

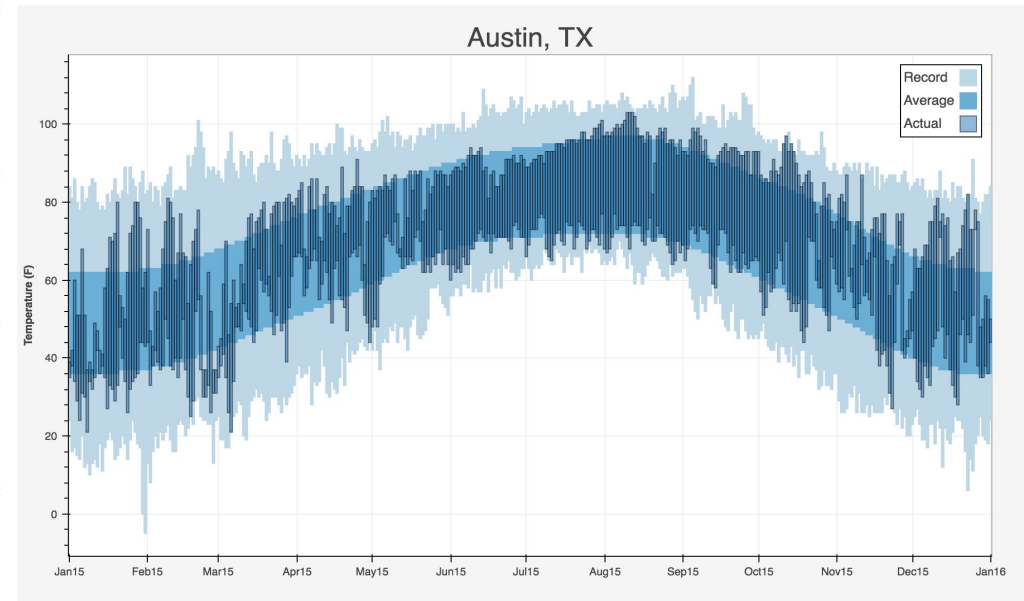
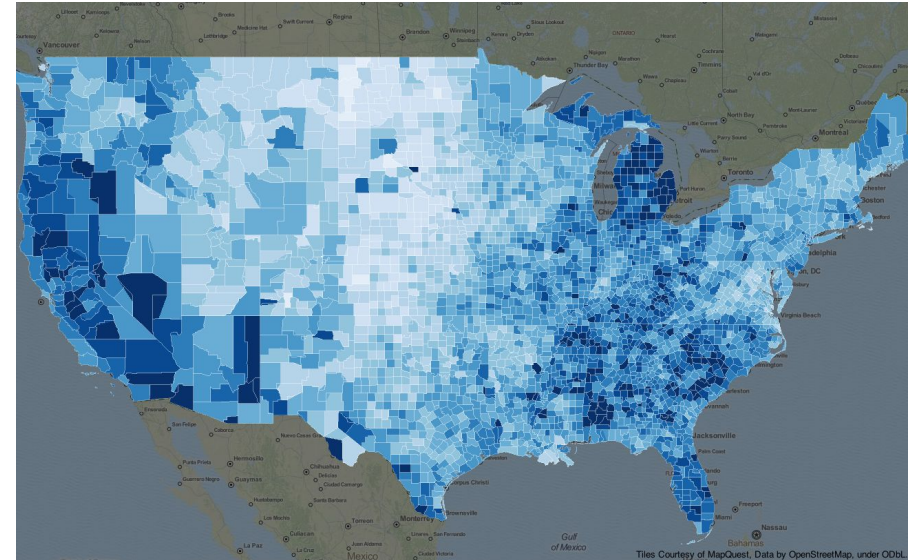
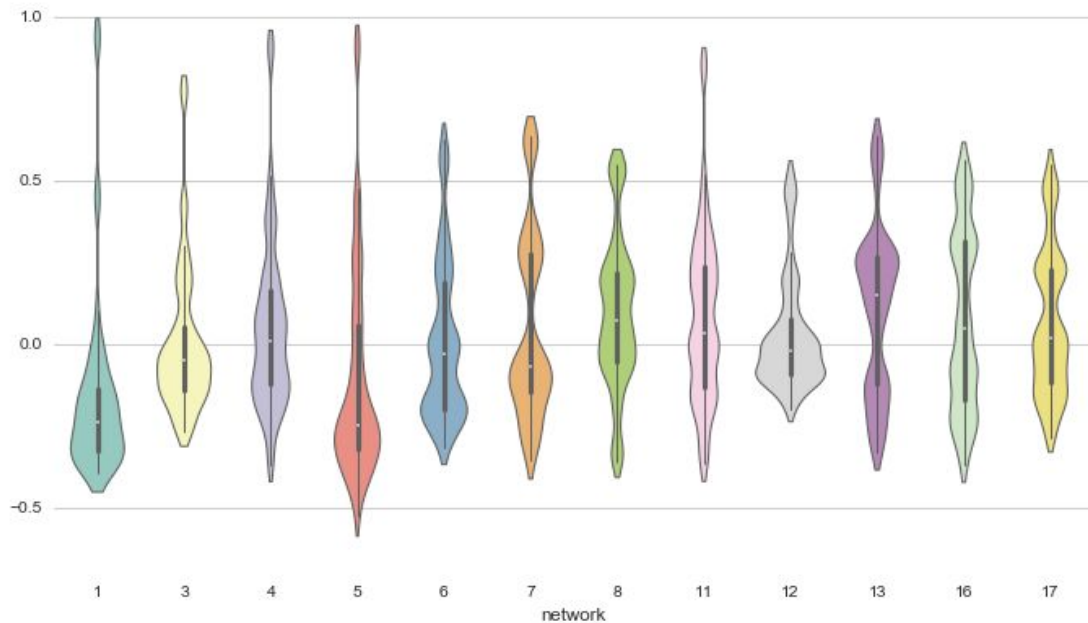
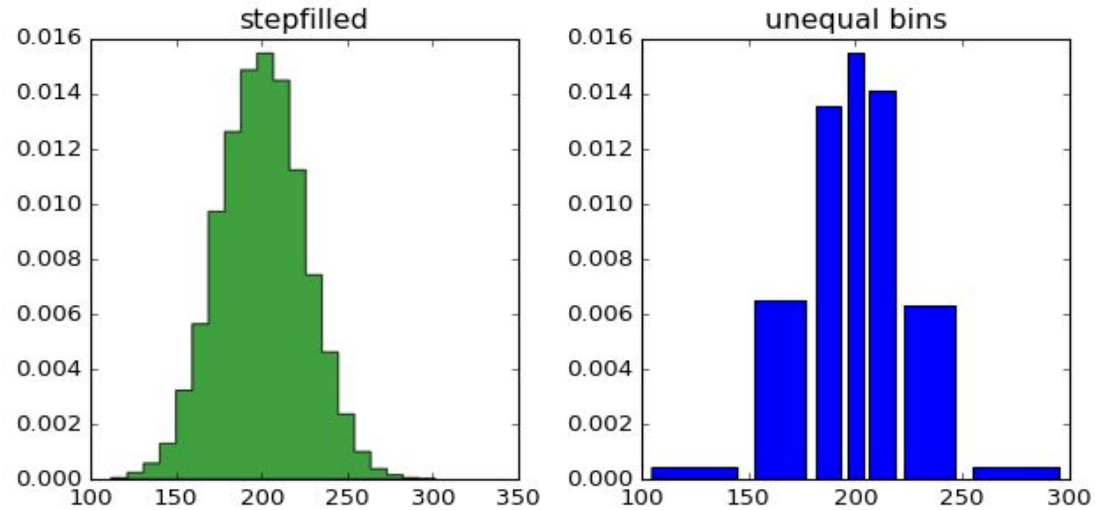
Visualization

graph

저녁이 있는 프로젝트
오상훈
6 Hours, 1 Month

10 Useful Python Data Visualization Libraries

- ❖ <https://mode.com/blog/python-data-visualization-libraries/>
- ❖ 학습 대상 : Matplotlib, Seaborn, Bokeh





구분	주요 시각화 방법
시간 시각화	막대 그래프, 누적 막대 그래프, 점 그래프
분포 시각화	파이 차트, 도우넛 차트, 트리맵, 누적 연속 그래프
관계 시각화	스캐터플롯, 버블차트, 히스토그램
비교 시각화	히트맵, 스타 차트, 평행 좌표계, 다차원 척도법
공간 시각화	지도 맵핑



Matplot Feature

- ❖ NumPy is often used along with packages like SciPy (Scientific Python) and Matplotlib (**plotting library**).

➤ 스타일 문자열은 색깔(color), 마커(marker), 선 종류(line style) 순서

ex) `plt.plot(x,y,"go")`

`plt.plot(x,y,'rs--')`

➤ 참조

- https://matplotlib.org/3.1.1/api/_as_gen/matplotlib.pyplot.html
- <https://matplotlib.org/gallery/index.html>
- <https://matplotlib.org/examples/index.html> > *_Reference

- ❖ 같이 하기

`from matplotlib import pyplot as plt`

`x = np.arange(1,11)`

`y = 2 * x + 5`

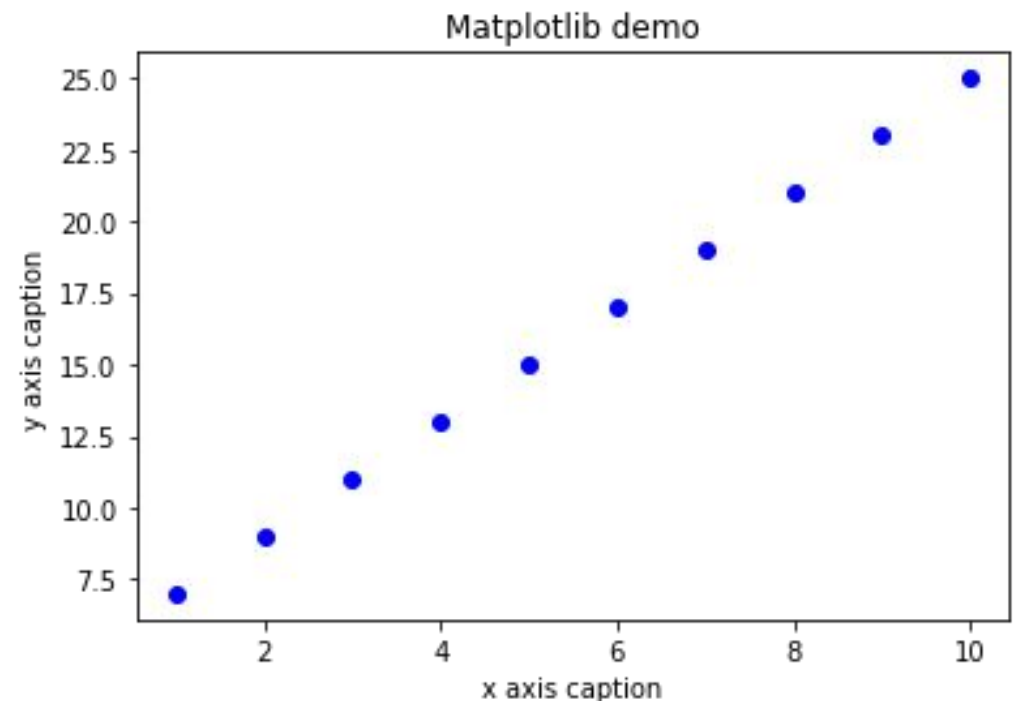
`plt.title("Matplotlib demo")`

`plt.xlabel("x axis caption")`

`plt.ylabel("y axis caption")`

`plt.plot(x,y,"bo")`

`plt.show()`



Matplot - 한글처리

❖ 시스템 폰트 찾기 : 환경 종속.

```
import matplotlib.font_manager as fm
systemfont = ""
for font in fm.fontManager.ttflist:
    print(font)
    if font.name.find('Nanum') != -1 & font.name.find('Gulim') != -1:
        systemfont = f.name
    print(systemfont)
```

❖ 한글 폰트 설정 #1

```
from matplotlib import rcParams
rcParams['font.family'] = systemfont
rcParams['font.size'] = 10
```

❖ 한글 폰트 설정 #2

```
from matplotlib import rcParams
mpl.rc('font', family=systemfont)
mpl.rc('axes', unicode_minus=False)
```

Matplot - Line Plots

❖ `pyplot.plot(*args, scalex=True, scaley=True, data=None, **kwargs)`

`x = [1, 2, 3, 4, 5, 6, 7, 8, 9]`

`y1 = [1, 3, 5, 3, 1, 3, 5, 3, 1]`

`y2 = [2, 4, 6, 4, 2, 4, 6, 4, 2]`

`plt.plot(x, y1, 'go--', label="line L")`

`plt.plot(x, y2, 'bo--', label="line H")`

`plt.xlabel("x axis")`

`plt.ylabel("y axis")`

`plt.title("Line Graph Example")`

`plt.show()`

❖ 해 보기

`student_score = [`

`[1, 90, 80, 85, 0, 0.0, 0, 0],`

`[2, 88, 85, 90, 0, 0.0, 0, 0],`

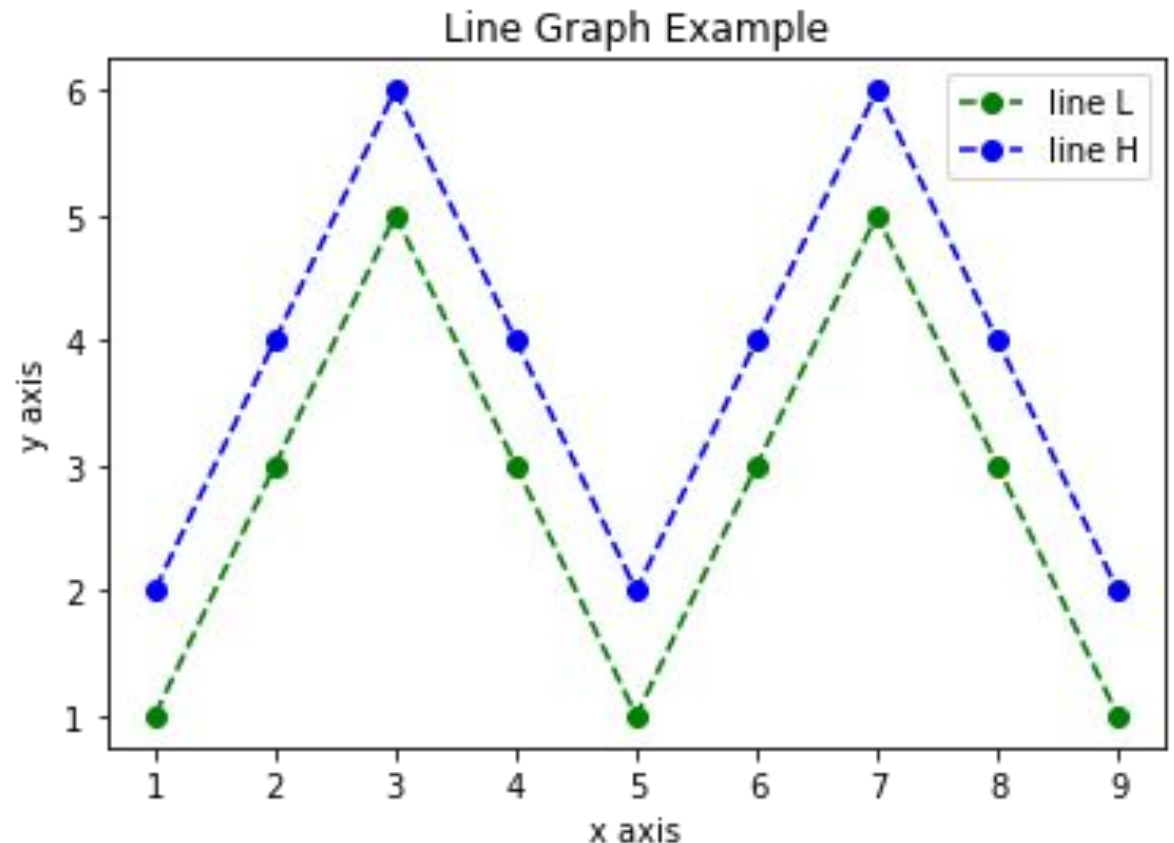
`[3, 32, 85, 90, 0, 0.0, 0, 0],`

`[4, 42, 75, 93, 0, 0.0, 0, 0],`

`[5, 82, 86, 88, 0, 0.0, 0, 0]`

`]`

➤ 각 구성원 점수 그래프 그리기



Matplot - Bar Plots

❖ `pyplot.bar(x, height, width=0.8, bottom=None, *, align='center', data=None, **kwargs)`

➤ Colors: https://matplotlib.org/api/colors_api.html

```
x1 = [1, 3, 4, 5, 6, 7, 9];    y1 = [4, 7, 2, 4, 7, 8, 3]
```

```
x2 = [2, 4, 6, 8, 10];        y2 = [5, 6, 2, 6, 2]
```

```
plt.bar(x1, y1, label="Blue Bar", color='b')
```

```
plt.bar(x2, y2, label="Green Bar", color='g')
```

```
plt.xlabel("bar number")
```

```
plt.ylabel("bar height")
```

```
plt.title("Bar Chart Example")
```

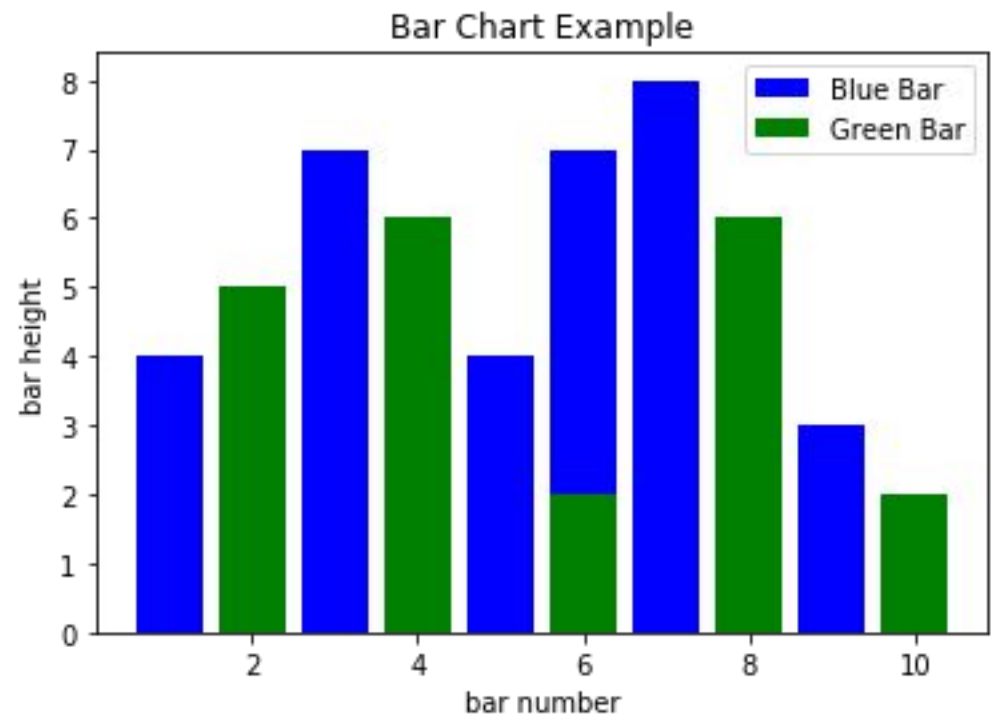
```
plt.show()
```

❖ 해 보기

```
student_score = [  
    [1, 90, 80, 85, 0, 0.0, 0, 0],  
    [2, 88, 85, 90, 0, 0.0, 0, 0],  
    [3, 32, 85, 90, 0, 0.0, 0, 0],  
    [4, 42, 75, 93, 0, 0.0, 0, 0],  
    [5, 82, 86, 88, 0, 0.0, 0, 0]
```

```
]
```

➤ 각 구성원 점수 그래프 그리기



Matplot - Histograms

❖ `hist(x[, bins, range, density, weights, ...])`

`n = 5 + np.random.randn(1000)`

`m = [m for m in range(len(n))]`

`plt.bar(m, n)`

`plt.title("Raw Data")`

`plt.show()`

`plt.hist(n, bins=20)`

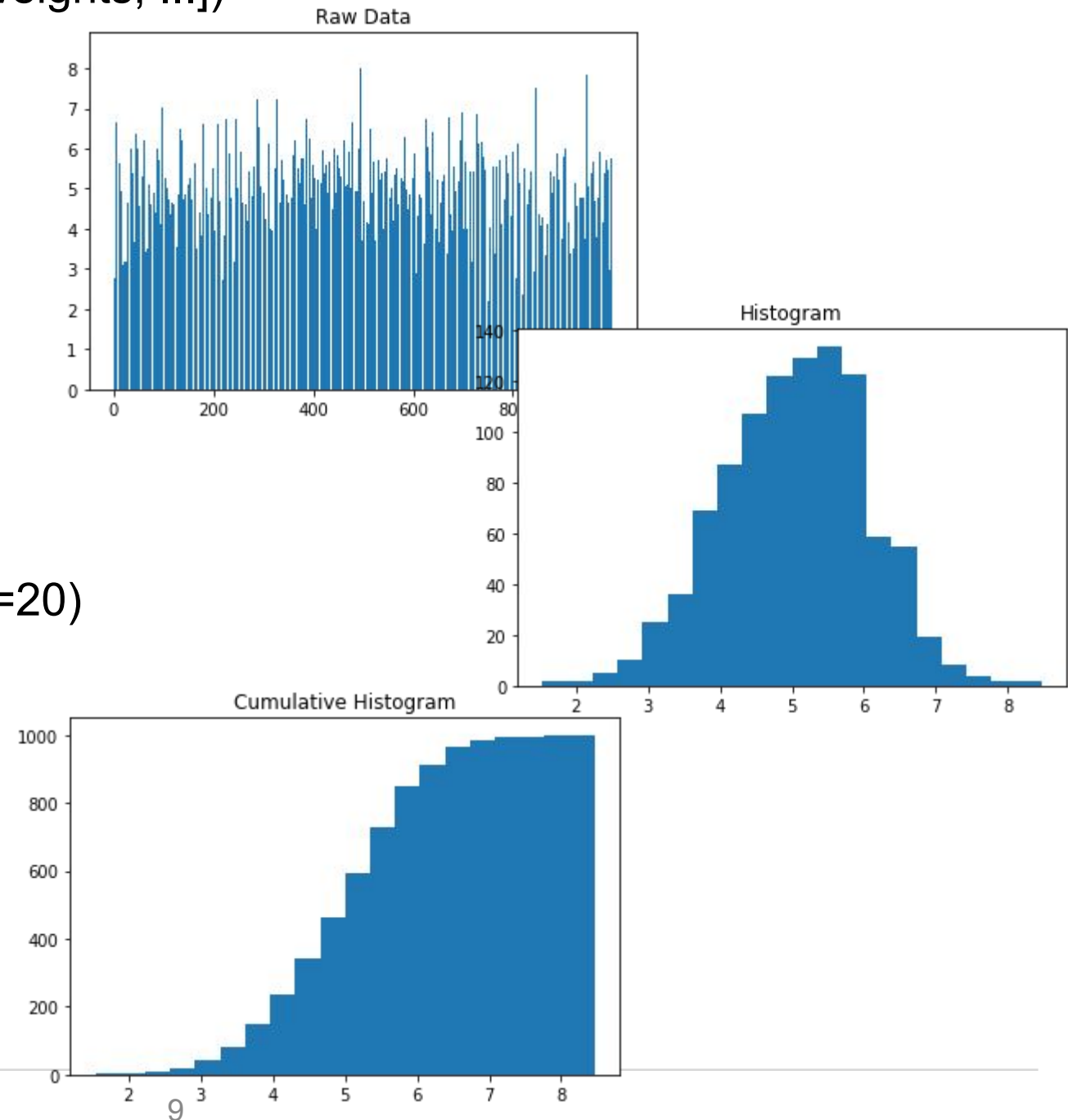
`plt.title("Histogram")`

`plt.show()`

`plt.hist(n, cumulative=True, bins=20)`

`plt.title("Cumulative Histogram")`

`plt.show()`



Matplot - Scatter Plots

❖ `scatter(x, y[, s, c, marker, cmap, norm, ...])`

➤ Markers: https://matplotlib.org/api/markers_api.html

■ `."`-point, `,"`-pixel, `"o"`-circle, `"v"`-triangle_down, `"^"`-triangle_up, ...

```
x1 = [2, 3, 4]; y1 = [5, 5, 5]
```

```
x2 = [1, 2, 3, 4, 5]; y2 = [2, 3, 2, 3, 4]
```

```
y3 = [6, 8, 7, 8, 7];
```

```
plt.scatter(x1, y1)
```

```
plt.scatter(x2, y2, marker='v', color='r')
```

```
plt.scatter(x2, y3, marker='^', color='m')
```

```
plt.title('Scatter Plot Example')
```

```
plt.show()
```

❖ 해보기

```
import numpy as np
```

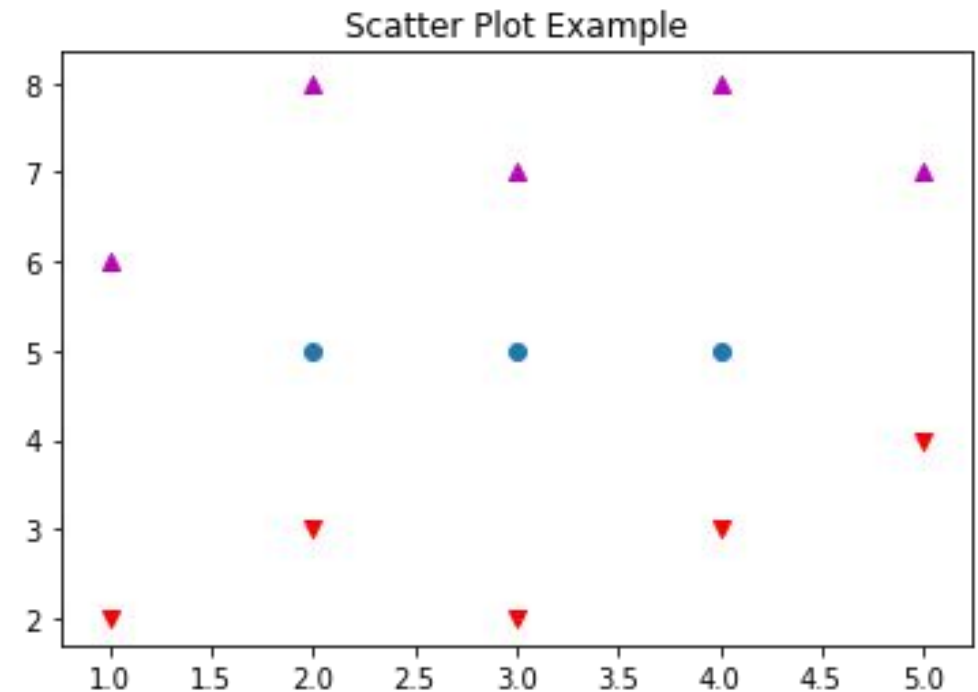
```
from sklearn import datasets
```

```
iris = datasets.load_iris()
```

➤ iris 종류별 그래프 그리기

❖ 더 해보기

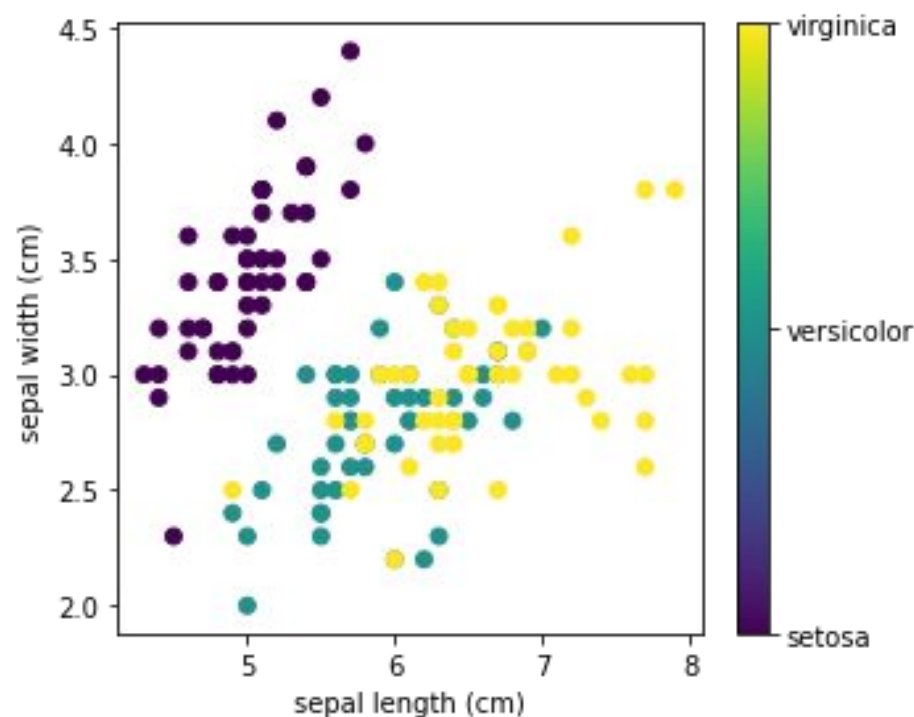
➤ iris 종류별 `mean`(평균), `median`(중간값), `std`(표준편차), `var`(분산)도 그리기



Matplot - Scatter Plots

```
from sklearn.datasets import load_iris
iris = load_iris()
# The indices of the features that we are plotting
x_index = 0
y_index = 1
# this formatter will label the colorbar with the correct target names
formatter = plt.FuncFormatter(lambda i, *args: iris.target_names[int(i)])
plt.figure(figsize=(5, 4))
plt.scatter(iris.data[:, x_index], iris.data[:, y_index], c=iris.target)
plt.colorbar(ticks=[0, 1, 2], format=formatter)
plt.xlabel(iris.feature_names[x_index])
plt.ylabel(iris.feature_names[y_index])

plt.tight_layout()
plt.show()
```



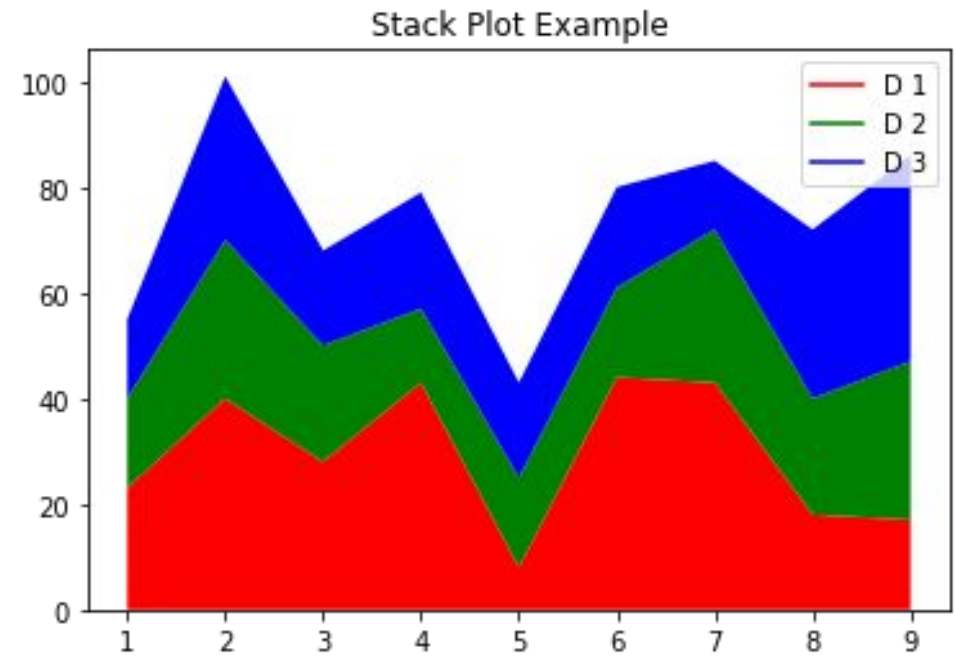
Matplot - Stack Plots

```
idxes = [ 1, 2, 3, 4, 5, 6, 7, 8, 9]
arr1  = [23, 40, 28, 43, 8, 44, 43, 18, 17]
arr2  = [17, 30, 22, 14, 17, 17, 29, 22, 30]
arr3  = [15, 31, 18, 22, 18, 19, 13, 32, 39]
```

Adding legend for stack plots is tricky.

```
plt.plot([], [], color='r', label = 'D 1')
plt.plot([], [], color='g', label = 'D 2')
plt.plot([], [], color='b', label = 'D 3')
```

```
plt.stackplot(idxes, arr1, arr2, arr3, colors= ['r', 'g', 'b'])
plt.title('Stack Plot Example')
#plt.legend()
plt.show()
```



Matplot - Pie Charts

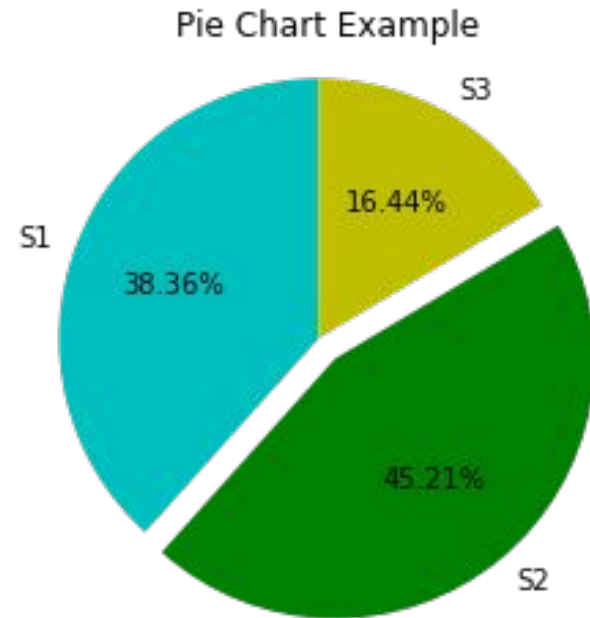
```
labels = 'S1', 'S2', 'S3'
```

```
sections = [56, 66, 24]
```

```
colors = ['c', 'g', 'y']
```

```
plt.pie(sections, labels=labels,  
       colors=colors,  
       startangle=90,  
       explode = (0, 0.1, 0),  
       autopct = '%1.2f%%')
```

```
plt.axis('equal') # Try commenting this out.  
plt.title('Pie Chart Example')  
plt.show()
```

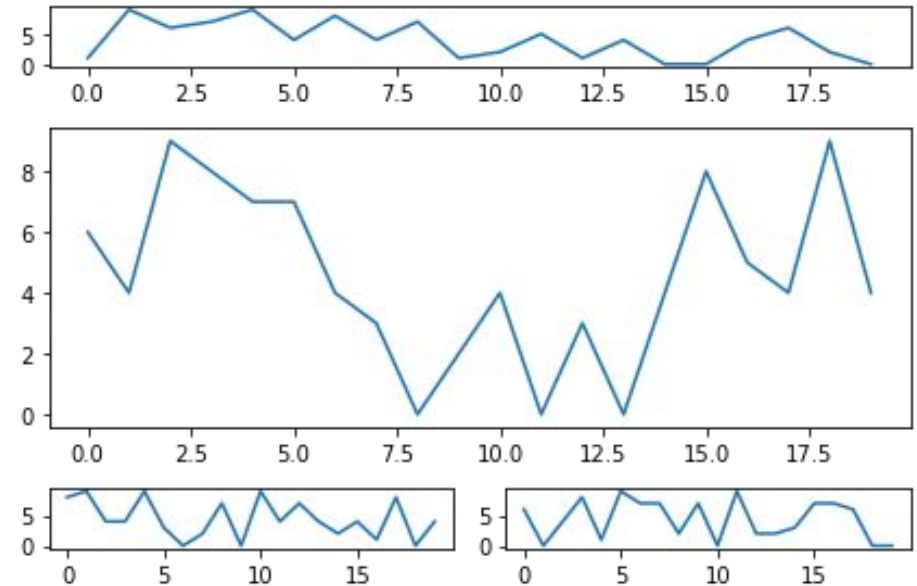


Matplot - Subplotting using Subplot2grid

```
def random_plots():  
    xs = []; ys = []  
    for i in range(20):  
        x = i  
        y = np.random.randint(10)  
        xs.append(x); ys.append(y)  
    return xs, ys
```

```
fig = plt.figure()  
ax1 = plt.subplot2grid((5, 2), (0, 0), rowspan=1, colspan=2)  
ax2 = plt.subplot2grid((5, 2), (1, 0), rowspan=3, colspan=2)  
ax3 = plt.subplot2grid((5, 2), (4, 0), rowspan=1, colspan=1)  
ax4 = plt.subplot2grid((5, 2), (4, 1), rowspan=1, colspan=1)
```

```
x, y = random_plots(); ax1.plot(x, y)  
x, y = random_plots(); ax2.plot(x, y)  
x, y = random_plots(); ax3.plot(x, y)  
x, y = random_plots(); ax4.plot(x, y)  
plt.tight_layout()  
plt.show()
```

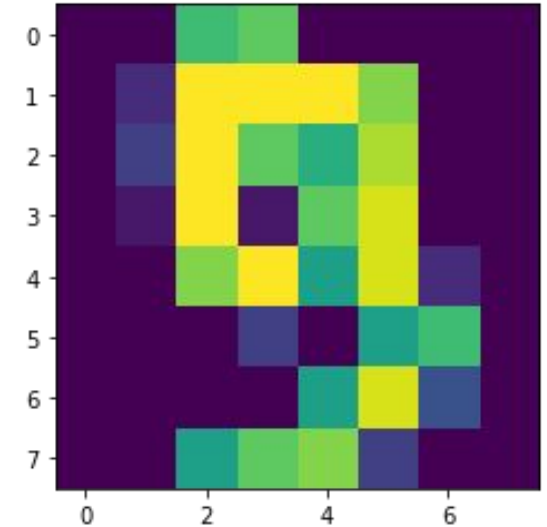
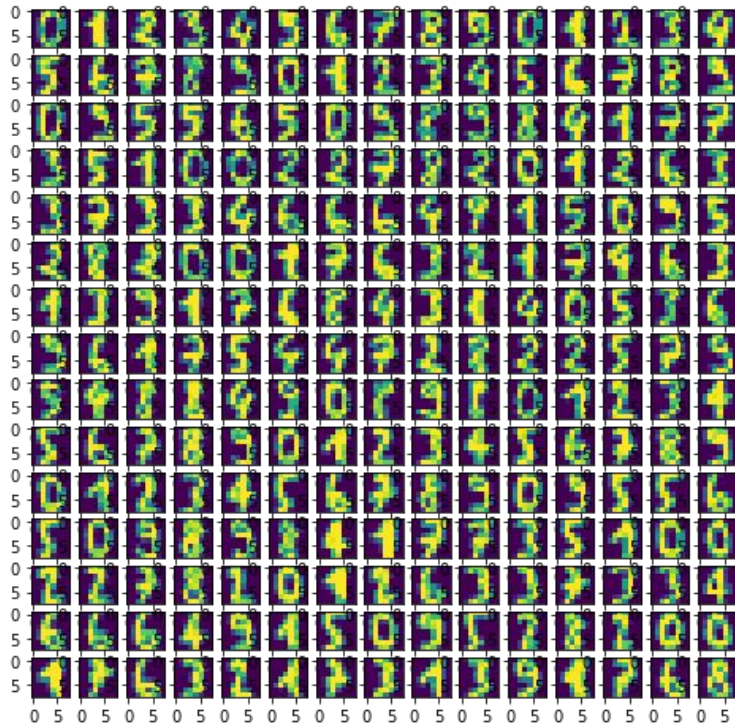


Try - How do I convert a numpy array to (and display) an image?

```
from sklearn.datasets import load_digits
digits = load_digits()
plt.imshow(digits.images[9])
plt.show()
```

❖ 모아서 출력

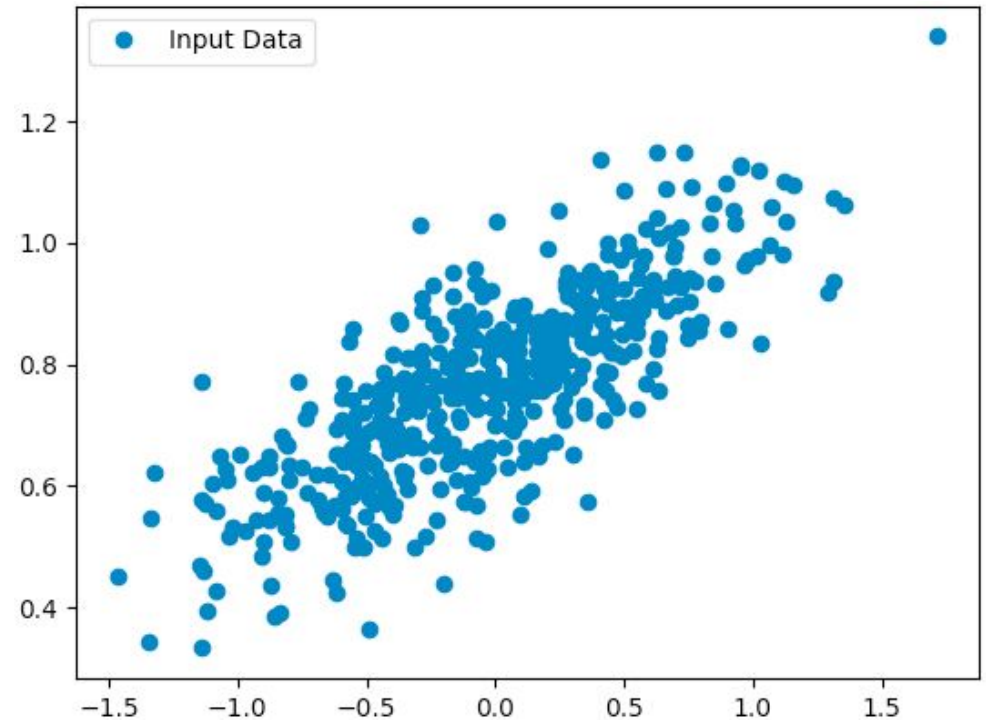
```
fig, axes = plt.subplots(10, 10, figsize=(8,8))
for i, ax in enumerate(axes.flat):
    ax.imshow(digits.images[i])
```



Trying - 선형회귀 시각화

```
import numpy as np
number_of_points = 500
x_point = []
y_point = []
a = 0.22; b = 0.78
for i in range(number_of_points):
    x = np.random.normal(0.0,0.5)
    y = a*x + b + np.random.normal(0.0, 0.1)
    x_point.append([x])
    y_point.append([y])
```

```
import matplotlib as mpl
mpl.use('TkAgg')
import matplotlib.pyplot as plt
plt.plot(x_point, y_point, 'o', label='Input Data')
[<matplotlib.lines.Line2D object at 0x11392bbe0>]
plt.legend()
plt.show()
```



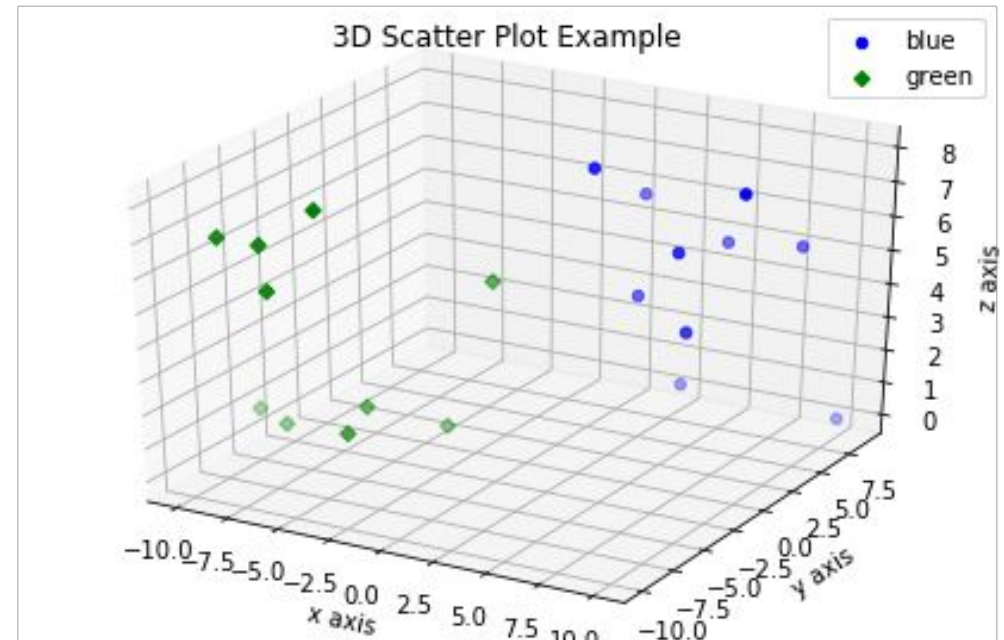
Matplot - 3D Scatter Plots

```
import numpy as np
from mpl_toolkits.mplot3d import axes3d

fig = plt.figure()
ax = fig.add_subplot(111, projection = '3d')
```

```
x1 = [1, 2, 3, 4, 5, 6, 7, 8, 9, 10]
y1 = np.random.randint(10, size=10)
z1 = np.random.randint(10, size=10)
x2 = [-1, -2, -3, -4, -5, -6, -7, -8, -9, -10]
y2 = np.random.randint(-10, 0, size=10)
z2 = np.random.randint(10, size=10)
```

```
ax.scatter(x1, y1, z1, c='b', marker='o', label='blue')
ax.scatter(x2, y2, z2, c='g', marker='D', label='green')
ax.set_xlabel('x axis'); ax.set_ylabel('y axis'); ax.set_zlabel('z axis')
plt.title("3D Scatter Plot Example")
plt.tight_layout()
plt.show()
```



Matplot - 3D Bar Plots

```
import numpy as np
```

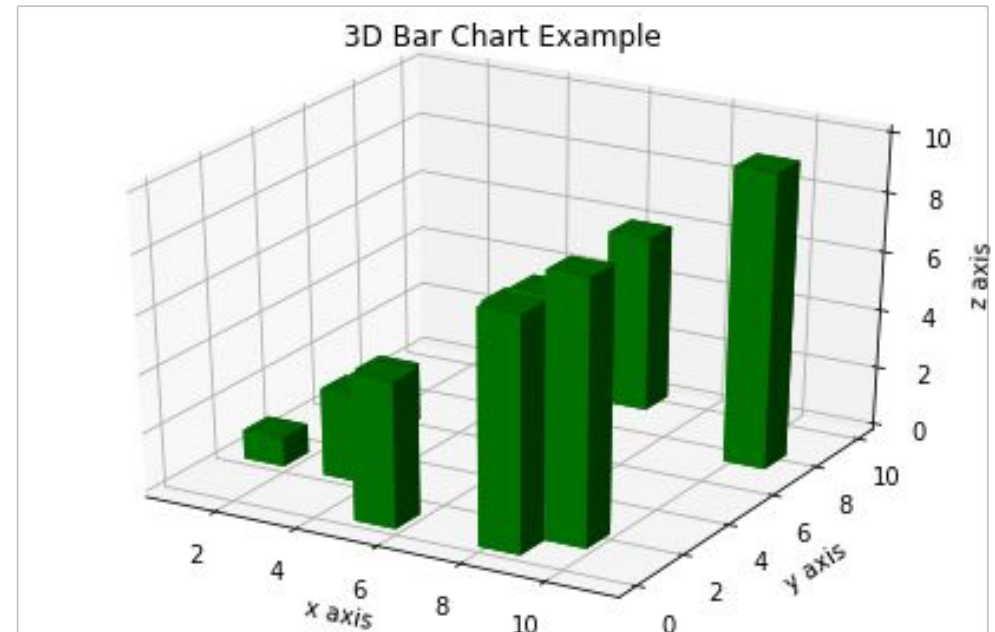
```
fig = plt.figure()  
ax = fig.add_subplot(111, projection = '3d')
```

```
x = [1, 2, 3, 4, 5, 6, 7, 8, 9, 10]  
y = np.random.randint(10, size=10)  
z = np.zeros(10)
```

```
dx = np.ones(10)  
dy = np.ones(10)  
dz = [1, 2, 3, 4, 5, 6, 7, 8, 9, 10]
```

```
ax.bar3d(x, y, z, dx, dy, dz, color='g')
```

```
ax.set_xlabel('x axis'); ax.set_ylabel('y axis'); ax.set_zlabel('z axis')  
plt.title("3D Bar Chart Example")  
plt.tight_layout()  
plt.show()
```



Matplot - Wireframe Plots

```
fig = plt.figure()
ax = fig.add_subplot(111, projection = '3d')

x, y, z = axes3d.get_test_data()

ax.plot_wireframe(x, y, z, rstride = 2, cstride = 2)

plt.title("Wireframe Plot Example")
plt.tight_layout()
plt.show()
```

