Experiment No. 1
Analyze the Boston Housing dataset and apply appropriate Regression Technique
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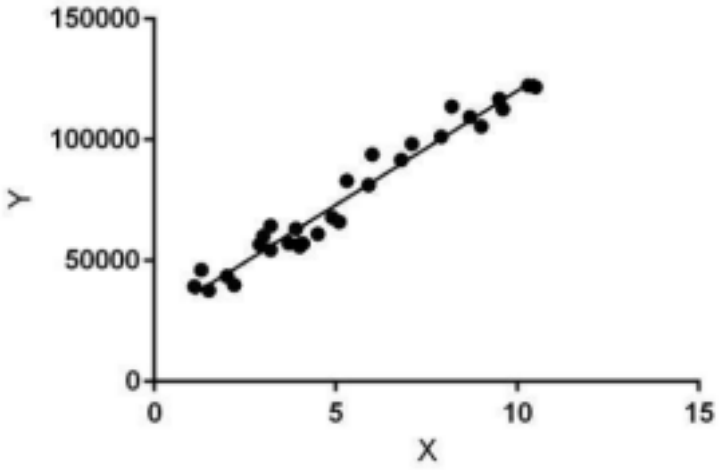
Aim: Analyze the Boston Housing dataset and apply appropriate Regression Technique.

Objective: Ablility to perform various feature engineering tasks, apply linear regression on the given dataset and minimise the error.

Theory:

Linear Regression is a machine learning algorithm based on supervised learning. It performs a regression task. Regression models a target prediction value based on independent variables. It is mostly used for finding out the relationship between variables and forecasting. Different regression models differ based on – the kind of relationship between dependent and independent variables they are considering, and the number of independent variables getting used.



Linear regression performs the task to predict a dependent variable value (y) based on a given independent variable (x). So, this regression technique finds out a linear relationship between x (input) and y(output). Hence, the name is Linear Regression.
In the figure above, X (input) is the work experience and Y (output) is the salary of a person. The regression line is the best fit line for our model.

Dataset:

The Boston Housing Dataset

The Boston Housing Dataset is a derived from information collected by the U.S. Census Service concerning housing in the area of Boston MA. The following describes the dataset columns:

CRIM - per capita crime rate by town
ZN - proportion of residential land zoned for lots over 25,000 sq.ft.
INDUS - proportion of non-retail business acres per town.
CHAS - Charles River dummy variable (1 if tract bounds river; 0
otherwise) NOX - nitric oxides concentration (parts per 10 million)
RM - average number of rooms per dwelling
AGE - proportion of owner-occupied units built prior to 1940
DIS - weighted distances to five Boston employment centres
RAD - index of accessibility to radial highways
TAX - full-value property-tax rate per $10,000
PTRATIO - pupil-teacher ratio by town
B - 1000(Bk - 0.63)^2 where Bk is the proportion of blacks by town
LSTAT - % lower status of the population
MEDV - Median value of owner-occupied homes in $1000's

Code:

Conclusion:

1.Here we learn about linear regression which can be used to predict the any aspect of the database.Linear Regression helps in predicting the values using mathematical calculations. The considered points are

```
'CRIM','ZN','INDUS','CHAS','AGE','DIS','RAD','TAX','PTRATIO','B'
, 'LSTAT'
```

2.The Mean Absolute Error (MAE) assesses regression model performance. MAE measures average absolute differences between predicted and actual values. Lower MAE signifies closer predictions to actual values

The Mean Sqaure Error is : `28.70878219455333`

The Absolute Error is :`3.6392107599548726`

```
import numpy as np
```

```
import pandas as pd
```

```
d=pd.read_csv('Boston-house-price-data.csv')
```

```
d.head()
```

```
      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
```

```
new_ds=d[['CRIM','ZN','INDUS','CHAS','AGE','DIS','RAD','TAX','PTRATIO','B','LSTAT']]
```

```
new_ds.shape
```

```
(506, 11)
```

```
x=new_ds.iloc[:,:-1].values
y=new_ds.iloc[:,-1].values
```

```
from sklearn.model_selection import train_test_split

xtrain, xtest, ytrain, ytest = train_test_split(x, y, test_size =0.2,
                                                random_state = 0)

print("xtrain shape : ", xtrain.shape)
print("xtest shape : ", xtest.shape)
print("ytrain shape : ", ytrain.shape)
print("ytest shape : ", ytest.shape)
```

```
xtrain shape : (404, 10)
xtest shape : (102, 10)
ytrain shape : (404,)
ytest shape : (102,)
```

```
from sklearn.linear_model import LinearRegression
regressor = LinearRegression()
regressor.fit(xtrain, ytrain)

y_pred = regressor.predict(xtest)
```

```
import matplotlib.pyplot as plt

plt.scatter(ytest, y_pred, c = 'green')
plt.xlabel("Price: in $1000's")
plt.ylabel("Predicted value")
plt.title("True value vs predicted value : Linear Regression")
plt.show()
```


```
from sklearn.metrics import mean_squared_error, mean_absolute_error
mse = mean_squared_error(ytest, y_pred)
mae = mean_absolute_error(ytest,y_pred)
print("Mean Square Error : ", mse)
print("Mean Absolute Error : ", mae)
```

```
Mean Square Error : 28.70878219455333
Mean Absolute Error : 3.6392107599548726
```