Chapter 10 - exercise 3: Teen Birth Rate & Poverty Level Data

Cho dữ liệu poverty.txt

Yêu cầu: Thực hiện thuật toán ADABoosting & thuật toán cơ sở/ XGBoost để từ Poverty Level => dự đoán Teen Birth Rate

1. Đọc dữ liệu, trực quan hóa dữ liệu.
2. Tạo X_train, X_test, y_train, y_test từ dữ liệu đọc được là các cột 'PovPct', "Brth18to19", "ViolCrime", "TeenBrth" (inputs) và "Brth15to17" (outputs) với tỷ lệ dữ liệu test là 0.3
3. Áp dụng ADABoosting & thuật toán cơ sở/ XGBoost
4. Tìm kết quả
5. Vẽ hình. Nhận xét kết quả
6. Nếu 'PovPct', "Brth18to19", "ViolCrime", "TeenBrth" lần lượt là [[16, 100,10, 61]] => Brth15to17 là bao nhiêu?

In [1]:
```
# from google.colab import drive
# drive.mount("/content/gdrive", force_remount=True)
```

In [2]:
```
#%cd '/content/gdrive/My Drive/LDS6_MachineLearning/practice/Chapter10_Boosting/
```

https://newonlinecourses.science.psu.edu/stat462/node/101/ (https://newonlinecourses.science.psu.edu/stat462/node/101/)

In [3]:
```
import pandas as pd
```

In [4]:
```
data = pd.read_csv("poverty.txt", sep="\t")
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 51 entries, 0 to 50
Data columns (total 6 columns):
Location      51 non-null object
PovPct        51 non-null float64
Brth15to17    51 non-null float64
Brth18to19    51 non-null float64
ViolCrime     51 non-null float64
TeenBrth      51 non-null float64
dtypes: float64(5), object(1)
memory usage: 2.5+ KB
```

In [5]:
```
data.head()
```

Out[5]:

	Location	PovPct	Brth15to17	Brth18to19	ViolCrime	TeenBrth
0	Alabama	20.1	31.5	88.7	11.2	54.5
1	Alaska	7.1	18.9	73.7	9.1	39.5
2	Arizona	16.1	35.0	102.5	10.4	61.2
3	Arkansas	14.9	31.6	101.7	10.4	59.9
4	California	16.7	22.6	69.1	11.2	41.1

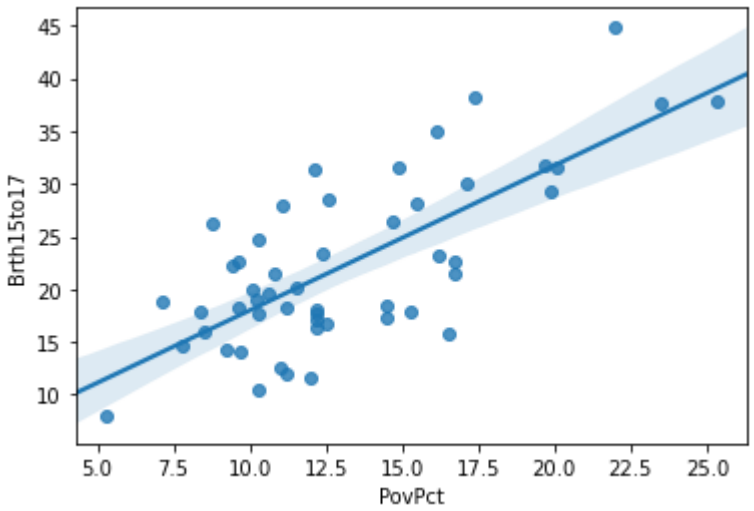
In [6]:
```
data.corr()
```

Out[6]:

	PovPct	Brth15to17	Brth18to19	ViolCrime	TeenBrth
PovPct	1.000000	0.730293	0.649660	0.469564	0.703285
Brth15to17	0.730293	1.000000	0.942449	0.640274	0.978826
Brth18to19	0.649660	0.942449	1.000000	0.477704	0.988975
ViolCrime	0.469564	0.640274	0.477704	1.000000	0.557937
TeenBrth	0.703285	0.978826	0.988975	0.557937	1.000000

In [7]:
```
import matplotlib.pyplot as plt
import seaborn as sns
```

In [8]:
```
sns.regplot(data=data, x='PovPct', y='Brth15to17')
plt.show()
```



In [9]:
```
inputs = data[['PovPct', "Brth18to19", "ViolCrime", "TeenBrth"]]
inputs.head()
```

Out[9]:

	PovPct	Brth18to19	ViolCrime	TeenBrth
0	20.1	88.7	11.2	54.5
1	7.1	73.7	9.1	39.5
2	16.1	102.5	10.4	61.2
3	14.9	101.7	10.4	59.9
4	16.7	69.1	11.2	41.1

In [10]:
```
outputs = data[['Brth15to17']]
outputs.head()
```

Out[10]:

	Brth15to17
0	31.5
1	18.9
2	35.0
3	31.6
4	22.6

In [11]:
```
import numpy as np
from sklearn.metrics import mean_squared_error, r2_score
from sklearn.linear_model import LinearRegression
from sklearn.model_selection import train_test_split
```

In [12]:
```
X_train, X_test, y_train, y_test = train_test_split(inputs, outputs,
                                                    test_size=0.3)
```

AdaBoost

In [13]:
```
from sklearn.ensemble import AdaBoostRegressor
from sklearn.tree import DecisionTreeRegressor
from sklearn.ensemble import RandomForestRegressor
#ml = DecisionTreeRegressor()
ml = LinearRegression()

clf = AdaBoostRegressor(n_estimators=50,
                        base_estimator=ml,
                        learning_rate=1)
```

In [14]:
```
clf.fit(X_train, y_train)
```

```
c:\program files\python36\lib\site-packages\sklearn\utils\validation.py:724: Da
taConversionWarning: A column-vector y was passed when a 1d array was expected.
Please change the shape of y to (n_samples, ), for example using ravel().
  y = column_or_1d(y, warn=True)
```

Out[14]:
```
AdaBoostRegressor(base_estimator=LinearRegression(copy_X=True,
                                                  fit_intercept=True,
                                                  n_jobs=None,
                                                  normalize=False),
                  learning_rate=1, loss='linear', n_estimators=50,
                  random_state=None)
```

In [15]:
```
clf.score(X_train, y_train)
```

Out[15]:
```
0.9904332196062103
```

In [16]:
```
clf.score(X_test, y_test)
```

Out[16]:
```
0.9783344773068102
```

In [17]:
```
from sklearn.metrics import mean_squared_error, r2_score
# The mean squared error
print("Mean squared error: %.2f"
      % mean_squared_error(outputs, clf.predict(inputs)))
# Explained variance score: 1 is perfect prediction
print('Variance score: %.2f' % clf.score(inputs, outputs))
```

```
Mean squared error: 0.80
Variance score: 0.99
```

In [18]:
```
# predict new sample
X_new = [[16, 100,10, 61]]
y_new = clf.predict(X_new)
y_new
```

Out[18]:
```
array([34.52433517])
```

XGBoost

In [19]:
```
import xgboost as xgb
```

In [20]:
```
xgb_model = xgb.XGBRegressor(random_state=42)
xgb_model.fit(X_train, y_train)
```

```
[14:34:28] WARNING: C:/Jenkins/workspace/xgboost-win64_release_0.90/src/objecti
ve/regression_obj.cu:152: reg:linear is now deprecated in favor of reg:squarede
rror.
```

Out[20]:
```
XGBRegressor(base_score=0.5, booster='gbtree', colsample_bylevel=1,
             colsample_bynode=1, colsample_bytree=1, gamma=0,
             importance_type='gain', learning_rate=0.1, max_delta_step=0,
             max_depth=3, min_child_weight=1, missing=None, n_estimators=100,
             n_jobs=1, nthread=None, objective='reg:linear', random_state=42,
             reg_alpha=0, reg_lambda=1, scale_pos_weight=1, seed=None,
             silent=None, subsample=1, verbosity=1)
```

In [21]:
```
xgb_model.score(X_train, y_train)
```

Out[21]:
```
0.999507827862636
```

In [22]:
```
xgb_model.score(X_test, y_test)
```

Out[22]:
```
0.9250866288320049
```

In [23]:
```
# The mean squared error
print("Mean squared error: %.2f"
      % mean_squared_error(outputs, xgb_model.predict(inputs)))
# Explained variance score: 1 is perfect prediction
print('Variance score: %.2f' % xgb_model.score(inputs, outputs))
```

```
Mean squared error: 1.21
Variance score: 0.98
```