matplotlib Cheat sheet

Version 3.2

Quick start

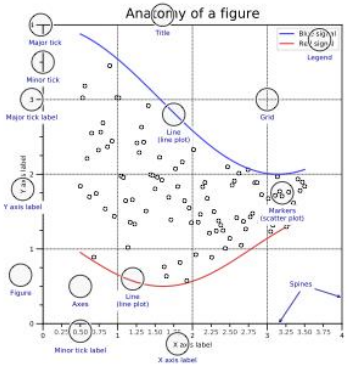
```
import numpy as np
import matplotlib as mpl
import matplotlib.pyplot as plt


X = np.linspace(0, 2*np.pi, 100)
Y = np.cos(X)

fig, ax = plt.subplots()
ax.plot(X,Y,color='C1')

fig.savefig("figure.pdf")
fig.show()
```

Anatomy of a figure



Subplots layout

```
subplot[s](cols,rows,…)
fig, axs = plt.subplots(3,3)
```

```
G = gridspec(cols,rows,…)
ax = G[0,:]
```

```
ax.inset_axes(extent)
```

```
d=make_axes_locatable(ax)
ax=d.new_horizontal('10%')
```

Getting help

- matplotlib.org
- github.com/matplotlib/matplotlib/issues
- discourse.matplotlib.org
- stackoverflow.com/matplotlib
- gitter.im/matplotlib
- twitter.com/matplotlib
- Matplotlib users mailing list

Basic plots

plot(**[X]**,**Y**,**[fmt]**,…)
X, **Y**, fmt, color, marker, linestyle

scatter(**X**,**Y**,…)
X, **Y**, [s]izes, [c]olors, markers, cmap

bar[h](**x**,**height**,…)
x, **height**, width, bottom, align, color

imshow(**Z**,**[cmap]**,…)
Z, cmap, interpolation, extent, origin

contour[f](**[X]**,**[Y]**,**Z**,„…)
X, Y, **Z**, levels, colors, extent, origin

quiver(**[X]**,**[Y]**,**U**,**V**,…)
X, Y, **U**, **V**, C, units, angles

pie(**X**,**[explode]**,…)
Z, explode, labels, colors, radius

text(**x**,**y**,**text**,…)
x, **y**, **text**, va, ha, size, weight, transform

fill[_between][x](…)
X, Y1, Y2, color, where

Advanced plots

step(**X**,**Y**,**[fmt]**,…)
X, **Y**, fmt, color, marker, where

boxplot(**X**,…)
X, notch, sym, bootstrap, widths

errorbar(**X**,**Y**,**xerr**,**yerr**,…)
X, **Y**, xerr, yerr, fmt

hist(**X**, **bins**, …)
X, bins, range, density, weights

violinplot(**D**,…)
D, positions, widths, vert

barbs(**[X]**,**[Y]**, **U**, **V**, …)
X, Y, **U**, **V**, C, length, pivot, sizes

eventplot(**positions**,…)
positions, orientation, lineoffsets

hexbin(**X**,**Y**,**C**,…)
X, **Y**, C, gridsize, bins

xcorr(**X**,**Y**,…)
X, **Y**, normed, detrend

Scales

```
ax.set_[xy]scale(scale,…)
```

linear any values
log values > 0
symlog any values
logit 0 < values < 1

Projections

```
subplot(…,projection=p)
```

p='polar'

p='3d'

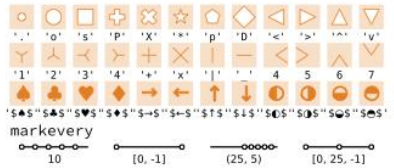
p=Orthographic()
from cartopy.crs import Cartographic

Lines

linestyle or ls

capstyle or dash_capstyle

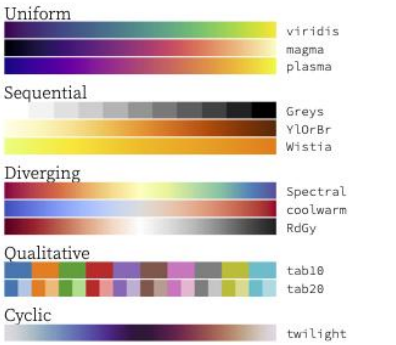
Markers



Colors

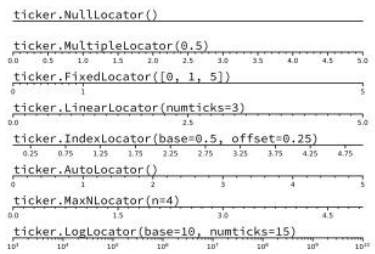
Colormaps

```
plt.get_cmap(name)
```



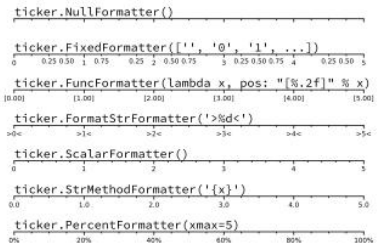
Tick locators

```
from matplotlib import ticker
ax.[xy]axis.set_[minor|major]_locator(locator)
```



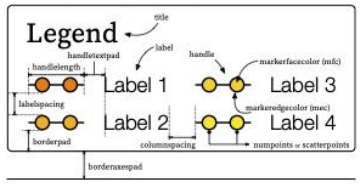
Tick formatters

```
from matplotlib import ticker
ax.[xy]axis.set_[minor|major]_formatter(formatter)
```

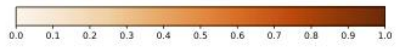


Ornaments

ax.legend(…)
handles, labels, loc, title, frameon



ax.colorbar(…)
mappable, ax, cax, orientation



ax.annotate(…)
text, **xy**, **xytext**, xycoords, textcoords, arrowprops

Event handling

```
fig, ax = plt.subplots()
def on_click(event):
  print(event)
fig.canvas.mpl_connect(
  'button_press_event', on_click)
```

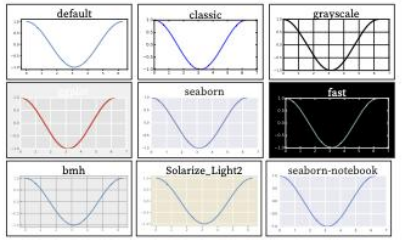
Animation

```
import matplotlib.animation as mpla

T = np.linspace(0,2*np.pi,100)
S = np.sin(T)
line, = plt.plot(T, S)
def animate(i):
  line.set_ydata(np.sin(T+i/50))
anim = mpla.FuncAnimation(
  plt.gcf(), animate, interval=5)
plt.show()
```

Styles

```
plt.style.use(style)
```



Quick reminder

```
ax.grid()
ax.patch.set_alpha(0)
ax.set_[xy]lim(vmin, vmax)
ax.set_[xy]label(label)
ax.set_[xy]ticks(list)
ax.set_[xy]ticklabels(list)
ax.set_[sup]title(title)
ax.tick_params(width=10, …)
ax.set_axis_[on|off]()

ax.tight_layout()
plt.gcf(), plt.gca()
mpl.rc('axes', linewidth=1, …)
fig.patch.set_alpha(0)
text=r'$\frac{-e^{i\pi}}{2^n}$'
```

Keyboard shortcuts

ctrl + s	Save	ctrl + w	Close plot
r	Reset view	f	Fullscreen 0/1
f	View forward	b	View back
p	Pan view	o	Zoom to rect
x	X pan/zoom	y	Y pan/zoom
g	Minor grid 0/1	G	Major grid 0/1
l	X axis log/linear	L	Y axis log/linear

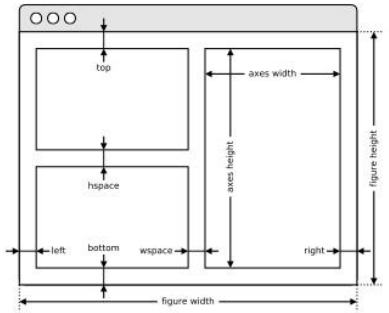
Ten Simple Rules

1. Know Your Audience
2. Identify Your Message
3. Adapt the Figure
4. Captions Are Not Optional
5. Do Not Trust the Defaults
6. Use Color Effectively
7. Do Not Mislead the Reader
8. Avoid "Chartjunk"
9. Message Trumps Beauty
10. Get the Right Tool

Axes adjustements

API

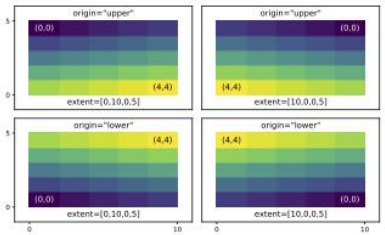
plt.**subplot_adjust**(...)



Extent & origin

API

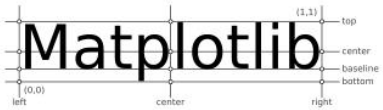
ax.**imshow**(extent=..., origin=...)



Text alignments

API

ax.**text**(..., ha=... , va=..., ...)



Text parameters

API

ax.**text**(..., family=... , size=..., weight = ...)
ax.**text**(..., fontproperties = ...)

The quick brown fox — xx-large (1.73)
The quick brown fox — x-large (1.44)
The quick brown fox — large (1.20)
The quick brown fox — medium (1.00)
The quick brown fox — small (0.83)
The quick brown fox — x-small (0.69)
The quick brown fox — xx-small (0.58)

The quick brown fox jumps over the lazy dog — black (900)
The quick brown fox jumps over the lazy dog — bold (700)
The quick brown fox jumps over the lazy dog — semibold (600)
The quick brown fox jumps over the lazy dog — normal (400)
The quick brown fox jumps over the lazy dog — ultralight (100)

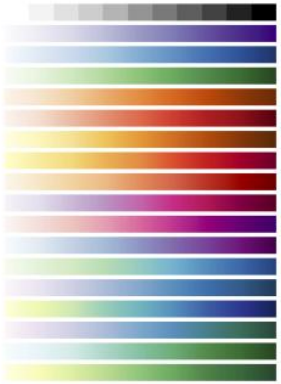
The quick brown fox jumps over the lazy dog — monospace
The quick brown fox jumps over the lazy dog — serif
The quick brown fox jumps over the lazy dog — sans
The quick brown fox jumps over the lazy dog — cursive

The quick brown fox jumps over the lazy dog — italic
The quick brown fox jumps over the lazy dog — normal

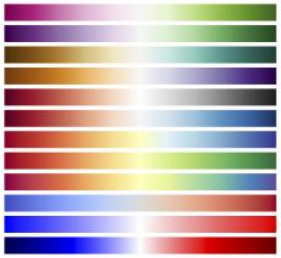
THE QUICK BROWN FOX JUMPS OVER THE LAZY DOG — small-caps
The quick brown fox jumps over the lazy dog — normal

Uniform colormaps

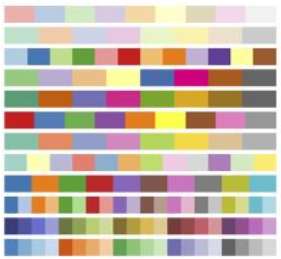
Sequential colormaps



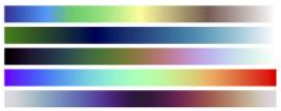
Diverging colormaps



Qualitative colormaps



Miscellaneous colormaps

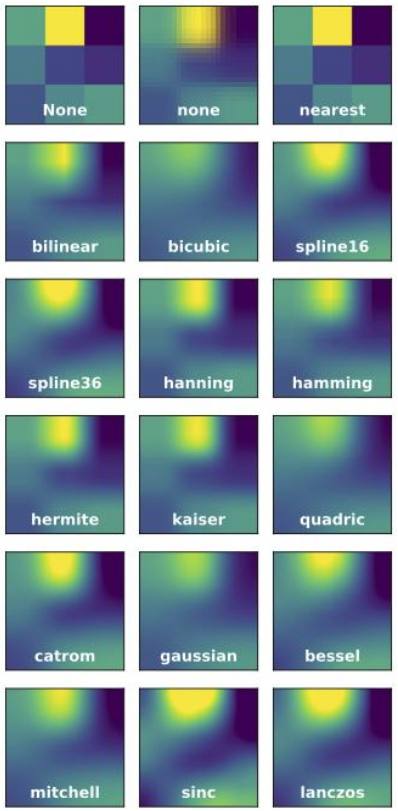


Color names

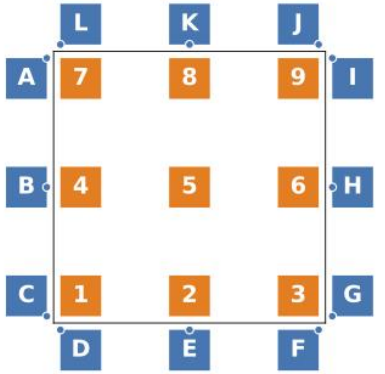
API

Image interpolation

API



Legend placement



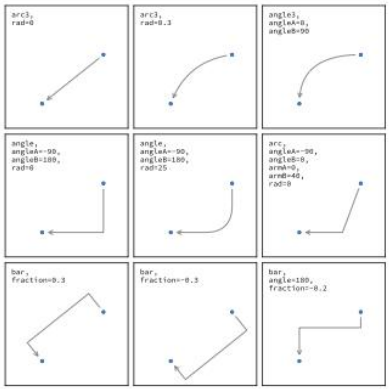
ax.**legend**(loc="string", bbox_to_anchor=(x,y))

1: lower left — 2: lower center — 3: lower right
4: left — 5: center — 6: right
7: upper left — 8: upper center — 9: upper right

A: upper right / (-.1,.9) — B: right / (-.1,.5)
C: lower right / (-.1,.1) — D: upper left / (-.1,-.1)
E: upper center / (.5,-.1) — F: upper right / (.9,-.1)
G: lower left / (1.1,.1) — H: left / (1.1,.5)
I: upper left / (1.1,.9) — J: lower right / (.9,1.1)
K: lower center / (.5,1.1) — L: lower left / (.1,1.1)

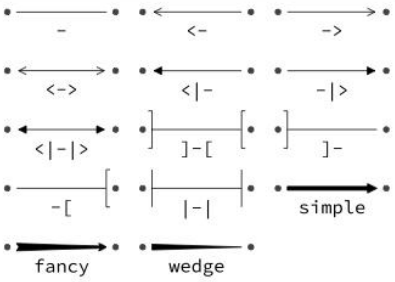
Annotation connection styles

API



Annotation arrow styles

API



How do I ...

... resize a figure?
→ fig.set_size_inches(w,h)
... save a figure?
→ fig.savefig("figure.pdf")
... save a transparent figure?
→ fig.savefig("figure.pdf", transparent=True)
... clear a figure?
→ ax.clear()
... close all figures?
→ plt.close("all")
... remove ticks?
→ ax.set_xticks([])
... remove tick labels ?
→ ax.set_[xy]ticklabels([])
... rotate tick labels ?
→ ax.set_[xy]ticks(rotation=90)
... hide top spine?
→ ax.spines['top'].set_visible(False)
... hide legend border?
→ ax.legend(frameon=False)
... show error as shaded region?
→ ax.fill_between(X, Y+error, Y-error)
... draw a rectangle?
→ ax.add_patch(plt.Rectangle((0, 0),1,1)
... draw a vertical line?
→ ax.axvline(x=0.5)
... draw outside frame?
→ ax.plot(..., clip_on=False)
... use transparency?
→ ax.plot(..., alpha=0.25)
... convert an RGB image into a gray image?
→ gray = 0.2989*R+0.5870*G+0.1140*B
... set figure background color?
→ fig.patch.set_facecolor("grey")
... get a reversed colormap?
→ plt.get_cmap("viridis_r")
... get a discrete colormap?
→ plt.get_cmap("viridis", 10)
... show a figure for one second?
→ fig.show(block=False), time.sleep(1)

Performance tips

```
scatter(X, Y)                          slow
plot(X, Y, marker="o", ls="")          fast

for i in range(n): plot(X[i])          slow
plot(sum([x+[None] for x in X],[]))    fast

cla(), imshow(…), canvas.draw()        slow
im.set_data(…), canvas.draw()          fast
```

Beyond Matplotlib

Seaborn: Statistical Data Visualization
Cartopy: Geospatial Data Processing
yt: Volumetric data Visualization
mpld3: Bringing Matplotlib to the browser
Datashader: Large data processing pipeline
plotnine: A Grammar of Graphics for Python

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