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Linear Regression with Python Scikit Learn

In this section we will see how the Python Scikit-Learn library for machine learning can be used to implement regression functions. We will start with simple linear regression involving two variables.

Simple Linear Regression

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

In [5]:
```
#importing relevant libraries

import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
```

In [7]:
```
df = pd.read_csv("data.csv")

print("Data imported")

print("shape:", df.shape)

#printing first 5 rows
df.head()
```

```
Data imported
shape: (25, 2)
```

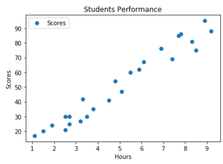
Out[7]:

	Hours	Scores
0	2.5	21
1	5.1	47
2	3.2	27
3	8.5	75
4	3.5	30

Plotting Data

In [8]:
```
#plotting data
df.plot(x='Hours', y='Scores', style="o")
x=df['Hours']
z=df['Scores']
plt.xlabel("Hours")
plt.ylabel("Scores")
plt.title("Students Performance")
```

Out[8]: `Text(0.5, 1.0, 'Students Performance')`



Preparing Data

In [10]:
```
#preparing data
X = df.iloc[:, :-1].values
y = df.iloc[:, 1].values
```

In [12]:
```
#Splitting data into train and test
from sklearn.model_selection import train_test_split
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.15, random_state=42)
```

Training Algorithm

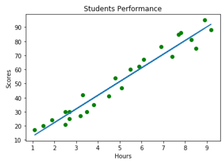
Linear Regression

In [13]:
```
#training
from sklearn.linear_model import LinearRegression
regressor = LinearRegression()
regressor.fit(X_train, y_train)
print("Training completed")
```

```
Training completed
```

In [14]:
```
# Plotting the regression line
line = regressor.coef_*X+regressor.intercept_

# Plotting for the test data
plt.scatter(X, y, c='green')
plt.plot(X, line)
plt.xlabel("Hours")
plt.ylabel("Scores")
plt.title("Students Performance")
plt.show()
```



Evaluating Score

In [15]:
```
#evaluating score of test data
accuracy = regressor.score(X_test, y_test)
print("Accuracy obtained on test dataset:", accuracy)
```

```
Accuracy obtained on test dataset: 0.9685603135908575
```

Predicting on Test Data

In [16]:
```
y_pred = regressor.predict(X_test)
print("X_test:", X_test.flatten())
print("Actual Value:", y_test)
print("Predicted Value:", y_pred)
```

```
X_test: [8.3 2.5 2.5 6.9]
Actual Value: [81 30 21 76]
Predicted Value: [83.33366331 27.09319812 27.09319812 69.75837861]
```

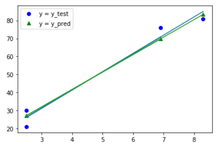
Plotting Actual Values, Predicted Values VS Test Data

In [17]:
```
plt.plot(X_test, y_test, 'bo')
plt.plot(X_test, y_pred, 'g^')
plt.legend(['y = y_test', 'y = y_pred', 'BlueLine = y_test', 'GreenLine = y_pred'], loc='upp
er left')

m, b = np.polyfit(X_test.flatten(), y_test, 1)
#m = slope, b=intercept
plt.plot(X_test, m*X_test + b, color ='tab:blue')

m, b = np.polyfit(X_test.flatten(), y_pred, 1)
#m = slope, b=intercept
plt.plot(X_test, m*X_test + b, color ='tab:green')

plt.show()
```



Testing model with our own data

In [18]:
```
# Let's test with our own data
hours = [[9.25]]
#hours.reshape(-1, 1)
own_pred = regressor.predict(hours)
print("No of Hours = {}".format(hours[0][0]))
print("Predicted Score = {}".format(own_pred[0]))
```

```
No of Hours = 9.25
Predicted Score = 92.54546364797365
```

Evaluating Model

Calculating Various KPIs

Root Mean Square Error

1.Mean Square Error 2.Mean Absolute Error 3.R2 4.Adjusted R2

In [19]:
```
from sklearn.metrics import r2_score, mean_squared_error, mean_absolute_error
from math import sqrt

RMSE = float(format(np.sqrt(mean_squared_error(y_test, y_pred)),'.3f'))
MSE = mean_squared_error(y_test, y_pred)
MAE = mean_absolute_error(y_test, y_pred)
r2 = r2_score(y_test, y_pred)
k=1
n=df.shape[0]
adj_r2 = 1-(1-r2)*(n-1)/(n-k-1)

print('Root Mean Square Error =',RMSE, '\nMean Square Error =',MSE, '\nMean Absolute Error
=',MAE, '\nR2 =', r2, '\nAdjusted R2 =', adj_r2)
```

```
Root Mean Square Error = 4.743
Mean Square Error = 22.4950956257414
Mean Absolute Error = 4.393821175688238
R2 = 0.9685603135908576
Adjusted R2 = 0.9671933707035035
```

In [ ]:
```

```