Chapter 2 - Exercise 5: Teen Birth Rate & Poverty Level Data

Cho dữ liệu poverty.txt

Yêu cầu: Thực hiện linenear regression để từ Poverty Level => dự đoán Teen Birth Rate

1. Đọc dữ liệu, chuẩn hóa dữ liệu nếu cần. Trực quan hóa dữ liệu.
2. Tạo X_train, X_test, y_train, y_test từ dữ liệu đọc được là 2 cột PovPct (inputs) và Brth15to17 (outputs) với tỷ lệ dữ liệu test là 0.2
3. Áp dụng linrear regression
4. Vẽ hình. Nhận xét kết quả
5. Nếu PovPct là 16 => Brth15to17 là bao nhiêu?

In [1]:

```
# from google.colab import drive
# drive.mount("/content/gdrive", force_remount=True)
# %cd '/content/gdrive/My Drive/LDS6_MachineLearning/practice/Chapter2_Linear_Reg
```

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

In [2]:

```
import pandas as pd
```

In [3]:

```
data = pd.read_csv("poverty.txt", sep="\t")
data.info()
```

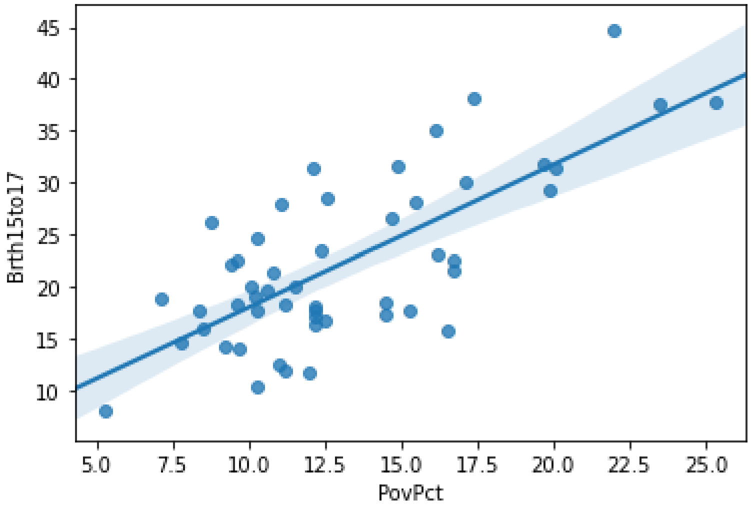
```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 51 entries, 0 to 50
Data columns (total 6 columns):
Location      51 non-null object
PovPct        51 non-null float64
Brth15to17    51 non-null float64
Brth18to19    51 non-null float64
ViolCrime     51 non-null float64
TeenBrth      51 non-null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

In [4]:
```
data.head()
```

Out[4]:
```
   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 [5]:
```
import matplotlib.pyplot as plt
import seaborn as sns
```

In [6]:
```
sns.regplot(data=data, x='PovPct', y='Brth15to17')
plt.show()
```



In [7]:
```
inputs = data[['PovPct']]
inputs.head()
```

Out[7]:
```
  PovPct
0   20.1
1    7.1
2   16.1
3   14.9
4   16.7
```

In [8]:

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

Out[8]:

```
   Brth15to17
0        31.5
1        18.9
2        35.0
3        31.6
4        22.6
```

In [9]:

```
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 [10]:

```
X_train, X_test, y_train, y_test = train_test_split(inputs,
                                                    outputs,
                                                    test_size=0.20)


regr1 = LinearRegression()
regr1 = regr1.fit(X_train, y_train)
```

In [11]:

```
y_pred = regr1.predict(X_test)
```

In [12]:

```
df = pd.DataFrame({'Actual': pd.DataFrame(y_test.values)[0].values,
                   'Prediction': pd.DataFrame(y_pred)[0].values})
df.head()
```

Out[12]:

```
   Actual  Prediction
0    15.9   15.919460
1    18.9   13.997651
2    17.2   20.998528
3    31.5   31.843024
4    16.8   21.410344
```

In [13]:
```
# The coefficients
m=regr1.coef_[0]
b=regr1.intercept_
print('Coefficients: \n', m)
print('Interceft: \n', b)
```

```
Coefficients: 
 [1.37272102]
Interceft: 
 [4.25133169]
```

In [14]:
```
# The mean squared error
print("Mean squared error: %.2f"
      % mean_squared_error(outputs, regr1.predict(inputs)))
# Explained variance score: 1 is perfect prediction
print('Variance score: %.2f' % regr1.score(inputs, outputs))
```

```
Mean squared error: 29.60
Variance score: 0.53
```

In [15]:
```
# Score = 53% => mô hình phù hợp ~ 53% dữ liệu => chưa là một mô hình phù hợp
```

In [16]:
```
# Check the score of train and test
regr1.score(X_train, y_train)
```

Out[16]:
```
0.540012697915842
```

In [17]:
```
regr1.score(X_test, y_test)
```

Out[17]:
```
0.5009581530641609
```

In [18]:
```
# Both Score of Training & score of Testing are low => Under fitting
```

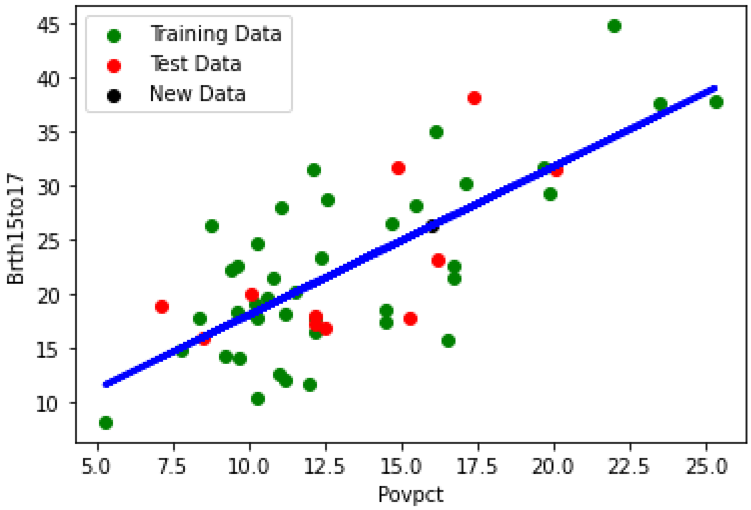
In [19]:
```
reg_line = [(m* float(x)) + b for x in np.array(inputs)]
```

In [20]:
```
x_now = [[16]]
y_now = regr1.predict(x_now)
print(y_now)
```

```
[[26.21486799]]
```

In [21]:

```
# Plot outputs
plt.scatter(X_train, y_train,  color='green', label="Training Data")
plt.scatter(X_test, y_test,  color='red', label= "Test Data")
plt.scatter(x_now, y_now,  color='black', label= "New Data")
plt.plot(inputs,reg_line, color="blue", linewidth=3)
plt.xlabel("Povpct")
plt.ylabel("Brth15to17")
plt.legend()
plt.show()
```



In [22]:

```
# Có giải pháp nào tốt hơn không???
```

Polynomial

In [23]:

```
import numpy as np
```

In [24]:

```
# Here we use a polynomial of the 3rd order (cubic)
f = np.polyfit(inputs['PovPct'], outputs['Brth15to17'], 3) # bac 3
p = np.poly1d(f)
p
```

Out[24]:

```
poly1d([-4.50252043e-04,  5.18694078e-02,  1.46589658e-01,  1.18676987e+01])
```

In [25]:
```
f
```

Out[25]:
```
array([-4.50252043e-04,  5.18694078e-02,  1.46589658e-01,  1.18676987e+01])
```

In [26]:
```
# Find R^2
from sklearn.metrics import r2_score
r_squared = r2_score(outputs, p(inputs))
print('The R-square value is: ', r_squared)
```

```
The R-square value is:  0.5416081543854674
```

In [27]:
```
# Find MSE
print('The mean square error using Polinormial Fit: ', \
    mean_squared_error(outputs['Brth15to17'], p(inputs['PovPct'])))
```

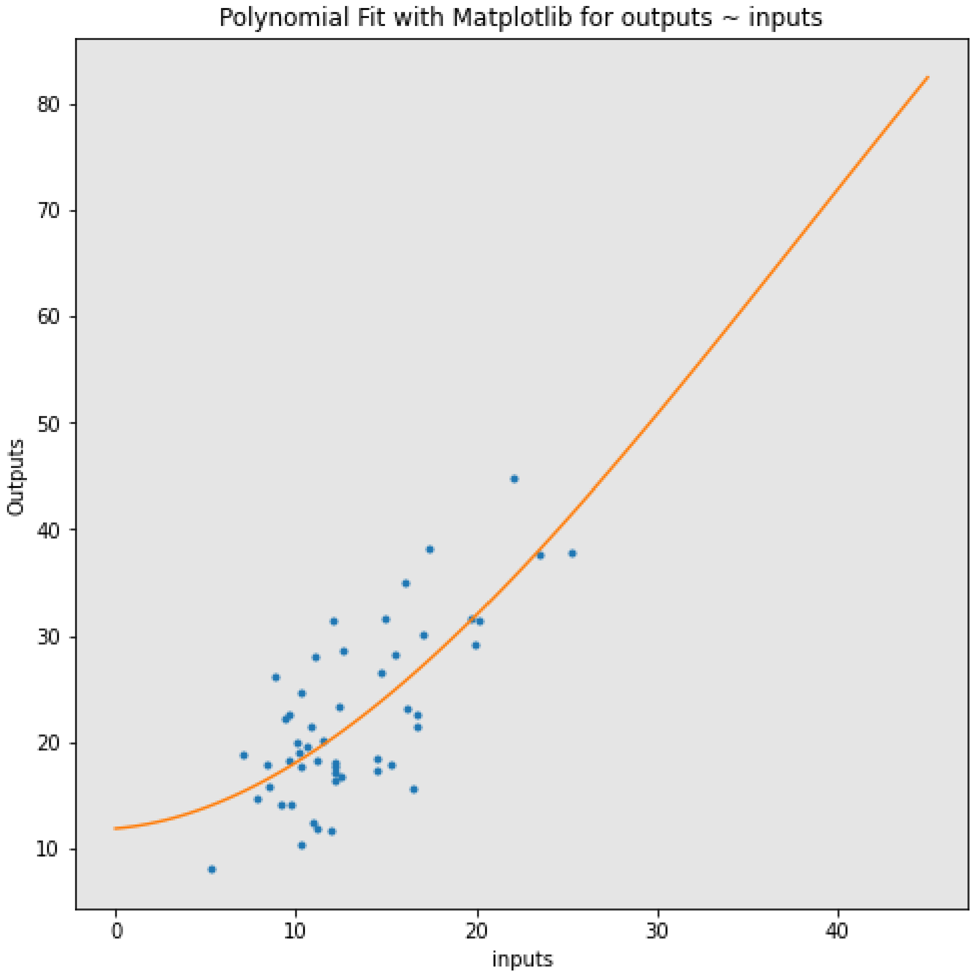
```
The mean square error using Polinormial Fit:  29.075472254035887
```

In [28]:
```
def PlotPolly(model, independent_variable, dependent_variabble, Name):
    x_new = np.linspace(0, 45, 100)
    y_new = model(x_new)

    plt.plot(independent_variable, dependent_variabble, '.', x_new, y_new, '-')
    plt.title('Polynomial Fit with Matplotlib for outputs ~ inputs')
    ax = plt.gca()
    ax.set_facecolor((0.898, 0.898, 0.898))
    fig = plt.gcf()
    plt.xlabel(Name)
    plt.ylabel('Outputs')

    plt.show()
    plt.close()
```

In [29]:
```
plt.figure(figsize=(8,8))
PlotPolly(p, inputs['PovPct'], outputs['Brth15to17'], 'inputs')
```



In [30]:

```
# Lựa chọn thuộc tính???
```