

Simple Linear Regression Using Least Square Method

AIM:

To implement simple linear regression using the Least Squares Method and

evaluate the model performance using Mean Squared Error and R^2 Score.

ALGORITHM:

Step 1: Import the required libraries (NumPy and Matplotlib).

Step 2: Generate synthetic data for the independent variable X and compute the

dependent variable y using a linear equation with added noise.

Step 3: Calculate the mean of X and y.

Step 4: Compute the slope and intercept using the Least Squares formula.

Step 5: Predict the output values y_{pred} using the regression equation.

Step 6: Plot the actual data points and the regression line.

Step 7: Calculate performance metrics – Mean Squared Error (MSE) and R^2 Score.

Step 8: Display the slope, intercept, MSE, and R^2 Score.

Step 9: End the program.

SORCE CODE:

```
import numpy as np
```

```
import matplotlib.pyplot as plt
```

1. Simulate data ($y = 2x + 5 + \text{noise}$)

```
np.random.seed(0)
```

```
X = np.random.rand(100) * 10
```

```
noise = np.random.randn(100)
```

```
y = 2 * X + 5 + noise
```

2. Least Squares Calculation

```
x_mean = np.mean(X)
```

```
y_mean = np.mean(y)
```

```
numerator = np.sum((X - x_mean) * (y - y_mean))
```

```
denominator = np.sum((X - x_mean) ** 2)
```

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```
slope = numerator / denominator
```

```
intercept = y_mean - slope * x_mean
```

3. Predictions

```
y_pred = slope * X + intercept
```

4. Plot

```
plt.figure(figsize=(6,4))
```

```
plt.scatter(X, y, label='Actual', color='blue')
```

```
plt.plot(X, y_pred, color='red', label='Prediction  
(Line of Best Fit)')
```

```
plt.title('Simple Linear Regression - Least Squares')
```

```
plt.xlabel('X')
```

```
plt.ylabel('y')
```

```
plt.legend()
```

```
plt.show()
```

5. Performance Metrics

```
mse = np.mean((y - y_pred) ** 2)
```

```
r2 = 1 - (np.sum((y - y_pred)**2) / np.sum((y - np.mean(y))**2))
```

6. Output

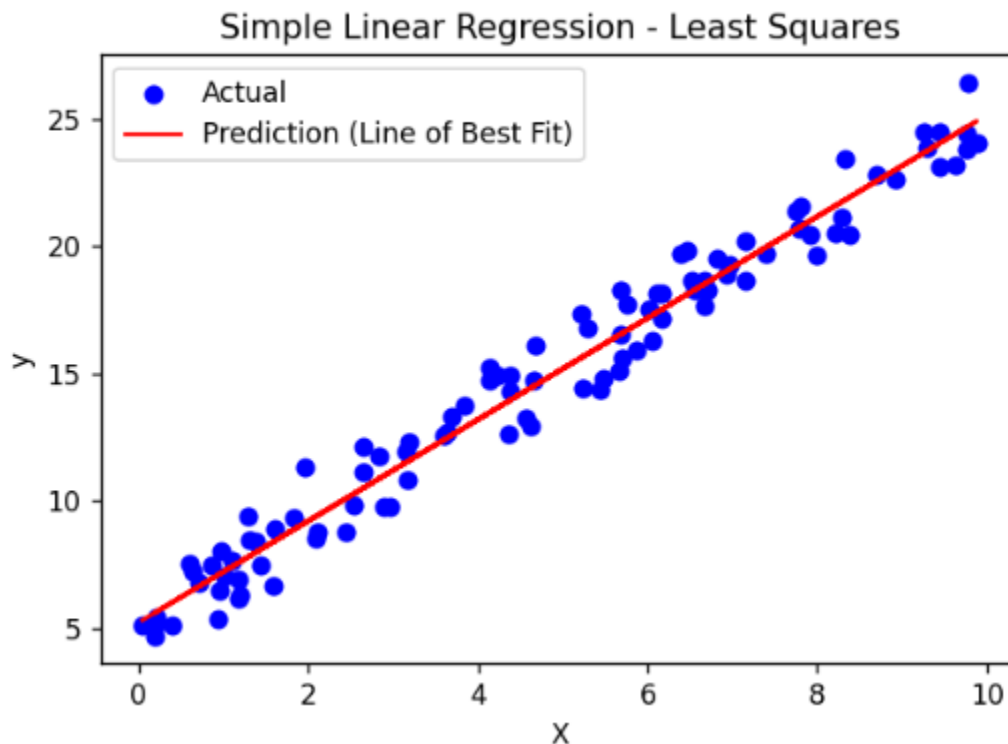
```
print(f"Intercept: {intercept:.2f}")
```

```
print(f"Slope: {slope:.2f}")
```

```
print(f"Mean Squared Error (MSE): {mse:.2f}")
```

```
print(f"R2 Score: {r2:.2f}")
```

OUTPUT:



RESULT:

Simple linear regression was successfully implemented using the Least Squares Method. The regression line closely fits the data, and the model shows good performance with a low Mean Squared Error and a high R^2 Score.