Linear Regression - Student Percentage Prediction

In [143…

```
# Libraries
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
```

In [144…

```
df = pd.read_csv('student_scores.csv')
df.head()
```

Out[144…

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

Data Splitting

In [145…

```
df.shape
```

Out[145…

```
(25, 2)
```

In [146…

```
X,y = df['Hours'],df['Scores']
```

In [147…

```
from sklearn.model_selection import train_test_split
```

In [148…

```
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)
```

Exploratory Data Analysis

In [149…

```
X_train.shape
```

Out[149…

```
(20,)
```

In [150…

```
X_train.dtypes
```

Out[150…

```
dtype('float64')
```

In [151…

```
X_train.info()
```

```
<class 'pandas.core.series.Series'>
Index: 20 entries, 9 to 6
Series name: Hours
Non-Null Count  Dtype
--------------  -----
20 non-null     float64
dtypes: float64(1)
memory usage: 320.0 bytes
```

In [152…

```
X_train.describe()
```

Out[152…

```
count    20.000000
mean      4.960000
std       2.566874
min       1.100000
25%       3.075000
50%       4.650000
75%       7.475000
max       9.200000
Name: Hours, dtype: float64
```

In [153…

```
X_train.isnull().sum()
```

Out[153…

```
0
```

In [154…

```
X_train[X_train.duplicated()]
```

```
Out[154…  20    2.7
          Name: Hours, dtype: float64
```

```
In [159…  y_train.drop(labels=[20],inplace=True)
```

```
In [160…  X_train.drop_duplicates(inplace=True)
```

```
In [161…  X_train.shape
```

```
Out[161…  (19,)
```

```
In [162…  lower,upper = np.percentile(X_train,25),np.percentile(X_train,75)
          iqr = upper-lower
          lb,ub = iqr-1.5*lower,iqr+1.5*upper
```

```
In [163…  lower,upper,iqr
```

```
Out[163…  (3.25, 7.550000000000001, 4.300000000000001)
```

```
In [164…  lb,ub
```

```
Out[164…  (-0.5749999999999993, 15.625000000000002)
```

```
In [165…  X_train[X_train<lb],X_train[X_train>ub]
```

```
Out[165…  (Series([], Name: Hours, dtype: float64),
           Series([], Name: Hours, dtype: float64))
```

- No Outliers Found

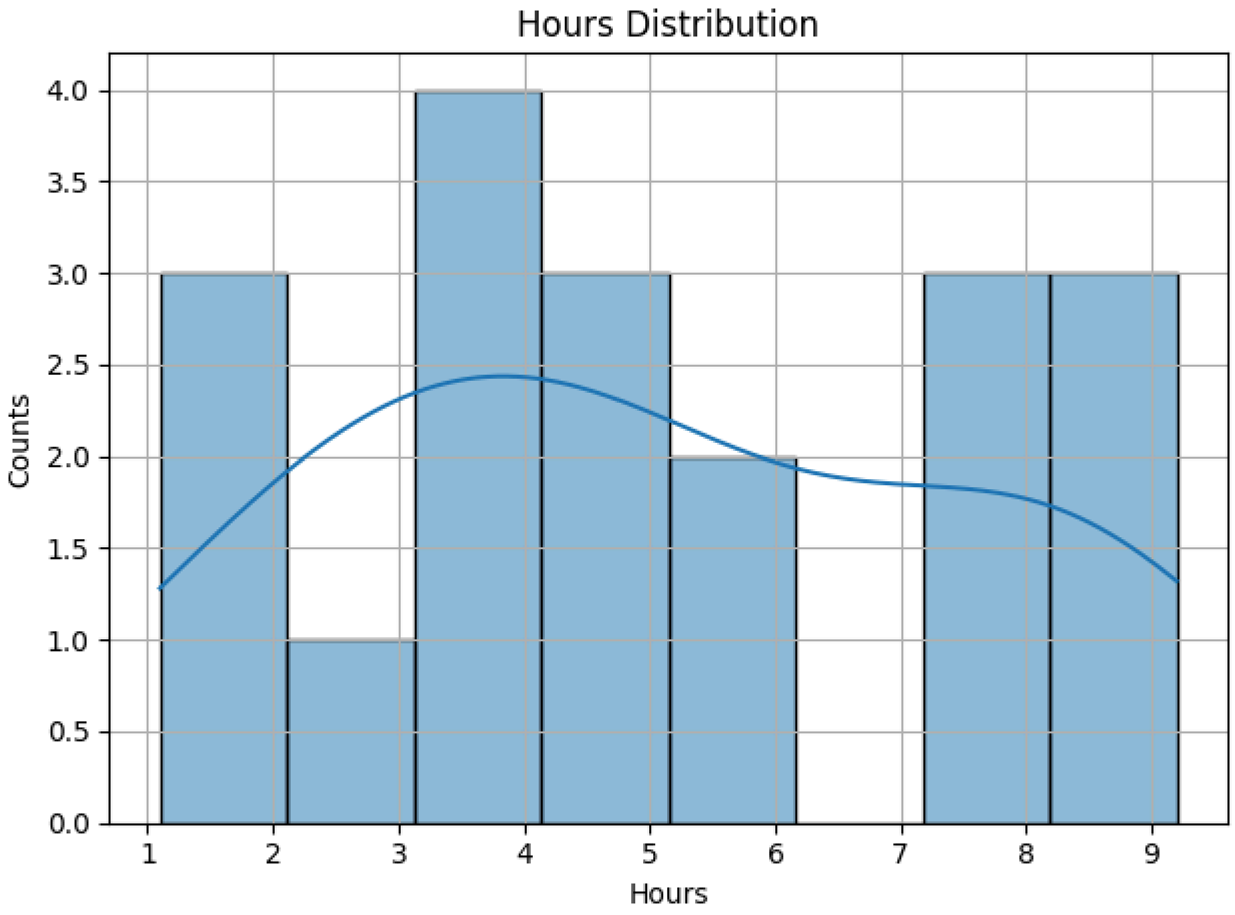
```
In [166…  X_train.head()
```

Out[166…

```
9     2.7
13    3.3
1     5.1
22    3.8
5     1.5
Name: Hours, dtype: float64
```

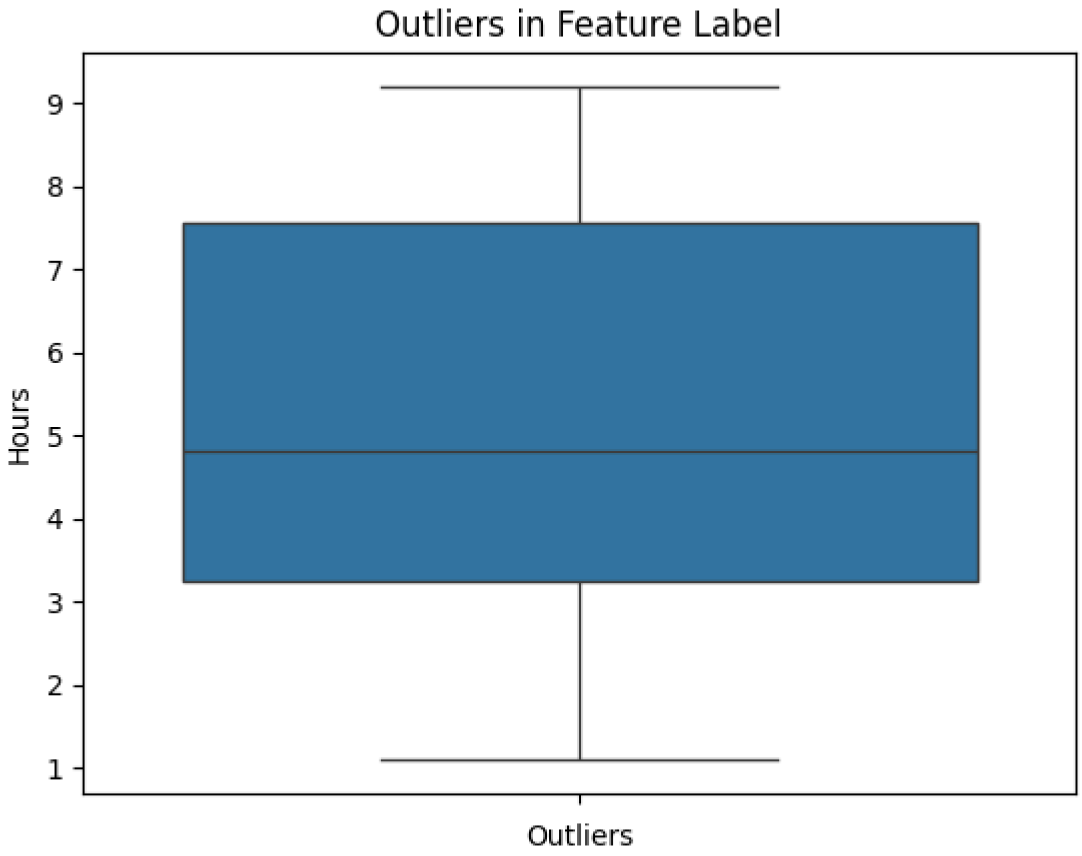
In [167…

```
sns.histplot(X_train,bins=8,kde=True)
plt.xlabel('Hours')
plt.ylabel('Counts')
plt.title('Hours Distribution')
plt.tight_layout()
plt.grid()
plt.show()
```



In [168…

```
sns.boxplot(data=X_train)
plt.xlabel('Outliers')
plt.ylabel('Hours')
plt.title('Outliers in Feature Label')
plt.show()
```



- No Outliers

Building Model

```
In [170…  # Normalization
```

```
In [174…  X_train = pd.DataFrame(X_train)
```

```
In [183…  X_test = pd.DataFrame(X_test)
```

In [184…

```
from sklearn.preprocessing import MinMaxScaler
scaler = MinMaxScaler()
X_train_normalized = scaler.fit_transform(X_train)
X_test_normalized = scaler.transform(X_test)
```

In [185…

```
from sklearn.linear_model import LinearRegression
model = LinearRegression()
model.fit(X_train_normalized, y_train)
print("Coefficients:", model.coef_)
print("Intercept:", model.intercept_)
```

```
Coefficients: [78.59073018]
Intercept: 13.341395700266219
```

In [210…

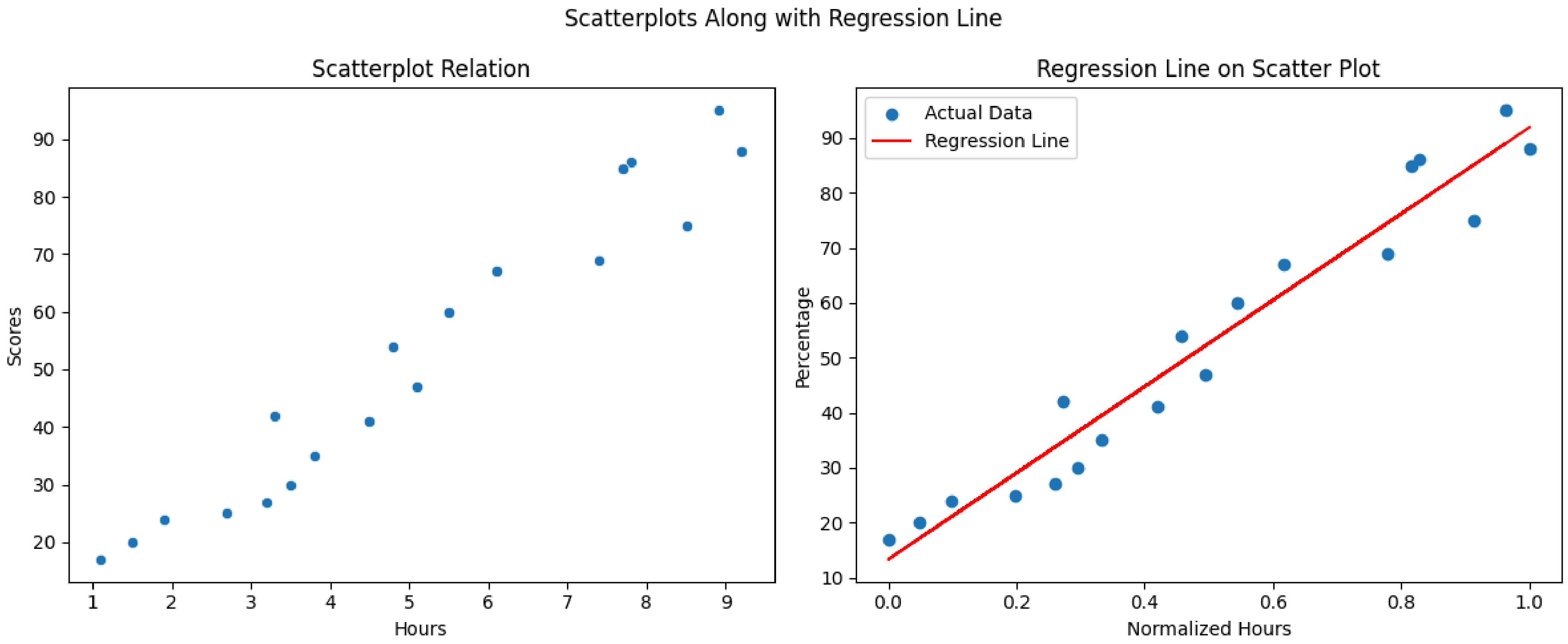
```
fig, axes = plt.subplots(1, 2, figsize=(12, 5))

# 1st Scatter plot
sns.scatterplot(x=X_train['Hours'], y=y_train, ax=axes[0])
axes[0].set_xlabel('Hours')
axes[0].set_ylabel('Scores')
axes[0].set_title('Scatterplot Relation')

# 2nd Scatter plot with Regression Line
axes[1].scatter(X_train_normalized[:, 0], y_train, label='Actual Data')

axes[1].plot(X_train_normalized[:, 0], model.predict(X_train_normalized), color='red', label='Regression Line')

# Add labels and title
axes[1].set_xlabel('Normalized Hours')
axes[1].set_ylabel('Percentage')
axes[1].set_title('Regression Line on Scatter Plot')
axes[1].legend()
plt.suptitle('Scatterplots Along with Regression Line')
plt.tight_layout()
plt.show()
```



Evaluation

In [211…

```python
from sklearn.metrics import mean_absolute_error, mean_squared_error, r2_score
y_pred = model.predict(X_test_normalized)
mae = mean_absolute_error(y_test, y_pred)
mse = mean_squared_error(y_test, y_pred)
rmse = np.sqrt(mse)
r2 = r2_score(y_test, y_pred)

print("Mean Absolute Error (MAE):", mae)
print("Mean Squared Error (MSE):", mse)
print("Root Mean Squared Error (RMSE):", rmse)
print("R-squared (R2):", r2)
```

```
Mean Absolute Error (MAE): 3.933980548404949
Mean Squared Error (MSE): 18.901095098644035
Root Mean Squared Error (RMSE): 4.347538970342191
R-squared (R2): 0.9678771327351393
```

Prediction

In [212…

```python
import warnings
warnings.filterwarnings("ignore")
hours_to_predict = float(input('Enter Hours to predict Percentage..'))
normalized_hours_to_predict = scaler.transform([[hours_to_predict]])

predicted_percentage = model.predict(normalized_hours_to_predict)

print(f"Predicted Percentage for {hours_to_predict} hours / day of study is : {round(predicted_percentage[0],2)}")
```

```
Predicted Percentage for 5.0 hours / day of study is : 51.18
```