

## Python For Data Science Cheat Sheet

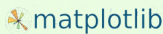
### Matplotlib

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#### Matplotlib

Matplotlib is a Python 2D plotting library which produces publication-quality figures in a variety of hardcopy formats and interactive environments across platforms.



#### 1 Prepare The Data

Also see Lists & NumPy

##### 1D Data

```
>>> import numpy as np
>>> x = np.linspace(0, 10, 100)
>>> y = np.cos(x)
>>> z = np.sin(x)
```

##### 2D Data or Images

```
>>> data = 2 * np.random.random((10, 10))
>>> data2 = 3 * np.random.random((10, 10))
>>> Y, X = np.mgrid[-3:3:100j, -3:3:100j]
>>> U = -1 - X**2 + Y
>>> V = 1 + X - Y**2
>>> from matplotlib.chook import get_sample_data
>>> img = np.load(get_sample_data('axes_grid/bivariate_normal.npy'))
```

#### 2 Create Plot

```
>>> import matplotlib.pyplot as plt
```

##### Figure

```
>>> fig = plt.figure()
>>> fig2 = plt.figure(figsize=plt.figaspect(2.0))
```

##### Axes

All plotting is done with respect to an Axes. In most cases, a subplot will fit your needs. A subplot is an axes on a grid system.

```
>>> fig.add_axes()
>>> ax1 = fig.add_subplot(221) # row-col-num
>>> ax3 = fig.add_subplot(212)
>>> fig3, axes = plt.subplots(nrows=2, ncols=2)
>>> fig4, axes2 = plt.subplots(ncols=3)
```

#### 3 Plotting Routines

##### 1D Data

```
>>> lines = ax.plot(x,y)
>>> ax.scatter(x,y)
>>> axes[0,0].bar([1,2,3],[3,4,5])
>>> axes[1,0].barh([0.5,1.2,5],[0,1,2])
>>> axes[1,1].axhline(0.45)
>>> axes[0,1].axvline(0.65)
>>> ax.fill(x,y,color='blue')
>>> ax.fill_between(x,y,color='yellow')
```

Draw points with lines or markers connecting them  
Draw unconnected points, scaled or colored  
Plot vertical rectangles (constant width)  
Plot horizontal rectangles (constant height)  
Draw a horizontal line across axes  
Draw a vertical line across axes  
Draw filled polygons  
Fill between y-values and 0

##### 2D Data or Images

```
>>> fig, ax = plt.subplots()
>>> im = ax.imshow(img,
>>>                 cmap='gist_earth',
>>>                 interpolation='nearest',
>>>                 vmin=-2,
>>>                 vmax=2)
```

Colormapped or RGB arrays

##### Vector Fields

```
>>> axes[0,1].arrow(0,0,0.5,0.5)
>>> axes[1,1].quiver(y,z)
>>> axes[0,1].streamplot(X,Y,U,V)
```

Add an arrow to the axes  
Plot a 2D field of arrows  
Plot 2D vector fields

##### Data Distributions

```
>>> ax1.hist(y)
>>> ax3.boxplot(y)
>>> ax3.violinplot(z)
```

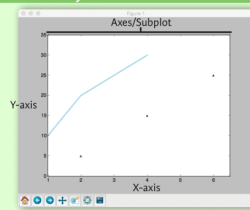
Plot a histogram  
Make a box and whisker plot  
Make a violin plot

```
>>> axes2[0].pcolor(data2)
>>> axes2[0].pcolormesh(data)
>>> CS = plt.contour(Y,X,U)
>>> axes2[2].contourf(data1)
>>> axes2[2] = ax.clabel(CS)
```

Pseudocolor plot of 2D array  
Pseudocolor plot of 2D array  
Plot contours  
Plot filled contours  
Label a contour plot

## Plot Anatomy & Workflow

### Plot Anatomy



### Workflow

The basic steps to creating plots with matplotlib are:

1 Prepare data 2 Create plot 3 Plot 4 Customize plot 5 Save plot 6 Show plot

```
>>> import matplotlib.pyplot as plt
>>> x = [1,2,3,4]
>>> y = [10,20,25,30]
>>> fig = plt.figure()
>>> ax = fig.add_subplot(111)
>>> ax.plot(x, y, color='lightblue', linewidth=3)
>>> ax.scatter([2,4,6],
>>>            [5,15,25],
>>>            color='darkgreen',
>>>            markers='x')
>>> ax.set_xlim(1, 6.5)
>>> plt.savefig('foo.png')
>>> plt.show()
```

#### 4 Customize Plot

##### Colors, Color Bars & Color Maps

```
>>> plt.plot(x, x, x, x**2, x, x**3)
>>> ax.plot(x, y, alpha=0.4)
>>> ax.plot(x, y, c='k')
>>> fig.colorbar(im, orientation='horizontal')
>>> im = ax.imshow(img,
>>>                 cmap='seismic')
```

##### Markers

```
>>> fig, ax = plt.subplots()
>>> ax.scatter(x,y,marker=".")
>>> ax.plot(x,y,marker="o")
```

##### Linestyles

```
>>> plt.plot(x,y,linewidth=4.0)
>>> plt.plot(x,y,ls='solid')
>>> plt.plot(x,y,ls='--')
>>> plt.plot(x,y,'--',x**2,y**2,'-.-')
>>> plt.setp(lines,color='r',linewidth=4.0)
```

##### Text & Annotations

```
>>> ax.text(1,
>>>         -2.1,
>>>         'Example Graph',
>>>         style='italic')
>>> ax.annotate("Sine",
>>>             xy=(8, 0),
>>>             xycoords='data',
>>>             xytext=(10.5, 0),
>>>             textcoords='data',
>>>             arrowprops=dict(arrowstyle="->",
>>>                             connectionstyle="arc3"),)
```

##### Mathtext

```
>>> plt.title(r'$\sigma_i=15$', fontsize=20)
```

##### Limits, Legends & Layouts

```
>>> ax.margins(x=0,y=0.1)
>>> ax.axis('equal')
>>> ax.set(xlim=[0,10.5],ylim=[-1.5,1.5])
>>> ax.set_xlim(0,10.5)
```

##### Legends

```
>>> ax.set(title='An Example Axes',
>>>         ylabel='Y-Axis',
>>>         xlabel='X-Axis')
>>> ax.legend(loc='best')
```

##### Ticks

```
>>> ax.xaxis.set(ticks=range(1,5),
>>>              ticklabels=[3,100,-12,"Foo"])
>>> ax.tick_params(axis='y',
>>>                 direction='inout',
>>>                 length=10)
```

##### Subplot Spacing

```
>>> fig3.subplots_adjust(wspace=0.5,
>>>                      hspace=0.3,
>>>                      left=0.125,
>>>                      right=0.9,
>>>                      top=0.9,
>>>                      bottom=0.1)
```

##### Axis Spines

```
>>> ax1.spines['top'].set_visible(False)
>>> ax1.spines['bottom'].set_position(('outward',10))
```

Add padding to a plot  
Set the aspect ratio of the plot to 1  
Set limits for x-and-y-axis  
Set limits for x-axis

Set a title and x-and-y-axis labels

No overlapping plot elements

Manually set x-ticks

Make y-ticks longer and go in and out

Adjust the spacing between subplots

Fit subplot(s) in to the figure area

Make the top axis line for a plot invisible

Move the bottom axis line outward

#### 5 Save Plot

##### Save figures

```
>>> plt.savefig('foo.png')
>>> plt.savefig('foo.png', transparent=True)
```

#### 6 Show Plot

```
>>> plt.show()
```

#### Close & Clear

```
>>> plt.cla()
>>> plt.clf()
>>> plt.close()
```

Clear an axis  
Clear the entire figure  
Close a window

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