LinearRegression Assignment 02

March 25, 2024

[6]:
```
# import necessary library
import pandas as pd
import matplotlib.pyplot as plt
from sklearn.linear_model import LinearRegression
import numpy as np
```

0.1 1) Data Exploration

[7]:
```
data = pd.read_csv('D:\\BCS\\Linear␣
↪Programming\\assignment\\asignment002\\student_scores_dataset.csv')
```

[8]:
```
data
```

[8]:

	Study Hours	Exam Scores
0	3.7	87.9
1	9.5	143.6
2	7.3	123.7
3	6.0	99.9
4	1.6	64.5
..	…	…
95	4.9	95.3
96	5.2	101.9
97	4.3	94.5
98	0.3	53.9
99	1.1	64.9

[100 rows x 2 columns]

[9]:
```
# study hours >>>> independent
# Exam Scores >>>>  dependent
```

[10]:
```
x = np.array(data['Study Hours']).reshape(-1,1)
y = np.array(data['Exam Scores'])
```

[11]:
```
#  checking for null values in y
pd.isnull(y).sum()
```

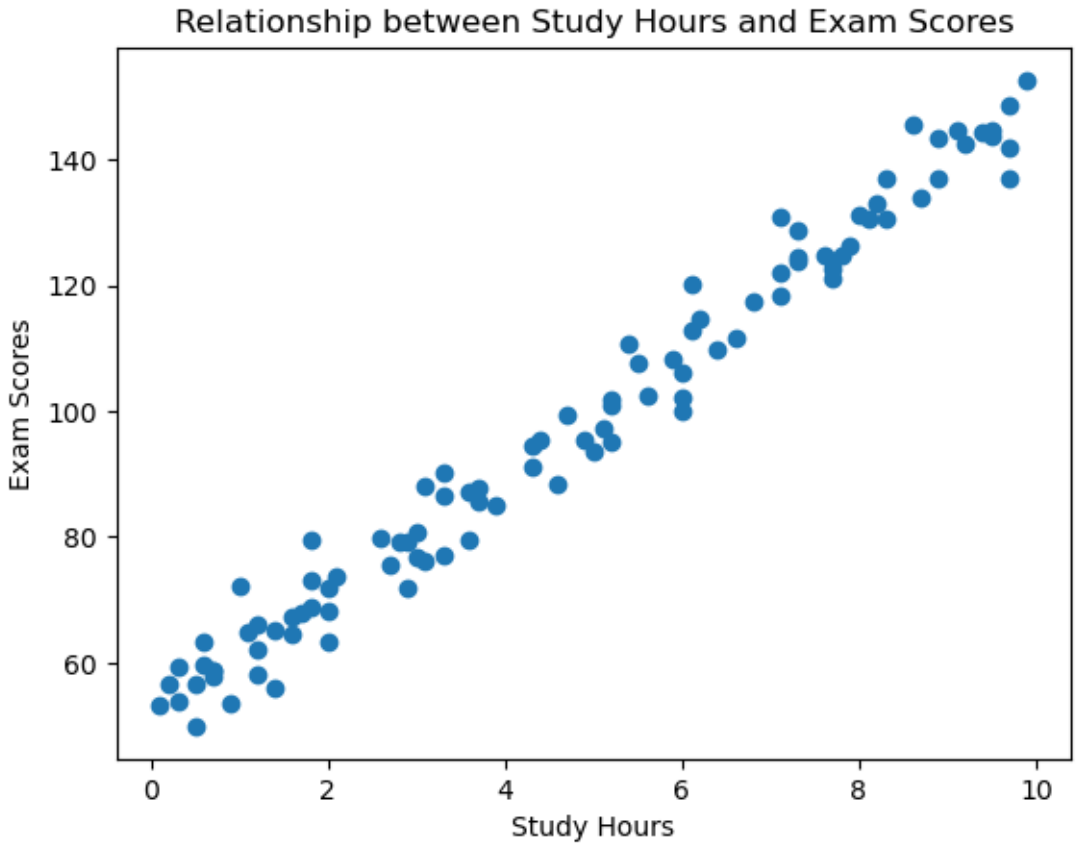
[11]:
```
0
```

[12]:
```
#  checking for null values in x
pd.isnull(x).sum()
```

[12]:
```
0
```

[13]:
```
plt.xlabel("Study Hours")
plt.ylabel("Exam Scores")
plt.title("Relationship between Study Hours and Exam Scores")
plt.scatter(x,y)
```

[13]:
```
<matplotlib.collections.PathCollection at 0x2f4eab72e10>
```



2) Data Preprocessing

[14]:
```
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import StandardScaler
```

[15]:
```
#  x_train, x_test, y_train, y_test = train_test_split(x, y, train_size=0.
↪2,test_size=0.8)
x_train, x_test, y_train, y_test = train_test_split(x, y,test_size=0.2)
```

Standardize the independent variables Standardization is used to rescale the features to have a mean of 0 and a standard deviation of 1 This process ensures that all features contribute equally to the model fitting, preventing some features from dominating others due to their scale. Standardization is typically applied to the independent variables (features),

[16]:
```
from sklearn.preprocessing import StandardScaler

# Initialize the scaler:
scaler = StandardScaler()


# Fit the scaler to the training data and transform it:
x_train_scaled = scaler.fit_transform(x_train)


# Transform the testing data using the same scaler:
# The reason we don't use fit() on the testing data (X_test)
# is because we want to apply the same transformation that was learned from the␣
 ↪training data (X_train).
x_test_scaled = scaler.transform(x_test)
```

0.2 3) Linear regression Model

[17]:
```
from sklearn.linear_model import LinearRegression
from sklearn.metrics import mean_squared_error

# trainig model on scaled training data

model = LinearRegression()
model.fit(x_train_scaled, y_train)
```

[17]:
```
LinearRegression()
```

[41]:
```
from sklearn.metrics import mean_absolute_error, mean_squared_error, r2_score

y_pred = model.predict(x_test_scaled)

mae = mean_absolute_error(y_test, y_pred)
mse = mean_squared_error(y_test, y_pred)
r2 = r2_score(y_test, y_pred)

print("Mean Absolute Error:", mae)
print("Mean Squared Error:", mse)
print("R-squared:", r2)
```

```
Mean Absolute Error: 4.106803834144092
Mean Squared Error: 24.864997972220653
R-squared: 0.9744505974057869
```

[43]:
```
model.intercept_
```

[43]:
```
96.72749999999999
```

[44]:
```
model.coef_
```

[44]:
```
array([28.41039775])
```

[46]:
```
# Perform necessary feature engineering

# Retrain the model
model.fit(x_train_scaled, y_train)
```

[46]:
```
LinearRegression()
```

[48]:
```
# Evaluate the performance
y_pred_updated = model.predict(x_test_scaled)

mae_updated = mean_absolute_error(y_test, y_pred_updated)
mse_updated = mean_squared_error(y_test, y_pred_updated)
r2_updated = r2_score(y_test, y_pred_updated)

print("Updated Model Performance:")
print("Mean Absolute Error:", mae_updated)
print("Mean Squared Error:", mse_updated)
print("R-squared:", r2_updated)

# Compare with initial model
print("Improvement in MAE:", mae - mae_updated)
print("Improvement in MSE:", mse - mse_updated)
print("Improvement in R-squared:", r2 - r2_updated)
```

```
Updated Model Performance:
Mean Absolute Error: 4.106803834144092
Mean Squared Error: 24.864997972220653
R-squared: 0.9744505974057869
Improvement in MAE: 0.0
Improvement in MSE: 0.0
Improvement in R-squared: 0.0
```