: [True | False] xdata: 1D array ydata: 1D array zorder: any number

hexbin(*x*, *y*, *C = None*, *gridsize = 100*, *bins = None*, *xscale = 'linear'*, *yscale = 'linear'*, *cmap=None*, *norm=None*, *vmin=None*, *vmax=None*, *alpha=None*, *linewidths=None*, *edgecolors='none' reduce_C_function = np.mean*, *mincnt=None*, *marginals=True kwargs...*)

Make a hexagonal binning plot.

Make a hexagonal binning plot of *x* versus *y*, where *x*, *y* are 1-D sequences of the same length, *N*. If *C* is *None* (the default), this is a histogram of the number of occurences of the observations at (x[i],y[i]).

If *C* is specified, it specifies values at the coordinate (x[i],y[i]). These values are accumulated for each hexagonal bin and then reduced according to *reduce_C_function*, which defaults to numpy's mean function (np.mean). (If *C* is specified, it must also be a 1-D sequence of the same length as *x* and *y*.)

x, *y* and/or *C* may be masked arrays, in which case only unmasked points will be plotted.

Optional keyword arguments:

***gridsize*: [100 | integer]** The number of hexagons in the *x*-direction, default is 100. The corresponding number of hexagons in the *y*-direction is chosen such that the hexagons are approximately regular. Alternatively, gridsize can be a tuple with two elements specifying the number of hexagons in the *x*-direction and the *y*-direction.

***bins*: [*None* | 'log' | integer | sequence]** If *None*, no binning is applied; the color of each hexagon directly corresponds to its count value.

If 'log', use a logarithmic scale for the color map. Internally, $log_{10}(i+1)$ is used to determine the hexagon color.

If an integer, divide the counts in the specified number of bins, and color the hexagons accordingly.

If a sequence of values, the values of the lower bound of the bins to be used.

***xscale*: ['linear' | 'log']** Use a linear or log10 scale on the horizontal axis.

***scale*: ['linear' | 'log']** Use a linear or log10 scale on the vertical axis.

***mincnt*: [*None* | a positive integer]** If not *None*, only display cells with more than *mincnt* number of points in the cell

***marginals*: [*True* | *False*]** if marginals is *True*, plot the marginal density as colormapped rectagles along the bottom of the x-axis and left of the y-axis

***extent*: [*None* | scalars (left, right, bottom, top)]** The limits of the bins. The default assigns the limits based on gridsize, x, y, xscale and yscale.

Other keyword arguments controlling color mapping and normalization arguments:

***cmap*: [*None* | Colormap]** a `matplotlib.colors.Colormap` instance. If *None*, defaults to rc `image.cmap`.

***norm*: [*None* | Normalize]** `matplotlib.colors.Normalize` instance is used to scale luminance data to 0,1.

***vmin* / *vmax*: scalar** *vmin* and *vmax* are used in conjunction with *norm* to normalize luminance data. If either are *None*, the min and max of the color array *C* is used. Note if you pass a norm instance, your settings for *vmin* and *vmax* will be ignored.

alpha*: scalar between 0 and 1, or *None the alpha value for the patches

***linewidths*: [*None* | scalar]** If *None*, defaults to rc lines.linewidth. Note that this is a tuple, and if you set the linewidths argument you must set it as a sequence of floats, as required by `RegularPolyCollection`.

Other keyword arguments controlling the Collection properties:

***edgecolors*: [*None* | `'none'` | mpl color | color sequence]** If `'none'`, draws the edges in the same color as the fill color. This is the default, as it avoids unsightly unpainted pixels between the hexagons.

If *None*, draws the outlines in the default color.

If a matplotlib color arg or sequence of rgba tuples, draws the outlines in the specified color.

Here are the standard descriptions of all the `Collection` kwargs:

agg_filter: unknown alpha: float or None animated: [True | False] antialiased or antialiaseds: Boolean or sequence of booleans array: unknown axes: an `Axes` instance clim: a length 2 sequence of floats clip_box: a `matplotlib.transforms.Bbox` instance clip_on: [True | False] clip_path: [(`Path`, `Transform`) | `Patch` | None] cmap: a colormap or registered colormap name color: matplotlib color arg or sequence of rgba tuples colorbar: unknown contains: a callable function edgecolor or edgecolors: matplotlib color arg or sequence of rgba tuples facecolor or facecolors: matplotlib color arg or sequence of rgba tuples figure: a `matplotlib.figure.Figure` instance gid: an id string hatch: ['/' | '\' | '|' | '-' | '+' | 'x' | 'o' | 'O' | '.' | '*'] label: string or anything printable with '%s' conversion. linestyle or linestyles or dashes: ['solid' | 'dashed', 'dashdot', 'dotted' | (offset, on-off-dash-seq)] linewidth or lw or linewidths: float or sequence of floats lod: [True | False] norm: unknown offset_position: unknown offsets: float or sequence of floats paths: unknown picker: [None|float|boolean|callable] pickradius: unknown rasterized: [True | False | None] snap: unknown transform: `Transform` instance url: a url string urls: unknown visible: [True | False] zorder: any number

Additional kwargs: hold = [True|False] overrides default hold state

hist(*x*, *bins=10*, *range=None*, *normed=False*, *weights=None*, *cumulative=False*, *bottom=None*, *histtype='bar'*, *align='mid'*, *orientation='vertical'*, *rwidth=None*, *log=False*, *color=None*, *label=None*, *stacked=False*, *kwargs...*)

Plot a histogram.

Compute and draw the histogram of *x*. The return value is a tuple (*n*, *bins*, *patches*) or ([*n0*, *n1*, ...], *bins*, [*patches0*, *patches1*,...]) if the input contains multiple data.

Multiple data can be provided via *x* as a list of datasets of potentially different length ([*x0*, *x1*, ...]), or as a 2-D ndarray in which each column is a dataset. Note that the ndarray form is transposed relative to the list form.

Masked arrays are not supported at present.

Keyword arguments:

***bins*:** Either an integer number of bins or a sequence giving the bins. If *bins* is an integer, *bins* + 1 bin edges will be returned, consistent with `numpy.histogram()` for numpy version >= 1.3, and with the *new* = True argument in earlier versions. Unequally spaced bins are supported if *bins* is a sequence.

***range*:** The lower and upper range of the bins. Lower and upper outliers are ignored. If not provided, *range* is (x.min(), x.max()). Range has no effect if *bins* is a sequence.

If *bins* is a sequence or *range* is specified, autoscaling is based on the specified bin range instead of the range of x.

***normed*:** If *True*, the first element of the return tuple will be the counts normalized to form a probability density, i.e., `n/(len(x)*dbin)`. In a probability density, the integral of the histogram should be 1; you can verify that with a trapezoidal integration of the probability density function:

```
pdf, bins, patches = ax.hist(...)
print np.sum(pdf * np.diff(bins))
```

Note: Until numpy release 1.5, the underlying numpy histogram function was incorrect with *normed*=*True* if bin sizes were unequal. MPL inherited that error. It is now corrected within MPL when using earlier numpy versions

---

***weights*:** An array of weights, of the same shape as *x*. Each value in *x* only contributes its associated weight towards the bin count (instead of 1). If *normed* is True, the weights are normalized, so that the integral of the density over the range remains 1.

***cumulative*:** If *True*, then a histogram is computed where each bin gives the counts in that bin plus all bins for smaller values. The last bin gives the total number of datapoints. If *normed* is also *True* then the histogram is normalized such that the last bin equals 1. If *cumulative* evaluates to less than 0 (e.g. -1), the direction of accumulation is reversed. In this case, if *normed* is also *True*, then the histogram is normalized such that the first bin equals 1.

***histtype*: ['bar' | 'barstacked' | 'step' | 'stepfilled']** The type of histogram to draw.

- 'bar' is a traditional bar-type histogram. If multiple data are given the bars are aranged side by side.
- 'barstacked' is a bar-type histogram where multiple data are stacked on top of each other.
- 'step' generates a lineplot that is by default unfilled.
- 'stepfilled' generates a lineplot that is by default filled.

***align*: ['left' | 'mid' | 'right']** Controls how the histogram is plotted.

- 'left': bars are centered on the left bin edges.

- 'mid': bars are centered between the bin edges.
- 'right': bars are centered on the right bin edges.

***orientation*: ['horizontal' | 'vertical']** If 'horizontal', `barh()` will be used for bar-type histograms and the *bottom* kwarg will be the left edges.

***rwidth*:** The relative width of the bars as a fraction of the bin width. If *None*, automatically compute the width. Ignored if *histtype* = 'step' or 'stepfilled'.

***log*:** If *True*, the histogram axis will be set to a log scale. If *log* is *True* and *x* is a 1D array, empty bins will be filtered out and only the non-empty (*n*, *bins*, *patches*) will be returned.

***color*:** Color spec or sequence of color specs, one per dataset. Default (*None*) uses the standard line color sequence.

***label*:** String, or sequence of strings to match multiple datasets. Bar charts yield multiple patches per dataset, but only the first gets the label, so that the legend command will work as expected:

```
ax.hist(10+2*np.random.randn(1000), label='men')
ax.hist(12+3*np.random.randn(1000), label='women', alpha=0.5)
ax.legend()
```

***stacked*:** If *True*, multiple data are stacked on top of each other If *False* multiple data are aranged side by side if histtype is 'bar' or on top of each other if histtype is 'step'

.

kwargs are used to update the properties of the `Patch` instances returned by *hist*:

agg_filter: unknown alpha: float or None animated: [True | False] antialiased or aa: [True | False] or None for default axes: an `Axes` instance clip_box: a `matplotlib.transforms.Bbox` instance clip_on: [True | False] clip_path: [(`Path`, `Transform`) | `Patch` | None] color: matplotlib color spec contains: a callable function edgecolor or ec: mpl color spec, or None for default, or 'none' for no color facecolor or fc: mpl color spec, or None for default, or 'none' for no color figure: a `matplotlib.figure.Figure` instance fill: [True | False] gid: an id string hatch: ['/' | '\' | '|' | '-' | '+' | 'x' | 'o' | 'O' | '.' | '*'] label: string or anything printable with '%s' conversion. linestyle or ls: ['solid' | 'dashed' | 'dashdot' | 'dotted'] linewidth or lw: float or None for default lod: [True | False] path_effects: unknown picker: [None|float|boolean|callable] rasterized: [True | False | None] snap: unknown transform: `Transform` instance url: a url string visible: [True | False] zorder: any number

Additional kwargs: hold = [True|False] overrides default hold state

`hist2d`(*x*, *y*, *bins = None*, *range=None*, *weights=None*, *cmin=None*, *cmax=None kwargs...*)

Make a 2D histogram plot.

Make a 2d histogram plot of *x* versus *y*, where *x*, *y* are 1-D sequences of the same length.

Optional keyword arguments: *bins*: [None | int | [int, int] | array_like | [array, array]]

The bin specification:

- If int, the number of bins for the two dimensions (nx=ny=bins).
- If [int, int], the number of bins in each dimension (nx, ny = bins).
- If array_like, the bin edges for the two dimensions (x_edges=y_edges=bins).
- If [array, array], the bin edges in each dimension (x_edges, y_edges = bins).

The default value is 10.

***range*: [*None* | array_like shape(2,2)]** The leftmost and rightmost edges of the bins along each dimension (if not specified explicitly in the bins parameters): [[xmin, xmax], [ymin, ymax]]. All values outside of this range will be considered outliers and not tallied in the histogram.

***normed*:[True|False]** Normalize histogram. The default value is False

***weights*: [*None* | array]** An array of values w_i weighing each sample (x_i, y_i).

cmin [[None| scalar]] All bins that has count less than cmin will not be displayed and these count values in the return value count histogram will also be set to nan upon return

cmax [[None| scalar]] All bins that has count more than cmax will not be displayed (set to none before passing to imshow) and these count values in the return value count histogram will also be set to nan upon return

Remaining keyword arguments are passed directly to `pcolorfast()`.

Rendering the histogram with a logarithmic color scale is accomplished by passing a `colors.LogNorm` instance to the *norm* keyword argument.

Additional kwargs: hold = [True|False] overrides default hold state

`hlines`(*y*, *xmin*, *xmax*, *colors='k'*, *linestyles='solid'*, *kwargs...*)

Plot horizontal lines.

Plot horizontal lines at each *y* from *xmin* to *xmax*.

Required arguments:

***y*:** a 1-D numpy array or iterable.

***xmin* and *xmax*:** can be scalars or `len(x)` numpy arrays. If they are scalars, then the respective values are constant, else the widths of the lines are determined by *xmin* and *xmax*.

Optional keyword arguments:

***colors*:** a line collections color argument, either a single color or a `len(y)` list of colors

***linestyles*:** ['solid' | 'dashed' | 'dashdot' | 'dotted']

Additional kwargs: hold = [True|False] overrides default hold state

`hold`()

Set the hold state. If *b* is None (default), toggle the hold state, else set the hold state to boolean value *b*:

```
hold()        # toggle hold
hold(True)    # hold is on
hold(False)   # hold is off
```

When *hold* is *True*, subsequent plot commands will be added to the current axes. When *hold* is *False*, the current axes and figure will be cleared on the next plot command.

`hot`()

set the default colormap to hot and apply to current image if any. See help(colormaps) for more information

`hsv`()

set the default colormap to hsv and apply to current image if any. See help(colormaps) for more information

`imread`()

Read an image from a file into an array.

fname may be a string path or a Python file-like object. If using a file object, it must be opened in binary mode.

If *format* is provided, will try to read file of that type, otherwise the format is deduced from the filename. If nothing can be deduced, PNG is tried.

Return value is a `numpy.array`. For grayscale images, the return array is MxN. For RGB images, the return value is MxNx3. For RGBA images the return value is MxNx4.

matplotlib can only read PNGs natively, but if PIL is installed, it will use it to load the image and return an array (if possible) which can be used with `imshow()`.

imsave()

Save an array as in image file.

The output formats available depend on the backend being used.

Arguments:

fname: A string containing a path to a filename, or a Python file-like object. If *format* is *None* and *fname* is a string, the output format is deduced from the extension of the filename.

arr: An MxN (luminance), MxNx3 (RGB) or MxNx4 (RGBA) array.

Keyword arguments:

***vmin/vmax*: [None | scalar]** *vmin* and *vmax* set the color scaling for the image by fixing the values that map to the colormap color limits. If either *vmin* or *vmax* is None, that limit is determined from the *arr* min/max value.

cmap: cmap is a colors.Colormap instance, eg cm.jet. If None, default to the rc image.cmap value.

format: One of the file extensions supported by the active backend. Most backends support png, pdf, ps, eps and svg.

origin ['upper' | 'lower'] Indicates where the [0,0] index of the array is in the upper left or lower left corner of the axes. Defaults to the rc image.origin value.

dpi The DPI to store in the metadata of the file. This does not affect the resolution of the output image.

imshow(*X*, *cmap=None*, *norm=None*, *aspect=None*, *interpolation=None*, *alpha=None*, *vmin=None*, *vmax=None*, *origin=None*, *extent=None*, *kwargs...*)

Display an image on the axes.

Display the image in *X* to current axes. *X* may be a float array, a uint8 array or a PIL image. If *X* is an array, *X* can have the following shapes:

- MxN – luminance (grayscale, float array only)
- MxNx3 – RGB (float or uint8 array)
- MxNx4 – RGBA (float or uint8 array)

The value for each component of MxNx3 and MxNx4 float arrays should be in the range 0.0 to 1.0; MxN float arrays may be normalised.

An `matplotlib.image.AxesImage` instance is returned.

Keyword arguments:

***cmap*: [*None* | Colormap]** A `matplotlib.colors.Colormap` instance, eg. cm.jet. If *None*, default to rc `image.cmap` value.

cmap is ignored when *X* has RGB(A) information

***aspect*: [*None* | 'auto' | 'equal' | scalar]** If 'auto', changes the image aspect ratio to match that of the axes

If 'equal', and *extent* is *None*, changes the axes aspect ratio to match that of the image. If *extent* is not *None*, the axes aspect ratio is changed to match that of the extent.

If *None*, default to rc `image.aspect` value.

interpolation:

Acceptable values are *None*, 'none', 'nearest', 'bilinear', 'bicubic', 'spline16', 'spline36', 'hanning', 'hamming', 'hermite', 'kaiser', 'quadric', 'catrom', 'gaussian', 'bessel', 'mitchell', 'sinc', 'lanczos'

If *interpolation* is *None*, default to rc `image.interpolation`. See also the *filternorm* and *filterrad* parameters

If *interpolation* is `'none'`, then no interpolation is performed on the Agg, ps and pdf backends. Other backends will fall back to 'nearest'.

***norm*: [*None* | Normalize]** An `matplotlib.colors.Normalize` instance; if *None*, default is `normalization()`. This scales luminance -> 0-1

norm is only used for an MxN float array.

***vmin/vmax*: [*None* | scalar]** Used to scale a luminance image to 0-1. If either is *None*, the min and max of the luminance values will be used. Note if *norm* is not *None*, the settings for *vmin* and *vmax* will be ignored.

***alpha*: scalar** The alpha blending value, between 0 (transparent) and 1 (opaque) or *None*

***origin*: [*None* | 'upper' | 'lower']** Place the [0,0] index of the array in the upper left or lower left corner of the axes. If *None*, default to rc `image.origin`.

***extent*: [*None* | scalars (left, right, bottom, top)]** Data limits for the axes. The default assigns zero-based row, column indices to the *x*, *y* centers of the pixels.

***shape*: [*None* | scalars (columns, rows)]** For raw buffer images

***filternorm*:** A parameter for the antigrain image resize filter. From the antigrain documentation, if *filternorm* = 1, the filter normalizes integer values and corrects the rounding errors. It doesn't do anything with the source floating point values, it corrects only integers according to the rule of 1.0 which means that any sum of pixel weights must be equal to 1.0. So, the filter function must produce a graph of the proper shape.

***filterrad*:** The filter radius for filters that have a radius parameter, i.e. when interpolation is one of: 'sinc', 'lanczos' or 'blackman'

Additional kwargs are `Artist` properties.

agg_filter: unknown alpha: float (0.0 transparent through 1.0 opaque) animated: [True | False] axes: an `Axes` instance clip_box: a `matplotlib.transforms.Bbox` instance clip_on: [True | False] clip_path: [(`Path`, `Transform`) | `Patch` | None] contains: a callable function figure: a `matplotlib.figure.Figure` instance gid: an id string label: string or anything printable with '%s' conversion. lod: [True | False] picker: [None|float|boolean|callable] rasterized: [True | False | None] snap: unknown transform: `Transform` instance url: a url string visible: [True | False] zorder: any number

Additional kwargs: hold = [True|False] overrides default hold state

`interactive`()

Set interactive mode to boolean b.

If b is True, then draw after every plotting command, eg, after xlabel

`ioff`()

Turn interactive mode off.

`ion`()

Turn interactive mode on.

is_numlike()
return true if *obj* looks like a number

is_string_like()
Return True if *obj* looks like a string

ishold()
Return the hold status of the current axes.

isinteractive()
Return status of interactive mode.

jet()
set the default colormap to jet and apply to current image if any. See help(colormaps) for more information

legend()
Place a legend on the current axes.

Call signature:

```
legend(*args, **kwargs)
```

Places legend at location *loc*. Labels are a sequence of strings and *loc* can be a string or an integer specifying the legend location.

To make a legend with existing lines:

```
legend()
```

`legend()` by itself will try and build a legend using the label property of the lines/patches/collections. You can set the label of a line by doing:

```
plot(x, y, label='my data')
```

or:

```
line.set_label('my data').
```

If label is set to '_nolegend_', the item will not be shown in legend.

To automatically generate the legend from labels:

```
legend( ('label1', 'label2', 'label3') )
```

To make a legend for a list of lines and labels:

```
legend( (line1, line2, line3), ('label1', 'label2', 'label3') )
```

To make a legend at a given location, using a location argument:

```
legend( ('label1', 'label2', 'label3'), loc='upper left')
```

or:

```
legend( (line1, line2, line3),  ('label1', 'label2', 'label3'), loc=2)
```

The location codes are

Location String	Location Code
'best'	0
'upper right'	1
'upper left'	2
'lower left'	3
'lower right'	4
'right'	5
'center left'	6
'center right'	7
'lower center'	8
'upper center'	9
'center'	10

Users can specify any arbitrary location for the legend using the *bbox_to_anchor* keyword argument. bbox_to_anchor can be an instance of BboxBase(or its derivatives) or a tuple of 2 or 4 floats. For example,

> loc = 'upper right', bbox_to_anchor = (0.5, 0.5)

will place the legend so that the upper right corner of the legend at the center of the axes.

The legend location can be specified in other coordinate, by using the *bbox_transform* keyword.

The loc itslef can be a 2-tuple giving x,y of the lower-left corner of the legend in axes coords (*bbox_to_anchor* is ignored).

Keyword arguments:

***prop*: [*None* | FontProperties | dict]** A `matplotlib.font_manager.FontProperties` instance. If *prop* is a dictionary, a new instance will be created with *prop*. If *None*, use rc settings.

***fontsize*: [size in points | 'xx-small' | 'x-small' | 'small' | 'medium' | 'large' | 'x-large' | 'xx-large']** Set the font size. May be either a size string, relative to the default font size, or an absolute font size in points. This argument is only used if prop is not specified.

***numpoints*: integer** The number of points in the legend for line

***scatterpoints*: integer** The number of points in the legend for scatter plot

***scatteroffsets*: list of floats** a list of yoffsets for scatter symbols in legend

***markerscale*: [*None* | scalar]** The relative size of legend markers vs. original. If *None*, use rc settings.

***frameon*: [*True* | *False*]** if *True*, draw a frame around the legend. The default is set by the rcParam 'legend.frameon'

***fancybox*: [*None* | *False* | *True*]** if *True*, draw a frame with a round fancybox. If *None*, use rc settings

***shadow*: [*None* | *False* | *True*]** If *True*, draw a shadow behind legend. If *None*, use rc settings.

ncol [integer] number of columns. default is 1

mode [["expand" | *None*]] if mode is "expand", the legend will be horizontally expanded to fill the axes area (or *bbox_to_anchor*)

bbox_to_anchor [an instance of BboxBase or a tuple of 2 or 4 floats] the bbox that the legend will be anchored.

bbox_transform [[an instance of Transform | *None*]] the transform for the bbox. transAxes if *None*.

title [string] the legend title

Padding and spacing between various elements use following keywords parameters. These values are measure in font-size units. E.g., a fontsize of 10 points and a handlelength=5 implies a handlelength of 50 points. Values from rcParams will be used if None.

Keyword	Description
borderpad	the fractional whitespace inside the legend border
labelspacing	the vertical space between the legend entries
handlelength	the length of the legend handles
handletextpad	the pad between the legend handle and text
borderaxespad	the pad between the axes and legend border
columnspacing	the spacing between columns

Note: Not all kinds of artist are supported by the legend command. See LINK (FIXME) for details.

locator_params()

Control behavior of tick locators.

Keyword arguments:

axis ['x' | 'y' | 'both'] Axis on which to operate; default is 'both'.

tight [True | False | None] Parameter passed to `autoscale_view()`. Default is None, for no change.

Remaining keyword arguments are passed to directly to the `set_params()` method.

Typically one might want to reduce the maximum number of ticks and use tight bounds when plotting small subplots, for example:

```
ax.locator_params(tight=True, nbins=4)
```

Because the locator is involved in autoscaling, `autoscale_view()` is called automatically after the parameters are changed.

This presently works only for the `MaxNLocator` used by default on linear axes, but it may be generalized.

loglog()

Make a plot with log scaling on both the *x* and *y* axis.

Call signature:

```
loglog(*args, **kwargs)
```

`loglog()` supports all the keyword arguments of `plot()` and `matplotlib.axes.Axes.set_xscale()` / `matplotlib.axes.Axes.set_yscale()`.

Notable keyword arguments:

***basex/basey*: scalar > 1** Base of the *x*/*y* logarithm

***subsx/subsy*: [*None* | sequence]** The location of the minor *x*/*y* ticks; *None* defaults to autosubs, which depend on the number of decades in the plot; see `matplotlib.axes.Axes.set_xscale()` / `matplotlib.axes.Axes.set_yscale()` for details

***nonposx/nonposy*: ['mask' | 'clip']** Non-positive values in *x* or *y* can be masked as invalid, or clipped to a very small positive number

The remaining valid kwargs are `Line2D` properties:

agg_filter: unknown alpha: float (0.0 transparent through 1.0 opaque) animated: [True | False] antialiased or aa: [True | False] axes: an `Axes` instance clip_box: a `matplotlib.transforms.Bbox` instance clip_on: [True | False] clip_path: [(`Path`,

`Transform`) | `Patch` | None] color or c: any matplotlib color contains: a callable function dash_capstyle: ['butt' | 'round' | 'projecting'] dash_joinstyle: ['miter' | 'round' | 'bevel'] dashes: sequence of on/off ink in points data: 2D array (rows are x, y) or two 1D arrays drawstyle: ['default' | 'steps' | 'steps-pre' | 'steps-mid' | 'steps-post'] figure: a `matplotlib.figure.Figure` instance fillstyle: ['full' | 'left' | 'right' | 'bottom' | 'top' | 'none'] gid: an id string label: string or anything printable with '%s' conversion. linestyle or ls: [`'-'` | `'--'` | `'-.'` | `':'` | `'None'` | `' '` | `''`] and any drawstyle in combination with a linestyle, e.g. `'steps--'`. linewidth or lw: float value in points lod: [True | False] marker: [`7` | `4` | `5` | `6` | `'o'` | `'D'` | `'h'` | `'H'` | `'_'` | `''` | `'None'` | `None` | `' '` | `'8'` | `'p'` | `','` | `'+'` | `'.'` | `'s'` | `'*'` | `'d'` | `3` | `0` | `1` | `2` | `'1'` | `'3'` | `'4'` | `'2'` | `'v'` | `'<'` | `'>'` | `'^'` | `'|'` | `'x'` | `'$...$'` | *tuple* | *Nx2 array*] markeredgecolor or mec: any matplotlib color markeredgewidth or mew: float value in points markerfacecolor or mfc: any matplotlib color markerfacecoloralt or mfcalt: any matplotlib color markersize or ms: float markevery: None | integer | (startind, stride) picker: float distance in points or callable pick function `fn(artist, event)` pickradius: float distance in points rasterized: [True | False | None] snap: unknown solid_capstyle: ['butt' | 'round' | 'projecting'] solid_joinstyle: ['miter' | 'round' | 'bevel'] transform: a `matplotlib.transforms.Transform` instance url: a url string visible: [True | False] xdata: 1D array ydata: 1D array zorder: any number

Additional kwargs: hold = [True|False] overrides default hold state

margins()

Set or retrieve autoscaling margins.

signatures:

```
margins()

margins(margin)

margins(xmargin, ymargin)

margins(x=xmargin, y=ymargin)

margins(..., tight=False)
```

All three forms above set the xmargin and ymargin parameters. All keyword parameters are optional. A single argument specifies both xmargin and ymargin. The *tight* parameter is passed to `autoscale_view()`, which is executed after a margin is changed; the default here is *True*, on the assumption that when margins are specified, no additional padding to match tick marks is usually desired. Setting *tight* to *None* will preserve the previous setting.

Specifying any margin changes only the autoscaling; for example, if *xmargin* is not None, then *xmargin* times the X data interval will be added to each end of that interval before it is used in autoscaling.

matshow()

Display an array as a matrix in a new figure window.

The origin is set at the upper left hand corner and rows (first dimension of the array) are displayed horizontally. The aspect ratio of the figure window is that of the array, unless this would make an excessively short or narrow figure.

Tick labels for the xaxis are placed on top.

With the exception of *fignum*, keyword arguments are passed to `imshow()`. You may set the *origin* kwarg to "lower" if you want the first row in the array to be at the bottom instead of the top.

***fignum*: [None | integer | False]** By default, `matshow()` creates a new figure window with automatic numbering. If *fignum* is given as an integer, the created figure will use this figure number. Because of how `matshow()` tries to set the figure aspect ratio to be the one of the array, if you provide the number of an already existing figure, strange things may happen.

If *fignum* is *False* or 0, a new figure window will **NOT** be created.

minorticks_off()
Remove minor ticks from the current plot.

minorticks_on()
Display minor ticks on the current plot.

Displaying minor ticks reduces performance; turn them off using minorticks_off() if drawing speed is a problem.

new_figure_manager()
Create a new figure manager instance

over()
Call a function with hold(True).

Calls:

```
func(args..., kwargs...)
```

with `hold(True)` and then restores the hold state.

pause()
Pause for *interval* seconds.

If there is an active figure it will be updated and displayed, and the gui event loop will run during the pause.

If there is no active figure, or if a non-interactive backend is in use, this executes time.sleep(interval).

This can be used for crude animation. For more complex animation, see `matplotlib.animation`.

This function is experimental; its behavior may be changed or extended in a future release.

pcolor()
Create a pseudocolor plot of a 2-D array.

Note: pcolor can be very slow for large arrays; consider using the similar but much faster `pcolormesh()` instead.

Call signatures:

```
pcolor(C, kwargs...)
pcolor(X, Y, C, kwargs...)
```

C is the array of color values.

X and *Y*, if given, specify the (*x*, *y*) coordinates of the colored quadrilaterals; the quadrilateral for C[i,j] has corners at:

```
(X[i,   j],   Y[i,   j]),
(X[i,   j+1], Y[i,   j+1]),
(X[i+1, j],   Y[i+1, j]),
(X[i+1, j+1], Y[i+1, j+1]).
```

Ideally the dimensions of *X* and *Y* should be one greater than those of *C*; if the dimensions are the same, then the last row and column of *C* will be ignored.

Note that the the column index corresponds to the *x*-coordinate, and the row index corresponds to *y*; for details, see the *Grid Orientation* section below.

If either or both of *X* and *Y* are 1-D arrays or column vectors, they will be expanded as needed into the appropriate 2-D arrays, making a rectangular grid.

X, *Y* and *C* may be masked arrays. If either C[i, j], or one of the vertices surrounding C[i,j] (*X* or *Y* at [i, j], [i+1, j], [i, j+1],[i+1, j+1]) is masked, nothing is plotted.

Keyword arguments:

***cmap*: [*None* | Colormap]** A `matplotlib.colors.Colormap` instance. If *None*, use rc settings.

***norm*: [*None* | Normalize]** An `matplotlib.colors.Normalize` instance is used to scale luminance data to 0,1. If *None*, defaults to `normalize()`.

***vmin/vmax*: [*None* | scalar]** *vmin* and *vmax* are used in conjunction with *norm* to normalize luminance data. If either is *None*, it is autoscaled to the respective min or max of the color array *C*. If not *None*, *vmin* or *vmax* passed in here override any pre-existing values supplied in the *norm* instance.

***shading*: ['flat' | 'faceted']** If 'faceted', a black grid is drawn around each rectangle; if 'flat', edges are not drawn. Default is 'flat', contrary to MATLAB.

This kwarg is deprecated; please use 'edgecolors' instead:

- shading='flat' – edgecolors='none'
- shading='faceted – edgecolors='k'

***edgecolors*: [*None* | `'none'` | color | color sequence]** If *None*, the rc setting is used by default.

If `'none'`, edges will not be visible.

An mpl color or sequence of colors will set the edge color

alpha*: `0 <= scalar <= 1` or *None the alpha blending value

Return value is a `matplotlib.collections.Collection` instance. The grid orientation follows the MATLAB convention: an array *C* with shape (*nrows*, *ncolumns*) is plotted with the column number as *X* and the row number as *Y*, increasing up; hence it is plotted the way the array would be printed, except that the *Y* axis is reversed. That is, *C* is taken as *C*(*y*, *x*).

Similarly for `meshgrid()`:

```
x = np.arange(5)
y = np.arange(3)
X, Y = meshgrid(x,y)
```

is equivalent to:

```
X = array([[0, 1, 2, 3, 4],
           [0, 1, 2, 3, 4],
           [0, 1, 2, 3, 4]])

Y = array([[0, 0, 0, 0, 0],
           [1, 1, 1, 1, 1],
           [2, 2, 2, 2, 2]])
```

so if you have:

```
C = rand( len(x), len(y))
```

then you need:

```
pcolor(X, Y, C.T)
```

or:

```
pcolor(C.T)
```

MATLAB `pcolor()` always discards the last row and column of *C*, but matplotlib displays the last row and column if *X* and *Y* are not specified, or if *X* and *Y* have one more row and column than *C*.

kwargs can be used to control the `PolyCollection` properties:

> agg_filter: unknown alpha: float or None animated: [True | False] antialiased or antialiaseds: Boolean or sequence of booleans array: unknown axes: an `Axes` instance clim: a length 2 sequence of floats clip_box: a `matplotlib.transforms.Bbox` instance clip_on: [True | False] clip_path: [(`Path`, `Transform`) | `Patch` | None] cmap: a colormap or registered colormap name color: matplotlib color arg or sequence of rgba tuples colorbar: unknown contains: a callable function edgecolor or edgecolors: matplotlib color arg or sequence of rgba tuples facecolor or facecolors: matplotlib color arg or sequence of rgba tuples figure: a `matplotlib.figure.Figure` instance gid: an id string hatch: ['/' | '\' | '|' | '-' | '+' | 'x' | 'o' | 'O' | '.' | '*'] label: string or anything printable with '%s' conversion. linestyle or linestyles or dashes: ['solid' | 'dashed', 'dashdot', 'dotted' | (offset, on-off-dash-seq)] linewidth or lw or linewidths: float or sequence of floats lod: [True | False] norm: unknown offset_position: unknown offsets: float or sequence of floats paths: unknown picker: [None|float|boolean|callable] pickradius: unknown rasterized: [True | False | None] snap: unknown transform: `Transform` instance url: a url string urls: unknown visible: [True | False] zorder: any number

Note: the default *antialiaseds* is False if the default *edgecolors*="none" is used. This eliminates artificial lines at patch boundaries, and works regardless of the value of alpha. If *edgecolors* is not "none", then the default *antialiaseds* is taken from rcParams['patch.antialiased'], which defaults to *True*. Stroking the edges may be preferred if *alpha* is 1, but will cause artifacts otherwise.

Additional kwargs: hold = [True|False] overrides default hold state

pcolormesh()

Plot a quadrilateral mesh.

Call signatures:

```
pcolormesh(C)
pcolormesh(X, Y, C)
pcolormesh(C, kwargs...)
```

Create a pseudocolor plot of a 2-D array.

pcolormesh is similar to `pcolor()`, but uses a different mechanism and returns a different object; pcolor returns a `PolyCollection` but pcolormesh returns a `QuadMesh`. It is much faster, so it is almost always preferred for large arrays.

C may be a masked array, but *X* and *Y* may not. Masked array support is implemented via *cmap* and *norm*; in contrast, `pcolor()` simply does not draw quadrilaterals with masked colors or vertices.

Keyword arguments:

***cmap*: [*None* | Colormap]** A `matplotlib.colors.Colormap` instance. If *None*, use rc settings.

***norm*: [*None* | Normalize]** A `matplotlib.colors.Normalize` instance is used to scale luminance data to 0,1. If *None*, defaults to `normalize()`.

***vmin/vmax*: [*None* | scalar]** *vmin* and *vmax* are used in conjunction with *norm* to normalize luminance data. If either is *None*, it is autoscaled to the respective min or max of the color array *C*. If not *None*, *vmin* or *vmax* passed in here override any pre-existing values supplied in the *norm* instance.

***shading*: ['flat' | 'gouraud']** 'flat' indicates a solid color for each quad. When 'gouraud', each quad will be Gouraud shaded. When gouraud shading, edgecolors is ignored.

***edgecolors*: [*None* | `'None'` | `'face'` | color | color sequence]** If *None*, the rc setting is used by default.

If `'None'`, edges will not be visible.

If `'face'`, edges will have the same color as the faces.

An mpl color or sequence of colors will set the edge color

alpha*: `0 <= scalar <= 1` or *None the alpha blending value

kwargs can be used to control the `matplotlib.collections.QuadMesh` properties:

agg_filter: unknown alpha: float or None animated: [True | False] antialiased or antialiaseds: Boolean or sequence of booleans array: unknown axes: an `Axes` instance clim: a length 2 sequence of floats clip_box: a `matplotlib.transforms.Bbox` instance clip_on: [True | False] clip_path: [(`Path`, `Transform`) | `Patch` | None] cmap: a colormap or registered colormap name color: matplotlib color arg or sequence of rgba tuples colorbar: unknown contains: a callable function edgecolor or edgecolors: matplotlib color arg or sequence of rgba tuples facecolor or facecolors: matplotlib color arg or sequence of rgba tuples figure: a `matplotlib.figure.Figure` instance gid: an id string hatch: ['/' | '\' | '|' | '-' | '+' | 'x' | 'o' | 'O' | '.' | '*'] label: string or anything printable with '%s' conversion. linestyle or linestyles or dashes: ['solid' | 'dashed', 'dashdot', 'dotted' | (offset, on-off-dash-seq)] linewidth or lw or linewidths: float or sequence of floats lod: [True | False] norm: unknown offset_position: unknown offsets: float or sequence of floats paths: unknown picker: [None|float|boolean|callable] pickradius: unknown rasterized: [True | False | None] snap: unknown transform: `Transform` instance url: a url string urls: unknown visible: [True | False] zorder: any number

Additional kwargs: hold = [True|False] overrides default hold state

pie()

Plot a pie chart.

Call signature:

```
pie(x, explode=None, labels=None,
    colors=('b', 'g', 'r', 'c', 'm', 'y', 'k', 'w'),
    autopct=None, pctdistance=0.6, shadow=False,
    labeldistance=1.1, startangle=None, radius=None)
```

Make a pie chart of array *x*. The fractional area of each wedge is given by x/sum(x). If sum(x) <= 1, then the values of x give the fractional area directly and the array will not be normalized. The wedges are plotted counterclockwise, by default starting from the x-axis.

Keyword arguments:

***explode*: [*None* | len(x) sequence]** If not *None*, is a `len(x)` array which specifies the fraction of the radius with which to offset each wedge.

***colors*: [*None* | color sequence]** A sequence of matplotlib color args through which the pie chart will cycle.

***labels*: [*None* | len(x) sequence of strings]** A sequence of strings providing the labels for each wedge

***autopct*: [*None* | format string | format function]** If not *None*, is a string or function used to label the wedges with their numeric value. The label will be placed inside the wedge. If it is a format string, the label will be `fmt%pct`. If it is a function, it will be called.

***pctdistance*: scalar** The ratio between the center of each pie slice and the start of the text generated by *autopct*. Ignored if *autopct* is *None*; default is 0.6.

***labeldistance*: scalar** The radial distance at which the pie labels are drawn

***shadow*: [*False* | *True*]** Draw a shadow beneath the pie.

***startangle*: [*None* | Offset angle]** If not *None*, rotates the start of the pie chart by *angle* degrees counterclockwise from the x-axis.

radius: [*None* | scalar] The radius of the pie, if *radius* is *None* it will be set to 1.

The pie chart will probably look best if the figure and axes are square. Eg.:

```
figure(figsize=(8,8))
ax = axes([0.1, 0.1, 0.8, 0.8])
```

Return value: If *autopct* is *None*, return the tuple (*patches*, *texts*):

- *patches* is a sequence of `matplotlib.patches.Wedge` instances
- *texts* is a list of the label `matplotlib.text.Text` instances.

If *autopct* is not *None*, return the tuple (*patches*, *texts*, *autotexts*), where *patches* and *texts* are as above, and *autotexts* is a list of `Text` instances for the numeric labels.

Additional kwargs: hold = [True|False] overrides default hold state

pink()

set the default colormap to pink and apply to current image if any. See help(colormaps) for more information

plot()

Plot lines and/or markers to the `Axes`. *args* is a variable length argument, allowing for multiple *x*, *y* pairs with an optional format string. For example, each of the following is legal:

```
plot(x, y)          # plot x and y using default line style and color
plot(x, y, 'bo')    # plot x and y using blue circle markers
plot(y)             # plot y using x as index array 0..N-1
plot(y, 'r+')       # ditto, but with red plusses
```

If *x* and/or *y* is 2-dimensional, then the corresponding columns will be plotted.

An arbitrary number of *x*, *y*, *fmt* groups can be specified, as in:

```
a.plot(x1, y1, 'g^', x2, y2, 'g-')
```

Return value is a list of lines that were added.

By default, each line is assigned a different color specified by a 'color cycle'. To change this behavior, you can edit the axes.color_cycle rcParam. Alternatively, you can use `set_default_color_cycle()`.

The following format string characters are accepted to control the line style or marker:

character	description
`'-'`	solid line style
`'--'`	dashed line style
`'-.'`	dash-dot line style
`':'`	dotted line style
`'.'`	point marker
`','`	pixel marker
`'o'`	circle marker
`'v'`	triangle_down marker
`'^'`	triangle_up marker
`'<'`	triangle_left marker
`'>'`	triangle_right marker
`'1'`	tri_down marker
`'2'`	tri_up marker
`'3'`	tri_left marker
`'4'`	tri_right marker
`'s'`	square marker
`'p'`	pentagon marker
`'*'`	star marker
`'h'`	hexagon1 marker
`'H'`	hexagon2 marker
`'+'`	plus marker
`'x'`	x marker
`'D'`	diamond marker
`'d'`	thin_diamond marker
`'|'`	vline marker
`'_'`	hline marker

The following color abbreviations are supported:

character	color
‘b’	blue
‘g’	green
‘r’	red
‘c’	cyan
‘m’	magenta
‘y’	yellow
‘k’	black
‘w’	white

In addition, you can specify colors in many weird and wonderful ways, including full names (`'green'`), hex strings (`'#008000'`), RGB or RGBA tuples (`(0,1,0,1)`) or grayscale intensities as a string (`'0.8'`). Of these, the string specifications can be used in place of a `fmt` group, but the tuple forms can be used only as `kwargs`.

Line styles and colors are combined in a single format string, as in `'bo'` for blue circles.

The *kwargs* can be used to set line properties (any property that has a `set_*` method). You can use this to set a line label (for auto legends), linewidth, anitialising, marker face color, etc. Here is an example:

```
plot([1,2,3], [1,2,3], 'go-', label='line 1', linewidth=2)
plot([1,2,3], [1,4,9], 'rs',  label='line 2')
axis([0, 4, 0, 10])
legend()
```

If you make multiple lines with one plot command, the kwargs apply to all those lines, e.g.:

```
plot(x1, y1, x2, y2, antialised=False)
```

Neither line will be antialiased.

You do not need to use format strings, which are just abbreviations. All of the line properties can be controlled by keyword arguments. For example, you can set the color, marker, linestyle, and markercolor with:

```
plot(x, y, color='green', linestyle='dashed', marker='o',
     markerfacecolor='blue', markersize=12).
```

See `Line2D` for details.

The kwargs are `Line2D` properties:

> agg_filter: unknown alpha: float (0.0 transparent through 1.0 opaque) animated: [True | False] antialiased or aa: [True | False] axes: an `Axes` instance clip_box: a `matplotlib.transforms.Bbox` instance clip_on: [True | False] clip_path: [(`Path`, `Transform`) | `Patch` | None] color or c: any matplotlib color contains: a callable function dash_capstyle: ['butt' | 'round' | 'projecting'] dash_joinstyle: ['miter' | 'round' | 'bevel'] dashes: sequence of on/off ink in points data: 2D array (rows are x, y) or two 1D arrays drawstyle: ['default' | 'steps' | 'steps-pre' | 'steps-mid' | 'steps-post'] figure: a `matplotlib.figure.Figure` instance fillstyle: ['full' | 'left' | 'right' | 'bottom' | 'top' | 'none'] gid: an id string label: string or anything printable with '%s' conversion. linestyle or ls: [`'-'` | `'--'` | `'-.'` | `':'` | `'None'` | `' '` | `''`] and any drawstyle in combination with a linestyle, e.g. `'steps--'`. linewidth or lw: float value in points lod: [True | False] marker: [`7` | `4` | `5` | `6` | `'o'` | `'D'` | `'h'` | `'H'` | `'_'` | `''` | `'None'` | `None` | `' '` | `'8'` | `'p'` | `','` | `'+'` | `'.'` | `'s'` | `'*'` | `'d'` | `3` | `0` | `1` | `2` | `'1'` | `'3'` | `'4'` | `'2'` | `'v'` | `'<'` | `'>'` | `'^'` | `'|'` | `'x'` | `'$...$'` | *tuple* | *Nx2 array*] markeredgecolor or mec: any matplotlib color markeredgewidth or mew: float value in points markerfacecolor or mfc: any matplotlib color markerfacecoloralt or mfcalt: any matplotlib color markersize or ms: float markevery: None | integer | (startind, stride) picker: float distance in points or callable pick function `fn(artist, event)` pickradius: float distance in points rasterized: [True | False | None] snap: unknown solid_capstyle: ['butt' | 'round' | 'projecting'] solid_joinstyle: ['miter' | 'round' | 'bevel'] transform: a `matplotlib.transforms.Transform` instance url: a url string visible: [True | False] xdata: 1D array ydata: 1D array zorder: any number

kwargs *scalex* and *scaley*, if defined, are passed on to `autoscale_view()` to determine whether the *x* and *y* axes are autoscaled; the default is *True*.

Additional kwargs: hold = [True|False] overrides default hold state

plot_date()

Plot with data with dates.

Call signature:

```
plot_date(x, y, fmt='bo', tz=None, xdate=True, ydate=False, kwargs...)
```

Similar to the `plot()` command, except the *x* or *y* (or both) data is considered to be dates, and the axis is labeled accordingly.

x and/or *y* can be a sequence of dates represented as float days since 0001-01-01 UTC.

Keyword arguments:

> ***fmt*: string** The plot format string.
>
> ***tz*: [*None* | timezone string | `tzinfo` instance]** The time zone to use in labeling dates. If *None*, defaults to rc value.
>
> ***xdate*: [*True* | *False*]** If *True*, the *x*-axis will be labeled with dates.
>
> ***ydate*: [*False* | *True*]** If *True*, the *y*-axis will be labeled with dates.

Note if you are using custom date tickers and formatters, it may be necessary to set the formatters/locators after the call to `plot_date()` since `plot_date()` will set the default tick locator to `matplotlib.dates.AutoDateLocator` (if the tick locator is not already set to a `matplotlib.dates.DateLocator` instance) and the default tick formatter to `matplotlib.dates.AutoDateFormatter` (if the tick formatter is not already set to a `matplotlib.dates.DateFormatter` instance).

Valid kwargs are `Line2D` properties:

> agg_filter: unknown alpha: float (0.0 transparent through 1.0 opaque) animated: [True | False] antialiased or aa: [True | False] axes: an `Axes` instance clip_box: a `matplotlib.transforms.Bbox` instance clip_on: [True | False] clip_path: [(`Path`, `Transform`) | `Patch` | None] color or c: any matplotlib color contains: a callable function dash_capstyle: ['butt' | 'round' | 'projecting'] dash_joinstyle: ['miter' | 'round' | 'bevel'] dashes: sequence of on/off ink in points data: 2D array (rows are x, y) or two 1D arrays drawstyle: ['default' | 'steps' | 'steps-pre' | 'steps-mid' | 'steps-post'] figure: a `matplotlib.figure.Figure` instance fillstyle: ['full' | 'left' | 'right' | 'bottom' | 'top' | 'none'] gid: an id string label: string or anything printable with '%s' conversion. linestyle or ls: [`'-'` | `'--'` | `'-.'` | `':'` | `'None'` | `' '` | `''`] and any drawstyle in combination with a linestyle, e.g. `'steps--'`. linewidth or lw: float value in points lod: [True | False] marker: [`7` | `4` | `5` | `6` | `'o'` | `'D'` | `'h'` | `'H'` | `'_'` | `''` | `'None'` | `None` | `' '` | `'8'` | `'p'` | `','` | `'+'` | `'.'` | `'s'` | `'*'` | `'d'` | `3` | `0` | `1` | `2` | `'1'` | `'3'` | `'4'` | `'2'` | `'v'` | `'<'` | `'>'` | `'^'` | `'|'` | `'x'` | `'$...$'` | *tuple* | *Nx2 array*] markeredgecolor or mec: any matplotlib color markeredgewidth or mew: float value in points markerfacecolor or mfc: any matplotlib color markerfacecoloralt or mfcalt: any matplotlib color markersize or ms: float markevery: None | integer | (startind, stride) picker: float distance in points or callable pick function `fn(artist, event)` pickradius: float distance in points rasterized: [True | False | None] snap: unknown solid_capstyle: ['butt' | 'round' | 'projecting'] solid_joinstyle: ['miter' | 'round' | 'bevel'] transform: a `matplotlib.transforms.Transform` instance url: a url string visible: [True | False] xdata: 1D array ydata: 1D array zorder: any number

Additional kwargs: hold = [True|False] overrides default hold state

plotfile()

Plot the data in in a file.

cols is a sequence of column identifiers to plot. An identifier is either an int or a string. If it is an int, it indicates the column number. If it is a string, it indicates the column header. matplotlib will make column headers lower case, replace spaces with underscores, and remove all illegal characters; so `'Adj Close*'` will have name `'adj_close'`.

- If len(*cols*) == 1, only that column will be plotted on the *y* axis.
- If len(*cols*) > 1, the first element will be an identifier for data for the *x* axis and the remaining elements will be the column indexes for multiple subplots if *subplots* is *True* (the default), or for lines in a single subplot if *subplots* is *False*.

plotfuncs, if not *None*, is a dictionary mapping identifier to an `Axes` plotting function as a string. Default is 'plot', other choices are 'semilogy', 'fill', 'bar', etc. You must use the same type of identifier in the *cols* vector as you use in the *plotfuncs* dictionary, eg., integer column numbers in both or column names in both. If *subplots* is *False*, then including any function such as 'semilogy' that changes the axis scaling will set the scaling for all columns.

comments, *skiprows*, *checkrows*, *delimiter*, and *names* are all passed on to `matplotlib.pylab.csv2rec()` to load the data into a record array.

If *newfig* is *True*, the plot always will be made in a new figure; if *False*, it will be made in the current figure if one exists, else in a new figure.

kwargs are passed on to plotting functions.

Example usage:

```
# plot the 2nd and 4th column against the 1st in two subplots
plotfile(fname, (0,1,3))

# plot using column names; specify an alternate plot type for volume
plotfile(fname, ('date', 'volume', 'adj_close'),
                              plotfuncs={'volume': 'semilogy'})
```

Note: plotfile is intended as a convenience for quickly plotting data from flat files; it is not intended as an alternative interface to general plotting with pyplot or matplotlib.

polar()

Make a polar plot.

call signature:

```
polar(theta, r, kwargs...)
```

Multiple *theta*, *r* arguments are supported, with format strings, as in `plot()`.

prism()

set the default colormap to prism and apply to current image if any. See help(colormaps) for more information

psd()

Plot the power spectral density.

Call signature:

```
psd(x, NFFT=256, Fs=2, Fc=0, detrend=mlab.detrend_none,
    window=mlab.window_hanning, noverlap=0, pad_to=None,
    sides='default', scale_by_freq=None, kwargs...)
```

The power spectral density by Welch's average periodogram method. The vector *x* is divided into *NFFT* length segments. Each segment is detrended by function *detrend* and windowed by function *window*. *noverlap* gives the length of the overlap between segments. The $|\mathrm{fft}(i)|^2$ of each segment i are averaged to compute *Pxx*, with a scaling to correct for power loss due to windowing. *Fs* is the sampling frequency.

Keyword arguments:

***NFFT*: integer** The number of data points used in each block for the FFT. Must be even; a power 2 is most efficient. The default value is 256. This should *NOT* be used to get zero padding, or the scaling of the result will be incorrect. Use *pad_to* for this instead.

***Fs*: scalar** The sampling frequency (samples per time unit). It is used to calculate the Fourier frequencies, freqs, in cycles per time unit. The default value is 2.

***detrend*: callable** The function applied to each segment before fft-ing, designed to remove the mean or linear trend. Unlike in MATLAB, where the *detrend* parameter is a vector, in matplotlib is it a function. The `pylab` module defines `detrend_none()`, `detrend_mean()`, and `detrend_linear()`, but you can use a custom function as well.

***window*: callable or ndarray** A function or a vector of length *NFFT*. To create window vectors see `window_hanning()`, `window_none()`, `numpy.blackman()`, `numpy.hamming()`, `numpy.bartlett()`, `scipy.signal()`, `scipy.signal.get_window()`, etc. The default is `window_hanning()`. If a function is passed as the argument, it must take a data segment as an argument and return the windowed version of the segment.

***pad_to*: integer** The number of points to which the data segment is padded when performing the FFT. This can be different from *NFFT*, which specifies the number of data points used. While not increasing the actual resolution of the psd (the minimum distance between resolvable peaks), this

can give more points in the plot, allowing for more detail. This corresponds to the *n* parameter in the call to fft(). The default is None, which sets *pad_to* equal to *NFFT*

***sides*: ['default' | 'onesided' | 'twosided']** Specifies which sides of the PSD to return. Default gives the default behavior, which returns one-sided for real data and both for complex data. 'onesided' forces the return of a one-sided PSD, while 'twosided' forces two-sided.

***scale_by_freq*: boolean** Specifies whether the resulting density values should be scaled by the scaling frequency, which gives density in units of Hz^-1. This allows for integration over the returned frequency values. The default is True for MATLAB compatibility.

***noverlap*: integer** The number of points of overlap between blocks. The default value is 0 (no overlap).

***Fc*: integer** The center frequency of *x* (defaults to 0), which offsets the x extents of the plot to reflect the frequency range used when a signal is acquired and then filtered and downsampled to baseband.

For plotting, the power is plotted as $10\log_{10}(P_{xx})$ for decibels, though *Pxx* itself is returned.

References: Bendat & Piersol – Random Data: Analysis and Measurement Procedures, John Wiley & Sons (1986)

kwargs control the `Line2D` properties:

agg_filter: unknown alpha: float (0.0 transparent through 1.0 opaque) animated: [True | False] antialiased or aa: [True | False] axes: an `Axes` instance clip_box: a `matplotlib.transforms.Bbox` instance clip_on: [True | False] clip_path: [(`Path`, `Transform`) | `Patch` | None] color or c: any matplotlib color contains: a callable function dash_capstyle: ['butt' | 'round' | 'projecting'] dash_joinstyle: ['miter' | 'round' | 'bevel'] dashes: sequence of on/off ink in points data: 2D array (rows are x, y) or two 1D arrays drawstyle: ['default' | 'steps' | 'steps-pre' | 'steps-mid' | 'steps-post'] figure: a `matplotlib.figure.Figure` instance fillstyle: ['full' | 'left' | 'right' | 'bottom' | 'top' | 'none'] gid: an id string label: string or anything printable with '%s' conversion. linestyle or ls: [`'-'` | `'--'` | `'-.'` | `':'` | `'None'` | `' '` | `''`] and any drawstyle in combination with a linestyle, e.g. `'steps--'`. linewidth or lw: float value in points lod: [True | False] marker: [`7` | `4` | `5` | `6` | `'o'` | `'D'` | `'h'` | `'H'` | `'_'` | `''` | `'None'` | `None` | `' '` | `'8'` | `'p'` | `','` | `'+'` | `'.'` | `'s'` | `'*'` | `'d'` | `3` | `0` | `1` | `2` | `'1'` | `'3'` | `'4'` | `'2'` | `'v'` | `'<'` | `'>'` | `'^'` | `'|'` | `'x'` | `'$...$'` | *tuple* | *Nx2 array*] markeredgecolor or mec: any matplotlib color markeredgewidth or mew: float value in points markerfacecolor or mfc: any matplotlib color markerfacecoloralt or mfcalt: any matplotlib color markersize or ms: float markevery: None | integer | (startind, stride) picker: float distance in points or callable pick function `fn(artist, event)` pickradius: float distance in points rasterized: [True | False | None] snap: unknown solid_capstyle: ['butt' | 'round' | 'projecting'] solid_joinstyle: ['miter' | 'round' | 'bevel'] transform: a `matplotlib.transforms.Transform` instance url: a url string visible: [True | False] xdata: 1D array ydata: 1D array zorder: any number

Additional kwargs: hold = [True|False] overrides default hold state

`pylab_setup`()

return new_figure_manager, draw_if_interactive and show for pylab

`quiver`()

Plot a 2-D field of arrows.

call signatures:

```
quiver(U, V, kw...)
quiver(U, V, C, kw...)
quiver(X, Y, U, V, kw...)
quiver(X, Y, U, V, C, kw...)
```

Arguments:

> ***X*, *Y*:** The x and y coordinates of the arrow locations (default is tail of arrow; see *pivot* kwarg)
>
> ***U*, *V*:** Give the x and y components of the arrow vectors
>
> ***C*:** An optional array used to map colors to the arrows

All arguments may be 1-D or 2-D arrays or sequences. If *X* and *Y* are absent, they will be generated as a uniform grid. If *U* and *V* are 2-D arrays but *X* and *Y* are 1-D, and if `len(X)` and `len(Y)` match the column and row dimensions of *U*, then *X* and *Y* will be expanded with `numpy.meshgrid()`.

U, *V*, *C* may be masked arrays, but masked *X*, *Y* are not supported at present.

Keyword arguments:

***units*: ['width' | 'height' | 'dots' | 'inches' | 'x' | 'y' | 'xy']** Arrow units; the arrow dimensions *except for length* are in multiples of this unit.

- 'width' or 'height': the width or height of the axes
- 'dots' or 'inches': pixels or inches, based on the figure dpi
- 'x', 'y', or 'xy': *X*, *Y*, or sqrt(X^2+Y^2) data units

The arrows scale differently depending on the units. For 'x' or 'y', the arrows get larger as one zooms in; for other units, the arrow size is independent of the zoom state. For 'width or 'height', the arrow size increases with the width and height of the axes, respectively, when the the window is resized; for 'dots' or 'inches', resizing does not change the arrows.

***angles*: ['uv' | 'xy' | array]** With the default 'uv', the arrow aspect ratio is 1, so that if *U*==*V* the angle of the arrow on the plot is 45 degrees CCW from the *x*-axis. With 'xy', the arrow points from (x,y) to (x+u, y+v). Alternatively, arbitrary angles may be specified as an array of values in degrees, CCW from the *x*-axis.

***scale*: [*None* | float]** Data units per arrow length unit, e.g. m/s per plot width; a smaller scale parameter makes the arrow longer. If *None*, a simple autoscaling algorithm is used, based on the average vector length and the number of vectors. The arrow length unit is given by the *scale_units* parameter

***scale_units*: *None*, or any of the *units* options.** For example, if *scale_units* is 'inches', *scale* is 2.0, and `(u,v) = (1,0)`, then the vector will be 0.5 inches long. If *scale_units* is 'width', then the vector will be half the width of the axes.

If *scale_units* is 'x' then the vector will be 0.5 x-axis units. To plot vectors in the x-y plane, with u and v having the same units as x and y, use "angles='xy', scale_units='xy', scale=1".

***width*:** Shaft width in arrow units; default depends on choice of units, above, and number of vectors; a typical starting value is about 0.005 times the width of the plot.

***headwidth*: scalar** Head width as multiple of shaft width, default is 3

***headlength*: scalar** Head length as multiple of shaft width, default is 5

***headaxislength*: scalar** Head length at shaft intersection, default is 4.5

***minshaft*: scalar** Length below which arrow scales, in units of head length. Do not set this to less than 1, or small arrows will look terrible! Default is 1

***minlength*: scalar** Minimum length as a multiple of shaft width; if an arrow length is less than this, plot a dot (hexagon) of this diameter instead. Default is 1.

***pivot*: ['tail' | 'middle' | 'tip']** The part of the arrow that is at the grid point; the arrow rotates about this point, hence the name *pivot*.

***color*: [color | color sequence]** This is a synonym for the `PolyCollection` facecolor kwarg. If *C* has been set, *color* has no effect.

The defaults give a slightly swept-back arrow; to make the head a triangle, make *headaxislength* the same as *headlength*. To make the arrow more pointed, reduce *headwidth* or increase *headlength* and *headaxislength*. To make the head smaller relative to the shaft, scale down all the head parameters. You will probably do best to leave minshaft alone.

linewidths and edgecolors can be used to customize the arrow outlines. Additional `PolyCollection` keyword arguments:

> agg_filter: unknown alpha: float or None animated: [True | False] antialiased or antialiaseds: Boolean or sequence of booleans array: unknown axes: an `Axes` instance clim: a length 2 sequence of floats clip_box: a `matplotlib.transforms.Bbox` instance clip_on: [True | False] clip_path: [(`Path`, `Transform`) | `Patch` | None] cmap: a colormap or registered colormap name color: matplotlib color arg or sequence of rgba tuples colorbar: unknown contains: a callable function edgecolor or edgecolors: matplotlib color arg or sequence of rgba tuples facecolor or facecolors: matplotlib color arg or sequence of rgba tuples figure: a `matplotlib.figure.Figure` instance gid: an id string hatch: ['/' | '\' | '|' | '-' | '+' | 'x' | 'o' | 'O' | '.' | '*'] label: string or anything printable with '%s' conversion. linestyle or linestyles or dashes: ['solid' | 'dashed', 'dashdot', 'dotted' | (offset, on-off-dash-seq)] linewidth or lw or linewidths: float or sequence of floats lod: [True | False] norm: unknown offset_position: unknown offsets: float or sequence of floats paths: unknown picker: [None|float|boolean|callable] pickradius: unknown rasterized: [True | False | None] snap: unknown transform: `Transform` instance url: a url string urls: unknown visible: [True | False] zorder: any number

Additional kwargs: hold = [True|False] overrides default hold state

`quiverkey`()

Add a key to a quiver plot.

Call signature:

```
quiverkey(Q, X, Y, U, label, kw...)
```

Arguments:

> ***Q*:** The Quiver instance returned by a call to quiver.
>
> ***X*, *Y*:** The location of the key; additional explanation follows.
>
> ***U*:** The length of the key
>
> ***label*:** A string with the length and units of the key

Keyword arguments:

> ***coordinates* = ['axes' | 'figure' | 'data' | 'inches']** Coordinate system and units for *X*, *Y*: 'axes' and 'figure' are normalized coordinate systems with 0,0 in the lower left and 1,1 in the upper right; 'data' are the axes data coordinates (used for the locations of the vectors in the quiver plot itself); 'inches' is position in the figure in inches, with 0,0 at the lower left corner.
>
> ***color*:** overrides face and edge colors from *Q*.
>
> ***labelpos* = ['N' | 'S' | 'E' | 'W']** Position the label above, below, to the right, to the left of the arrow, respectively.
>
> ***labelsep*:** Distance in inches between the arrow and the label. Default is 0.1
>
> ***labelcolor*:** defaults to default `Text` color.
>
> ***fontproperties*:** A dictionary with keyword arguments accepted by the `FontProperties` initializer: *family*, *style*, *variant*, *size*, *weight*

Any additional keyword arguments are used to override vector properties taken from *Q*.

The positioning of the key depends on *X*, *Y*, *coordinates*, and *labelpos*. If *labelpos* is 'N' or 'S', *X*, *Y* give the position of the middle of the key arrow. If *labelpos* is 'E', *X*, *Y* positions the head, and if *labelpos* is 'W', *X*, *Y* positions the tail; in either of these two cases, *X*, *Y* is somewhere in the middle of the arrow+label key object.

Additional kwargs: hold = [True|False] overrides default hold state

rc()

Set the current rc params. Group is the grouping for the rc, eg. for `lines.linewidth` the group is `lines`, for `axes.facecolor`, the group is `axes`, and so on. Group may also be a list or tuple of group names, eg. (*xtick*, *ytick*). *kwargs* is a dictionary attribute name/value pairs, eg:

```
rc('lines', linewidth=2, color='r')
```

sets the current rc params and is equivalent to:

```
rcParams['lines.linewidth'] = 2
rcParams['lines.color'] = 'r'
```

The following aliases are available to save typing for interactive users:

Alias	Property
'lw'	'linewidth'
'ls'	'linestyle'
'c'	'color'
'fc'	'facecolor'
'ec'	'edgecolor'
'mew'	'markeredgewidth'
'aa'	'antialiased'

Thus you could abbreviate the above rc command as:

```
rc('lines', lw=2, c='r')
```

Note you can use python's kwargs dictionary facility to store dictionaries of default parameters. Eg, you can customize the font rc as follows:

```
font = {'family' : 'monospace',
        'weight' : 'bold',
        'size'   : 'larger'}

rc('font', font...)  # pass in the font dict as kwargs
```

This enables you to easily switch between several configurations. Use `rcdefaults()` to restore the default rc params after changes.

rcdefaults()

Restore the default rc params. These are not the params loaded by the rc file, but mpl's internal params. See rc_file_defaults for reloading the default params from the rc file

register_cmap()

Add a colormap to the set recognized by `get_cmap()`.

It can be used in two ways:

```
register_cmap(name='swirly', cmap=swirly_cmap)

register_cmap(name='choppy', data=choppydata, lut=128)
```

In the first case, *cmap* must be a `colors.Colormap` instance. The *name* is optional; if absent, the name will be the `name` attribute of the *cmap*.

In the second case, the three arguments are passed to the `colors.LinearSegmentedColormap` initializer, and the resulting colormap is registered.

rgrids()

Get or set the radial gridlines on a polar plot.

call signatures:

```
lines, labels = rgrids()
lines, labels = rgrids(radii, labels=None, angle=22.5, kwargs...)
```

When called with no arguments, `rgrid()` simply returns the tuple (*lines*, *labels*), where *lines* is an array of radial gridlines (`Line2D` instances) and *labels* is an array of tick labels (`Text` instances). When called with arguments, the labels will appear at the specified radial distances and angles.

labels, if not *None*, is a len(*radii*) list of strings of the labels to use at each angle.

If *labels* is None, the rformatter will be used

Examples:

```
# set the locations of the radial gridlines and labels
lines, labels = rgrids( (0.25, 0.5, 1.0) )

# set the locations and labels of the radial gridlines and labels
lines, labels = rgrids( (0.25, 0.5, 1.0), ('Tom', 'Dick', 'Harry' )
```

savefig()

Save the current figure.

Call signature:

```
savefig(fname, dpi=None, facecolor='w', edgecolor='w',
        orientation='portrait', papertype=None, format=None,
        transparent=False, bbox_inches=None, pad_inches=0.1)
```

The output formats available depend on the backend being used.

Arguments:

***fname*:** A string containing a path to a filename, or a Python file-like object, or possibly some backend-dependent object such as `PdfPages`.

If *format* is *None* and *fname* is a string, the output format is deduced from the extension of the filename. If the filename has no extension, the value of the rc parameter `savefig.format` is used.

If *fname* is not a string, remember to specify *format* to ensure that the correct backend is used.

Keyword arguments:

***dpi*: [*None* | `scalar > 0`]** The resolution in dots per inch. If *None* it will default to the value `savefig.dpi` in the matplotlibrc file.

***facecolor*, *edgecolor*:** the colors of the figure rectangle

***orientation*: ['landscape' | 'portrait']** not supported on all backends; currently only on postscript output

***papertype*:** One of 'letter', 'legal', 'executive', 'ledger', 'a0' through 'a10', 'b0' through 'b10'. Only supported for postscript output.

***format*:** One of the file extensions supported by the active backend. Most backends support png, pdf, ps, eps and svg.

***transparent*:** If *True*, the axes patches will all be transparent; the figure patch will also be transparent unless facecolor and/or edgecolor are specified via kwargs. This is useful, for example, for displaying a plot on top of a colored background on a web page. The transparency of these patches will be restored to their original values upon exit of this function.

***bbox_inches*:** Bbox in inches. Only the given portion of the figure is saved. If 'tight', try to figure out the tight bbox of the figure.

***pad_inches*:** Amount of padding around the figure when bbox_inches is 'tight'.

***bbox_extra_artists*:** A list of extra artists that will be considered when the tight bbox is calculated.

sca()

Set the current Axes instance to *ax*.

The current Figure is updated to the parent of *ax*.

scatter()

Make a scatter plot.

Call signatures:

```
scatter(x, y, s=20, c='b', marker='o', cmap=None, norm=None,
        vmin=None, vmax=None, alpha=None, linewidths=None,
        verts=None, kwargs...)
```

Make a scatter plot of *x* versus *y*, where *x*, *y* are converted to 1-D sequences which must be of the same length, *N*.

Keyword arguments:

***s*:** size in points^2. It is a scalar or an array of the same length as *x* and *y*.

***c*:** a color. *c* can be a single color format string, or a sequence of color specifications of length *N*, or a sequence of *N* numbers to be mapped to colors using the *cmap* and *norm* specified via kwargs (see below). Note that *c* should not be a single numeric RGB or RGBA sequence because that is indistinguishable from an array of values to be colormapped. *c* can be a 2-D array in which the rows are RGB or RGBA, however.

***marker*:** can be one of:

marker	description
7	caretdown
4	caretleft
5	caretright
6	caretup
'o'	circle
'D'	diamond
'h'	hexagon1
'H'	hexagon2
'_'	hline
''	nothing
'None'	nothing
None	nothing
' '	nothing
'8'	octagon
'p'	pentagon
','	pixel
'+'	plus

Continued on next page

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marker	description
`'.'`	point
`'s'`	square
`'*'`	star
`'d'`	thin_diamond
`3`	tickdown
`0`	tickleft
`1`	tickright
`2`	tickup
`'1'`	tri_down
`'3'`	tri_left
`'4'`	tri_right
`'2'`	tri_up
`'v'`	triangle_down
`'<'`	triangle_left
`'>'`	triangle_right
`'^'`	triangle_up
`'|'`	vline
`'x'`	x
`'$...$'`	render the string using mathtext.
verts	a list of (x, y) pairs used for Path vertices.
path	a `Path` instance.
(*numsides*, *style*, *angle*)	see below

The marker can also be a tuple (*numsides*, *style*, *angle*), which will create a custom, regular symbol.

***numsides*:** the number of sides

***style*:** the style of the regular symbol:

Value	Description
0	a regular polygon
1	a star-like symbol
2	an asterisk
3	a circle (*numsides* and *angle* is ignored)

***angle*:** the angle of rotation of the symbol, in degrees

For backward compatibility, the form (*verts*, 0) is also accepted, but it is equivalent to just *verts* for giving a raw set of vertices that define the shape.

Any or all of *x*, *y*, *s*, and *c* may be masked arrays, in which case all masks will be combined and only unmasked points will be plotted.

Other keyword arguments: the color mapping and normalization arguments will be used only if *c* is an array of floats.

***cmap*: [*None* | Colormap]** A `matplotlib.colors.Colormap` instance or registered name. If *None*, defaults to rc `image.cmap`. *cmap* is only used if *c* is an array of floats.

***norm*: [*None* | Normalize]** A `matplotlib.colors.Normalize` instance is used to scale luminance data to 0, 1. If *None*, use the default `normalize()`. *norm* is only used if *c* is an array of floats.

***vmin*/*vmax*:** *vmin* and *vmax* are used in conjunction with norm to normalize luminance data. If either are *None*, the min and max of the color array *C* is used. Note if you pass a *norm* instance, your settings for *vmin* and *vmax* will be ignored.

alpha*: `0 <= scalar <= 1` or *None The alpha value for the patches

***linewidths*: [*None* | scalar | sequence]** If *None*, defaults to (lines.linewidth,). Note that this is a tuple, and if you set the linewidths argument you must set it as a sequence of floats, as required by `RegularPolyCollection`.

Optional kwargs control the `Collection` properties; in particular:

***edgecolors*:** The string 'none' to plot faces with no outlines

***facecolors*:** The string 'none' to plot unfilled outlines

Here are the standard descriptions of all the `Collection` kwargs:

agg_filter: unknown alpha: float or None animated: [True | False] antialiased or antialiaseds: Boolean or sequence of booleans array: unknown axes: an `Axes` instance clim: a length 2 sequence of floats clip_box: a `matplotlib.transforms.Bbox` instance clip_on: [True | False] clip_path: [(`Path`, `Transform`) | `Patch` | None] cmap: a colormap or registered colormap name color: matplotlib color arg or sequence of rgba tuples colorbar: unknown contains: a callable function edgecolor or edgecolors: matplotlib color arg or sequence of rgba tuples facecolor or facecolors: matplotlib color arg or sequence of rgba tuples figure: a `matplotlib.figure.Figure` instance gid: an id string hatch: ['/' | '\' | '|' | '-' | '+' | 'x' | 'o' | 'O' | '.' | '*'] label: string or anything printable with '%s' conversion. linestyle or linestyles or dashes: ['solid' | 'dashed', 'dashdot', 'dotted' | (offset, on-off-dash-seq)] linewidth or lw or linewidths: float or sequence of floats lod: [True | False] norm: unknown offset_position: unknown offsets: float or sequence of floats paths: unknown picker: [None|float|boolean|callable] pickradius: unknown rasterized: [True | False | None] snap: unknown transform: `Transform` instance url: a url string urls: unknown visible: [True | False] zorder: any number

Additional kwargs: hold = [True|False] overrides default hold state

`sci`()

Set the current image. This image will be the target of colormap commands like `jet()`, `hot()` or `clim()`). The current image is an attribute of the current axes.

`semilogx`()

Make a plot with log scaling on the *x* axis.

Call signature:

```
semilogx(*args, **kwargs)
```

`semilogx()` supports all the keyword arguments of `plot()` and `matplotlib.axes.Axes.set_xscale()`.

Notable keyword arguments:

***basex*: scalar > 1** Base of the *x* logarithm

***subsx*: [*None* | sequence]** The location of the minor xticks; *None* defaults to autosubs, which depend on the number of decades in the plot; see `set_xscale()` for details.

***nonposx*: ['mask' | 'clip']** Non-positive values in *x* can be masked as invalid, or clipped to a very small positive number

The remaining valid kwargs are `Line2D` properties:

agg_filter: unknown alpha: float (0.0 transparent through 1.0 opaque) animated: [True | False] antialiased or aa: [True | False] axes: an `Axes` instance clip_box: a `matplotlib.transforms.Bbox` instance clip_on: [True | False] clip_path: [(`Path`, `Transform`) | `Patch` | None] color or c: any matplotlib color contains: a callable function dash_capstyle: ['butt' | 'round' | 'projecting'] dash_joinstyle: ['miter' | 'round' | 'bevel'] dashes:

sequence of on/off ink in points data: 2D array (rows are x, y) or two 1D arrays drawstyle: ['default' | 'steps' | 'steps-pre' | 'steps-mid' | 'steps-post'] figure: a `matplotlib.figure.Figure` instance fillstyle: ['full' | 'left' | 'right' | 'bottom' | 'top' | 'none'] gid: an id string label: string or anything printable with '%s' conversion. linestyle or ls: [`'-'` | `'--'` | `'-.'` | `':'` | `'None'` | `' '` | `''`] and any drawstyle in combination with a linestyle, e.g. `'steps--'`. linewidth or lw: float value in points lod: [True | False] marker: [`7` | `4` | `5` | `6` | `'o'` | `'D'` | `'h'` | `'H'` | `'_'` | `''` | `'None'` | `None` | `' '` | `'8'` | `'p'` | `','` | `'+'` | `'.'` | `'s'` | `'*'` | `'d'` | `3` | `0` | `1` | `2` | `'1'` | `'3'` | `'4'` | `'2'` | `'v'` | `'<'` | `'>'` | `'^'` | `'|'` | `'x'` | `'$...$'` | *tuple* | *Nx2 array*] markeredgecolor or mec: any matplotlib color markeredgewidth or mew: float value in points markerfacecolor or mfc: any matplotlib color markerfacecoloralt or mfcalt: any matplotlib color markersize or ms: float markevery: None | integer | (startind, stride) picker: float distance in points or callable pick function `fn(artist, event)` pickradius: float distance in points rasterized: [True | False | None] snap: unknown solid_capstyle: ['butt' | 'round' | 'projecting'] solid_joinstyle: ['miter' | 'round' | 'bevel'] transform: a `matplotlib.transforms.Transform` instance url: a url string visible: [True | False] xdata: 1D array ydata: 1D array zorder: any number

Additional kwargs: hold = [True|False] overrides default hold state

semilogy()

Make a plot with log scaling on the *y* axis.

call signature:

```
semilogy(*args, **kwargs)
```

`semilogy()` supports all the keyword arguments of `plot()` and `matplotlib.axes.Axes.set_yscale()`.

Notable keyword arguments:

***basey*: scalar > 1** Base of the *y* logarithm

***subsy*: [*None* | sequence]** The location of the minor yticks; *None* defaults to autosubs, which depend on the number of decades in the plot; see `set_yscale()` for details.

***nonposy*: ['mask' | 'clip']** Non-positive values in *y* can be masked as invalid, or clipped to a very small positive number

The remaining valid kwargs are `Line2D` properties:

agg_filter: unknown alpha: float (0.0 transparent through 1.0 opaque) animated: [True | False] antialiased or aa: [True | False] axes: an `Axes` instance clip_box: a `matplotlib.transforms.Bbox` instance clip_on: [True | False] clip_path: [(`Path`, `Transform`) | `Patch` | None] color or c: any matplotlib color contains: a callable function dash_capstyle: ['butt' | 'round' | 'projecting'] dash_joinstyle: ['miter' | 'round' | 'bevel'] dashes: sequence of on/off ink in points data: 2D array (rows are x, y) or two 1D arrays drawstyle: ['default' | 'steps' | 'steps-pre' | 'steps-mid' | 'steps-post'] figure: a `matplotlib.figure.Figure` instance fillstyle: ['full' | 'left' | 'right' | 'bottom' | 'top' | 'none'] gid: an id string label: string or anything printable with '%s' conversion. linestyle or ls: [`'-'` | `'--'` | `'-.'` | `':'` | `'None'` | `' '` | `''`] and any drawstyle in combination with a linestyle, e.g. `'steps--'`. linewidth or lw: float value in points lod: [True | False] marker: [`7` | `4` | `5` | `6` | `'o'` | `'D'` | `'h'` | `'H'` | `'_'` | `''` | `'None'` | `None` | `' '` | `'8'` | `'p'` | `','` | `'+'` | `'.'` | `'s'` | `'*'` | `'d'` | `3` | `0` | `1` | `2` | `'1'` | `'3'` | `'4'` | `'2'` | `'v'` | `'<'` | `'>'` | `'^'` | `'|'` | `'x'` | `'$...$'` | *tuple* | *Nx2 array*] markeredgecolor or mec: any matplotlib color markeredgewidth or mew: float value in points markerfacecolor or mfc: any matplotlib color markerfacecoloralt or mfcalt: any matplotlib color markersize or ms: float markevery: None | integer | (startind, stride) picker: float distance in points or callable pick function `fn(artist, event)` pickradius: float distance in points rasterized: [True | False | None] snap: unknown solid_capstyle: ['butt' | 'round' | 'projecting'] solid_joinstyle: ['miter' | 'round' | 'bevel']

transform: a `matplotlib.transforms.Transform` instance url: a url string visible: [True | False] xdata: 1D array ydata: 1D array zorder: any number

Additional kwargs: hold = [True|False] overrides default hold state

set_cmap()

Set the default colormap. Applies to the current image if any. See help(colormaps) for more information.

cmap must be a `colors.Colormap` instance, or the name of a registered colormap.

See `register_cmap()` and `get_cmap()`.

setp()

Set a property on an artist object.

matplotlib supports the use of `setp()` ("set property") and `getp()` to set and get object properties, as well as to do introspection on the object. For example, to set the linestyle of a line to be dashed, you can do:

```
>>> line, = plot([1,2,3])
>>> setp(line, linestyle='--')
```

If you want to know the valid types of arguments, you can provide the name of the property you want to set without a value:

```
>>> setp(line, 'linestyle')
    linestyle: [ '-' | '--' | '-.' | ':' | 'steps' | 'None' ]
```

If you want to see all the properties that can be set, and their possible values, you can do:

```
>>> setp(line)
    ... long output listing omitted
```

`setp()` operates on a single instance or a list of instances. If you are in query mode introspecting the possible values, only the first instance in the sequence is used. When actually setting values, all the instances will be set. E.g., suppose you have a list of two lines, the following will make both lines thicker and red:

```
>>> x = arange(0,1.0,0.01)
>>> y1 = sin(2*pi*x)
>>> y2 = sin(4*pi*x)
>>> lines = plot(x, y1, x, y2)
>>> setp(lines, linewidth=2, color='r')
```

`setp()` works with the MATLAB style string/value pairs or with python kwargs. For example, the following are equivalent:

```
>>> setp(lines, 'linewidth', 2, 'color', r')  # MATLAB style

>>> setp(lines, linewidth=2, color='r')       # python style
```

show()

Display a figure.

When running in ipython with its pylab mode, display all figures and return to the ipython prompt.

In non-interactive mode, display all figures and block until the figures have been closed; in interactive mode it has no effect unless figures were created prior to a change from non-interactive to interactive mode (not recommended). In that case it displays the figures but does not block.

A single experimental keyword argument, *block*, may be set to True or False to override the blocking behavior described above.

specgram()

Plot a spectrogram.

Call signature:

```
specgram(x, NFFT=256, Fs=2, Fc=0, detrend=mlab.detrend_none,
         window=mlab.window_hanning, noverlap=128,
         cmap=None, xextent=None, pad_to=None, sides='default',
         scale_by_freq=None, kwargs...)
```

Compute a spectrogram of data in *x*. Data are split into *NFFT* length segments and the PSD of each section is computed. The windowing function *window* is applied to each segment, and the amount of overlap of each segment is specified with *noverlap*.

Keyword arguments:

***NFFT*: integer** The number of data points used in each block for the FFT. Must be even; a power 2 is most efficient. The default value is 256. This should *NOT* be used to get zero padding, or the scaling of the result will be incorrect. Use *pad_to* for this instead.

***Fs*: scalar** The sampling frequency (samples per time unit). It is used to calculate the Fourier frequencies, freqs, in cycles per time unit. The default value is 2.

***detrend*: callable** The function applied to each segment before fft-ing, designed to remove the mean or linear trend. Unlike in MATLAB, where the *detrend* parameter is a vector, in matplotlib is it a function. The `pylab` module defines `detrend_none()`, `detrend_mean()`, and `detrend_linear()`, but you can use a custom function as well.

***window*: callable or ndarray** A function or a vector of length *NFFT*. To create window vectors see `window_hanning()`, `window_none()`, `numpy.blackman()`, `numpy.hamming()`, `numpy.bartlett()`, `scipy.signal()`, `scipy.signal.get_window()`, etc. The default is `window_hanning()`. If a function is passed as the argument, it must take a data segment as an argument and return the windowed version of the segment.

***pad_to*: integer** The number of points to which the data segment is padded when performing the FFT. This can be different from *NFFT*, which specifies the number of data points used. While not increasing the actual resolution of the psd (the minimum distance between resolvable peaks), this can give more points in the plot, allowing for more detail. This corresponds to the *n* parameter in the call to fft(). The default is None, which sets *pad_to* equal to *NFFT*

***sides*: ['default' | 'onesided' | 'twosided']** Specifies which sides of the PSD to return. Default gives the default behavior, which returns one-sided for real data and both for complex data. 'onesided' forces the return of a one-sided PSD, while 'twosided' forces two-sided.

***scale_by_freq*: boolean** Specifies whether the resulting density values should be scaled by the scaling frequency, which gives density in units of Hz^-1. This allows for integration over the returned frequency values. The default is True for MATLAB compatibility.

***noverlap*: integer** The number of points of overlap between blocks. The default value is 128.

***Fc*: integer** The center frequency of *x* (defaults to 0), which offsets the y extents of the plot to reflect the frequency range used when a signal is acquired and then filtered and downsampled to baseband.

***cmap*:** A `matplotlib.colors.Colormap` instance; if *None*, use default determined by rc

***xextent*:** The image extent along the x-axis. xextent = (xmin,xmax) The default is (0,max(bins)), where bins is the return value from `specgram()`

kwargs:

Additional kwargs are passed on to imshow which makes the specgram image

Return value is (*Pxx*, *freqs*, *bins*, *im*):

- *bins* are the time points the spectrogram is calculated over

- *freqs* is an array of frequencies
- *Pxx* is an array of shape *(len(times), len(freqs))* of power
- *im* is a `AxesImage` instance

Note: If *x* is real (i.e. non-complex), only the positive spectrum is shown. If *x* is complex, both positive and negative parts of the spectrum are shown. This can be overridden using the *sides* keyword argument.

Additional kwargs: hold = [True|False] overrides default hold state

spectral()

set the default colormap to spectral and apply to current image if any. See help(colormaps) for more information

spring()

set the default colormap to spring and apply to current image if any. See help(colormaps) for more information

spy()

Plot the sparsity pattern on a 2-D array.

Call signature:

```
spy(Z, precision=0, marker=None, markersize=None,
    aspect='equal', kwargs...)
```

`spy(Z)` plots the sparsity pattern of the 2-D array *Z*.

If *precision* is 0, any non-zero value will be plotted; else, values of $|Z| > precision$ will be plotted.

For `scipy.sparse.spmatrix` instances, there is a special case: if *precision* is 'present', any value present in the array will be plotted, even if it is identically zero.

The array will be plotted as it would be printed, with the first index (row) increasing down and the second index (column) increasing to the right.

By default aspect is 'equal', so that each array element occupies a square space; set the aspect kwarg to 'auto' to allow the plot to fill the plot box, or to any scalar number to specify the aspect ratio of an array element directly.

Two plotting styles are available: image or marker. Both are available for full arrays, but only the marker style works for `scipy.sparse.spmatrix` instances.

If *marker* and *markersize* are *None*, an image will be returned and any remaining kwargs are passed to `imshow()`; else, a `Line2D` object will be returned with the value of marker determining the marker type, and any remaining kwargs passed to the `plot()` method.

If *marker* and *markersize* are *None*, useful kwargs include:

- *cmap*
- *alpha*

See Also:

imshow() For image options.

For controlling colors, e.g. cyan background and red marks, use:

```
cmap = mcolors.ListedColormap(['c','r'])
```

If *marker* or *markersize* is not *None*, useful kwargs include:

- *marker*
- *markersize*
- *color*

Useful values for *marker* include:

- 's' square (default)
- 'o' circle
- '.' point
- ',' pixel

See Also:

plot() For plotting options

Additional kwargs: hold = [True|False] overrides default hold state

stackplot()

Draws a stacked area plot.

x : 1d array of dimension N

y [2d array of dimension MxN, OR any number 1d arrays each of dimension] 1xN. The data is assumed to be unstacked. Each of the following calls is legal:

```
stackplot(x, y)               # where y is MxN
stackplot(x, y1, y2, y3, y4)  # where y1, y2, y3, y4, are all 1xNm
```

Keyword arguments:

colors [A list or tuple of colors. These will be cycled through and] used to colour the stacked areas. All other keyword arguments are passed to `fill_between()`

Returns *r* : A list of `PolyCollection`, one for each element in the stacked area plot.

Additional kwargs: hold = [True|False] overrides default hold state

stem()

Create a stem plot.

Call signature:

```
stem(x, y, linefmt='b-', markerfmt='bo', basefmt='r-')
```

A stem plot plots vertical lines (using *linefmt*) at each *x* location from the baseline to *y*, and places a marker there using *markerfmt*. A horizontal line at 0 is is plotted using *basefmt*.

Return value is a tuple (*markerline*, *stemlines*, *baseline*).

See Also:

This document for details.

Additional kwargs: hold = [True|False] overrides default hold state

step()

Make a step plot.

Call signature:

```
step(x, y, args..., kwargs...)
```

Additional keyword args to `step()` are the same as those for `plot()`.

x and *y* must be 1-D sequences, and it is assumed, but not checked, that *x* is uniformly increasing.

Keyword arguments:

***where*: ['pre' | 'post' | 'mid']** If 'pre', the interval from x[i] to x[i+1] has level y[i+1]

If 'post', that interval has level y[i]

If 'mid', the jumps in *y* occur half-way between the *x*-values.

Additional kwargs: hold = [True|False] overrides default hold state

`streamplot()`

Draws streamlines of a vector flow.

x*, *y [1d arrays] an *evenly spaced* grid.

u*, *v [2d arrays] x and y-velocities. Number of rows should match length of y, and the number of columns should match x.

density [float or 2-tuple] Controls the closeness of streamlines. When *density = 1*, the domain is divided into a 25x25 grid—*density* linearly scales this grid. Each cell in the grid can have, at most, one traversing streamline. For different densities in each direction, use [density_x, density_y].

linewidth [numeric or 2d array] vary linewidth when given a 2d array with the same shape as velocities.

color [matplotlib color code, or 2d array] Streamline color. When given an array with the same shape as velocities, *color* values are converted to colors using *cmap*.

cmap [`Colormap`] Colormap used to plot streamlines and arrows. Only necessary when using an array input for *color*.

norm [`Normalize`] Normalize object used to scale luminance data to 0, 1. If None, stretch (min, max) to (0, 1). Only necessary when *color* is an array.

arrowsize [float] Factor scale arrow size.

arrowstyle [str] Arrow style specification. See `FancyArrowPatch`.

minlength [float] Minimum length of streamline in axes coordinates.

Returns:

stream_container [StreamplotSet] Container object with attributes

- lines: *matplotlib.collections.LineCollection* of streamlines
- arrows: collection of *matplotlib.patches.FancyArrowPatch* objects representing arrows half-way along stream lines.

This container will probably change in the future to allow changes to the colormap, alpha, etc. for both lines and arrows, but these changes should be backward compatible.

Additional kwargs: hold = [True|False] overrides default hold state

`subplot()`

Return a subplot axes positioned by the given grid definition.

Typical call signature:

```
subplot(nrows, ncols, plot_number)
```

Where *nrows* and *ncols* are used to notionally split the figure into `nrows * ncols` sub-axes, and *plot_number* is used to identify the particular subplot that this function is to create within the notional grid. *plot_number* starts at 1, increments across rows first and has a maximum of `nrows * ncols`.

In the case when *nrows*, *ncols* and *plot_number* are all less than 10, a convenience exists, such that the a 3 digit number can be given instead, where the hundreds represent *nrows*, the tens represent *ncols* and the units represent *plot_number*. For instance:

```
subplot(211)
```

produces a subaxes in a figure which represents the top plot (i.e. the first) in a 2 row by 1 column notional grid (no grid actually exists, but conceptually this is how the returned subplot has been positioned).

Note: Creating a new subplot with a position which is entirely inside a pre-existing axes will trigger the larger axes to be deleted:

```
import matplotlib.pyplot as plt
# plot a line, implicitly creating a subplot(111)
plt.plot([1,2,3])
# now create a subplot which represents the top plot of a grid
# with 2 rows and 1 column. Since this subplot will overlap the
# first, the plot (and its axes) previously created, will be removed
plt.subplot(211)
plt.plot(range(12))
plt.subplot(212, axisbg='y') # creates 2nd subplot with yellow background
```

If you do not want this behavior, use the `add_subplot()` method or the `axes()` function instead.

Keyword arguments:

***axisbg*:** The background color of the subplot, which can be any valid color specifier. See `matplotlib.colors` for more information.

***polar*:** A boolean flag indicating whether the subplot plot should be a polar projection. Defaults to *False*.

***projection*:** A string giving the name of a custom projection to be used for the subplot. This projection must have been previously registered. See `matplotlib.projections`.

See Also:

`axes()` For additional information on `axes()` and `subplot()` keyword arguments.

`examples/pylab_examples/polar_scatter.py` For an example

Example:

`subplot2grid()`

Create a subplot in a grid. The grid is specified by *shape*, at location of *loc*, spanning *rowspan*, *colspan* cells in each direction. The index for loc is 0-based.

```
subplot2grid(shape, loc, rowspan=1, colspan=1)
```

is identical to

```
gridspec=GridSpec(shape[0], shape[2])
subplotspec=gridspec.new_subplotspec(loc, rowspan, colspan)
subplot(subplotspec)
```

`subplot_tool()`

Launch a subplot tool window for a figure.

A `matplotlib.widgets.SubplotTool` instance is returned.

subplots()

Create a figure with a set of subplots already made.

This utility wrapper makes it convenient to create common layouts of subplots, including the enclosing figure object, in a single call.

Keyword arguments:

nrows [int] Number of rows of the subplot grid. Defaults to 1.

ncols [int] Number of columns of the subplot grid. Defaults to 1.

sharex [string or bool] If *True*, the X axis will be shared amongst all subplots. If *True* and you have multiple rows, the x tick labels on all but the last row of plots will have visible set to *False* If a string must be one of "row", "col", "all", or "none". "all" has the same effect as *True*, "none" has the same effect as *False*. If "row", each subplot row will share a X axis. If "col", each subplot column will share a X axis and the x tick labels on all but the last row will have visible set to *False*.

sharey [string or bool] If *True*, the Y axis will be shared amongst all subplots. If *True* and you have multiple columns, the y tick labels on all but the first column of plots will have visible set to *False* If a string must be one of "row", "col", "all", or "none". "all" has the same effect as *True*, "none" has the same effect as *False*. If "row", each subplot row will share a Y axis. If "col", each subplot column will share a Y axis and the y tick labels on all but the last row will have visible set to *False*.

squeeze [bool] If *True*, extra dimensions are squeezed out from the returned axis object:

- if only one subplot is constructed (nrows=ncols=1), the resulting single Axis object is returned as a scalar.
- for Nx1 or 1xN subplots, the returned object is a 1-d numpy object array of Axis objects are returned as numpy 1-d arrays.
- for NxM subplots with N>1 and M>1 are returned as a 2d array.

If *False*, no squeezing at all is done: the returned axis object is always a 2-d array contaning Axis instances, even if it ends up being 1x1.

subplot_kw [dict] Dict with keywords passed to the `add_subplot()` call used to create each subplots.

fig_kw [dict] Dict with keywords passed to the `figure()` call. Note that all keywords not recognized above will be automatically included here.

Returns:

fig, ax : tuple

- *fig* is the `matplotlib.figure.Figure` object
- *ax* can be either a single axis object or an array of axis objects if more than one subplot was created. The dimensions of the resulting array can be controlled with the squeeze keyword, see above.

Examples:

```
x = np.linspace(0, 2*np.pi, 400)
y = np.sin(x**2)

# Just a figure and one subplot
f, ax = plt.subplots()
ax.plot(x, y)
ax.set_title('Simple plot')
```

```
# Two subplots, unpack the output array immediately
f, (ax1, ax2) = plt.subplots(1, 2, sharey=True)
ax1.plot(x, y)
ax1.set_title('Sharing Y axis')
ax2.scatter(x, y)

# Four polar axes
plt.subplots(2, 2, subplot_kw=dict(polar=True))

# Share a X axis with each column of subplots
plt.subplots(2, 2, sharex='col')

# Share a Y axis with each row of subplots
plt.subplots(2, 2, sharey='row')

# Share a X and Y axis with all subplots
plt.subplots(2, 2, sharex='all', sharey='all')
# same as
plt.subplots(2, 2, sharex=True, sharey=True)
```

subplots_adjust()

Tune the subplot layout.

call signature:

```
subplots_adjust(left=None, bottom=None, right=None, top=None,
                wspace=None, hspace=None)
```

The parameter meanings (and suggested defaults) are:

```
left  = 0.125  # the left side of the subplots of the figure
right = 0.9    # the right side of the subplots of the figure
bottom = 0.1   # the bottom of the subplots of the figure
top = 0.9      # the top of the subplots of the figure
wspace = 0.2   # the amount of width reserved for blank space between subplots
hspace = 0.2   # the amount of height reserved for white space between subplots
```

The actual defaults are controlled by the rc file

summer()

set the default colormap to summer and apply to current image if any. See help(colormaps) for more information

suptitle()

Add a centered title to the figure.

kwargs are `matplotlib.text.Text` properties. Using figure coordinates, the defaults are:

x [0.5] The x location of the text in figure coords

y [0.98] The y location of the text in figure coords

horizontalalignment ['center'] The horizontal alignment of the text

verticalalignment ['top'] The vertical alignment of the text

A `matplotlib.text.Text` instance is returned.

Example:

```
fig.suptitle('this is the figure title', fontsize=12)
```

switch_backend()

Switch the default backend. This feature is **experimental**, and is only expected to work switching to an image

backend. Eg, if you have a bunch of PostScript scripts that you want to run from an interactive ipython session, you may want to switch to the PS backend before running them to avoid having a bunch of GUI windows popup. If you try to interactively switch from one GUI backend to another, you will explode.

Calling this command will close all open windows.

table()

Add a table to the current axes.

Call signature:

```
table(cellText=None, cellColours=None,
      cellLoc='right', colWidths=None,
      rowLabels=None, rowColours=None, rowLoc='left',
      colLabels=None, colColours=None, colLoc='center',
      loc='bottom', bbox=None):
```

Returns a `matplotlib.table.Table` instance. For finer grained control over tables, use the `Table` class and add it to the axes with `add_table()`.

Thanks to John Gill for providing the class and table.

kwargs control the `Table` properties:

> agg_filter: unknown alpha: float (0.0 transparent through 1.0 opaque) animated: [True | False] axes: an `Axes` instance clip_box: a `matplotlib.transforms.Bbox` instance clip_on: [True | False] clip_path: [(`Path`, `Transform`) | `Patch` | None] contains: a callable function figure: a `matplotlib.figure.Figure` instance fontsize: a float in points gid: an id string label: string or anything printable with '%s' conversion. lod: [True | False] picker: [None|float|boolean|callable] rasterized: [True | False | None] snap: unknown transform: `Transform` instance url: a url string visible: [True | False] zorder: any number

text()

Add text to the axes.

Call signature:

```
text(x, y, s, fontdict=None, kwargs...)
```

Add text in string *s* to axis at location *x*, *y*, data coordinates.

Keyword arguments:

> ***fontdict*:** A dictionary to override the default text properties. If *fontdict* is *None*, the defaults are determined by your rc parameters.
>
> ***withdash*: [*False* | *True*]** Creates a `TextWithDash` instance instead of a `Text` instance.

Individual keyword arguments can be used to override any given parameter:

```
text(x, y, s, fontsize=12)
```

The default transform specifies that text is in data coords, alternatively, you can specify text in axis coords (0,0 is lower-left and 1,1 is upper-right). The example below places text in the center of the axes:

```
text(0.5, 0.5,'matplotlib',
     horizontalalignment='center',
     verticalalignment='center',
     transform = ax.transAxes)
```

You can put a rectangular box around the text instance (eg. to set a background color) by using the keyword *bbox*. *bbox* is a dictionary of `matplotlib.patches.Rectangle` properties. For example:

```
text(x, y, s, bbox=dict(facecolor='red', alpha=0.5))
```

Valid kwargs are `Text` properties:

> agg_filter: unknown alpha: float (0.0 transparent through 1.0 opaque) animated: [True | False] axes: an `Axes` instance backgroundcolor: any matplotlib color bbox: rectangle prop dict clip_box: a `matplotlib.transforms.Bbox` instance clip_on: [True | False] clip_path: [(`Path`, `Transform`) | `Patch` | None] color: any matplotlib color contains: a callable function family or fontfamily or fontname or name: [FONTNAME | 'serif' | 'sans-serif' | 'cursive' | 'fantasy' | 'monospace'] figure: a `matplotlib.figure.Figure` instance fontproperties or font_properties: a `matplotlib.font_manager.FontProperties` instance gid: an id string horizontalalignment or ha: ['center' | 'right' | 'left'] label: string or anything printable with '%s' conversion. linespacing: float (multiple of font size) lod: [True | False] multialignment: ['left' | 'right' | 'center'] path_effects: unknown picker: [None|float|boolean|callable] position: (x,y) rasterized: [True | False | None] rotation: [angle in degrees | 'vertical' | 'horizontal'] rotation_mode: unknown size or fontsize: [size in points | 'xx-small' | 'x-small' | 'small' | 'medium' | 'large' | 'x-large' | 'xx-large'] snap: unknown stretch or fontstretch: [a numeric value in range 0-1000 | 'ultra-condensed' | 'extra-condensed' | 'condensed' | 'semi-condensed' | 'normal' | 'semi-expanded' | 'expanded' | 'extra-expanded' | 'ultra-expanded'] style or fontstyle: ['normal' | 'italic' | 'oblique'] text: string or anything printable with '%s' conversion. transform: `Transform` instance url: a url string variant or fontvariant: ['normal' | 'small-caps'] verticalalignment or va or ma: ['center' | 'top' | 'bottom' | 'baseline'] visible: [True | False] weight or fontweight: [a numeric value in range 0-1000 | 'ultralight' | 'light' | 'normal' | 'regular' | 'book' | 'medium' | 'roman' | 'semibold' | 'demibold' | 'demi' | 'bold' | 'heavy' | 'extra bold' | 'black'] x: float y: float zorder: any number

thetagrids()

Get or set the theta locations of the gridlines in a polar plot.

If no arguments are passed, return a tuple (*lines*, *labels*) where *lines* is an array of radial gridlines (`Line2D` instances) and *labels* is an array of tick labels (`Text` instances):

```
lines, labels = thetagrids()
```

Otherwise the syntax is:

```
lines, labels = thetagrids(angles, labels=None, fmt='%d', frac = 1.1)
```

set the angles at which to place the theta grids (these gridlines are equal along the theta dimension).

angles is in degrees.

labels, if not *None*, is a len(angles) list of strings of the labels to use at each angle.

If *labels* is *None*, the labels will be `fmt%angle`.

frac is the fraction of the polar axes radius at which to place the label (1 is the edge). Eg. 1.05 is outside the axes and 0.95 is inside the axes.

Return value is a list of tuples (*lines*, *labels*):

- *lines* are `Line2D` instances
- *labels* are `Text` instances.

Note that on input, the *labels* argument is a list of strings, and on output it is a list of `Text` instances.

Examples:

```
# set the locations of the radial gridlines and labels
lines, labels = thetagrids( range(45,360,90) )
```

```
# set the locations and labels of the radial gridlines and labels
lines, labels = thetagrids( range(45,360,90), ('NE', 'NW', 'SW','SE') )
```

tick_params()

Change the appearance of ticks and tick labels.

Keyword arguments:

axis [['x' | 'y' | 'both']] Axis on which to operate; default is 'both'.

reset [[True | False]] If *True*, set all parameters to defaults before processing other keyword arguments. Default is *False*.

which [['major' | 'minor' | 'both']] Default is 'major'; apply arguments to *which* ticks.

direction [['in' | 'out' | 'inout']] Puts ticks inside the axes, outside the axes, or both.

length Tick length in points.

width Tick width in points.

color Tick color; accepts any mpl color spec.

pad Distance in points between tick and label.

labelsize Tick label font size in points or as a string (e.g. 'large').

labelcolor Tick label color; mpl color spec.

colors Changes the tick color and the label color to the same value: mpl color spec.

zorder Tick and label zorder.

bottom, top, left, right [[bool | 'on' | 'off']] controls whether to draw the respective ticks.

labelbottom, labeltop, labelleft, labelright Boolean or ['on' | 'off'], controls whether to draw the respective tick labels.

Example:

```
ax.tick_params(direction='out', length=6, width=2, colors='r')
```

This will make all major ticks be red, pointing out of the box, and with dimensions 6 points by 2 points. Tick labels will also be red.

ticklabel_format()

Change the *~matplotlib.ticker.ScalarFormatter* used by default for linear axes.

Optional keyword arguments:

Keyword	Description
style	['sci' (or 'scientific')	'plain'] plain turns off scientific notation
scilimits	(m, n), pair of integers; if *style* is 'sci', scientific notation will be used for numbers outside the range 10'm':sup: to 10'n':sup:. Use (0,0) to include all numbers.
useOffset	[True	False	offset]; if True, the offset will be calculated as needed; if False, no offset will be used; if a numeric offset is specified, it will be used.
axis	['x'	'y'	'both']
useLocale	If True, format the number according to the current locale. This affects things such as the character used for the decimal separator. If False, use C-style (English) formatting. The default setting is controlled by the axes.formatter.use_locale rcparam.

Only the major ticks are affected. If the method is called when the `ScalarFormatter` is not the `Formatter` being used, an `AttributeError` will be raised.

tight_layout()

Automatically adjust subplot parameters to give specified padding.

Parameters:

pad [float] padding between the figure edge and the edges of subplots, as a fraction of the font-size.

h_pad, w_pad [float] padding (height/width) between edges of adjacent subplots. Defaults to *pad_inches*.

rect [if rect is given, it is interpreted as a rectangle] (left, bottom, right, top) in the normalized figure coordinate that the whole subplots area (including labels) will fit into. Default is (0, 0, 1, 1).

title()

Set the title of the current axis.

Default font override is:

```
override = {'fontsize': 'medium',
            'verticalalignment': 'baseline',
            'horizontalalignment': 'center'}
```

See Also:

text() for information on how override and the optional args work.

tricontour()

Draw contours on an unstructured triangular grid. `tricontour()` and `tricontourf()` draw contour lines and filled contours, respectively. Except as noted, function signatures and return values are the same for both versions.

The triangulation can be specified in one of two ways; either:

```
tricontour(triangulation, ...)
```

where triangulation is a `Triangulation` object, or

```
tricontour(x, y, ...)
tricontour(x, y, triangles, ...)
tricontour(x, y, triangles=triangles, ...)
tricontour(x, y, mask=mask, ...)
tricontour(x, y, triangles, mask=mask, ...)
```

in which case a Triangulation object will be created. See `Triangulation` for a explanation of these possibilities.

The remaining arguments may be:

```
tricontour(..., Z)
```

where *Z* is the array of values to contour, one per point in the triangulation. The level values are chosen automatically.

```
tricontour(..., Z, N)
```

contour *N* automatically-chosen levels.

```
tricontour(..., Z, V)
```

draw contour lines at the values specified in sequence *V*

```
tricontourf(..., Z, V)
```

fill the (len(*V*)-1) regions between the values in *V*

```
tricontour(Z, kwargs...)
```

Use keyword args to control colors, linewidth, origin, cmap ... see below for more details.

`C = tricontour(...)` returns a `TriContourSet` object.

Optional keyword arguments:

***colors*: [*None* | string | (mpl_colors)]** If *None*, the colormap specified by cmap will be used.

If a string, like 'r' or 'red', all levels will be plotted in this color.

If a tuple of matplotlib color args (string, float, rgb, etc), different levels will be plotted in different colors in the order specified.

***alpha*: float** The alpha blending value

***cmap*: [*None* | Colormap]** A cm `Colormap` instance or *None*. If *cmap* is *None* and *colors* is *None*, a default Colormap is used.

***norm*: [*None* | Normalize]** A `matplotlib.colors.Normalize` instance for scaling data values to colors. If *norm* is *None* and *colors* is *None*, the default linear scaling is used.

***levels* [level0, level1, ..., leveln]** A list of floating point numbers indicating the level curves to draw; eg to draw just the zero contour pass `levels=[0]`

***origin*: [*None* | 'upper' | 'lower' | 'image']** If *None*, the first value of *Z* will correspond to the lower left corner, location (0,0). If 'image', the rc value for `image.origin` will be used.

This keyword is not active if *X* and *Y* are specified in the call to contour.

extent: [*None* | (x0,x1,y0,y1)]

If *origin* is not *None*, then *extent* is interpreted as in `matplotlib.pyplot.imshow()`: it gives the outer pixel boundaries. In this case, the position of Z[0,0] is the center of the pixel, not a corner. If *origin* is *None*, then (*x0*, *y0*) is the position of Z[0,0], and (*x1*, *y1*) is the position of Z[-1,-1].

This keyword is not active if *X* and *Y* are specified in the call to contour.

***locator*: [*None* | ticker.Locator subclass]** If *locator* is None, the default `MaxNLocator` is used. The locator is used to determine the contour levels if they are not given explicitly via the *V* argument.

***extend*: ['neither' | 'both' | 'min' | 'max']** Unless this is 'neither', contour levels are automatically added to one or both ends of the range so that all data are included. These added ranges are then mapped to the special colormap values which default to the ends of the colormap range, but can be set via `matplotlib.colors.Colormap.set_under()` and `matplotlib.colors.Colormap.set_over()` methods.

***xunits*, *yunits*: [*None* | registered units]** Override axis units by specifying an instance of a `matplotlib.units.ConversionInterface`.

tricontour-only keyword arguments:

***linewidths*: [*None* | number | tuple of numbers]** If *linewidths* is *None*, the default width in `lines.linewidth` in `matplotlibrc` is used.

If a number, all levels will be plotted with this linewidth.

If a tuple, different levels will be plotted with different linewidths in the order specified

***linestyles*: [*None* | 'solid' | 'dashed' | 'dashdot' | 'dotted']** If *linestyles* is *None*, the 'solid' is used.

linestyles can also be an iterable of the above strings specifying a set of linestyles to be used. If this iterable is shorter than the number of contour levels it will be repeated as necessary.

If contour is using a monochrome colormap and the contour level is less than 0, then the linestyle specified in `contour.negative_linestyle` in `matplotlibrc` will be used.

tricontourf-only keyword arguments:

***antialiased*: [*True* | *False*]** enable antialiasing

***nchunk*: [0 | integer]** If 0, no subdivision of the domain. Specify a positive integer to divide the domain into subdomains of roughly *nchunk* by *nchunk* points. This may never actually be advantageous, so this option may be removed. Chunking introduces artifacts at the chunk boundaries unless *antialiased* is *False*.

Note: tricontourf fills intervals that are closed at the top; that is, for boundaries *z1* and *z2*, the filled region is:

```
z1 < z <= z2
```

There is one exception: if the lowest boundary coincides with the minimum value of the *z* array, then that minimum value will be included in the lowest interval.

Additional kwargs: hold = [True|False] overrides default hold state

tricontourf()

Draw contours on an unstructured triangular grid. `tricontour()` and `tricontourf()` draw contour lines and filled contours, respectively. Except as noted, function signatures and return values are the same for both versions.

The triangulation can be specified in one of two ways; either:

```
tricontour(triangulation, ...)
```

where triangulation is a `Triangulation` object, or

```
tricontour(x, y, ...)
tricontour(x, y, triangles, ...)
tricontour(x, y, triangles=triangles, ...)
tricontour(x, y, mask=mask, ...)
tricontour(x, y, triangles, mask=mask, ...)
```

in which case a Triangulation object will be created. See `Triangulation` for a explanation of these possibilities.

The remaining arguments may be:

```
tricontour(..., Z)
```

where *Z* is the array of values to contour, one per point in the triangulation. The level values are chosen automatically.

```
tricontour(..., Z, N)
```

contour *N* automatically-chosen levels.

```
tricontour(..., Z, V)
```

draw contour lines at the values specified in sequence *V*

```
tricontourf(..., Z, V)
```

fill the (len(*V*)-1) regions between the values in *V*

```
tricontour(Z, kwargs...)
```

Use keyword args to control colors, linewidth, origin, cmap ... see below for more details.

`C = tricontour(...)` returns a `TriContourSet` object.

Optional keyword arguments:

***colors*: [*None* | string | (mpl_colors)]** If *None*, the colormap specified by cmap will be used.

If a string, like 'r' or 'red', all levels will be plotted in this color.

If a tuple of matplotlib color args (string, float, rgb, etc), different levels will be plotted in different colors in the order specified.

***alpha*: float** The alpha blending value

***cmap*: [*None* | Colormap]** A cm `Colormap` instance or *None*. If *cmap* is *None* and *colors* is *None*, a default Colormap is used.

***norm*: [*None* | Normalize]** A `matplotlib.colors.Normalize` instance for scaling data values to colors. If *norm* is *None* and *colors* is *None*, the default linear scaling is used.

***levels* [level0, level1, ..., leveln]** A list of floating point numbers indicating the level curves to draw; eg to draw just the zero contour pass `levels=[0]`

***origin*: [*None* | 'upper' | 'lower' | 'image']** If *None*, the first value of *Z* will correspond to the lower left corner, location (0,0). If 'image', the rc value for `image.origin` will be used.

This keyword is not active if *X* and *Y* are specified in the call to contour.

extent: [*None* | (x0,x1,y0,y1)]

If *origin* is not *None*, then *extent* is interpreted as in `matplotlib.pyplot.imshow()`: it gives the outer pixel boundaries. In this case, the position of Z[0,0] is the center of the pixel, not a corner. If *origin* is *None*, then (*x0*, *y0*) is the position of Z[0,0], and (*x1*, *y1*) is the position of Z[-1,-1].

This keyword is not active if *X* and *Y* are specified in the call to contour.

***locator*: [*None* | ticker.Locator subclass]** If *locator* is None, the default `MaxNLocator` is used. The locator is used to determine the contour levels if they are not given explicitly via the *V* argument.

***extend*: ['neither' | 'both' | 'min' | 'max']** Unless this is 'neither', contour levels are automatically added to one or both ends of the range so that all data are included. These added ranges are then mapped to the special colormap values which default to the ends of the colormap range, but can be set via `matplotlib.colors.Colormap.set_under()` and `matplotlib.colors.Colormap.set_over()` methods.

***xunits*, *yunits*: [*None* | registered units]** Override axis units by specifying an instance of a `matplotlib.units.ConversionInterface`.

tricontour-only keyword arguments:

***linewidths*: [*None* | number | tuple of numbers]** If *linewidths* is *None*, the default width in `lines.linewidth` in `matplotlibrc` is used.

If a number, all levels will be plotted with this linewidth.

If a tuple, different levels will be plotted with different linewidths in the order specified

***linestyles*: [*None* | 'solid' | 'dashed' | 'dashdot' | 'dotted']** If *linestyles* is *None*, the 'solid' is used.

linestyles can also be an iterable of the above strings specifying a set of linestyles to be used. If this iterable is shorter than the number of contour levels it will be repeated as necessary.

If contour is using a monochrome colormap and the contour level is less than 0, then the linestyle specified in `contour.negative_linestyle` in `matplotlibrc` will be used.

tricontourf-only keyword arguments:

***antialiased*: [*True* | *False*]** enable antialiasing

***nchunk*: [0 | integer]** If 0, no subdivision of the domain. Specify a positive integer to divide the domain into subdomains of roughly *nchunk* by *nchunk* points. This may never actually be advantageous, so this option may be removed. Chunking introduces artifacts at the chunk boundaries unless *antialiased* is *False*.

Note: tricontourf fills intervals that are closed at the top; that is, for boundaries *z1* and *z2*, the filled region is:

```
z1 < z <= z2
```

There is one exception: if the lowest boundary coincides with the minimum value of the *z* array, then that minimum value will be included in the lowest interval.

Additional kwargs: hold = [True|False] overrides default hold state

tripcolor()

Create a pseudocolor plot of an unstructured triangular grid.

The triangulation can be specified in one of two ways; either:

```
tripcolor(triangulation, ...)
```

where triangulation is a `Triangulation` object, or

```
tripcolor(x, y, ...)
tripcolor(x, y, triangles, ...)
tripcolor(x, y, triangles=triangles, ...)
tripcolor(x, y, mask=mask, ...)
tripcolor(x, y, triangles, mask=mask, ...)
```

in which case a Triangulation object will be created. See `Triangulation` for a explanation of these possibilities.

The next argument must be *C*, the array of color values, either one per point in the triangulation if color values are defined at points, or one per triangle in the triangulation if color values are defined at triangles. If there are the same number of points and triangles in the triangulation it is assumed that color values are defined at points; to force the use of color values at triangles use the kwarg *facecolors*=C instead of just *C*.

shading may be 'flat' (the default) or 'gouraud'. If *shading* is 'flat' and C values are defined at points, the color values used for each triangle are from the mean C of the triangle's three points. If *shading* is 'gouraud' then color values must be defined at points. *shading* of 'faceted' is deprecated; please use *edgecolors* instead.

The remaining kwargs are the same as for `pcolor()`.

Additional kwargs: hold = [True|False] overrides default hold state

triplot()

Draw a unstructured triangular grid as lines and/or markers.

The triangulation to plot can be specified in one of two ways; either:

```
triplot(triangulation, ...)
```

where triangulation is a `Triangulation` object, or

```
triplot(x, y, ...)
triplot(x, y, triangles, ...)
triplot(x, y, triangles=triangles, ...)
triplot(x, y, mask=mask, ...)
triplot(x, y, triangles, mask=mask, ...)
```

in which case a Triangulation object will be created. See `Triangulation` for a explanation of these possibilities.

The remaining args and kwargs are the same as for `plot()`.

Additional kwargs: hold = [True|False] overrides default hold state

twinx()
Make a second axes that shares the *x*-axis. The new axes will overlay *ax* (or the current axes if *ax* is *None*). The ticks for *ax2* will be placed on the right, and the *ax2* instance is returned.

See Also:

examples/api_examples/two_scales.py For an example

twiny()
Make a second axes that shares the *y*-axis. The new axis will overlay *ax* (or the current axes if *ax* is *None*). The ticks for *ax2* will be placed on the top, and the *ax2* instance is returned.

vlines()
Plot vertical lines.

Call signature:

```
vlines(x, ymin, ymax, color='k', linestyles='solid')
```

Plot vertical lines at each *x* from *ymin* to *ymax*. *ymin* or *ymax* can be scalars or len(*x*) numpy arrays. If they are scalars, then the respective values are constant, else the heights of the lines are determined by *ymin* and *ymax*.

colors **:** A line collection's color args, either a single color or a `len(x)` list of colors

linestyles : ['solid' | 'dashed' | 'dashdot' | 'dotted']

Returns the `matplotlib.collections.LineCollection` that was added.

kwargs are `LineCollection` properties:

> agg_filter: unknown alpha: float or None animated: [True | False] antialiased or antialiaseds: Boolean or sequence of booleans array: unknown axes: an `Axes` instance clim: a length 2 sequence of floats clip_box: a `matplotlib.transforms.Bbox` instance clip_on: [True | False] clip_path: [(`Path`, `Transform`) | `Patch` | None] cmap: a colormap or registered colormap name color: matplotlib color arg or sequence of rgba tuples colorbar: unknown contains: a callable function edgecolor or edgecolors: matplotlib color arg or sequence of rgba tuples facecolor or facecolors: matplotlib color arg or sequence of rgba tuples figure: a `matplotlib.figure.Figure` instance gid: an id string hatch: ['/' | '\' | '|' | '-' | '+' | 'x' | 'o' | 'O' | '.' | '*'] label: string or anything printable with '%s' conversion. linestyle or linestyles or dashes: ['solid' | 'dashed', 'dashdot', 'dotted' | (offset, on-off-dash-seq)] linewidth or lw or linewidths: float or sequence of floats lod: [True | False] norm: unknown offset_position: unknown offsets: float or sequence of floats paths: unknown picker: [None|float|boolean|callable] pickradius: unknown rasterized: [True | False | None] segments: unknown snap: unknown transform: `Transform` instance url: a url string urls: unknown verts: unknown visible: [True | False] zorder: any number

Additional kwargs: hold = [True|False] overrides default hold state

waitforbuttonpress()

Call signature:

```
waitforbuttonpress(self, timeout=-1)
```

Blocking call to interact with the figure.

This will return True is a key was pressed, False if a mouse button was pressed and None if *timeout* was reached without either being pressed.

If *timeout* is negative, does not timeout.

winter()

set the default colormap to winter and apply to current image if any. See help(colormaps) for more information

xcorr()

Plot the cross correlation between *x* and *y*.

Call signature:

```
xcorr(self, x, y, normed=True, detrend=mlab.detrend_none,
  usevlines=True, maxlags=10, kwargs...)
```

If *normed* = *True*, normalize the data by the cross correlation at 0-th lag. *x* and y are detrended by the *detrend* callable (default no normalization). *x* and *y* must be equal length.

Data are plotted as `plot(lags, c, **kwargs)`

Return value is a tuple (*lags*, *c*, *line*) where:

- *lags* are a length `2*maxlags+1` lag vector
- *c* is the `2*maxlags+1` auto correlation vector
- ***line* is a `Line2D` instance** returned by `plot()`.

The default *linestyle* is *None* and the default *marker* is 'o', though these can be overridden with keyword args. The cross correlation is performed with `numpy.correlate()` with *mode* = 2.

If *usevlines* is *True*:

> `vlines()` rather than `plot()` is used to draw vertical lines from the origin to the xcorr. Otherwise the plotstyle is determined by the kwargs, which are `Line2D` properties.
>
> The return value is a tuple (*lags*, *c*, *linecol*, *b*) where *linecol* is the `matplotlib.collections.LineCollection` instance and *b* is the *x*-axis.

maxlags is a positive integer detailing the number of lags to show. The default value of *None* will return all `(2*len(x)-1)` lags.

Example:

`xcorr()` is top graph, and `acorr()` is bottom graph.

Additional kwargs: hold = [True|False] overrides default hold state

xlabel()

Set the *x* axis label of the current axis.

Default override is:

```
override = {
    'fontsize'            : 'small',
    'verticalalignment'   : 'top',
```

```
    'horizontalalignment' : 'center'
    }
```

See Also:

text() For information on how override and the optional args work

xlim()

Get or set the *x* limits of the current axes.

```
xmin, xmax = xlim()    # return the current xlim
xlim( (xmin, xmax) )   # set the xlim to xmin, xmax
xlim( xmin, xmax )     # set the xlim to xmin, xmax
```

If you do not specify args, you can pass the xmin and xmax as kwargs, eg.:

```
xlim(xmax=3) # adjust the max leaving min unchanged
xlim(xmin=1) # adjust the min leaving max unchanged
```

Setting limits turns autoscaling off for the x-axis.

The new axis limits are returned as a length 2 tuple.

xscale()

Set the scaling of the *x*-axis.

call signature:

```
xscale(scale, kwargs...)
```

The available scales are: 'linear' | 'log' | 'symlog'

Different keywords may be accepted, depending on the scale:

'linear'

'log'

***basex*/*basey*:** The base of the logarithm

***nonposx*/*nonposy*: ['mask' | 'clip']** non-positive values in *x* or *y* can be masked as invalid, or clipped to a very small positive number

***subsx*/*subsy*:** Where to place the subticks between each major tick. Should be a sequence of integers. For example, in a log10 scale: `[2, 3, 4, 5, 6, 7, 8, 9]`

will place 8 logarithmically spaced minor ticks between each major tick.

'symlog'

***basex*/*basey*:** The base of the logarithm

***linthreshx*/*linthreshy*:** The range (-*x*, *x*) within which the plot is linear (to avoid having the plot go to infinity around zero).

***subsx*/*subsy*:** Where to place the subticks between each major tick. Should be a sequence of integers. For example, in a log10 scale: `[2, 3, 4, 5, 6, 7, 8, 9]`

will place 8 logarithmically spaced minor ticks between each major tick.

***linscalex*/*linscaley*:** This allows the linear range (-*linthresh* to *linthresh*) to be stretched relative to the logarithmic range. Its value is the number of decades to use for each half of the linear range. For example, when *linscale* == 1.0 (the default), the space used for

the positive and negative halves of the linear range will be equal to one decade in the logarithmic range.

xticks()

Get or set the *x*-limits of the current tick locations and labels.

```
# return locs, labels where locs is an array of tick locations and
# labels is an array of tick labels.
locs, labels = xticks()

# set the locations of the xticks
xticks( arange(6) )

# set the locations and labels of the xticks
xticks( arange(5), ('Tom', 'Dick', 'Harry', 'Sally', 'Sue') )
```

The keyword args, if any, are `Text` properties. For example, to rotate long labels:

```
xticks( arange(12), calendar.month_name[1:13], rotation=17 )
```

ylabel()

Set the *y* axis label of the current axis.

Defaults override is:

```
override = {
   'fontsize'            : 'small',
   'verticalalignment'   : 'center',
   'horizontalalignment' : 'right',
   'rotation'='vertical' : }
```

See Also:

`text()` For information on how override and the optional args work.

ylim()

Get or set the *y*-limits of the current axes.

```
ymin, ymax = ylim()   # return the current ylim
ylim( (ymin, ymax) )  # set the ylim to ymin, ymax
ylim( ymin, ymax )    # set the ylim to ymin, ymax
```

If you do not specify args, you can pass the *ymin* and *ymax* as kwargs, eg.:

```
ylim(ymax=3) # adjust the max leaving min unchanged
ylim(ymin=1) # adjust the min leaving max unchanged
```

Setting limits turns autoscaling off for the y-axis.

The new axis limits are returned as a length 2 tuple.

yscale()

Set the scaling of the *y*-axis.

call signature:

```
yscale(scale, kwargs...)
```

The available scales are: 'linear' | 'log' | 'symlog'

Different keywords may be accepted, depending on the scale:

'linear'

'log'

basex/basey: The base of the logarithm

nonposx/nonposy: **['mask' | 'clip']** non-positive values in *x* or *y* can be masked as invalid, or clipped to a very small positive number

subsx/subsy: Where to place the subticks between each major tick. Should be a sequence of integers. For example, in a log10 scale: `[2, 3, 4, 5, 6, 7, 8, 9]`

will place 8 logarithmically spaced minor ticks between each major tick.

'symlog'

basex/basey: The base of the logarithm

linthreshx/linthreshy: The range (-*x*, *x*) within which the plot is linear (to avoid having the plot go to infinity around zero).

subsx/subsy: Where to place the subticks between each major tick. Should be a sequence of integers. For example, in a log10 scale: `[2, 3, 4, 5, 6, 7, 8, 9]`

will place 8 logarithmically spaced minor ticks between each major tick.

linscalex/linscaley: This allows the linear range (-*linthresh* to *linthresh*) to be stretched relative to the logarithmic range. Its value is the number of decades to use for each half of the linear range. For example, when *linscale* == 1.0 (the default), the space used for the positive and negative halves of the linear range will be equal to one decade in the logarithmic range.

yticks()

Get or set the *y*-limits of the current tick locations and labels.

```
# return locs, labels where locs is an array of tick locations and
# labels is an array of tick labels.
locs, labels = yticks()

# set the locations of the yticks
yticks( arange(6) )

# set the locations and labels of the yticks
yticks( arange(5), ('Tom', 'Dick', 'Harry', 'Sally', 'Sue') )
```

The keyword args, if any, are `Text` properties. For example, to rotate long labels:

```
yticks( arange(12), calendar.month_name[1:13], rotation=45 )
```

CHAPTER

THREE

INDICES AND TABLES

- *genindex*
- *modindex*
- *search*