The Sparks Foundation - GRIP July 2021

Task 1: Prediction using Supervised ML

Level: Beginner

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Problem Statement

- **Predict the percentage of an student based on the no. of study hours.**
- **This is a simple linear regression task as it involves just 2 variables.**
- **What will be predicted score if a student studies for 9.25 hrs/ day?**

Work Flow **1) Data collection**

2) Data Pre-processing

3) Data preparation

4) Train – Test data

5) Linear Regression Model

6) Training Linear Regression Model

7) Making Prediction

8) Model Evaluation

Importing Libraries

In [ ]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
```

Data collection and Pre-processing

In [4]:
```
# loading dataset into pandas dataframe
data = pd.read_csv("http://bit.ly/w-data")
print("Data set collected successfully")
```

```
Data set collected successfully
```

In [5]:
```
# check first 10 attributes
data.head(10)
```

Out[5]:

	Hours	Scores
0	2.5	21
1	5.1	47
2	3.2	27
3	8.5	75
4	3.5	30
5	1.5	20
6	9.2	88
7	5.5	60
8	8.3	81
9	2.7	25

Exploratory data analysis

In [6]:
```
# getting the shape of data set
data.shape
```

Out[6]:
```
(25, 2)
```

In [7]:
```
# getting the attributes
data.columns
```

Out[7]:
```
Index(['Hours', 'Scores'], dtype='object')
```

In [8]:
```
# getting the datatypes
data.dtypes
```

Out[8]:
```
Hours     float64
Scores      int64
dtype: object
```

In [9]:
```
# 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 [10]:
```
# getting the statistical values
data.describe().transpose()
```

Out[10]:

	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 [11]:
```
# checking the null values if any
data.isnull().sum()
```

Out[11]:
```
Hours     0
Scores    0
dtype: int64
```

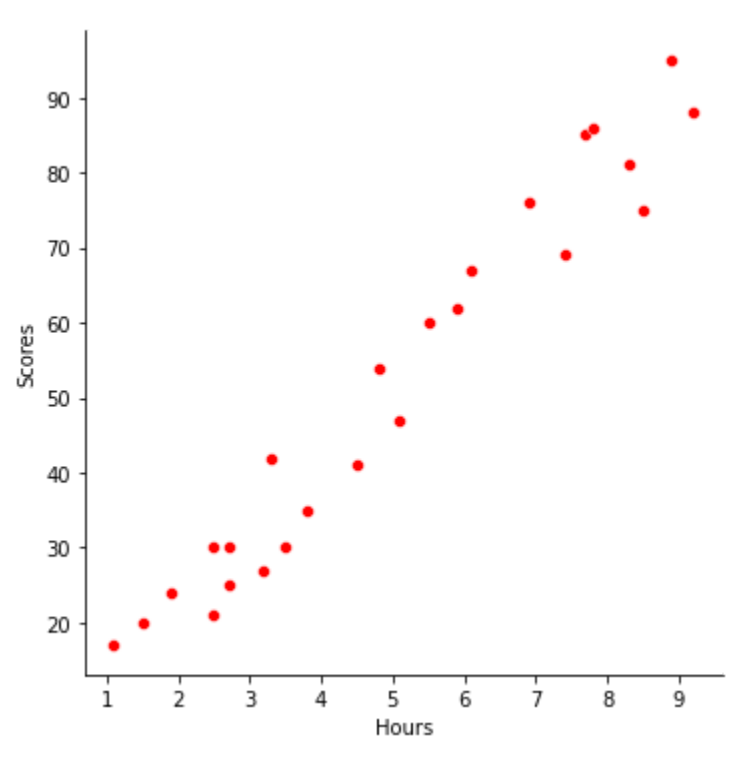
In [12]:
```
# checkin the duplicate values if any
data.duplicated().sum()
```

Out[12]:
```
0
```

Data Visualization

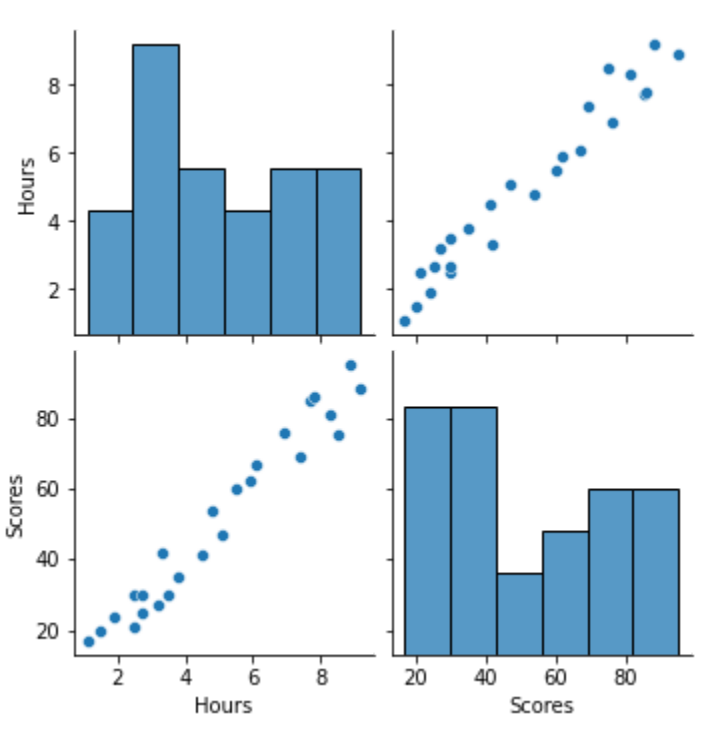
In [13]:
```
# line plot
sns.relplot(data = data, x = 'Hours', y = 'Scores', color = 'red')
```

Out[13]:
```
<seaborn.axisgrid.FacetGrid at 0x2a44b336550>
```



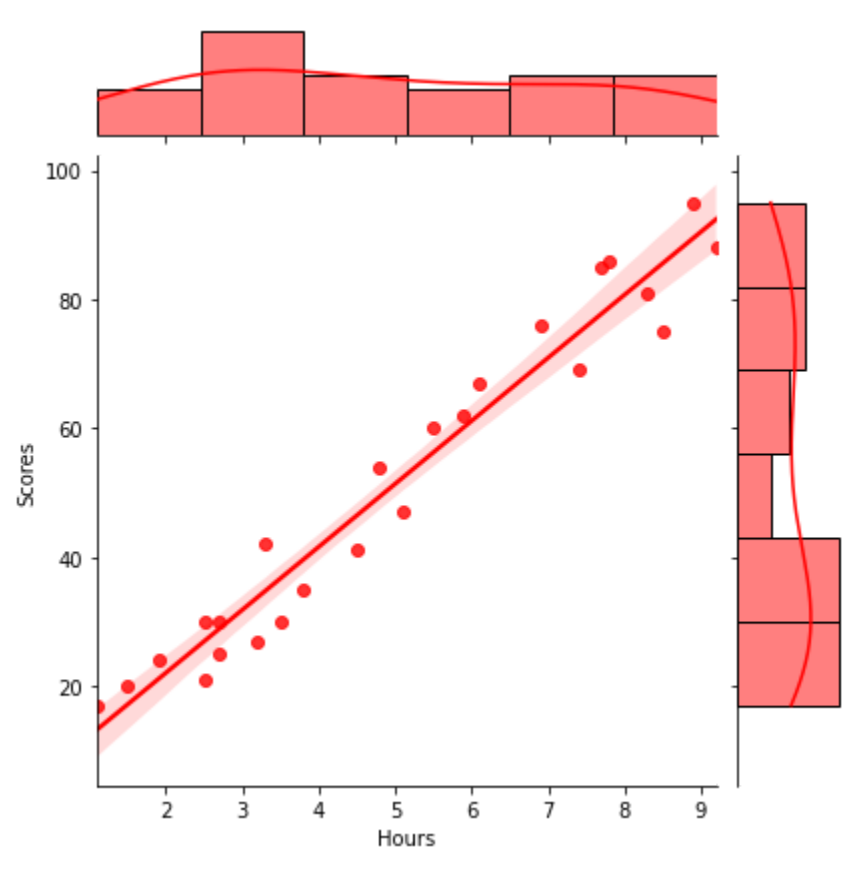
In [14]:
```
# pair plot
sns.pairplot(data , )
```

Out[14]:
```
<seaborn.axisgrid.PairGrid at 0x2a44e439760>
```



In [15]:
```
# joint plot
sns.jointplot(data = data, x = 'Hours', y = 'Scores', kind = 'reg', color = 'red')
```

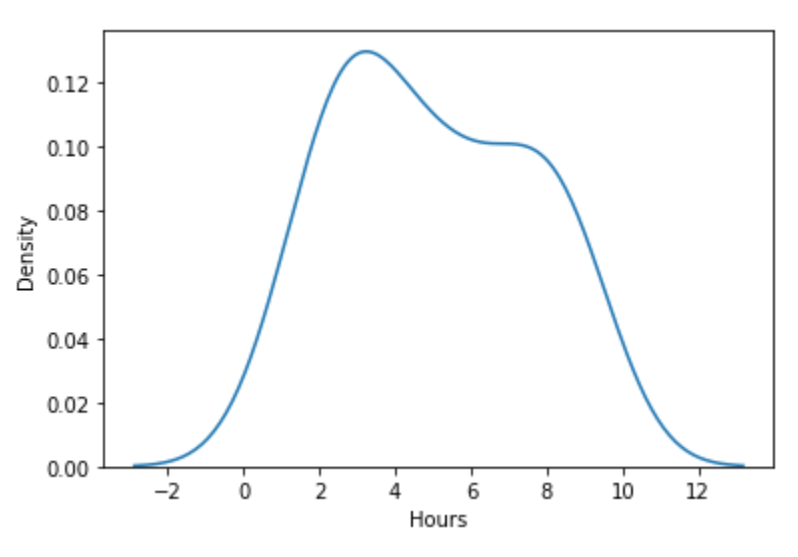
Out[15]:
```
<seaborn.axisgrid.JointGrid at 0x2a44e6c9d00>
```



In [16]:
```
# histogram
sns.distplot(data['Hours'], bins = 10, kde = True , hist = False)
```

```
c:\users\agraw\appdata\local\programs\python\python39\lib\site-packages\seaborn\distributions.py:2557: FutureWarning: `distplot` is a deprecated fu
nction and will be removed in a future version. Please adapt your code to use either `displot` (a figure-level function with similar flexibility) o
r `kdeplot` (an axes-level function for kernel density plots).
  warnings.warn(msg, FutureWarning)
```

Out[16]:
```
<AxesSubplot:xlabel='Hours', ylabel='Density'>
```



Data Preperation

In [18]:
```
#Divide the dataset into "attributes" (inputs) and "labels" (outputs).
x = data.iloc[:, :-1].values
y = data.iloc[:, 1].values


print('Data prepared Successfully')
```

```
Data prepared Successfully
```

In [23]:
```
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 = 2)
```

Model Training

In [ ]:
```
from sklearn.linear_model import LinearRegression
linreg = LinearRegression()
linreg.fit(x_train,y_train)
```

In [25]:
```
# intercept
print("Intercept : ",linreg.intercept_)
```

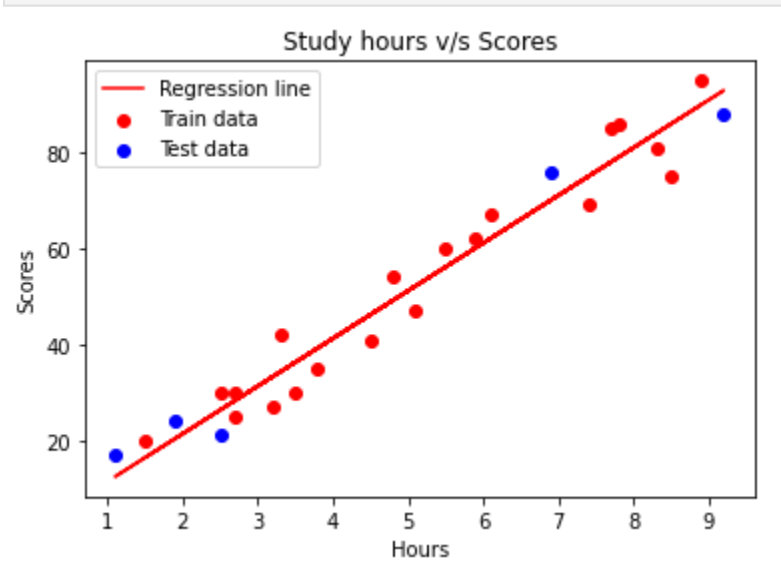
```
Intercept :  1.5079104828268939
```

In [26]:
```
# coefficient
print("Coefficient : ",linreg.coef_)
```

```
Coefficient :  [9.94061514]
```

In [27]:
```
# plotting the regression line
line = linreg.coef_*x+linreg.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 the prediction

In [28]:
```
# predicting the score of sutudents
y_pred = linreg.predict(x_test)
print(y_pred)
```

```
[12.44258714 26.35944834 20.39507925 92.9615698  70.09815497]
```

In [29]:
```
print(x_test)
```

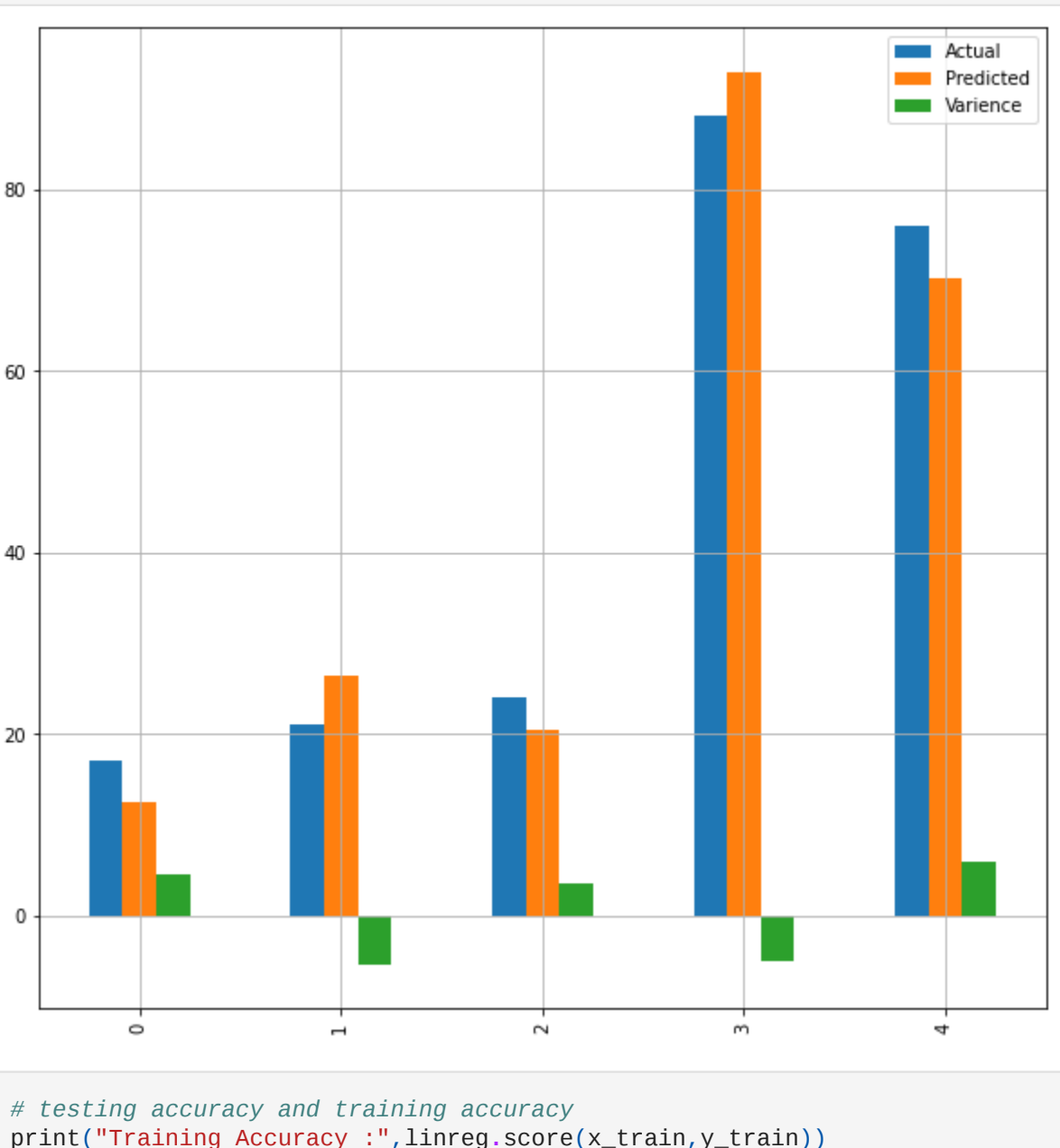
```
[[1.1]
 [2.5]
 [1.9]
 [9.2]
 [6.9]]
```

In [30]:
```
# Comparing Actual vs Predicted
df = pd.DataFrame({'Actual': y_test, 'Predicted': y_pred, 'Varience':y_test-y_pred})
df
```

Out[30]:

	Actual	Predicted	Varience
0	17	12.442587	4.557413
1	21	26.359448	-5.359448
2	24	20.395079	3.604921
3	88	92.961570	-4.961570
4	76	70.098155	5.901845

In [31]:
```
# plotting actual v/s predicted
df.plot(kind = 'bar', figsize = (10,10))
plt.grid()
plt.show()
```



In [32]:
```
# testing accuracy and training accuracy
print("Training Accuracy :",linreg.score(x_train,y_train))
print("Testing Accuracy :",linreg.score(x_test,y_test))
```

```
Training Accuracy : 0.9423348138802985
Testing Accuracy : 0.9735538080811826
```

Making a predictive model

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

In [33]:
```
Hours = 9.25
model_prediction = linreg.predict([[Hours]])
print("No. of Study Hours = {}".format(Hours))
print("Predicted Score = {}".format(model_prediction[0]))
```

```
No. of Study Hours = 9.25
Predicted Score = 93.45860055685799
```

In [34]:
```
# r2_score
from sklearn.metrics import r2_score
r2score = round(r2_score(y_pred, y_test)*100,3)
print("The r2 score : ",r2score)
```

```
The r2 score :  97.532
```

Absolute Error of the Test data of Linear regression : 4.877039354964476

Mean Squared Error of Test data of Linear regression : 24.387620339856596

Root Mean Squared Error of Test data of Linear regression : 4.9383823606376005

Conclusion:

If the student studies for 9.25 hrs/ day, the predicted score will be 93.45

Task 1 Completed !