Data Science and Business Analytics

The Sparks Foundation - GRIP June 2021

Author: **Heena Kasat**

TASK 1: **Prediction using Supervised ML**

In this task, we will predict the percentage of marks that a student is expected to score based on the number of hours they studied. This is a simple Linear Regression task as it involves just two variables.

The steps are as follows:-

1) Exploratory Data Analysis

2) Data Preparation

3) ML Model/Algorithm

4) Evaluation of Model

Dataset Url - http://bit.ly/w-data

1. Exploratory Data Analysis

Importing libraries

In [1]:
```
# Importing all libraries required
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
```

In [2]:
```
%%HTML
<style type="text/css">
table.dataframe td, table.dataframe th {
    border-style: solid;
}
</style>
```

Hours	Scores
2.5	21
5.1	47
3.2	27
8.5	75
3.5	30
1.5	20
9.2	88
5.5	60
8.3	81
2.7	25
7.7	85
5.9	62
4.5	41
3.3	42
1.1	17

In [3]:
```
# getting the shape of data set
data.shape
```

Out[3]:
```
(25, 2)
```

In [4]:
```
# getting the information about dataset
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 25 entries, 0 to 24
Data columns (total 2 columns):
 #   Column  Non-Null Count  Dtype  
---  ------  --------------  -----  
 0   Hours   25 non-null    float64
 1   Scores  25 non-null    int64  
dtypes: float64(1), int64(1)
memory usage: 528.0 bytes
```

In [5]:
```
# getting the attributes
data.columns
```

Out[5]:
```
Index(['Hours', 'Scores'], dtype='object')
```

In [6]:
```
# getting the datatypes
data.dtypes
```

Out[6]:
```
Hours     float64
Scores      int64
dtype: object
```

In [7]:
```
# getting the statistical values
data.describe()
```

Out[7]:

	Hours	Scores
count	25.000000	25.000000
mean	5.012000	51.480000
std	2.525094	25.286887
min	1.100000	17.000000
25%	2.700000	30.000000
50%	4.800000	47.000000
75%	7.400000	75.000000
max	9.200000	95.000000

In [8]:
```
#function to describe the count, mean and percentile, also the median of the dataset
data.describe().transpose()
```

Out[8]:

	count	mean	std	min	25%	50%	75%	max
Hours	25.0	5.012	2.525094	1.1	2.7	4.8	7.4	9.2
Scores	25.0	51.480	25.286887	17.0	30.0	47.0	75.0	95.0

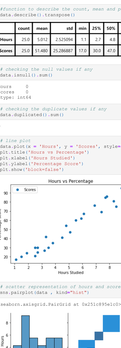
In [9]:
```
# checking the null values if any
data.isnull().sum()
```

Out[9]:
```
Hours     0
Scores    0
dtype: int64
```

In [10]:
```
# checking the duplicate values if any
data.duplicated().sum()
```

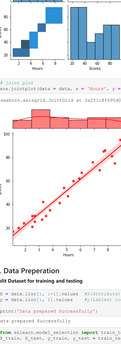
Out[10]:
```
0
```

In [11]:
```
# line plot
data.plot(x = 'Hours', y = 'Scores', style='x')
plt.title('Hours vs Percentage')
plt.xlabel('Hours Studied')
plt.ylabel('Percentage Score')
plt.show(block=False)
```



In [12]:
```
# scatter representation of hours and scores using a pairplot
sns.pairplot(data , kind="kde")
```

Out[12]:
```
<seaborn.axisgrid.PairGrid at 0x251c895e1c0>
```



In [13]:
```
# joint plot
sns.jointplot(x = data, x = 'Hours', y = 'Scores', kind = 'reg', color = 'red')
```

Out[13]:
```
<seaborn.axisgrid.JointGrid at 0x251c8f490d0>
```

2. Data Preperation

Split Dataset for training and testing

In [14]:
```
X = data.iloc[:, :-1].values  #(Attributes) containing Hours starting with index '0'
y = data.iloc[:, 1].values    #(Labels) containing Scores starting with index '1'

print("Data prepared Successfully")
```

```
Data prepared Successfully
```

In [15]:
```
from sklearn.model_selection import train_test_split
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=101)
```

3. ML Model/Algorithm

In this step the algorithm is trained and the predictions are made.

In [16]:
```
#the Linear Regression Model :/ trained
from sklearn.linear_model import LinearRegression
regressor = LinearRegression()
regressor.fit(X_train, y_train)
```

Out[16]:
```
LinearRegression()
```

In [17]:
```
# intercept
print("Intercept :-",regressor.intercept_)
```

```
Intercept :- 2.3112129830203902
```

In [18]:
```
# coefficient
print("Coefficient :-",regressor.coef_)
```

```
Coefficient :- [9.73333705]
```

In [19]:
```
# plotting the regression line
line = regressor.coef_*X + regressor.intercept_

# Plotting for the test data
plt.scatter(X_train, y_train, label = "Train data", color = 'red')
plt.scatter(X_test, y_test, label = "Test data", color = 'blue')
plt.title("Study hours v/s Scores")
plt.plot(X, line, color = 'red', label = 'Regression line')
plt.xlabel('Hours')
plt.ylabel('Scores')
plt.legend()
plt.show()
```

Making predictions

In [20]:
```
# predicting the score if students
y_pred = regressor.predict(X_test)
print(y_pred)
```

```
[26.84539693 77.45853691 39.4986961  74.53860149 56.04531809]
```

In [21]:
```
print(X_test)
```

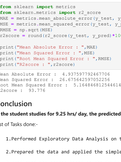
```
[[2.5]
 [7.8]
 [3.8]
 [7.4]
 [5.5]]
```

In [22]:
```
# Comparing Actual vs Predicted
df = pd.DataFrame({'Actual':y_test, 'Predicted': y_pred, 'Variance':y_test-y_pred})
df
```

Out[22]:

	Actual	Predicted	Variance
0	30	26.845397	3.154603
1	85	77.458536	7.541464
2	35	39.498696	-4.498696
3	69	74.538601	-5.538601
4	60	56.045318	3.954682

In [23]:
```
# plotting actual v/s predicted
df.plot(kind= 'bar', figsize = (10,10))
plt.grid()
plt.show()
```



In [24]:
```
# training accuracy and testing accuracy
print("Training Accuracy :",regressor.score(X_train,y_train))
print("Testing Accuracy :",regressor.score(X_test,y_test))
```

```
Training Accuracy : 0.9543933311163377
Testing Accuracy : 0.9377551767871869
```

Making a predictive model

Our aim is to predict the score, if the student studies for 9.25 hrs a day through the model.

In [25]:
```
hours = 9.25
hr1 = np.array(hours)
hr1 = hr1.reshape(1,1)
own_pred = regressor.predict(hr1)
print("No of Hours = {}".format(hours))
print("Predicted Score = {}".format(own_pred[0]))
```

```
No of Hours = 9.25
Predicted Score = 92.34521556023958
```

Predicting the score which is defined by the user

In [26]:
```
hours = float(input("Enter the no of Hours = "))
hr1 = np.array([hours])
hr1 = hr1.reshape(1,1)
own_pred = regressor.predict(hr1)
print("No of Hours = {}".format(hours))
print("Predicted Score = {}".format(own_pred[0]))
```

```
Enter the no of Hours = 9.25
No of Hours = 9.25
Predicted Score = 92.34521556023958
```

4. Evaluation of the Model

The final step is to evaluate the performance of algorithm.

In [27]:
```
from sklearn import metrics
from sklearn.metrics import r2_score
MAE = metrics.mean_absolute_error(y_test, y_pred)
MSE = metrics.mean_squared_error(y_test, y_pred)
RMSE = np.sqrt(MSE)
r2score = round(r2_score(y_test, y_pred)*100,3)

print("Mean Absolute Error :",MAE)
print("Mean Squared Error :",MSE)
print("Root Mean Squared Error :",RMSE)
print("R2score :",r2score)
```

```
Mean Absolute Error : 4.397597932467706
Mean Squared Error : 26.675642597052256
Root Mean Squared Error : 5.164668123546516
R2score : 93.776
```

Conclusion

If the student studies for 9.25 hrs/ day, the predicted score will be 92.54

List of Tasks done:-

1. Performed Exploratory Data Analysis on the dataset.

2. Prepared the data and applied the simple Linear Regression Algorithm.

3. Predicted the scores based on the Study Hours.

4. Evaluated the Algorithm.