Visualization

Data handling section

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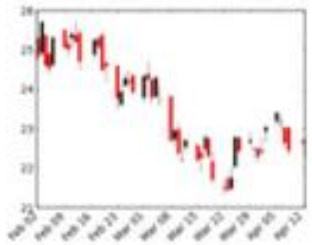
matplotlib

우리의 데이터는 어떻게 생겼을까?

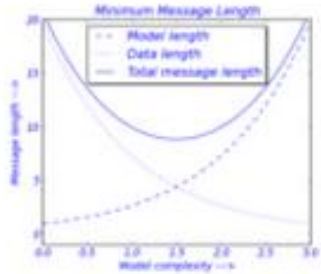
Visualization
데이터 시각화

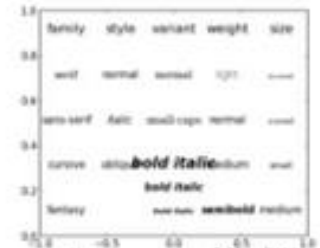
파이썬의 대표적인 시각화 도구

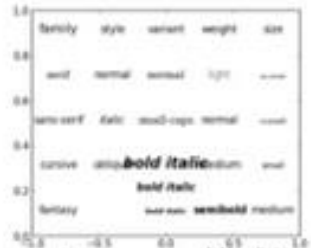

matplotlib




SPY daily


Minimum Message Length
Model length
Data length
Total message length
Message length ⟶ n
Model complexity ⟶ n


family
style
variant
weight
size
normal
bold
bold italic
italic
semibold
monospace
large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variant
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bold
bold italic
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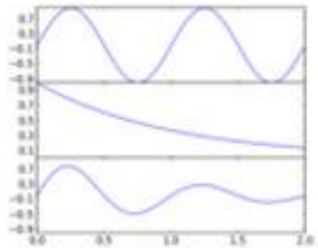
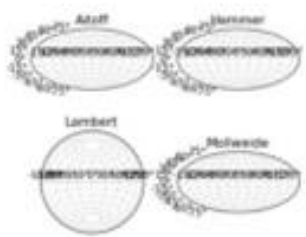
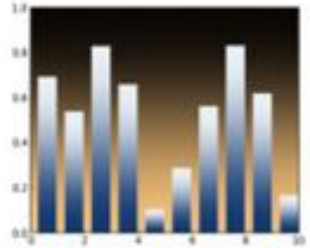
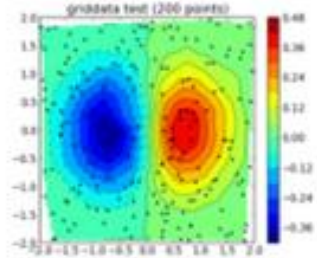
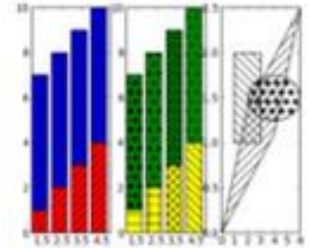
semibold
monospace
large

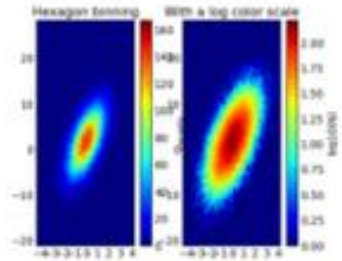


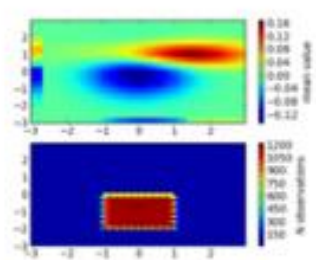

Aitoff
Hammer
Lambert
Mollweide

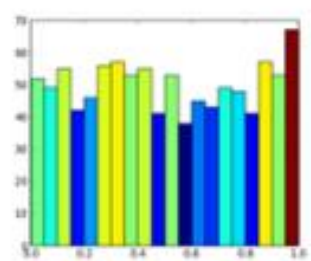


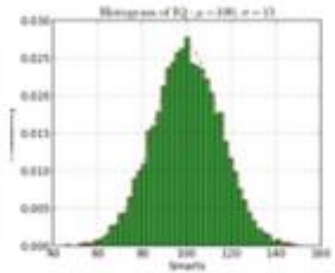

griddata test (200 points)

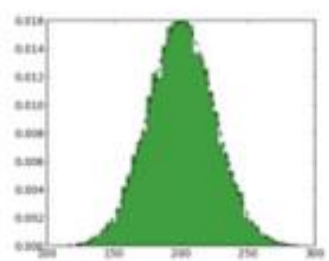


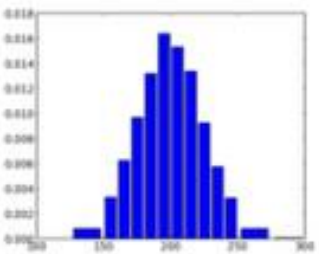

Hexagon binning
With a log color scale

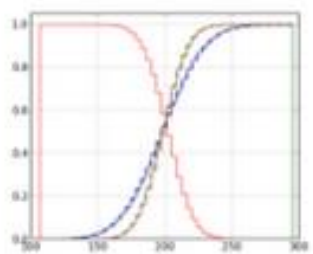

mean value
N observations

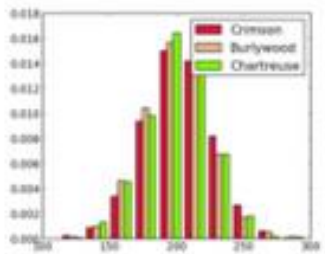


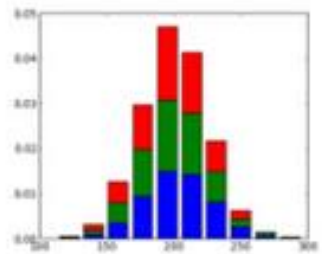


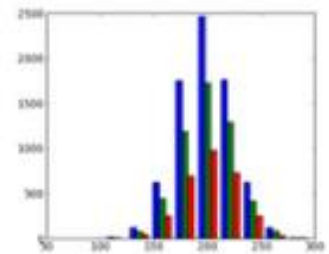







Crimson
Burlywood
Chartreuse





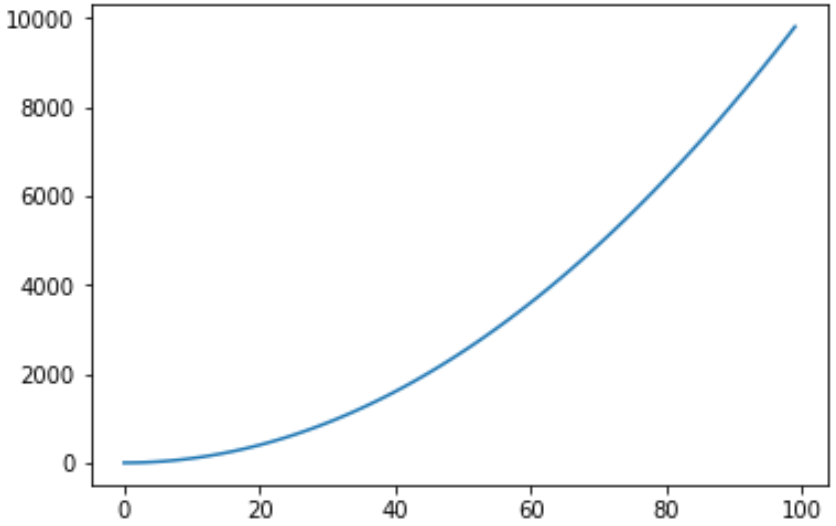
다양한 graph 지원
Pandas 연동!

기본 사용법

matplotlib

- pyplot 객체를 사용하여 데이터를 표시
- pyplot 객체에 그래프들을 쌓은 다음 flush

```
import matplotlib.pyplot as plt

X = range(100)
Y = [value**2 for value in X]
plt.plot(X, Y)
plt.show()
```



matplotlib

- 최대 단점 argument를 kwargs 받음,
- 고정된 argument가 없어서
  alt+tab으로 확인이 어려움

```
Signature: plt.plot(*args, **kwargs)
Docstring:
Plot lines and/or markers to the
:class:`~matplotlib.axes.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
```

matplotlib

- Graph는 원래 figure 객체에 생성됨
- pyplot 객체 사용시, 기본 figure에 그래프가 그려짐

```
X_1 = range(100)
Y_1 = [np.cos(value) for value in X]

X_2 = range(100)
Y_2 = [np.sin(value) for value in X]

plt.plot(X_1, Y_1)
plt.plot(X_2, Y_2)
plt.show()
```

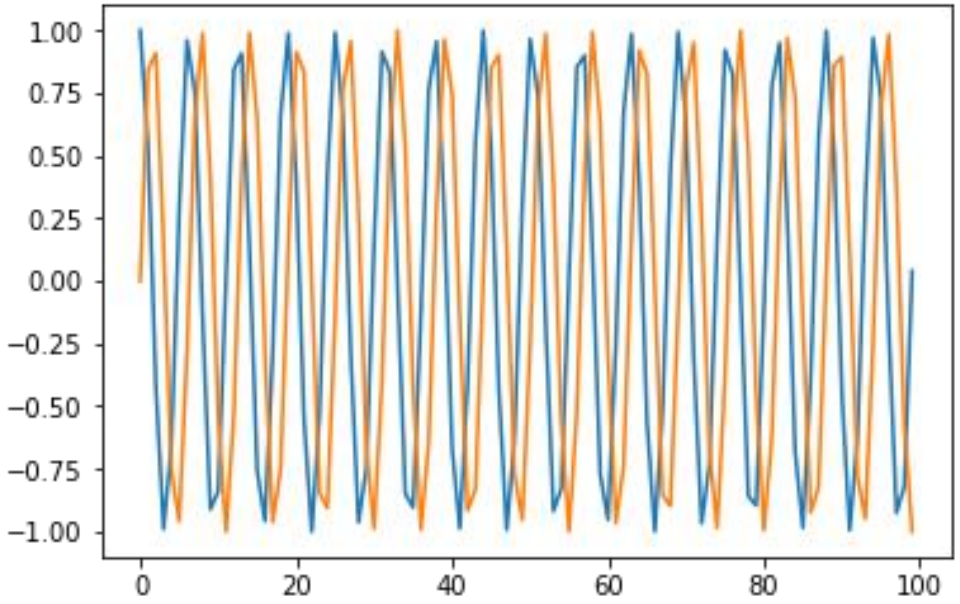
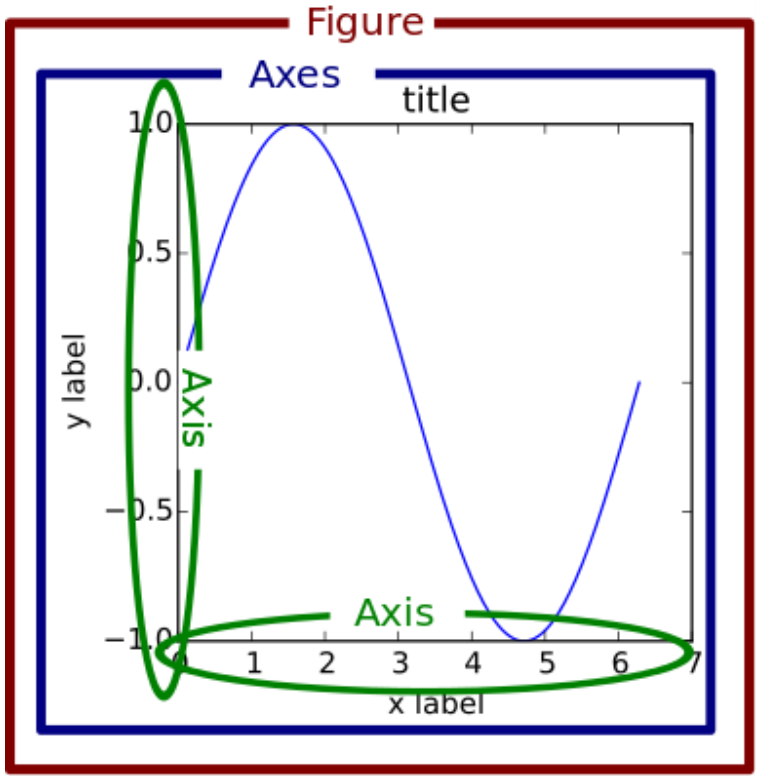


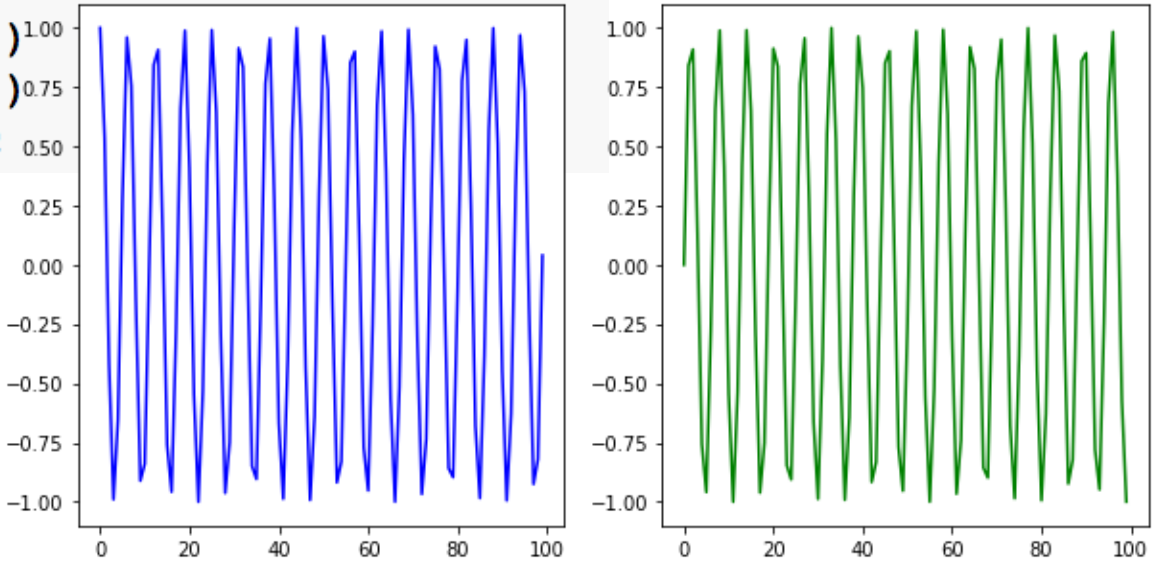
Figure & Axes

- Matplotlib는 Figure 안에 Axes로 구성
- Figure 위에 여러 개의 Axes를 생성



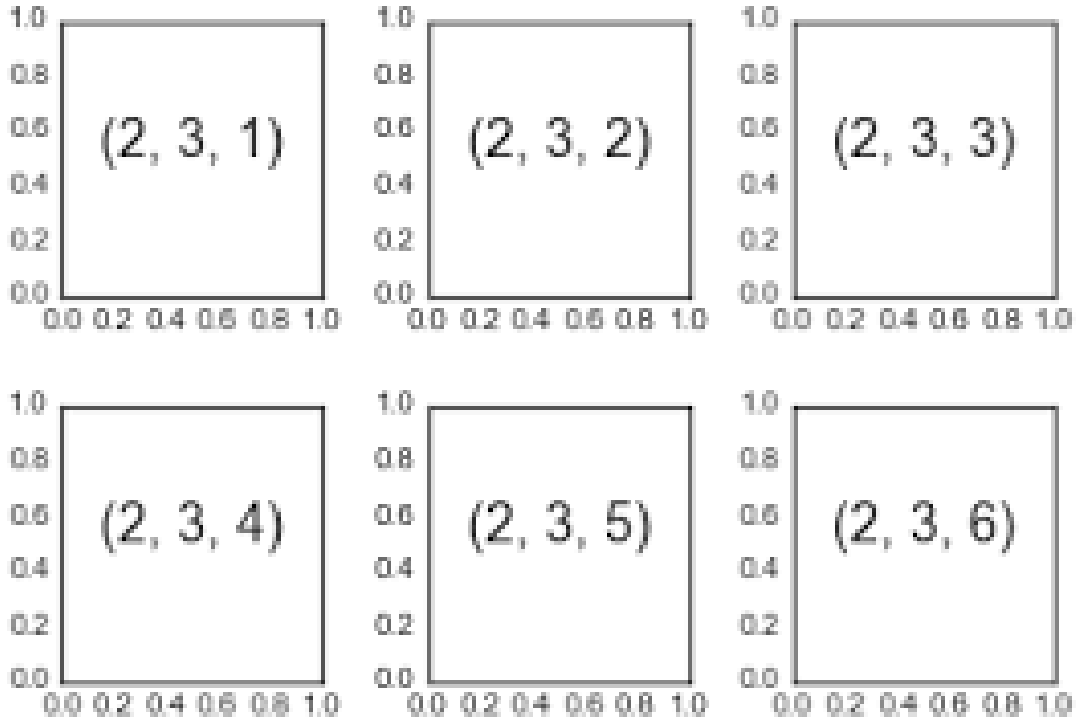
matplotlib

```
fig = plt.figure() # figure 반환
fig.set_size_inches(10,5) # 크기지정
ax_1 = fig.add_subplot(1,2,1) # 두개의 plot 생성
ax_2 = fig.add_subplot(1,2,2)  # 두개의 plot 생성

ax_1.plot(X_1, Y_1, c="b")
ax_2.plot(X_2, Y_2, c="g")
plt.show() # show & flush
```



subplots

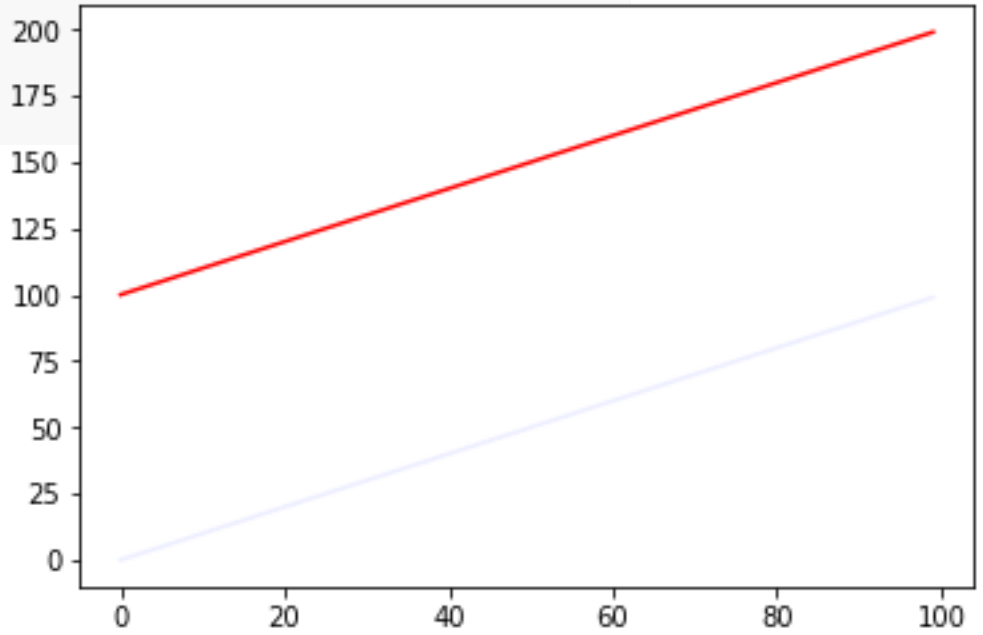
- Subplot의 순서를 grid로 작성



Set color

- Color 속성을 사용
- Float → 흑백, rgb color, predefined color 사용

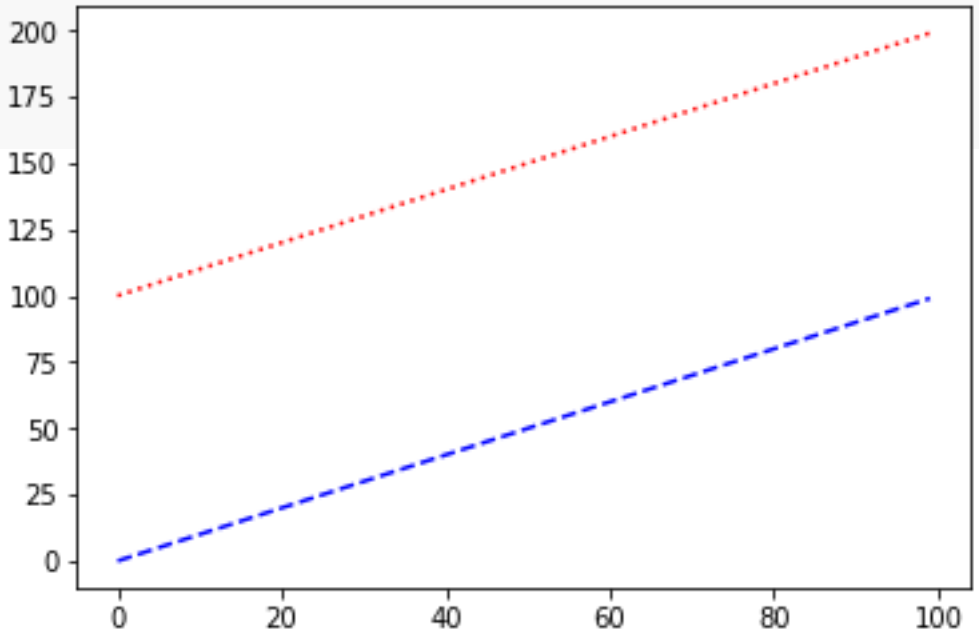
```
plt.plot(X_1, Y_1, color="#eeefff")
plt.plot(X_2, Y_2, color="r")

plt.show()
```



Set linstyle

- ls 또는 linestyle 속성 사용

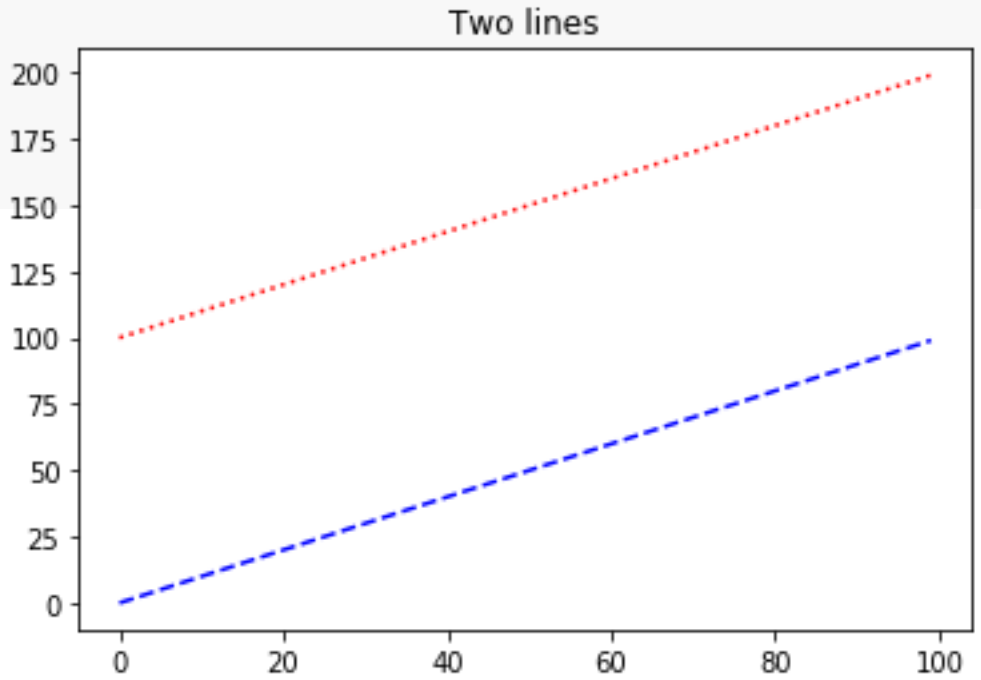
```
plt.plot(X_1, Y_1, c="b", linestyle="dashed")
plt.plot(X_2, Y_2, c="r", ls="dotted")

plt.show()
```



Set title

- Pyplot에 title함수 사용, figure의 subplot별 입력 가능

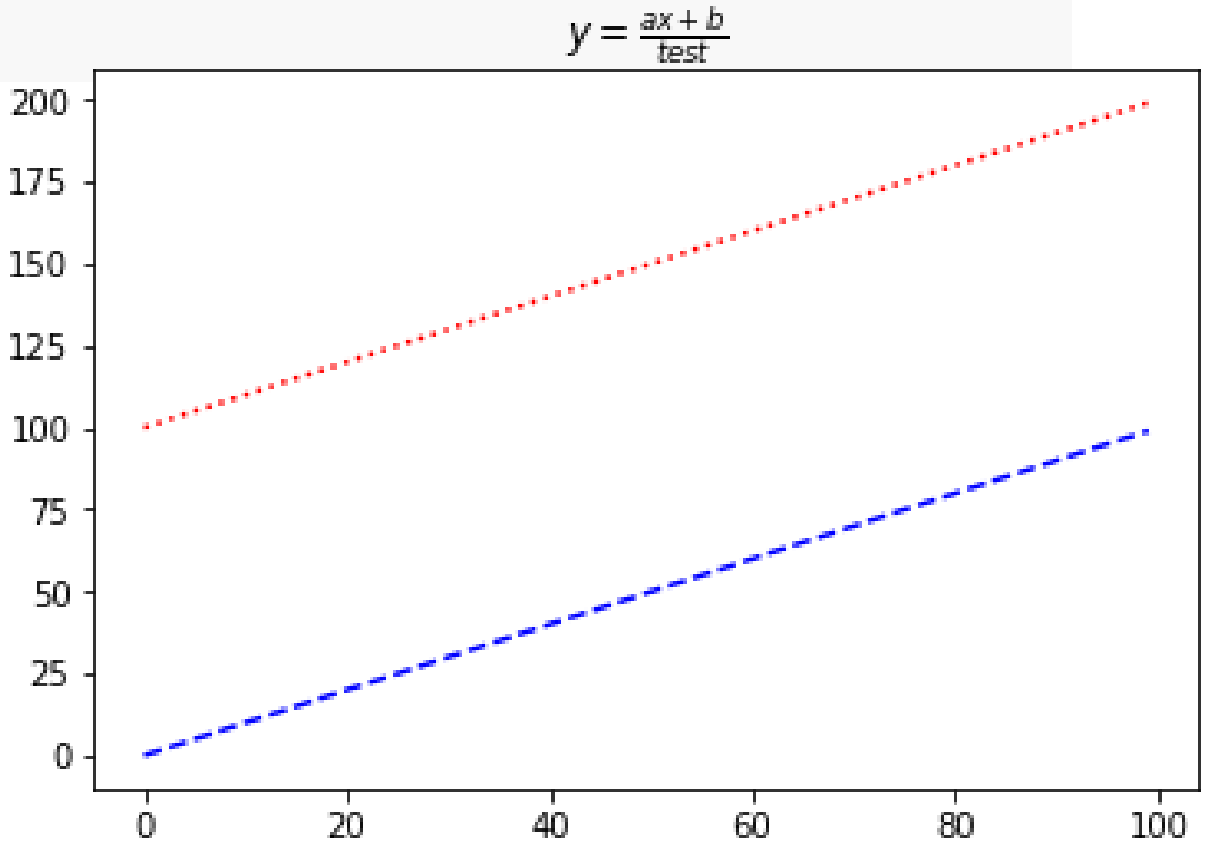
```
plt.plot(X_1, Y_1, color="b", linestyle="dashed")
plt.plot(X_2, Y_2, color="r", linestyle="dotted")

plt.title("Two lines")
plt.show()
```



Set title

- Latex 타입의 표현도 가능 (수식 표현 가능)

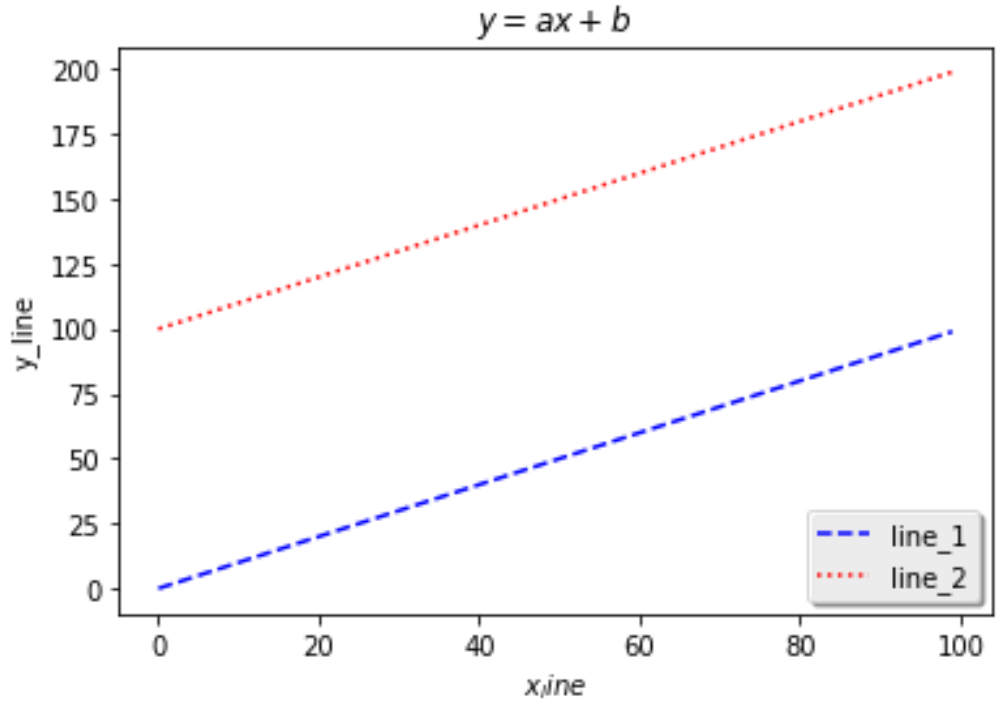
```
plt.title('$y = \\frac{ax + b}{test}$')
plt.show()
```



Set legend

- Legend 함수로 범례를 표시함, loc 위치등 속성 지정

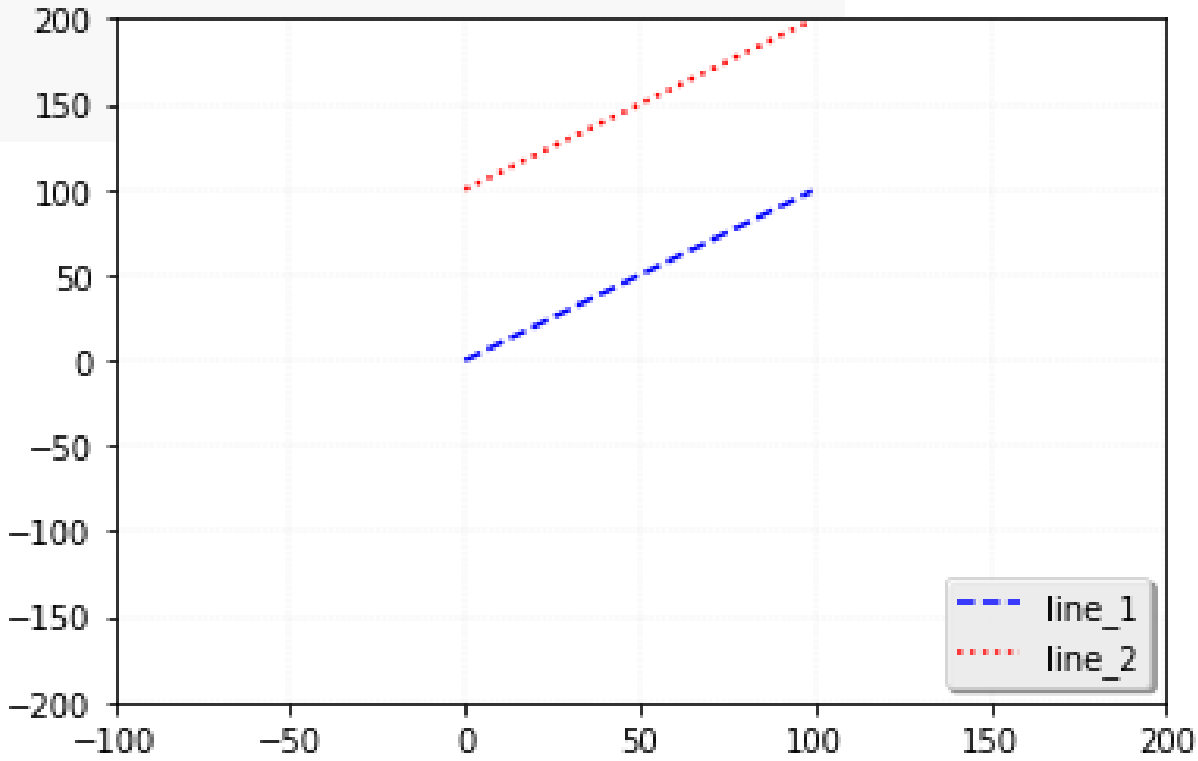
```
plt.plot(X_1, Y_1, color="b", linestyle="dashed", label='line_1')
plt.plot(X_2, Y_2, color="r", linestyle="dotted", label='line_2')
plt.legend(shadow=True, fancybox=True, loc="lower right")
```



Set grid & xylim

- Graph 보조선을 긋는 grid와 xy축 범위 한계를 지정

```
plt.grid(True, lw=0.4, ls="--", c=".90")
plt.xlim(-100, 200)
plt.ylim(-200, 200)
```

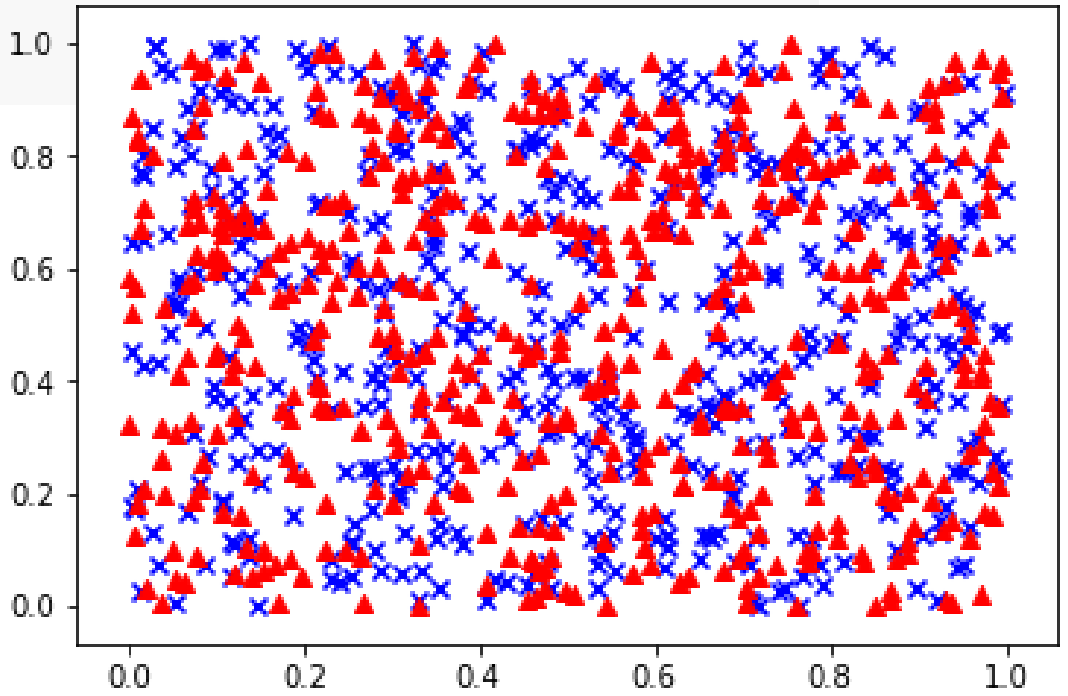


Matplotlib Graph

Scatter

- scatter 함수 사용, marker: scatter 모양지정

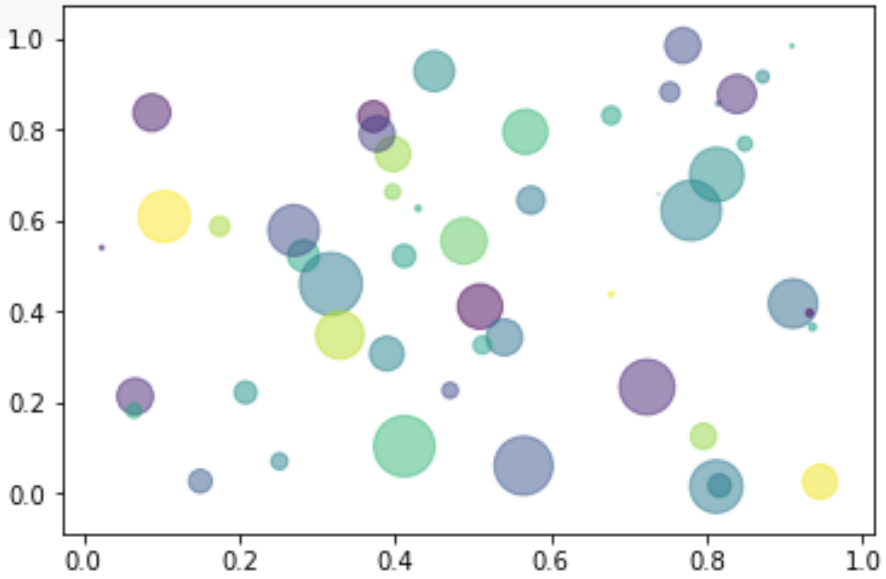
```
data_1 = np.random.rand(512, 2)
data_2 = np.random.rand(512, 2)

plt.scatter(data_1[:,0], data_1[:,1], c="b", marker="x")
plt.scatter(data_2[:,0], data_2[:,1], c="r", marker="^")

plt.show()
```



Scatter

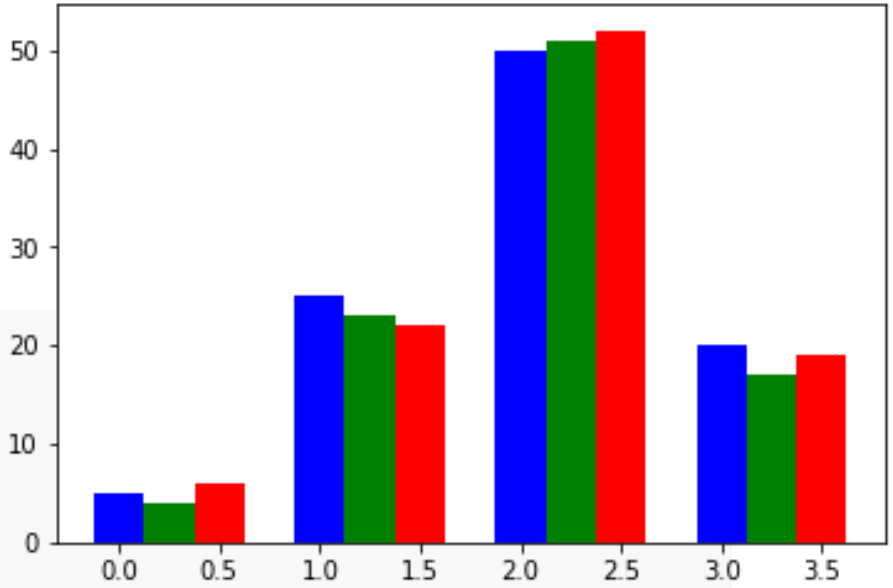
- s: 데이터의 크기를 지정, 데이터의 크기비교가능

```
N = 50
x = np.random.rand(N)
y = np.random.rand(N)
colors = np.random.rand(N)
area = np.pi * (15 * np.random.rand(N))**2
plt.scatter(x, y, s=area, c=colors, alpha=0.5)
plt.show()
```



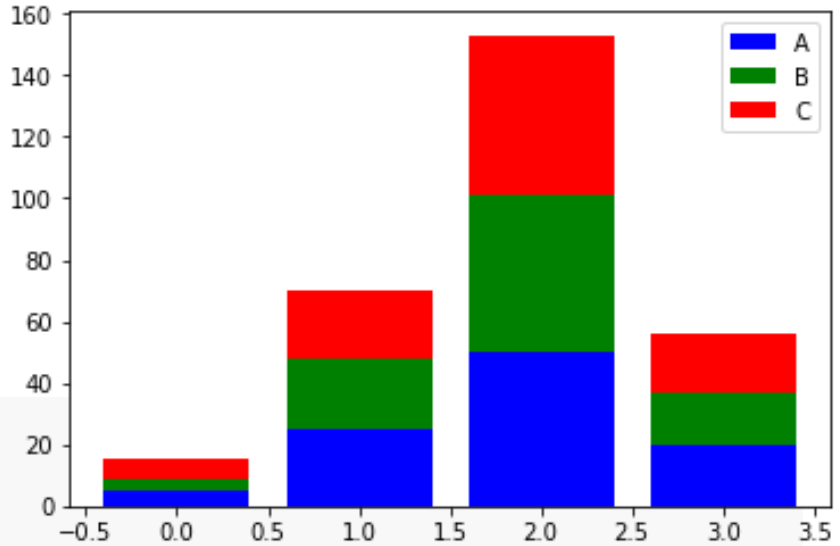
Bar chart

- Bar 함수 사용




```
data = [[5., 25., 50., 20.],
        [4., 23., 51., 17],
        [6., 22., 52., 19]]

X = np.arange(4)
plt.bar(X + 0.00, data[0], color = 'b', width = 0.25)
plt.bar(X + 0.25, data[1], color = 'g', width = 0.25)
plt.bar(X + 0.50, data[2], color = 'r', width = 0.25)
plt.xticks(X+0.25, ("A","B","C", "D"))
plt.show()
```

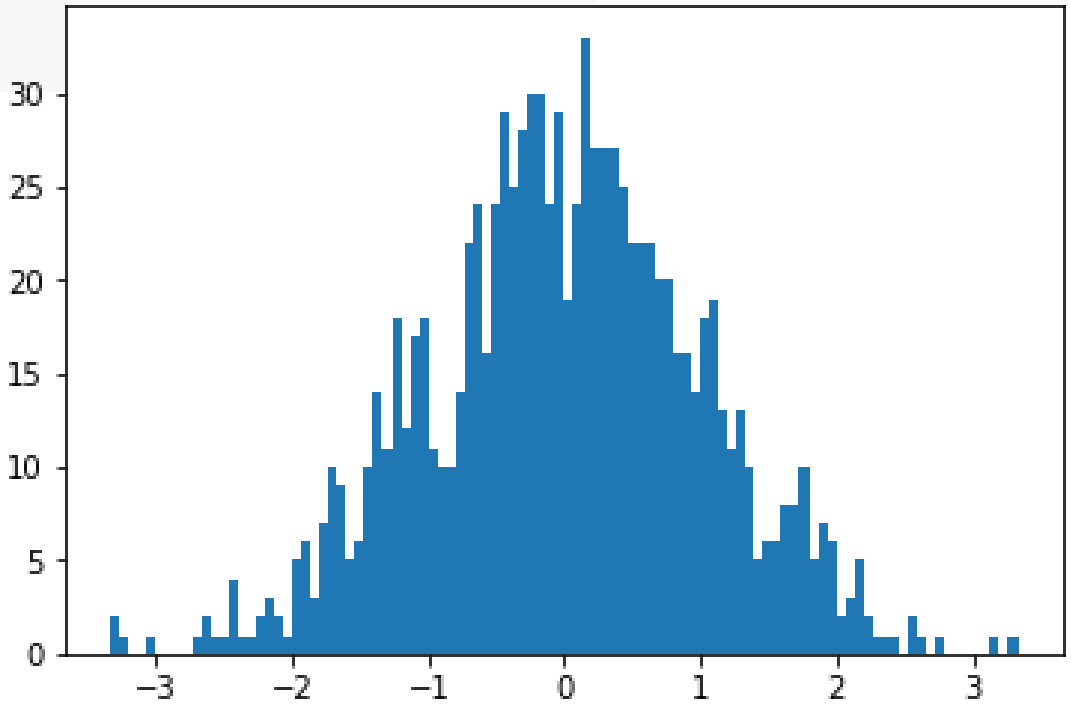
Bar chart




```
color_list = ['b', 'g', 'r']
data_label = ["A","B","C"]
X = np.arange(data.shape[1])
for i in range(data.shape[0]):
    plt.bar(X, data[i], bottom = np.sum(data[:i], axis=0),
            color = color_list[i], label=data_label[i])
plt.legend()
plt.show()
```

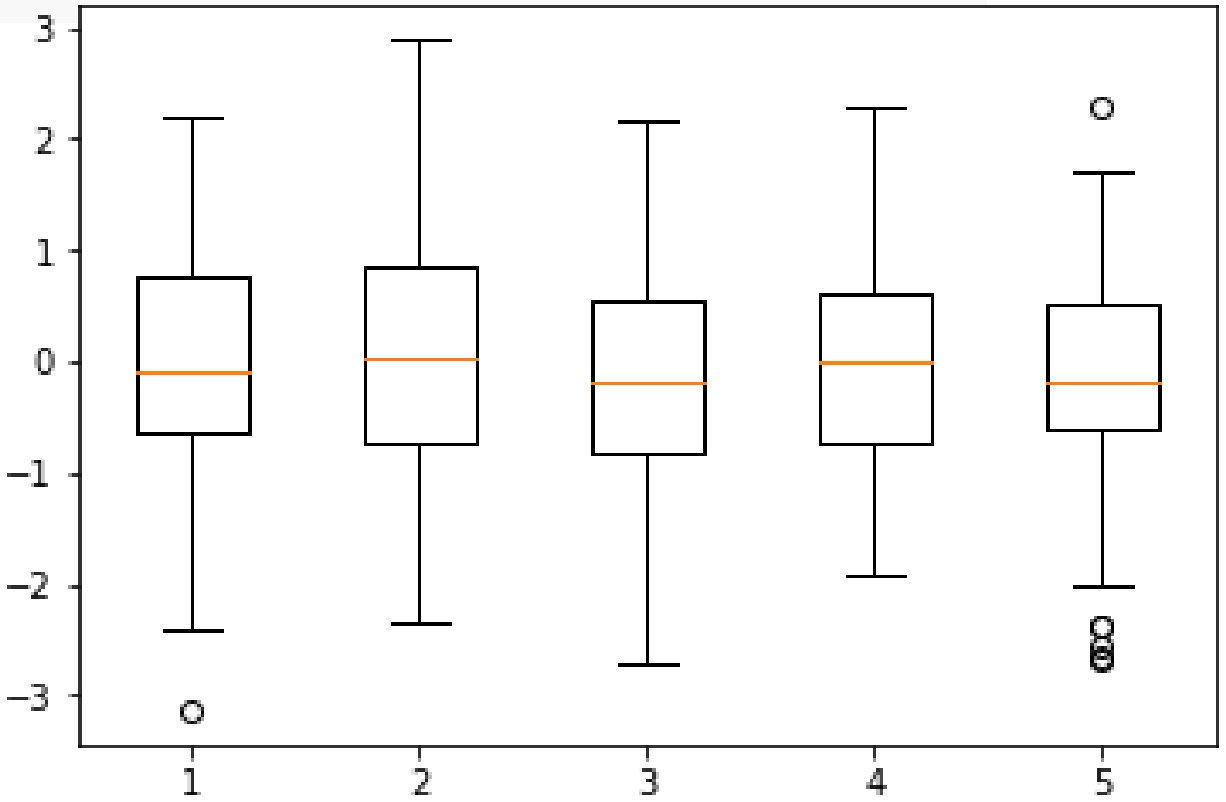
histogram

```
X = np.random.randn(1000)
plt.hist(X,bins=100)
plt.show()
```



boxplot

```
data = np.random.randn(100,5)
plt.boxplot(data)
plt.show()
```



matplotlib with pandas

pandas matplotlib

- matplotlib를 사용한 그래프 지원
- Dataframe, series별로 그래프 작성 가능

	CRIM	ZN	INDUS	CHAS	NOX	RM	AGE	DIS	RAD	TAX	PTRATIO	B	LSTAT	MEDV
0	0.00632	18.0	2.31	0	0.538	6.575	65.2	4.0900	1	296.0	15.3	396.90	4.98	24.0
1	0.02731	0.0	7.07	0	0.469	6.421	78.9	4.9671	2	242.0	17.8	396.90	9.14	21.6
2	0.02729	0.0	7.07	0	0.469	7.185	61.1	4.9671	2	242.0	17.8	392.83	4.03	34.7
3	0.03237	0.0	2.18	0	0.458	6.998	45.8	6.0622	3	222.0	18.7	394.63	2.94	33.4
4	0.06905	0.0	2.18	0	0.458	7.147	54.2	6.0622	3	222.0	18.7	396.90	5.33	36.2

Boston House Price Dataset

X 변수
13개

Y 변수

[01] CRIM	자치시(town) 별 1인당 범죄율
[02] ZN	25,000 평방피트를 초과하는 거주지역의 비율
[03] INDUS	비소매상업지역이 점유하고 있는 토지의 비율
[04] CHAS	찰스강에 대한 더미변수(강의 경계에 위치한 경우는 1, 아니면 0)
[05] NOX	10ppm 당 농축 일산화질소
[06] RM	주택 1가구당 평균 방의 개수
[07] AGE	1940년 이전에 건축된 소유주택의 비율
[08] DIS	5개의 보스턴 직업센터까지의 접근성 지수
[09] RAD	방사형 도로까지의 접근성 지수
[10] TAX	10,000 달러 당 재산세율
[11] PTRATIO	자치시(town)별 학생/교사 비율
[12] B	1000(Bk-0.63)^2, 여기서 Bk는 자치시별 흑인의 비율을 말함.
[13] LSTAT	모집단의 하위계층의 비율(%)
[14] MEDV	본인 소유의 주택가격(중앙값) (단위: $1,000)

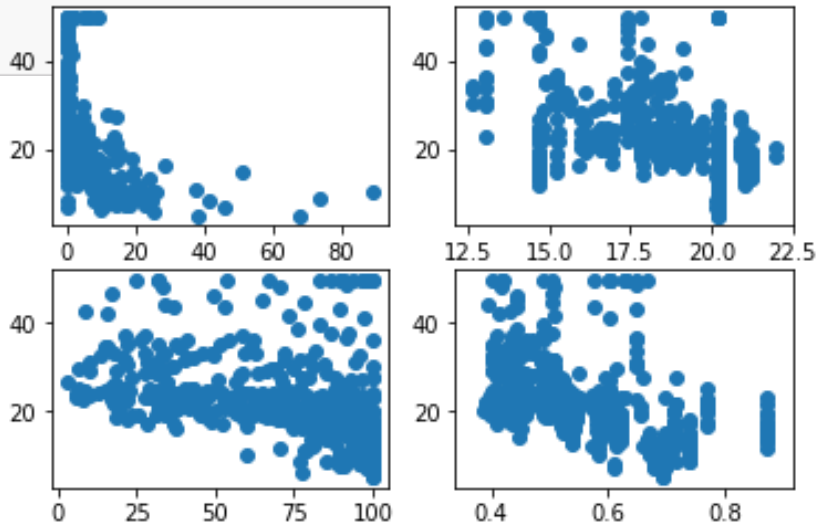
http://www.dator.co.kr/ctg258/textyle/1721307

http://www.cs.toronto.edu/~delve/data/boston/bostonDetail.html

pandas matplotlib

- 데이터간의 상관관계를 볼 때 scatter graph 사용 가능

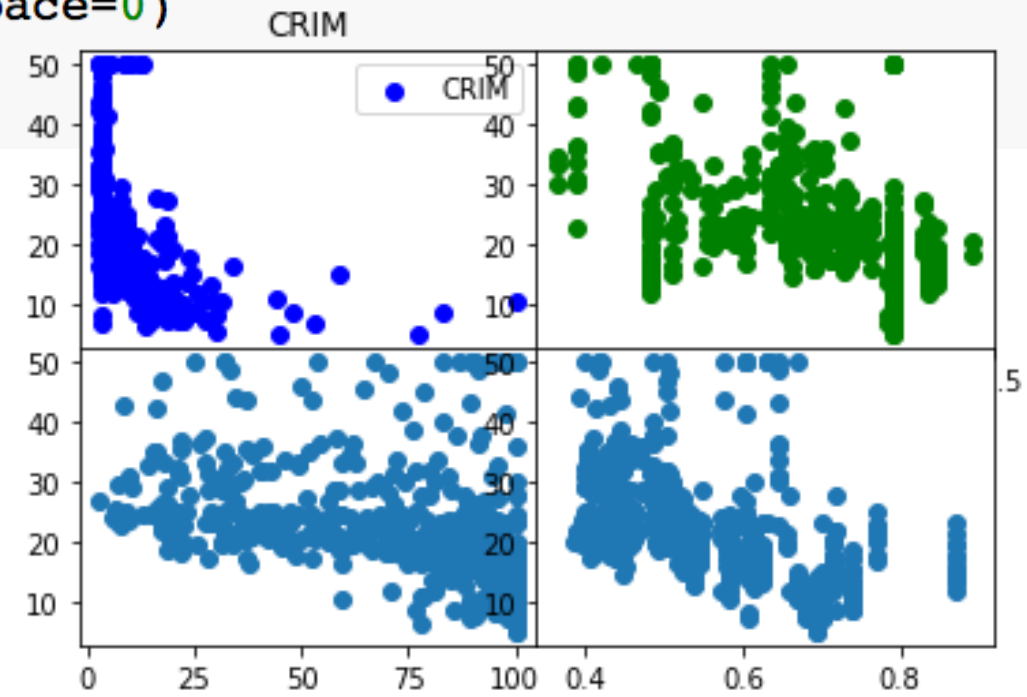
```
fig = plt.figure()
ax = []
for i in range(1,5):
    ax.append(fig.add_subplot(2,2,i))
ax[0].scatter(df_data["CRIM"], df_data["MEDV"])
ax[1].scatter(df_data["PTRATIO"], df_data["MEDV"])
ax[2].scatter(df_data["AGE"], df_data["MEDV"])
ax[3].scatter(df_data["NOX"], df_data["MEDV"])
plt.show()
```



pandas matplotlib

- matplotlib의 꾸미기 함수 그대로 사용함

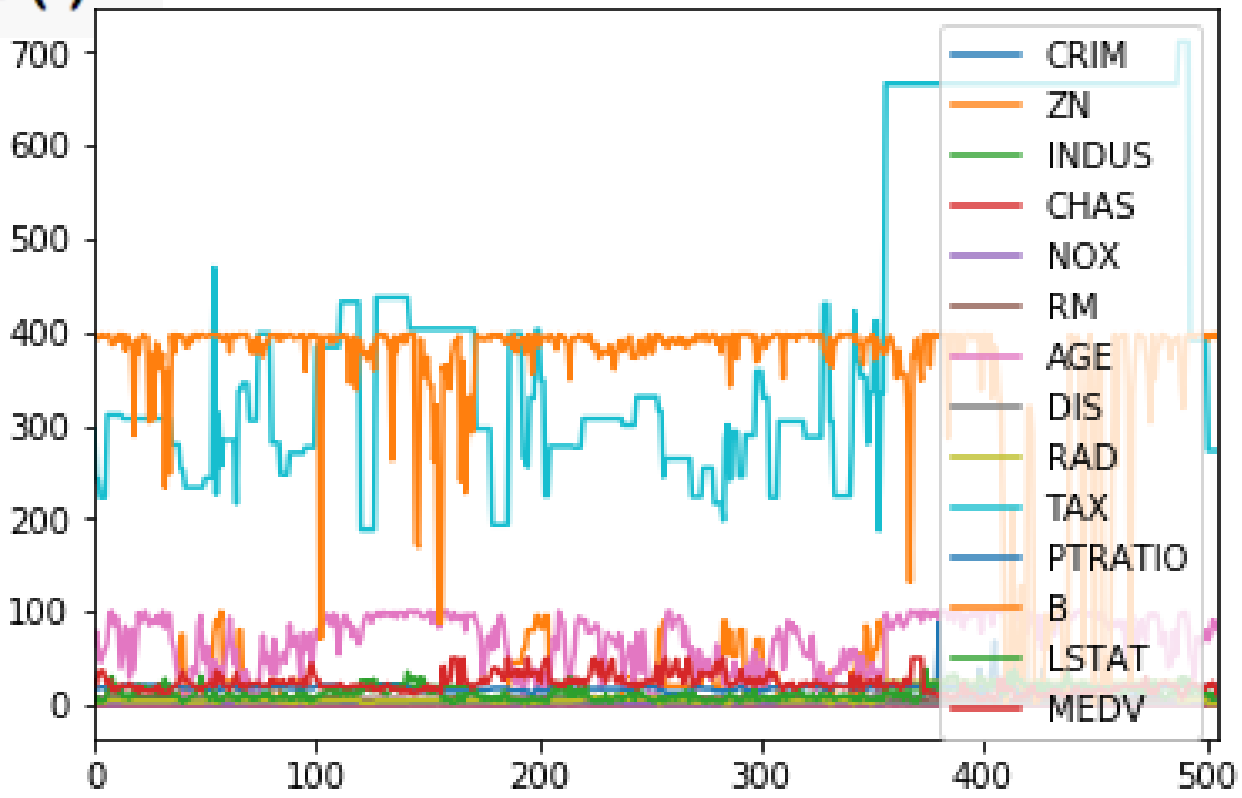
```
ax[0].scatter(df_data["CRIM"], df_data["MEDV"], color="b", label="CRIM")
ax[1].scatter(df_data["PTRATIO"], df_data["MEDV"], color="g"  )
ax[2].scatter(df_data["AGE"], df_data["MEDV"] )
ax[3].scatter(df_data["NOX"], df_data["MEDV"])
plt.subplots_adjust(wspace=0, hspace=0)
ax[0].legend()
ax[0].set_title("CRIM")
```



pandas matplotlib - plot function

- plot 함수를 사용하면 전체 데이터의 graph를 그림

```
df_data.plot()
```



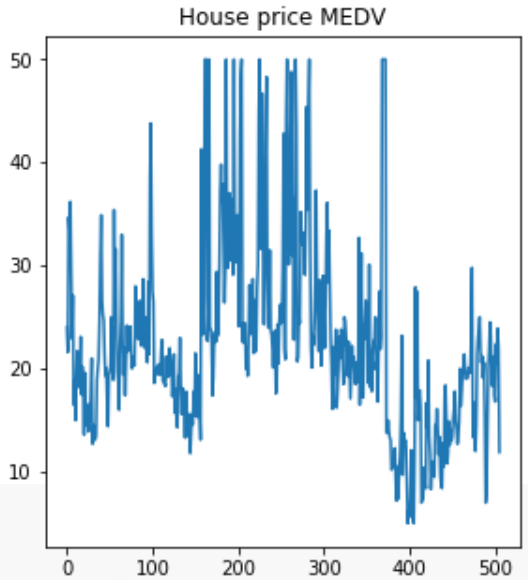
pandas matplotlib - plot function

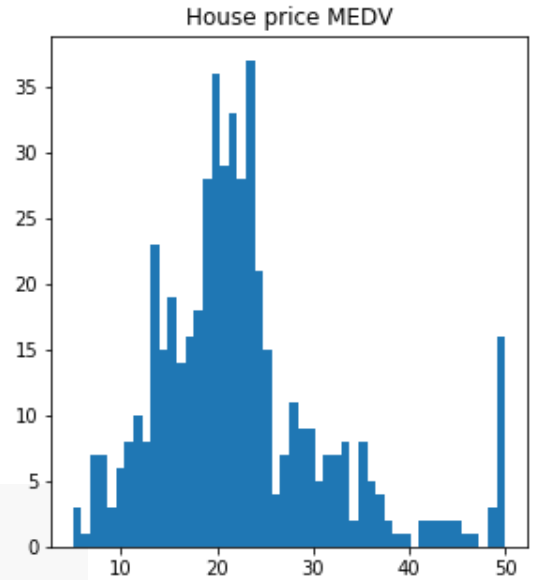
- kind : plot 종류
- x : x축 컬럼
- y : y축 컬럼

```
import matplotlib.pyplot as plt
import pandas as pd

df.plot(kind='scatter',x='num_children',y='num_pets',color='red')
plt.show()
```

http://queirozf.com/entries/pandas-dataframe-plot-examples-with-matplotlib-pyplot

pandas matplotlib

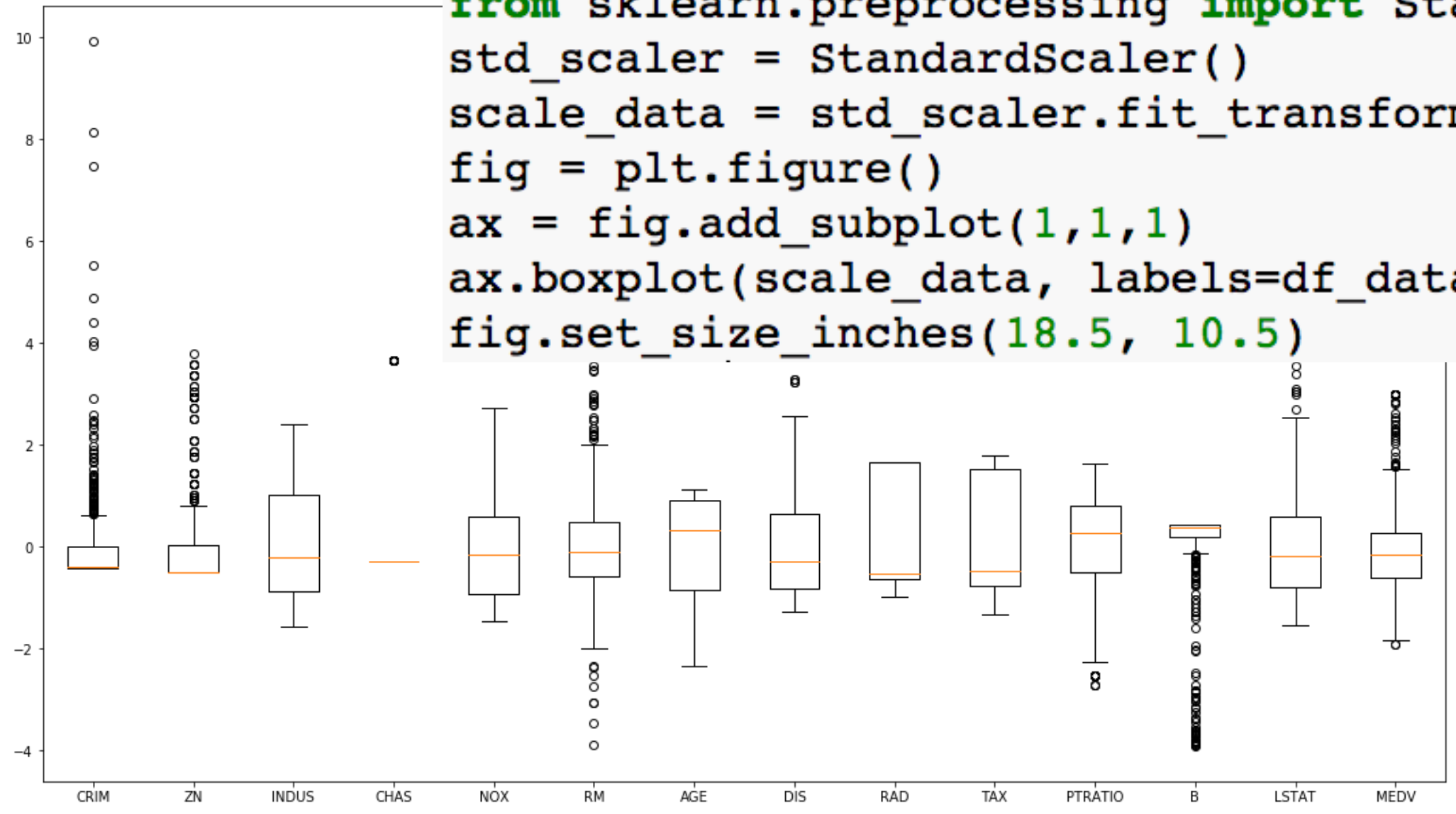





```
fig = plt.figure()
fig.set_size_inches(10,5)
ax_1 = fig.add_subplot(1,2,1)
ax_2 = fig.add_subplot(1,2,2)
ax_1.plot(df_data["MEDV"])
ax_2.hist(df_data["MEDV"], bins=50)
ax_1.set_title("House price MEDV")
ax_2.set_title("House price MEDV")
```

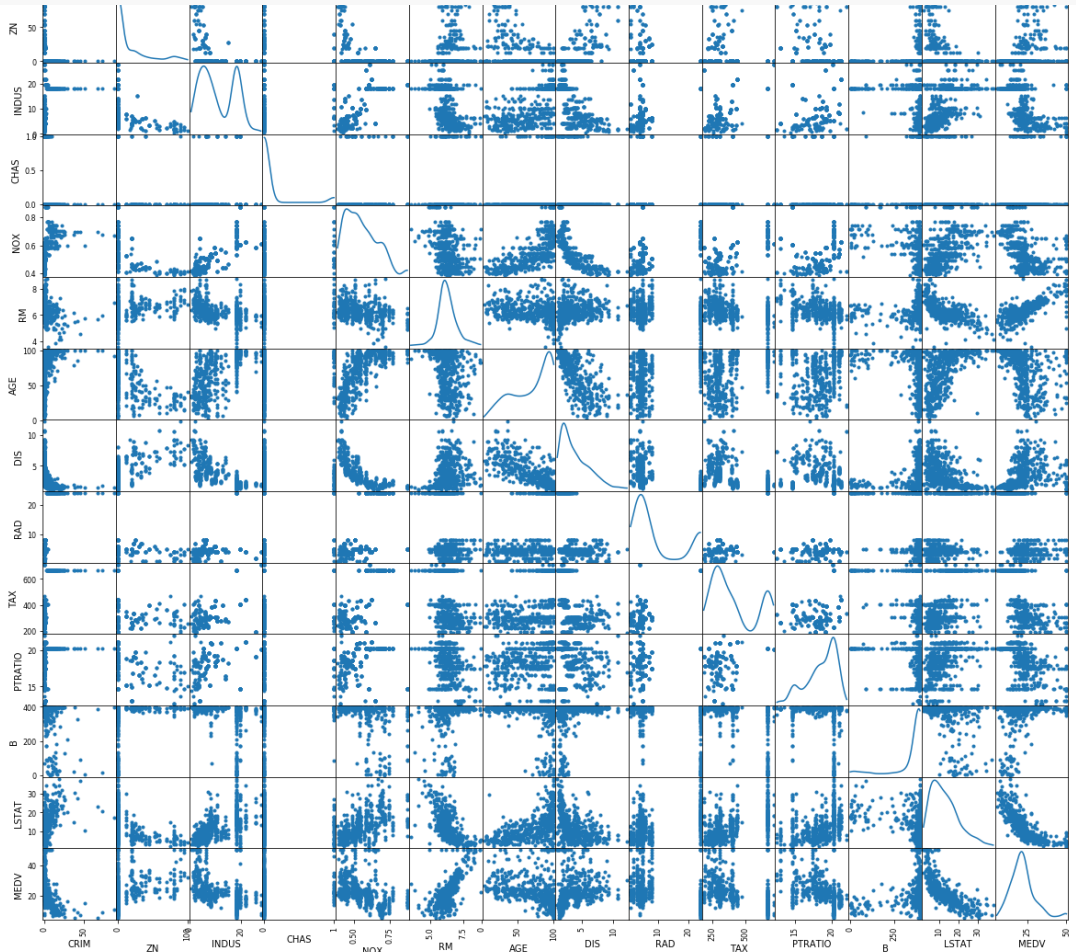
Scaled boxplot

```
from sklearn.preprocessing import StandardScaler
std_scaler = StandardScaler()
scale_data = std_scaler.fit_transform(df_data)
fig = plt.figure()
ax = fig.add_subplot(1,1,1)
ax.boxplot(scale_data, labels=df_data.columns)
fig.set_size_inches(18.5, 10.5)
```



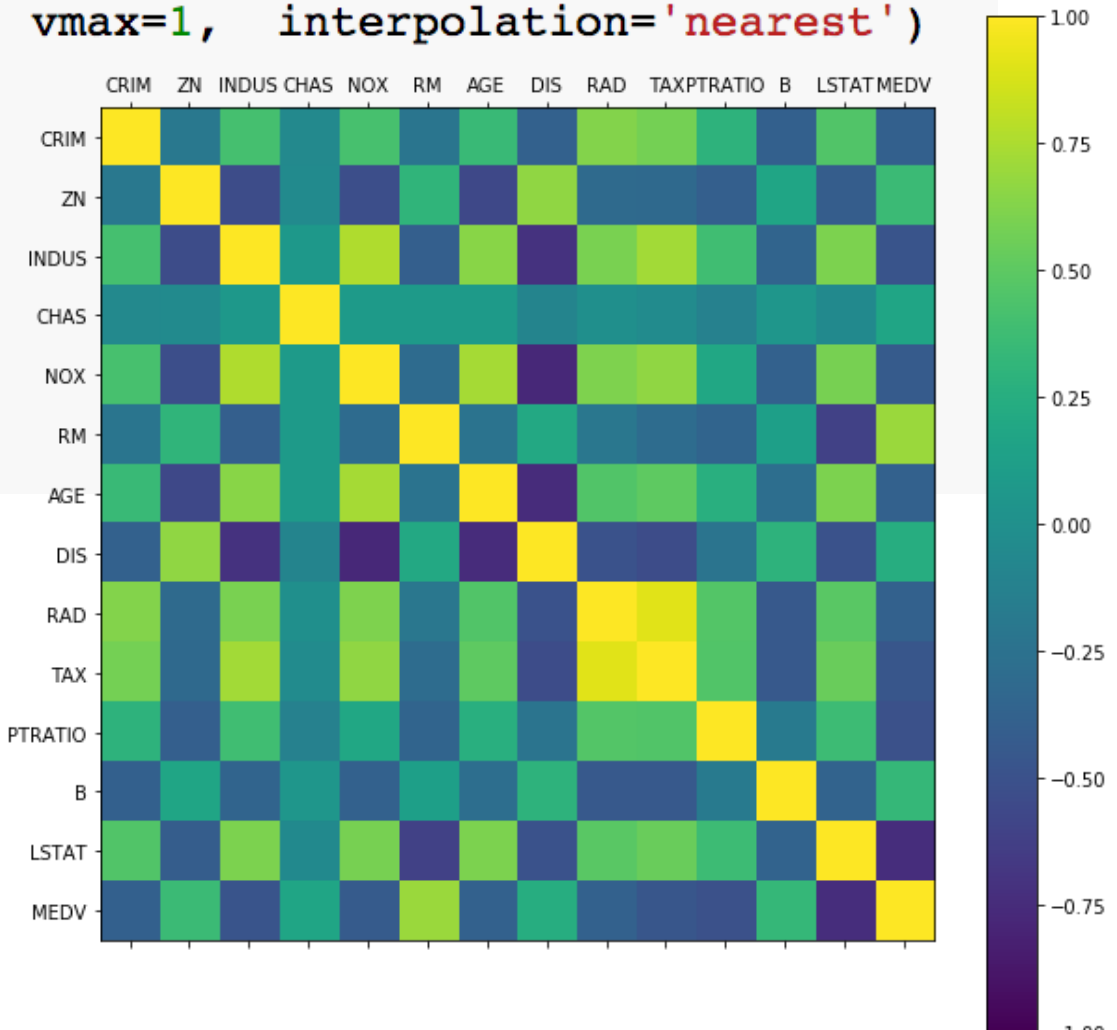
Scatter matrix

```
pd.scatter_matrix(df_data, diagonal="kde", alpha=1,  figsize=(20, 20))
plt.show()
```



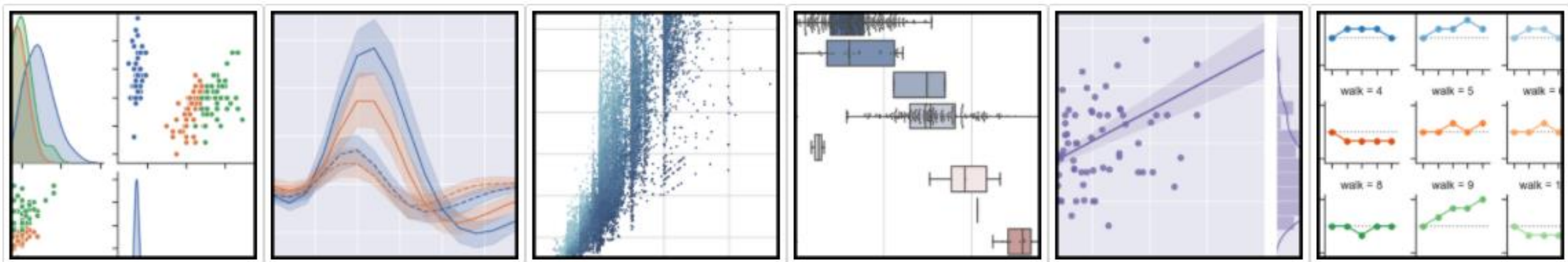
Scatter matrix

```
fig = plt.figure()
ax = fig.add_subplot(111)
cax = ax.matshow(corr_data, vmin=-1, vmax=1,  interpolation='nearest')
fig.colorbar(cax)
fig.set_size_inches(10,10)
ticks= np.arange(0,14,1)
ax.set_xticks(ticks)
ax.set_yticks(ticks)

ax.set_xticklabels(df_data.columns)
ax.set_yticklabels(df_data.columns)
```



seaborn

seaborn: statistical data visualization



Matplotlib를 더 쉽게!

seaborn

- 기존 matplotlib에 기본 설정을 추가
- 복잡한 그래프를 간단하게 만들 수 있는 wrapper
- 간단한 코드 + 예쁜 결과

seaborn

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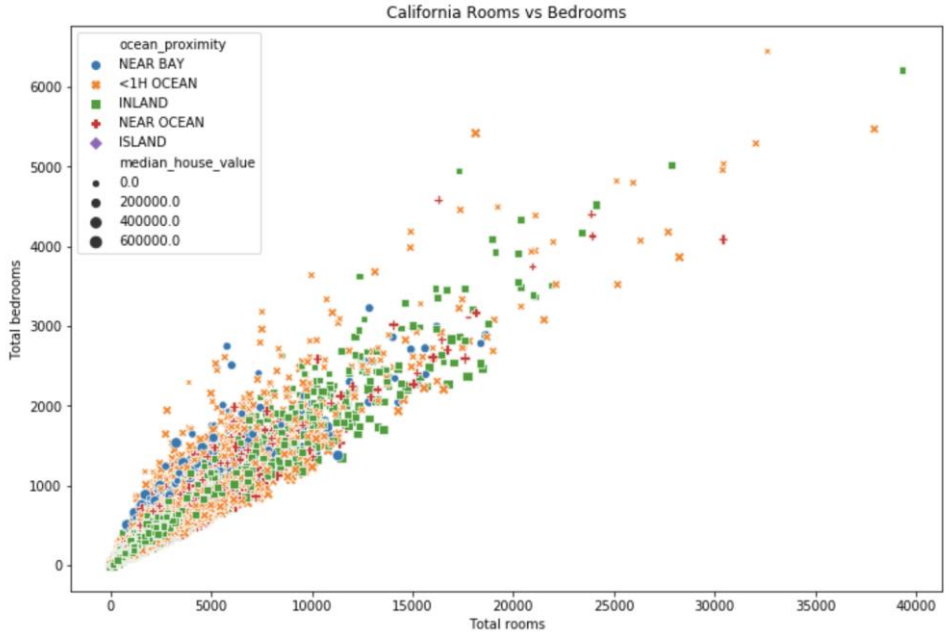
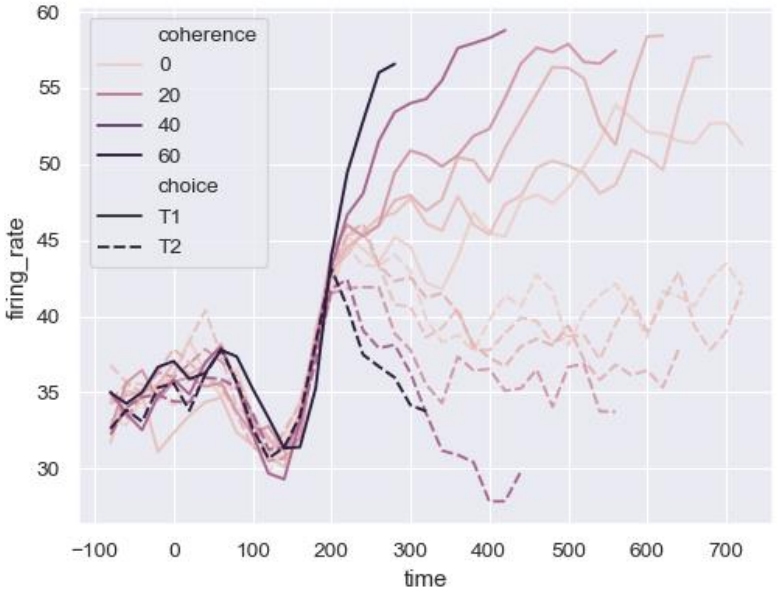




seaborn - basic plots

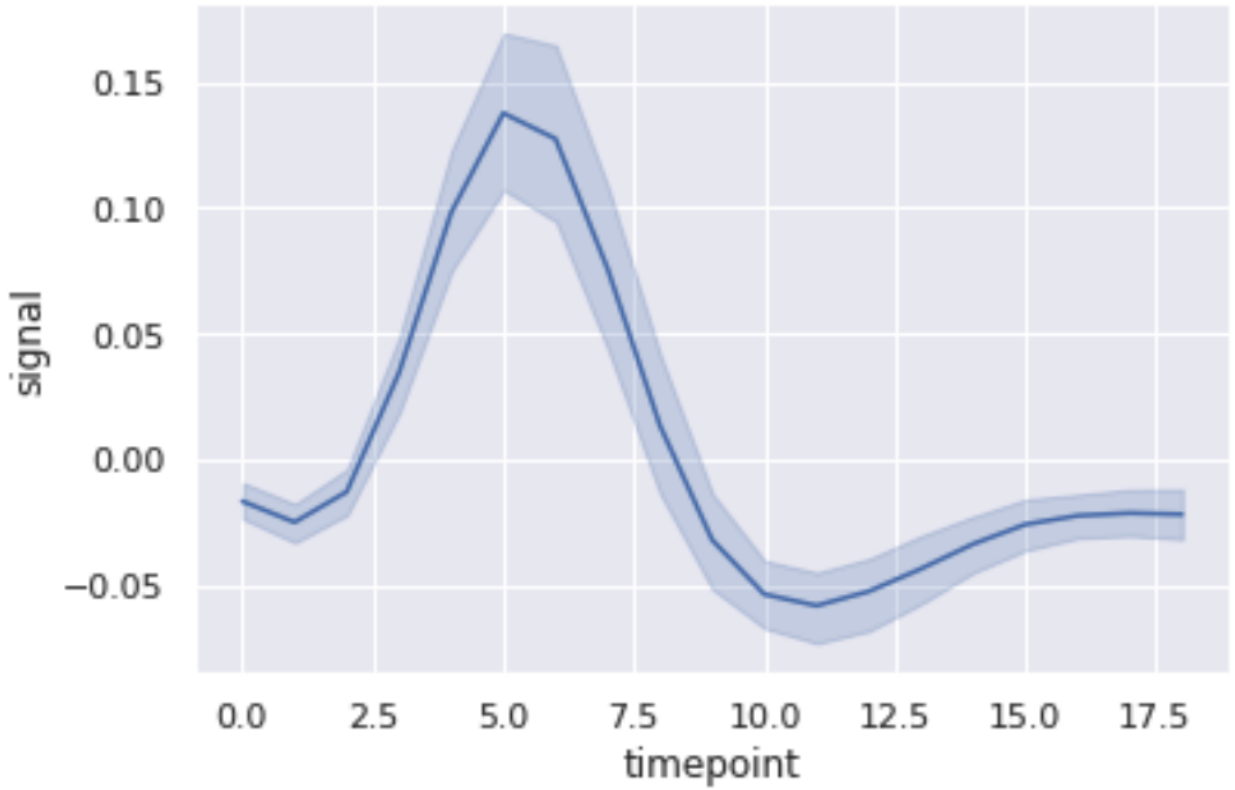
- matplotlib와 같은 기본적인 plot
- 손쉬운 설정으로 데이터 산출
- lineplot, scatterplot, countplot 등

```
sns.lineplot(x="total_bill", y="tip", data=tips)
```

seaborn - basic plots

```
1  # Plot the responses for different events and regions
2  sns.lineplot(x="timepoint", y="signal", data=fmri)
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x1a23af3278>
```



seaborn - basic plots

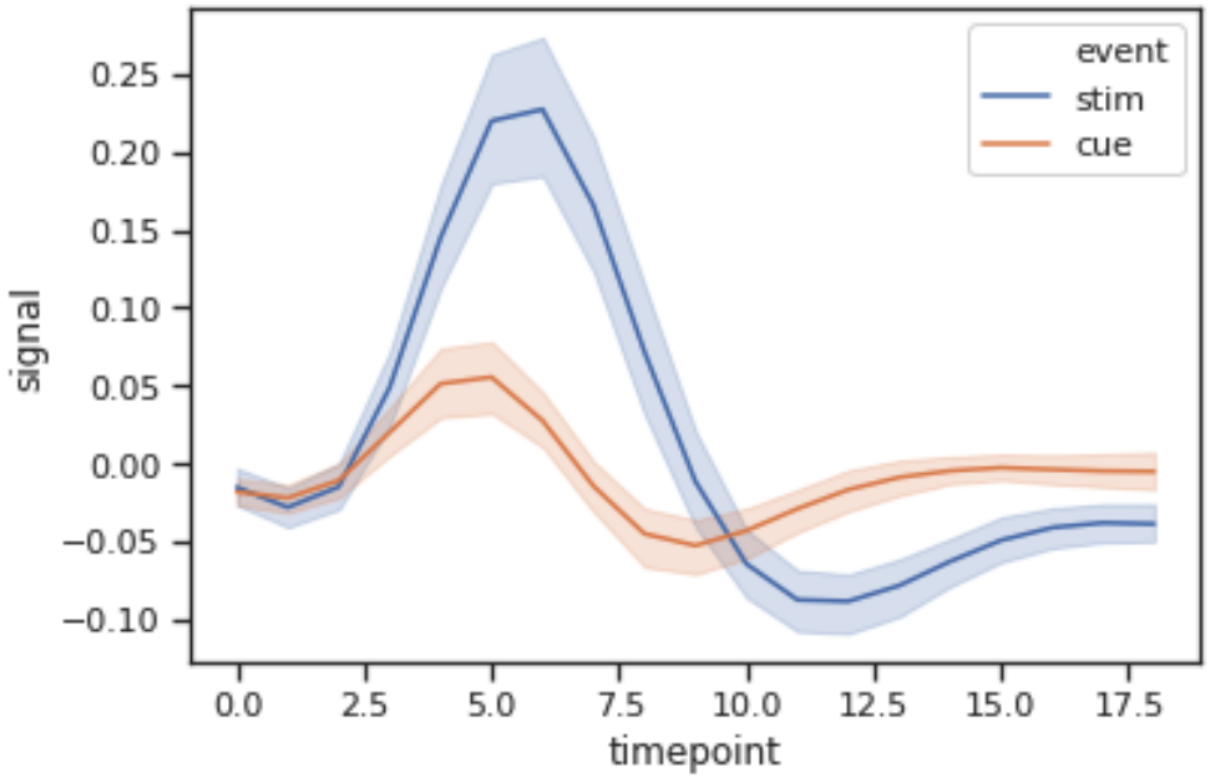
```
1 fmri.sample(n=10, random_state=1)
```

	subject	timepoint	event	region	signal
806	s6	18	cue	parietal	0.019532
691	s5	15	cue	frontal	-0.019507
148	s5	8	stim	parietal	0.006805
676	s13	0	cue	parietal	-0.018394
156	s11	7	stim	parietal	0.254042
27	s1	17	stim	parietal	-0.038021
200	s11	4	stim	parietal	0.087175
262	s3	0	stim	parietal	-0.008576
94	s4	12	stim	parietal	-0.090036
339	s4	5	stim	frontal	0.455575

seaborn - basic plots

```
1  sns.lineplot(x="timepoint", y="signal", hue="event", data=fmri)
```

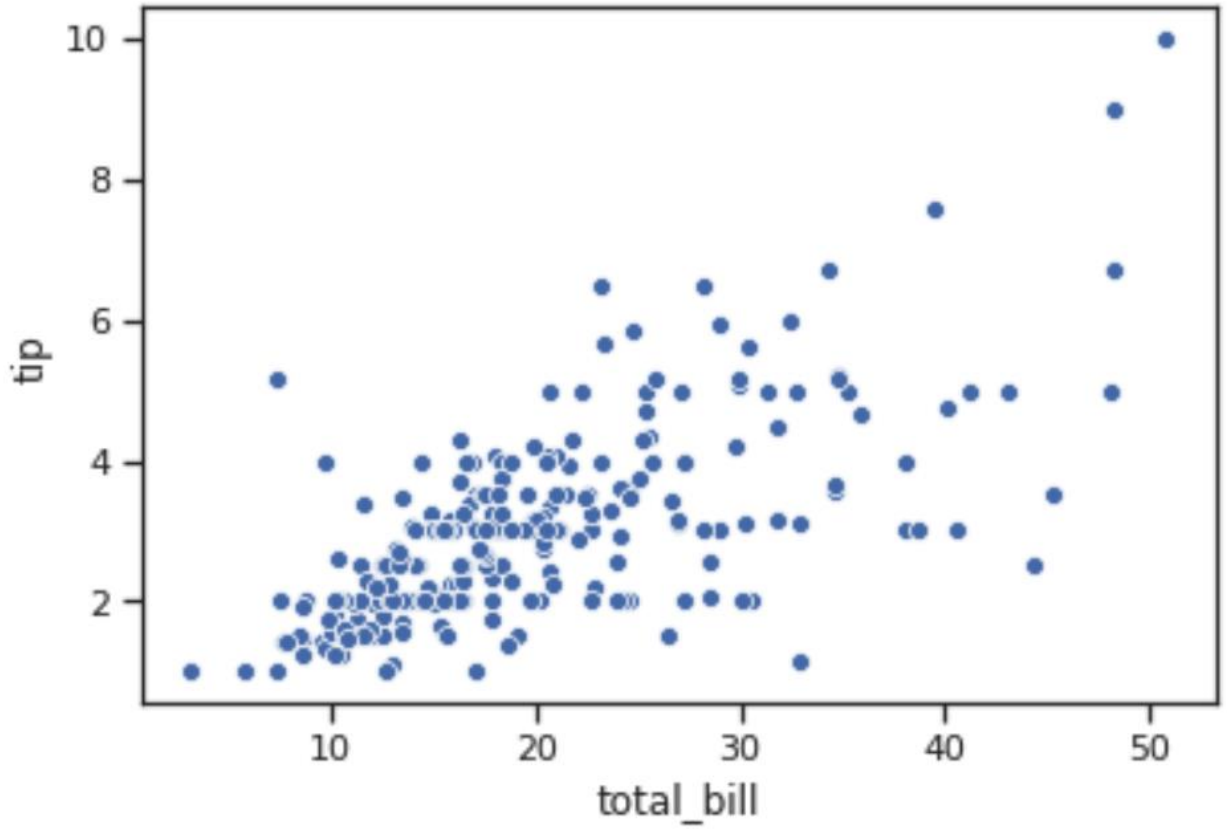
```
<matplotlib.axes._subplots.AxesSubplot at 0x1a24a1bac8>
```



seaborn - basic plots

```
1  sns.scatterplot(x="total_bill", y="tip", data=tips)
```

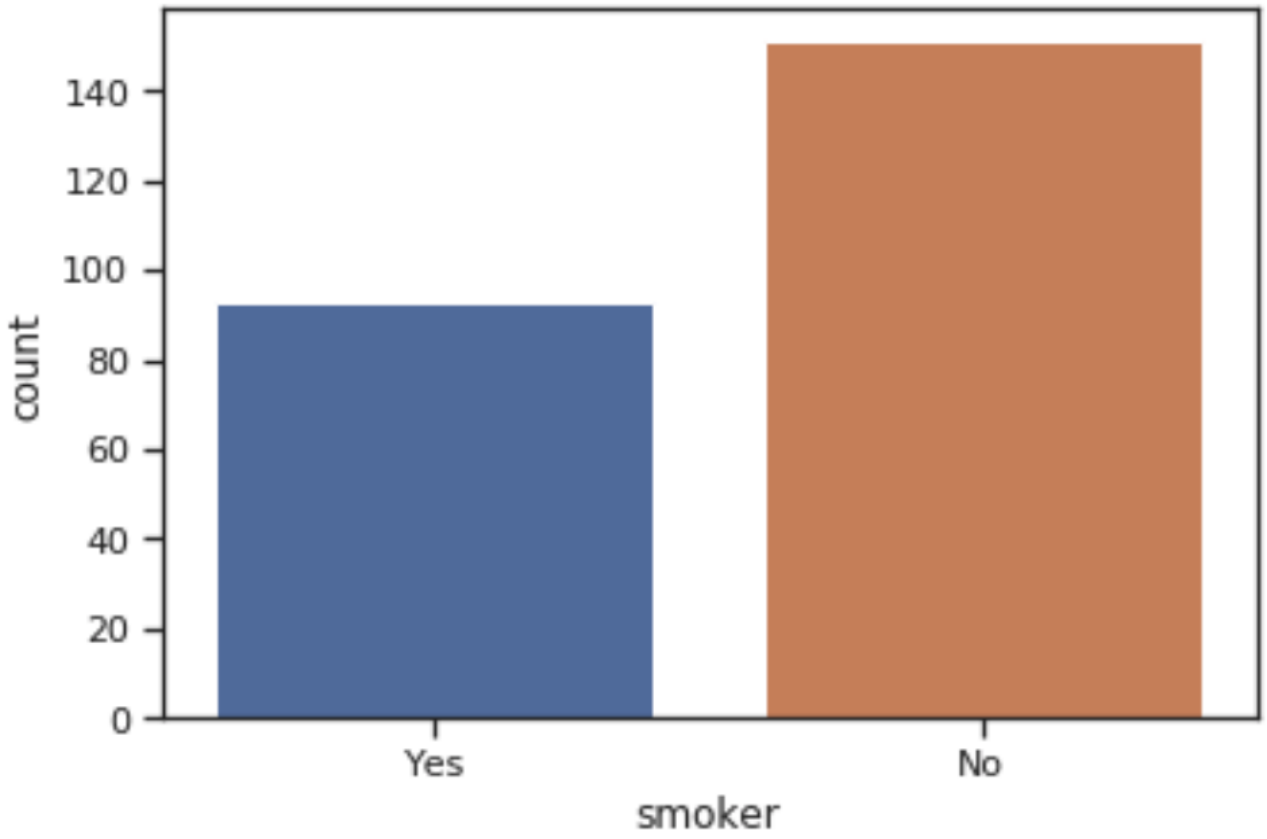
```
<matplotlib.axes._subplots.AxesSubplot at 0x1a25d37e10>
```



seaborn - basic plots

```
1  sns.countplot(x="smoker",data=tips)
```

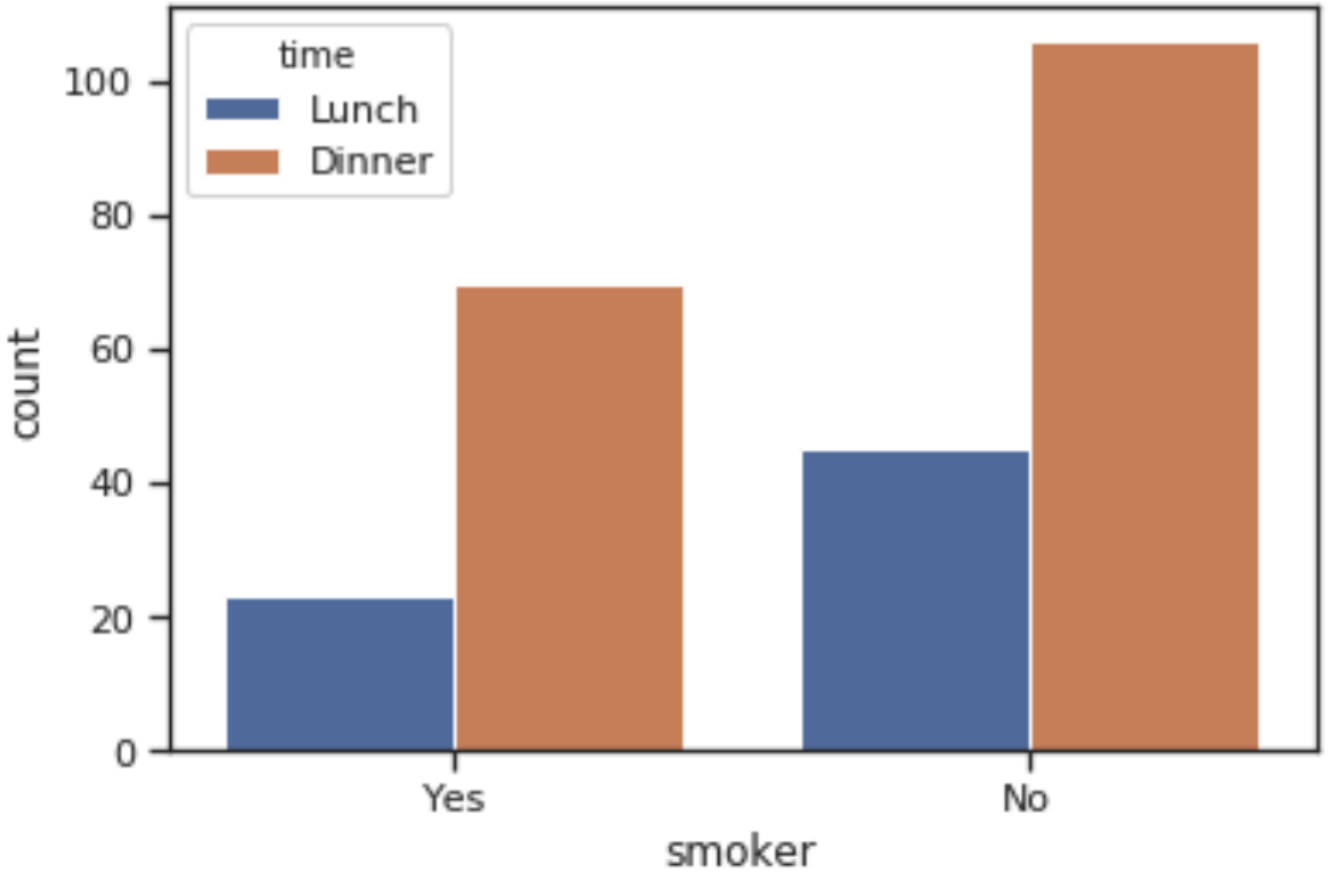
```
<matplotlib.axes._subplots.AxesSubplot at 0x1a257d4eb8>
```



seaborn - basic plots

```
1  sns.countplot(x="smoker", hue="time", data=tips)
```

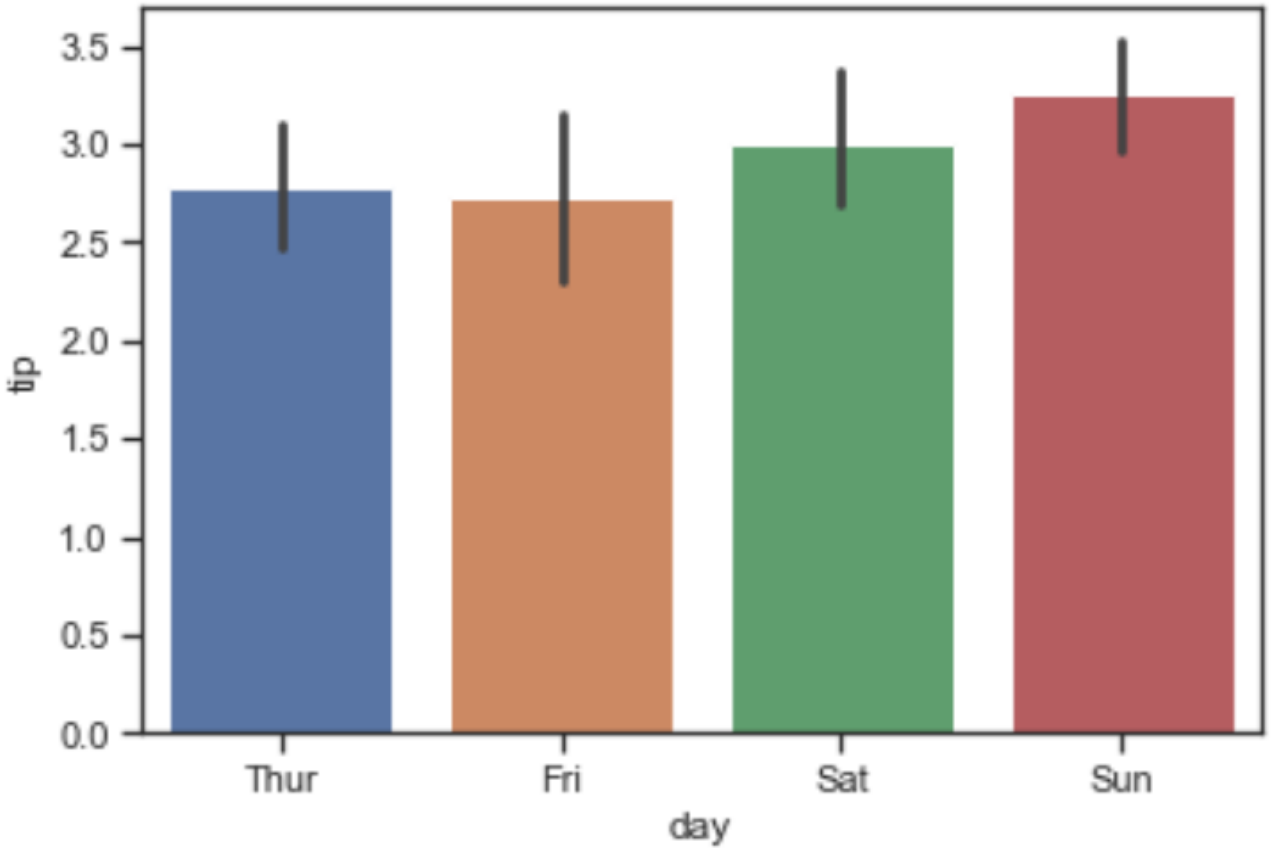
```
<matplotlib.axes._subplots.AxesSubplot at 0x1a24ef6d30>
```



seaborn - basic plots

```
sns.barplot(x="day", y="tip", data=tips)
```

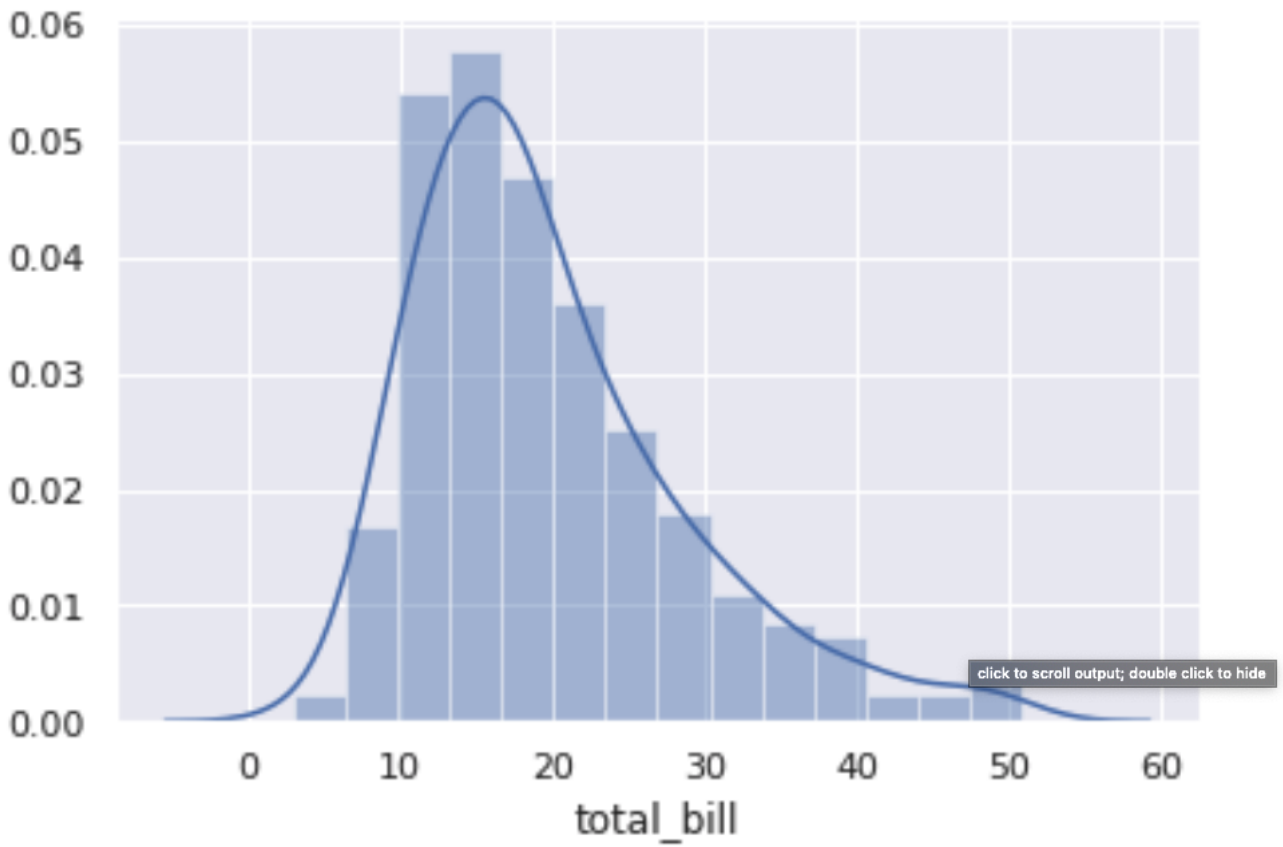
```
<matplotlib.axes._subplots.AxesSubplot at 0x171688f9c08>
```



seaborn - basic plots

```
1  sns.set(style="darkgrid")
2  sns.distplot(tips["total_bill"])
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x1a26db24a8>
```



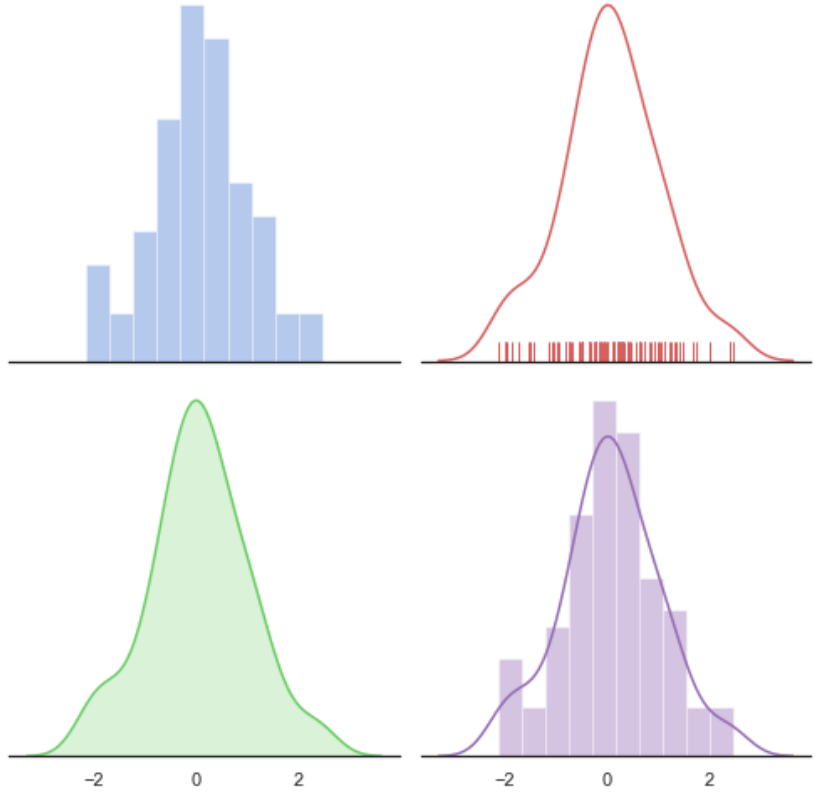
seaborn – predefined plots

- Viloinplot – boxplot에 distribution을 함께표현
- Stripplot – scatter와 category 정보를 함께 표현
- Swarmplot – 분포와 함께 scatter를 함께 표현
- Pointplot – categor별로 numeri의 평균, 신뢰구간 표시
- regplot – scatter + 선형함수를 함께 표시

seaborn - mutliple plots

- 한 개이상의 도표를 하나의 plot에 작성
- Axes를 사용해서 grid를 나누는 방법

```
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt

sns.set(style="white", palette="muted", color_codes=True)
rs = np.random.RandomState(10)

f, axes = plt.subplots(2, 2, figsize=(7, 7), sharex=True)
sns.despine(left=True)

d = rs.normal(size=100)

sns.distplot(d, kde=False, color="b", ax=axes[0, 0])
sns.distplot(d, hist=False, rug=True, color="r", ax=axes[0, 1])
sns.distplot(d, hist=False, color="g", kde_kws={"shade": True}, ax=axes[1, 0])
sns.distplot(d, color="m", ax=axes[1, 1])

plt.setp(axes, yticks=[])
plt.tight_layout()
```



seaborn – predefined mutliple plots

- replot – Numeric 데이터 중심의 분포 / 선형 표시
- catplot – category 데이터 중심의 표시
- FacetGrid – 특정 조건에 따른 다양한 plot을 grid로 표시
- pairplot – 데이터 간의 상관관계 표시
- lmplot – regression 모델과 category 데이터를 함께 표시

SAMSUNG

Data Science Academy