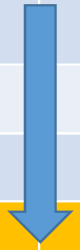
# 이웃회귀

# 회귀(Regression)

- 연속적인 숫자를 예측하는 것
- 변수 간의 관련성을 분석하여, 측정된 데이터로부터 예측 수행
- 독립변수로부터 수학식을 통하여 종속변수의 값을 추정

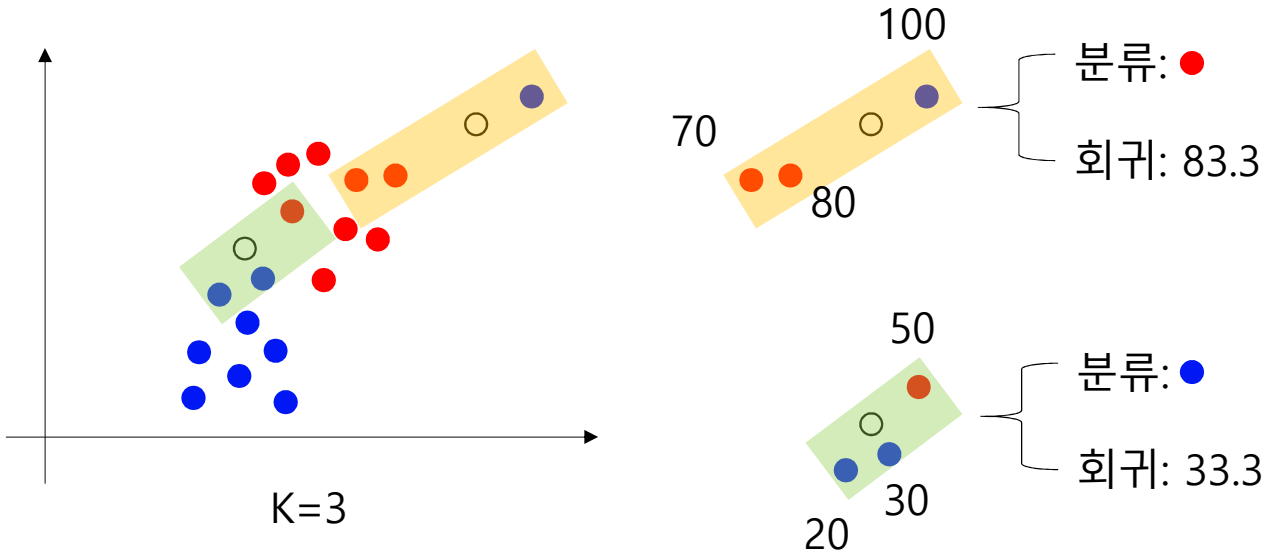
| 월 | 평균기온 | 선풍기 판매수 | 난방기 판매수 |
|---|---|---|---|
| 봄 | 12 | 80 | 50 |
| 여름 | 23 | 100 | 5 |
| 가을 | 13 | 50 | 70 |
| 겨울 | 1 | ? | ? |



독립변수 종속변수

# KNN 이웃회귀

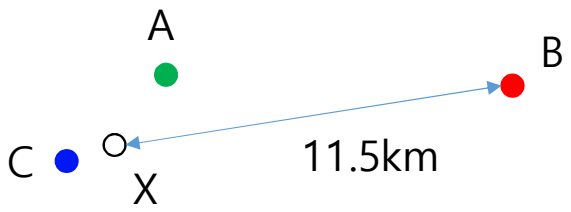
- KNN 분류와 유사하지만, 클래스를 결정하는 것이 아닌 임의의 값을 예측하는 문제
- 가장 가까운 이웃 K개의 점을 결정하여, 그들의 값들로부터 예측값을 계산 (ex, 평균)



# 단순회귀, 가중회귀

- 단순회귀: 가장 가까운 이웃들의 값들을 단순히 평균하여 추정하는 방식
- 가중회귀: 각 이웃이 얼마나 가까이 있는지에 따라 가중 평균을 구해 거리가 가까울수록 데이터가 더 유사할 것이라고 보고 가중치를 부여하는 방식

| 영화 | 리뷰점수 | 거리(km) |
|---|---|---|
| **A** | 5.0 | 3.2 |
| **B** | 6.8 | 11.5 |
| **C** | 9.0 | 1.1 |




X의 리뷰점수?

$$\frac{5.0 + 6.8 + 9.0}{1 + 1 + 1} = 6.9$$

단순회귀

$$\frac{\frac{5.0}{3.2} + \frac{6.8}{11.5} + \frac{9.0}{1.1}}{\frac{1}{3.2} + \frac{1}{11.5} + \frac{1}{1.1}} = 7.9$$

가중회귀

# 데이터셋

```python
import pandas as pd
data3 = pd.read_csv("data/health.csv")
h = data3[["H"]]
w = data3[["W"]]
# print("DataFrame", x.shape, y.shape)
# print(x); print("\n"); print(y)
# h = data3["H"]
# w = data3["W"]
# print("Series", x.shape, y.shape)
```

```
DataFrame (10, 1) (10, 1)
```

```
Series (10,) (10,)
```

health.csv


| | H |
|---|---|
| 0 | 130.1 |
| 1 | 120.5 |
| 2 | 127.3 |
| 3 | 122.9 |
| 4 | 126.0 |
| 5 | 152.8 |
| 6 | 155.9 |
| 7 | 158.5 |
| 8 | 156.6 |
| 9 | 150.1 |

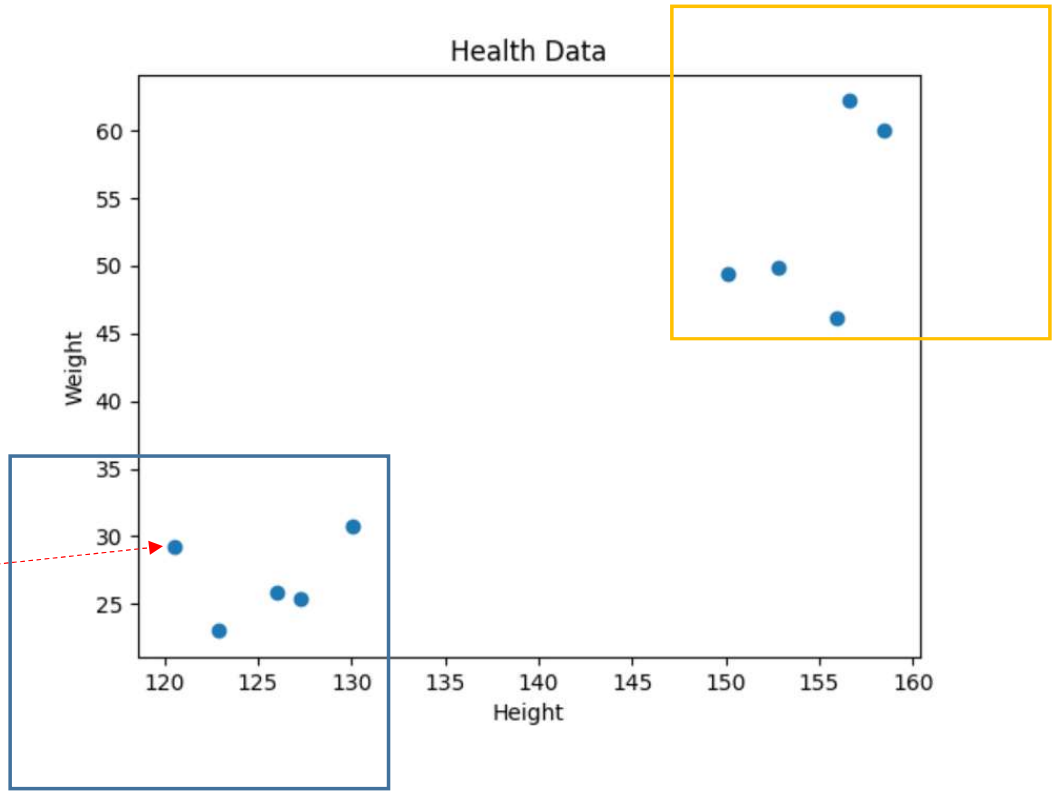
| | W |
|---|---|
| 0 | 30.7 |
| 1 | 29.2 |
| 2 | 25.4 |
| 3 | 23.0 |
| 4 | 25.8 |
| 5 | 49.9 |
| 6 | 46.2 |
| 7 | 60.0 |
| 8 | 62.2 |
| 9 | 49.4 |

# 데이터 시각화

```
import matplotlib.pyplot as plt
plt.scatter(h, w)
plt.xlabel("Height")
plt.ylabel("Weight")
plt.title("Health Data")
plt.show()
```

| | H |
|---|---|
| 0 | 130.1 |
| 1 | 120.5 |
| 2 | 127.3 |
| 3 | 122.9 |
| 4 | 126.0 |
| 5 | 152.8 |
| 6 | 155.9 |
| 7 | 158.5 |
| 8 | 156.6 |
| 9 | 150.1 |

| | W |
|---|---|
| 0 | 30.7 |
| 1 | 29.2 |
| 2 | 25.4 |
| 3 | 23.0 |
| 4 | 25.8 |
| 5 | 49.9 |
| 6 | 46.2 |
| 7 | 60.0 |
| 8 | 62.2 |
| 9 | 49.4 |




어른

어린이

# sklearn.neighbors.KneighborsRegressor

*class* sklearn.neighbors.KNeighborsRegressor(*n_neighbors=5, *, weights='uniform', algorithm='auto', leaf_size=30, p=2, metric='minkowski', metric_params=None, n_jobs=None*) [source]

Regression based on k-nearest neighbors.

```
>>> X = [[0], [1], [2], [3]]
>>> y = [0, 0, 1, 1]
>>> from sklearn.neighbors import KNeighborsClassifier
>>> neigh = KNeighborsClassifier(n_neighbors=3)
>>> neigh.fit(X, y)
KNeighborsClassifier(...)
>>> print(neigh.predict([[1.1]]))
[0]
>>> print(neigh.predict_proba([[0.9]]))
[[0.666... 0.333...]]
```

y: 클래스

```
>>> X = [[0], [1], [2], [3]]
>>> y = [0, 0, 1, 1]
>>> from sklearn.neighbors import KNeighborsRegressor
>>> neigh = KNeighborsRegressor(n_neighbors=2)
>>> neigh.fit(X, y)
KNeighborsRegressor(...)
>>> print(neigh.predict([[1.5]]))
[0.5]
```

y: 값

https://scikit-learn.org/stable/modules/generated/sklearn.neighbors.KNeighborsRegressor.html#sklearn.neighbors.KNeighborsRegressor

# 예측

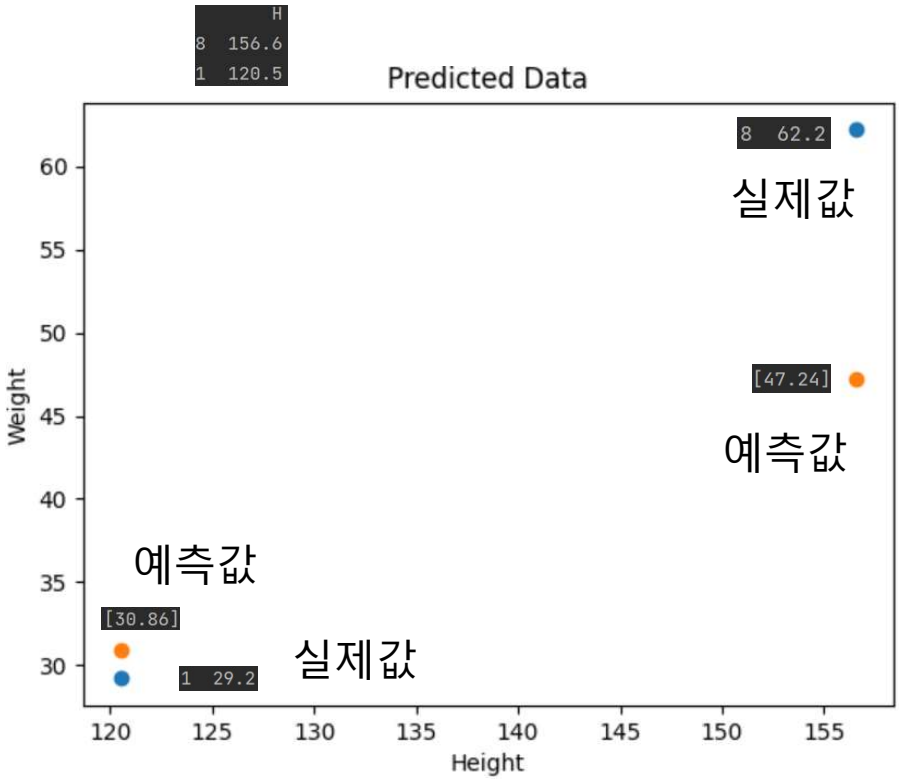
```
from sklearn.model_selection import train_test_split
train_data, test_data, train_target, test_target = train_test_split(
    h, w, test_size = 0.2, random_state = 42)

from sklearn.neighbors import KNeighborsRegressor
knr = KNeighborsRegressor()
knr.fit(train_data, train_target)
print("Train-Eval:", knr.score(train_data, train_target))
print("Test-Eval :", knr.score(test_data, test_target))
```

```
Train-Eval: 0.7913472691260918
Test-Eval : 0.5839169880624423
```

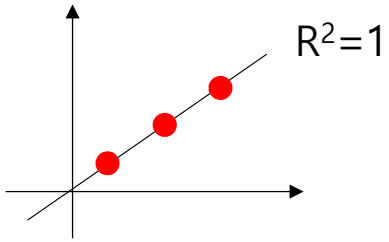
```
test_pred = knr.predict(test_data)
# print(test_data)
# print(test_target)
# print(test_pred)
import matplotlib.pyplot as plt
```

구현

```
plt.show()
```



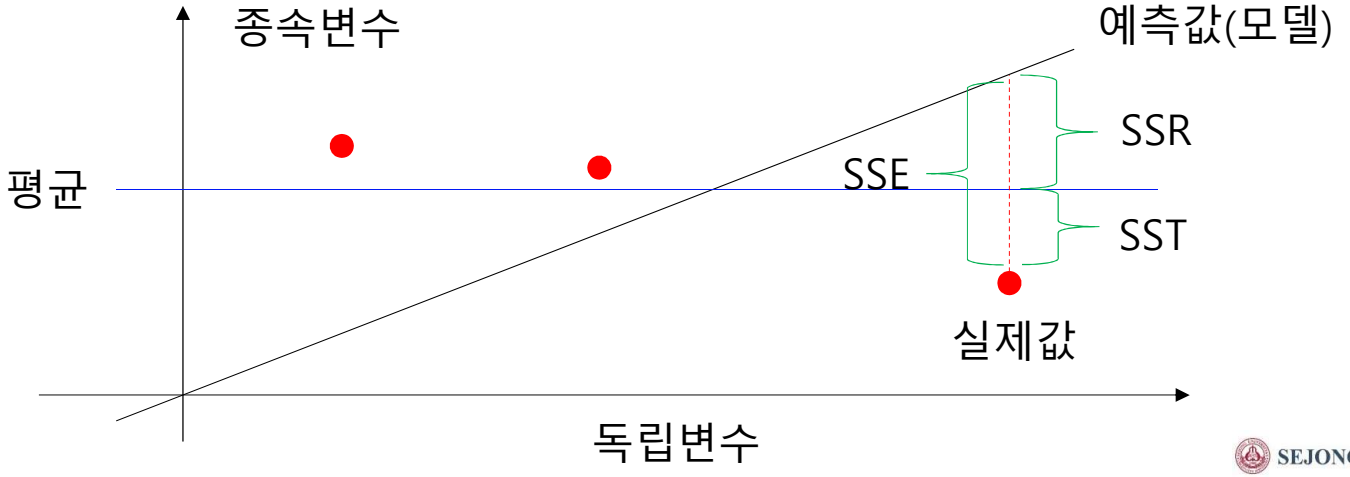
# 결정계수(Coefficient of Determination)



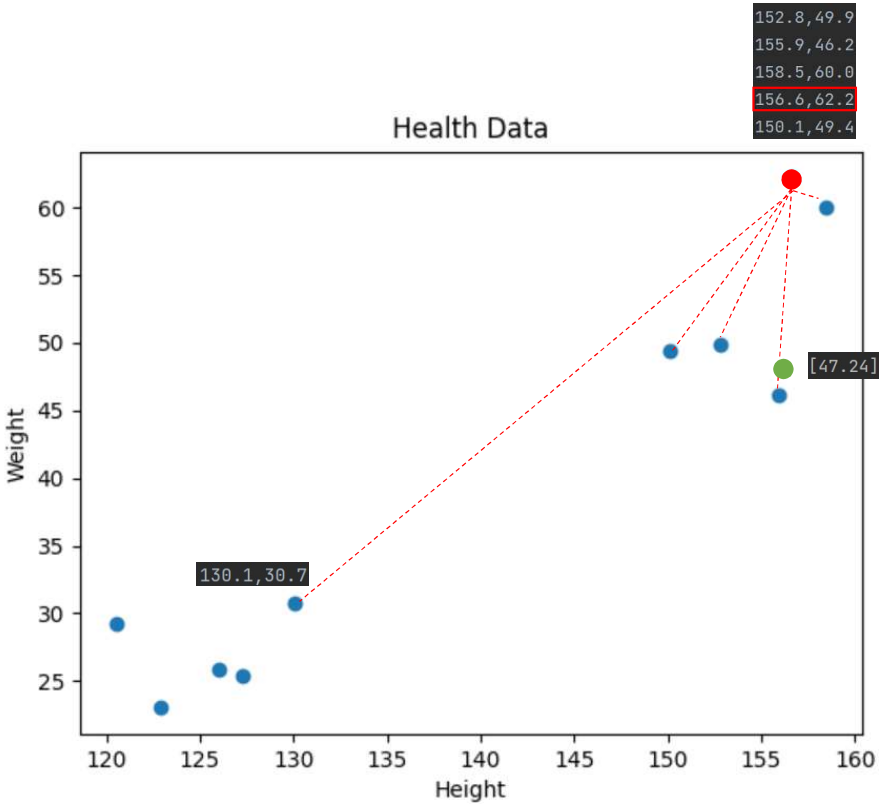

- 회귀 문제에서의 성능 측정 도구 (결정계수=$R^2$, $0 \le R^2 \le 1$)
- 독립변수로부터 설명 가능한 종속변수의 변동 비율
  - SST(Total Sum of Squares): 총 변동 (예측값에 대한 편차 제곱합)
  - SSE(Error Sum of Squares): 직선으로 설명 불가능한 변동 (예측값 오차에 대한 제곱합)
  - SSR(Regression Sum of Squares): 직선으로 설명 가능한 변동 (예측값과 평균값의 차이에 대한 제곱합)

$$R^2 = \frac{SSR}{SST} = 1 - \frac{SSE}{SST}$$

$$= 1 - \frac{\Sigma(\text{정답} - \text{예측})^2}{\Sigma(\text{정답} - \text{평균})^2}$$



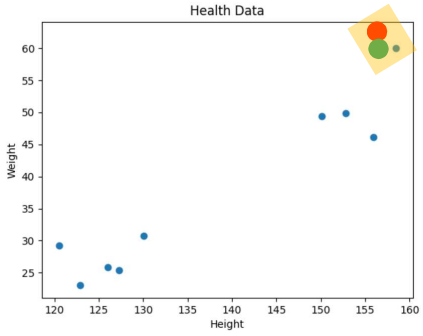
# 결과분석

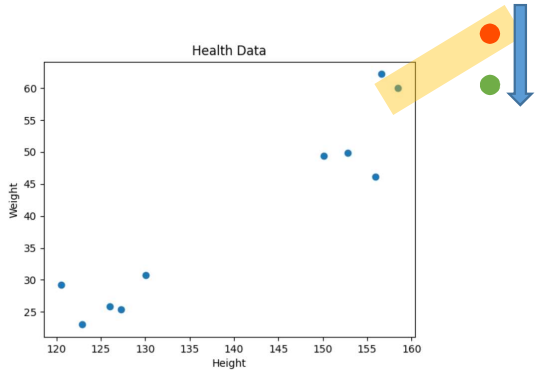



*class* sklearn.neighbors.KNeighborsRegressor(*n_neighbors=5*, **, weights='uniform', algorithm='auto', leaf_size=30, p=2, metric='minkowski', metric_params=None, n_jobs=None*) [source]

Regression based on k-nearest neighbors.

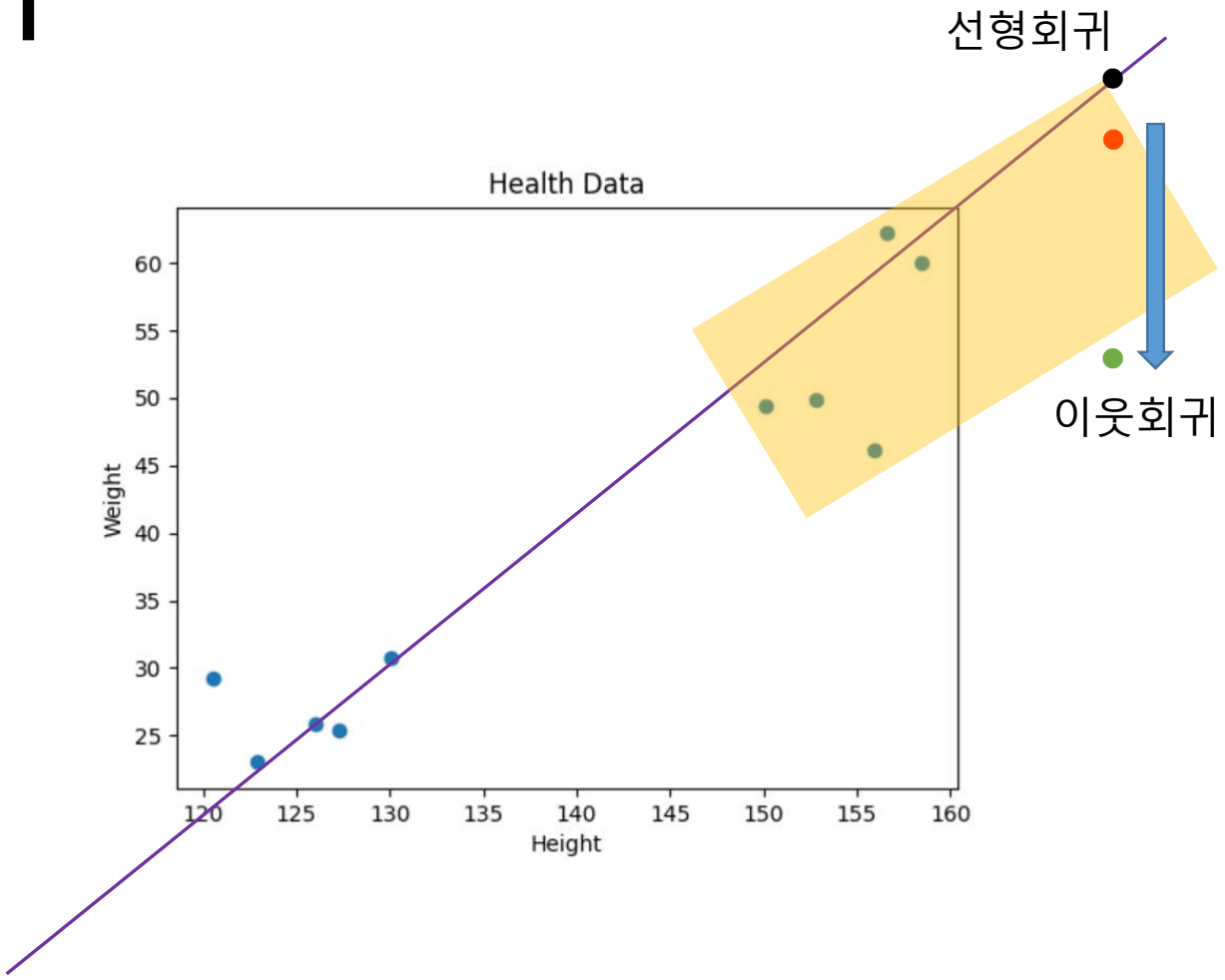
$$Pred = \frac{49.9 + 46.2 + 60.0 + 49.4 + 30.7}{5} = 47.24$$




K=1 경우, 문제점

# 선형회귀


선형회귀
이웃회귀
Health Data
Weight
Height
60
55
50
45
40
35
30
25
120
125
130
135
140
145
150
155
160

# 참고자료

- 지능기전공학부 최유경 교수님 자료, https://github.com/sejongresearch/2021.MachineLearning
- 코랩(Colab), https://colab.research.google.com/
- 파이썬(Python), https://www.python.org/doc/
- 사이킷런(sckit-learn), https://scikit-learn.org/stable/index.html
- 판다스(pandas), https://pandas.pydata.org/
- 맷플롯립(matplotlib), https://matplotlib.org/
- 씨본(seaborn), https://seaborn.pydata.org/
- 캐글(Kaggle), https://www.kaggle.com/
- 넘파이(numpy), https://numpy.org/doc/stable/
- 스택오퍼플러우(stackoverflow), https://stackoverflow.com/