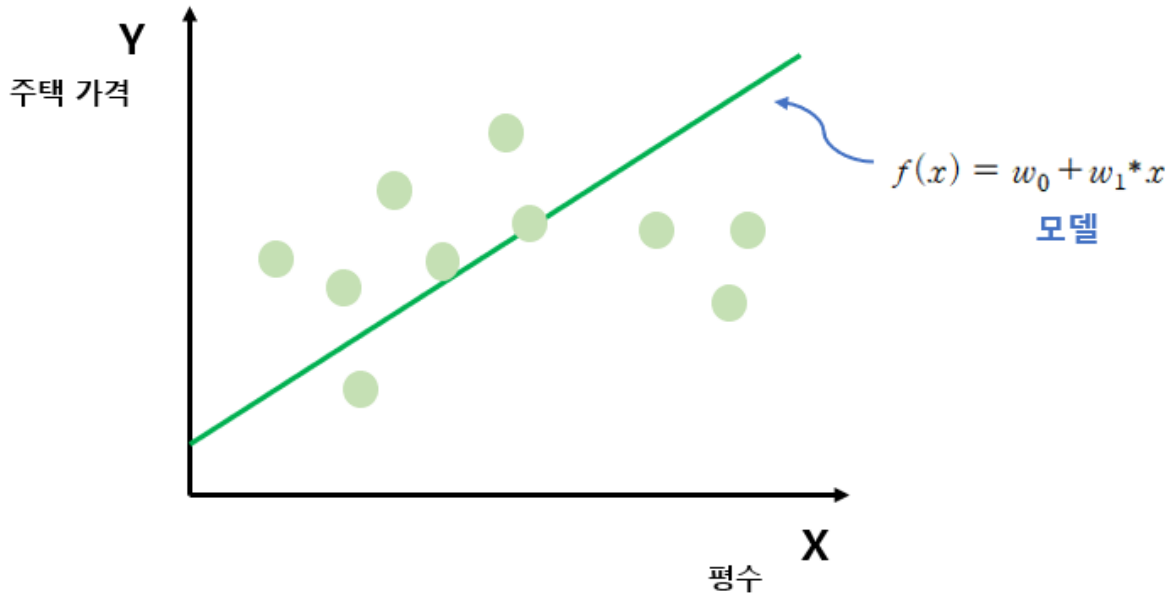
다항회귀

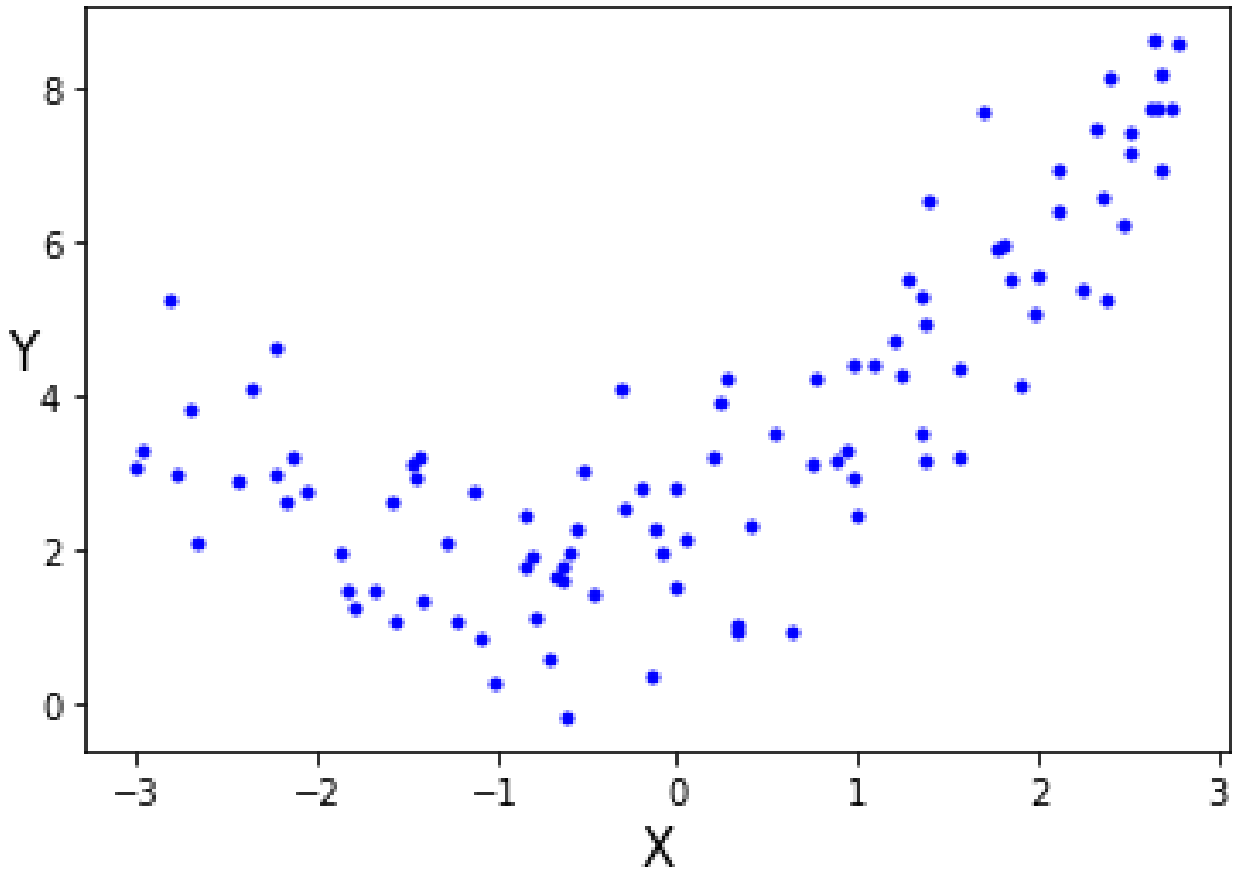
목차

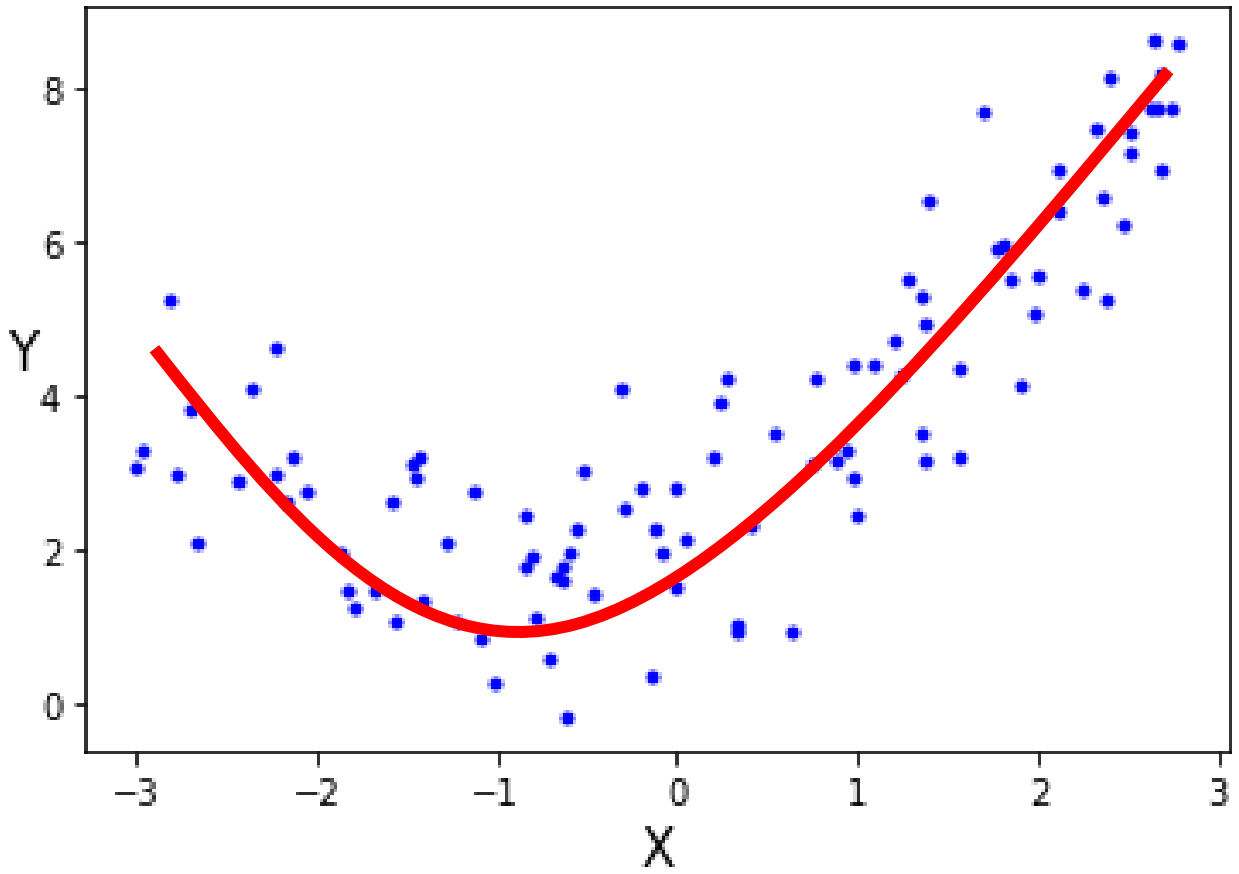
1. 다항회귀
2. 다항회귀 Overfitting

실제 값

$$Y_i = w_0 + w_1 * X_i \ldots Error_i$$




8
6
4
2
0
Y
−3
−2
−1
0
1
2
3
X


8
6
4
2
0
Y
−3
−2
−1
0
1
2
3
X

다항회귀

$$Y = w_0 + w_1 x_1 + w_2 x_2 + w_3 x_1 x_2 + w_4 x_1^2 + w_5 x_2^2$$

(w_n은 상수, x_n은 변수)

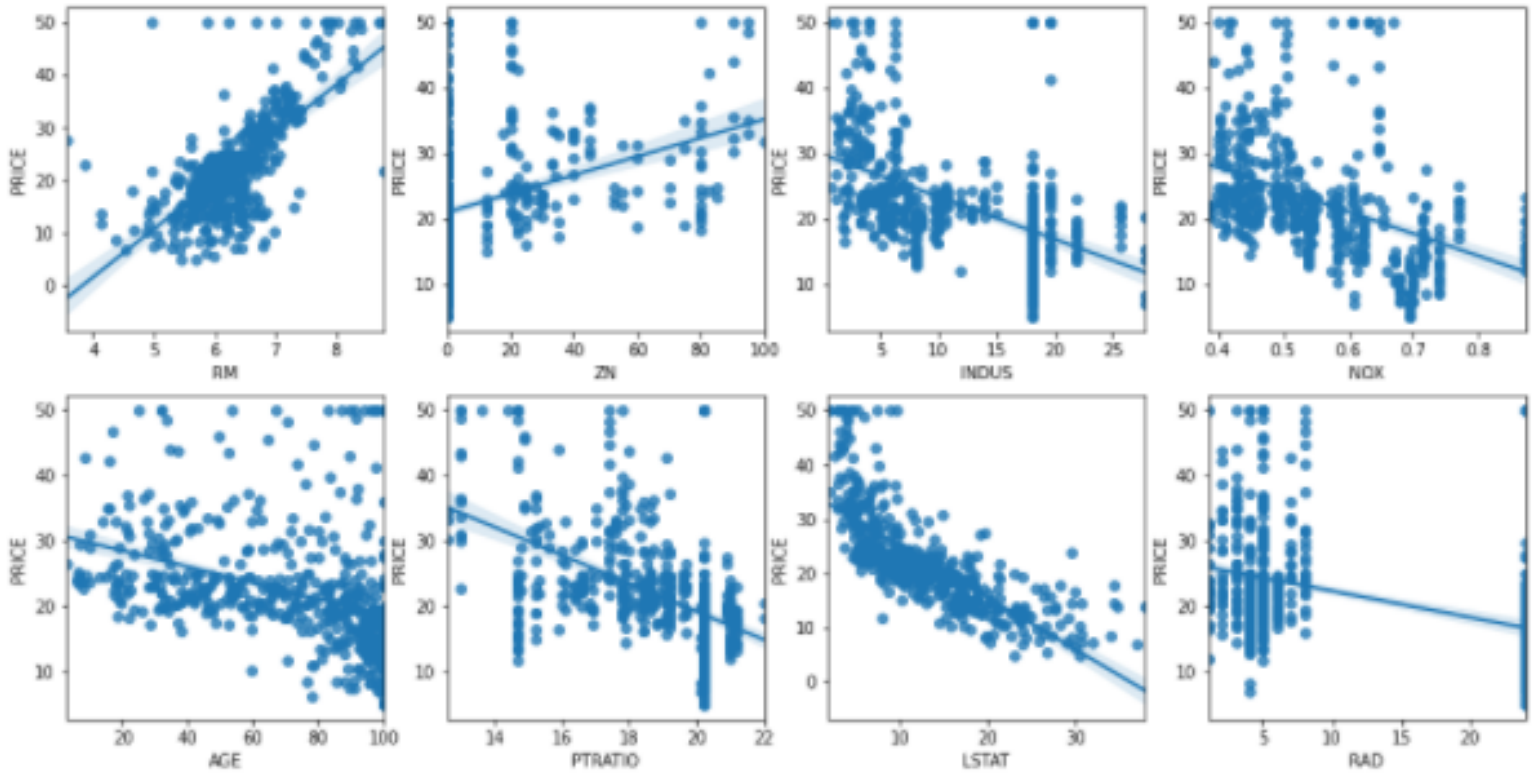
```
1  import numpy as np
2  import matplotlib.pyplot as plt
3  import pandas as pd
4  import seaborn as sns
5  from scipy import stats
6  from sklearn.datasets import load_boston
7  %matplotlib inline
8
9  boston = load_boston()
10 bostonDF = pd.DataFrame(boston.data , columns = boston.feature_names)
11 bostonDF['PRICE'] = boston.target
12 print('Boston 데이타셋 크기 :',bostonDF.shape)
13 bostonDF.head()
```

```
Boston 데이타셋 크기 : (506, 14)
```

	CRIM	ZN	INDUS	CHAS	NOX	RM	AGE	DIS	RAD	TAX	PTRATIO	B	LST
0	0.00632	18.0	2.31	0.0	0.538	6.575	65.2	4.0900	1.0	296.0	15.3	396.90	4
1	0.02731	0.0	7.07	0.0	0.469	6.421	78.9	4.9671	2.0	242.0	17.8	396.90	9
2	0.02729	0.0	7.07	0.0	0.469	7.185	61.1	4.9671	2.0	242.0	17.8	392.83	4
3	0.03237	0.0	2.18	0.0	0.458	6.998	45.8	6.0622	3.0	222.0	18.7	394.63	2
4	0.06905	0.0	2.18	0.0	0.458	7.147	54.2	6.0622	3.0	222.0	18.7	396.90	5

- CRIM: 지역별 범죄 발생률
- ZN: 25,000평방피트를 초과하는 거주 지역의 비율
- NDUS: 비상업 지역 넓이 비율
- CHAS: 찰스강에 대한 더미 변수(강의 경계에 위치한 경우는 1, 아니면 0)
- NOX: 일산화질소 농도
- RM: 거주할 수 있는 방 개수
- AGE: 1940년 이전에 건축된 소유 주택의 비율
- DIS: 5개 주요 고용센터까지의 가중 거리
- RAD: 고속도로 접근 용이도
- TAX: 10,000달러당 재산세율
- PTRATIO: 지역의 교사와 학생 수 비율
- B: 지역의 흑인 거주 비율
- LSTAT: 하위 계층의 비율
- MEDV: 본인 소유의 주택 가격(중앙값)

```python
fig, axs = plt.subplots(figsize=(16,8) , ncols=4 , nrows=2)
lm_features = ['RM','ZN','INDUS','NOX','AGE','PTRATIO','LSTAT','RAD']
for i , feature in enumerate(lm_features):
    row = int(i/4)
    col = i%4
    sns.regplot(x=feature , y='PRICE',data=bostonDF , ax=axs[row][col])
```



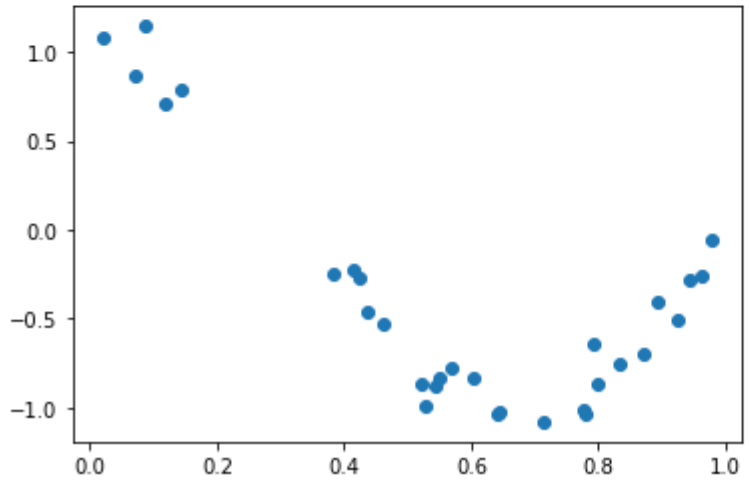
```
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LinearRegression
from sklearn.metrics import mean_squared_error , r2_score

y_target = bostonDF['PRICE']
X_data = bostonDF.drop(['PRICE'],axis=1,inplace=False)

X_train , X_test , y_train , y_test = train_test_split(X_data , y_target ,test_si

lr = LinearRegression()
lr.fit(X_train ,y_train )


```

```
1 coeff = pd.Series(data=np.round(lr.coef_, 1), index=X_data.columns )
2 coeff.sort_values(ascending=False)
```

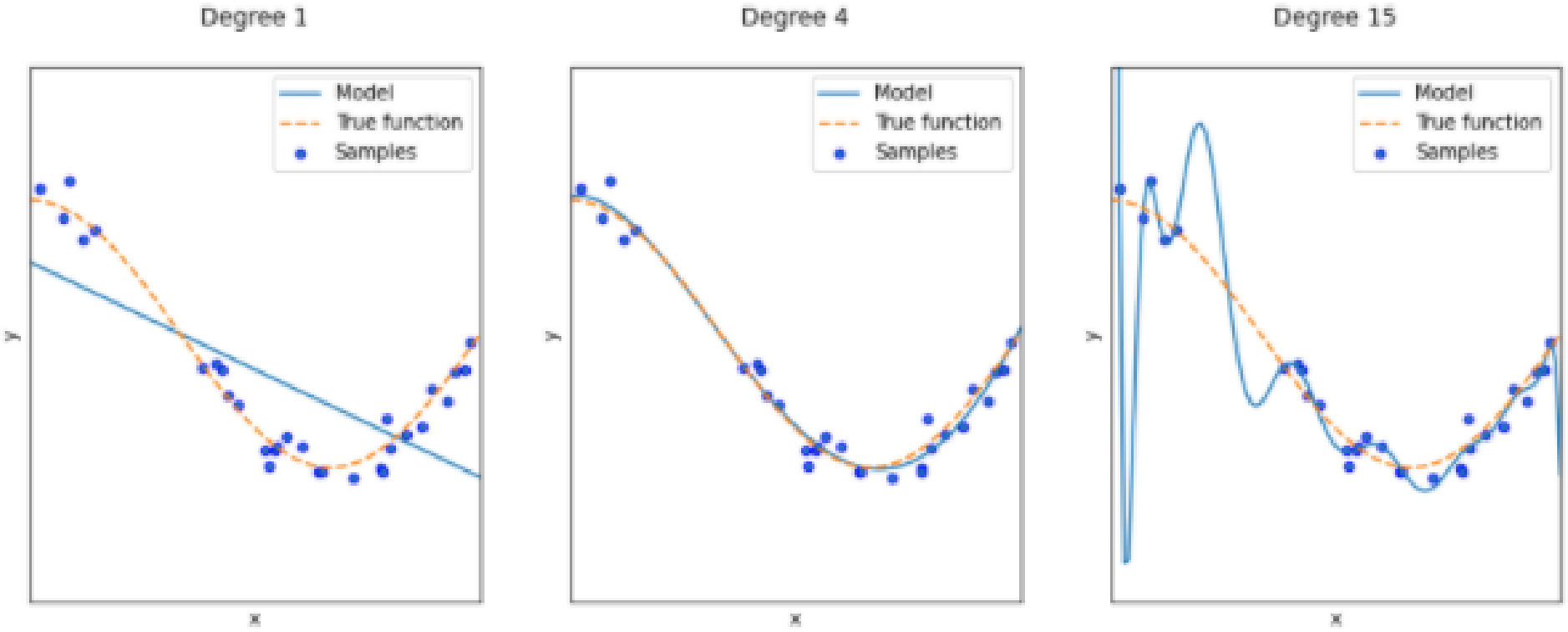
```
RM          3.4
CHAS        3.0
RAD         0.4
ZN          0.1
B           0.0
TAX        -0.0
AGE         0.0
INDUS       0.0
CRIM       -0.1
LSTAT      -0.6
PTRATIO    -0.9
DIS        -1.7
NOX       -19.8
dtype: float64
```

```python
import numpy as np
import matplotlib.pyplot as plt
from sklearn.pipeline import Pipeline
from sklearn.preprocessing import PolynomialFeatures
from sklearn.linear_model import LinearRegression
from sklearn.model_selection import cross_val_score
%matplotlib inline

def true_fun(X):
    return np.cos(1.5 * np.pi * X)

np.random.seed(0)
n_samples = 30
X = np.sort(np.random.rand(n_samples))
y = true_fun(X) + np.random.randn(n_samples) * 0.1
plt.scatter(X,y)
```

```
<matplotlib.collections.PathCollection at 0x187ae2cdd30>
```



```
plt.figure(figsize = (14,5))
degrees = [1,4,15]

for i in range(len(degrees)):
    ax = plt.subplot(1, len(degrees), i + 1)
    plt.setp(ax, xticks=(), yticks=())

    polynomial_features = PolynomialFeatures(degree = degrees[i]
                                             , include_bias = False)
    linear_regression = LinearRegression()
    pipeline = Pipeline([("polynomial_features", polynomial_features),
                         ("linear_regression", linear_regression)])
    pipeline.fit(X.reshape(-1, 1), y)

    X_test = np.linspace(0, 1, 100)

    plt.plot(X_test, pipeline.predict(X_test[:, np.newaxis]), label="Model")

    plt.plot(X_test, true_fun(X_test), '--', label="True function")
    plt.scatter(X, y, edgecolor='b', s=20, label="Samples")

    plt.xlabel("x"); plt.ylabel("y"); plt.xlim((0,1));plt.ylim((-2,2)); plt.leger
    plt.title("Degree {}₩nMSE = {:.2e}(+/- {:.2e})".format(degrees[i], -scores.me

```


Degree 1
Degree 4
Degree 15
Model
True function
Samples
y
x

Any Question??

감사합니다