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Experiment-1.1

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Subject Name: Machine Learning Lab   **Subject Code: 23CSH-651**

Aim of the Experiment :

Write a program in Python to implement Linear Regression Algorithm.

Theory :

Linear Regression assumes a linear relationship between the dependent and independent variables, which implies that dependent variable changes proportionally with changes in independent variables.

Simple Linear Regression involves predicting a dependent variable based on a single independent variable. It establishes the relationship between two variables using a straight line. The line is drawn by finding the slope and intercept, which define the line and minimize regression errors.

The equation for Simple Linear Regression is:

$$y = m*x + c$$

where, y = dependent variable

x = independent variable (predictor)

m = coefficient of regression (slope)

c = constant (intercept)

Code for Experiment :

```
# Import Libraries
import numpy as np
import matplotlib.pyplot as plt
```

```python
# Estimate Coefficients of Linear Regression Line
def estimate_coefficient(x, y):
        # Number of observations
        n = np.size(x)

        # Mean of x and y vector
        x_mean = np.mean(x)
        y_mean = np.mean(y)

        # Calculating cross-deviation and deviation about x
        D_xy = np.sum(x*y) - n*(x_mean)*(y_mean)
        D_xx = np.sum(x*x) - n*(x_mean)*(x_mean)

        # Calculating regression coefficients
        m = D_xy / D_xx
        b = y_mean - m*(x_mean)

        return (b, m)

# Plot the Regression Line and the Data Points
def plot_regression_line(x, y, b):
        # Plotting the actual points as scatter plot
        plt.scatter(x, y, color = "m", marker = "o", s = 30)

        # Predicted response vector
        y_pred = b[0] + b[1]*x

        # Plotting the Regression Line
        plt.plot(x, y_pred, color = "g")

        # Putting Labels
        plt.xlabel('x')
        plt.ylabel('y')
        plt.title('Scatterplot of Data Points along with Regression Line')

# Observations / Data
x = np.array([1, 2, 3, 4, 5, 6, 7, 8, 9, 10])
y = np.array([1, 3, 2, 5, 7, 8, 8, 9, 10, 12])
print("x: ",x)
print("y: ",y)

# Estimating the Coefficients
b = estimate_coefficient(x, y)
print("Estimated coefficients:\nc = {}\nm = {}".format(b[0],b[1]))

# Plotting Regression Line
plot_regression_line(x,y,b)
```
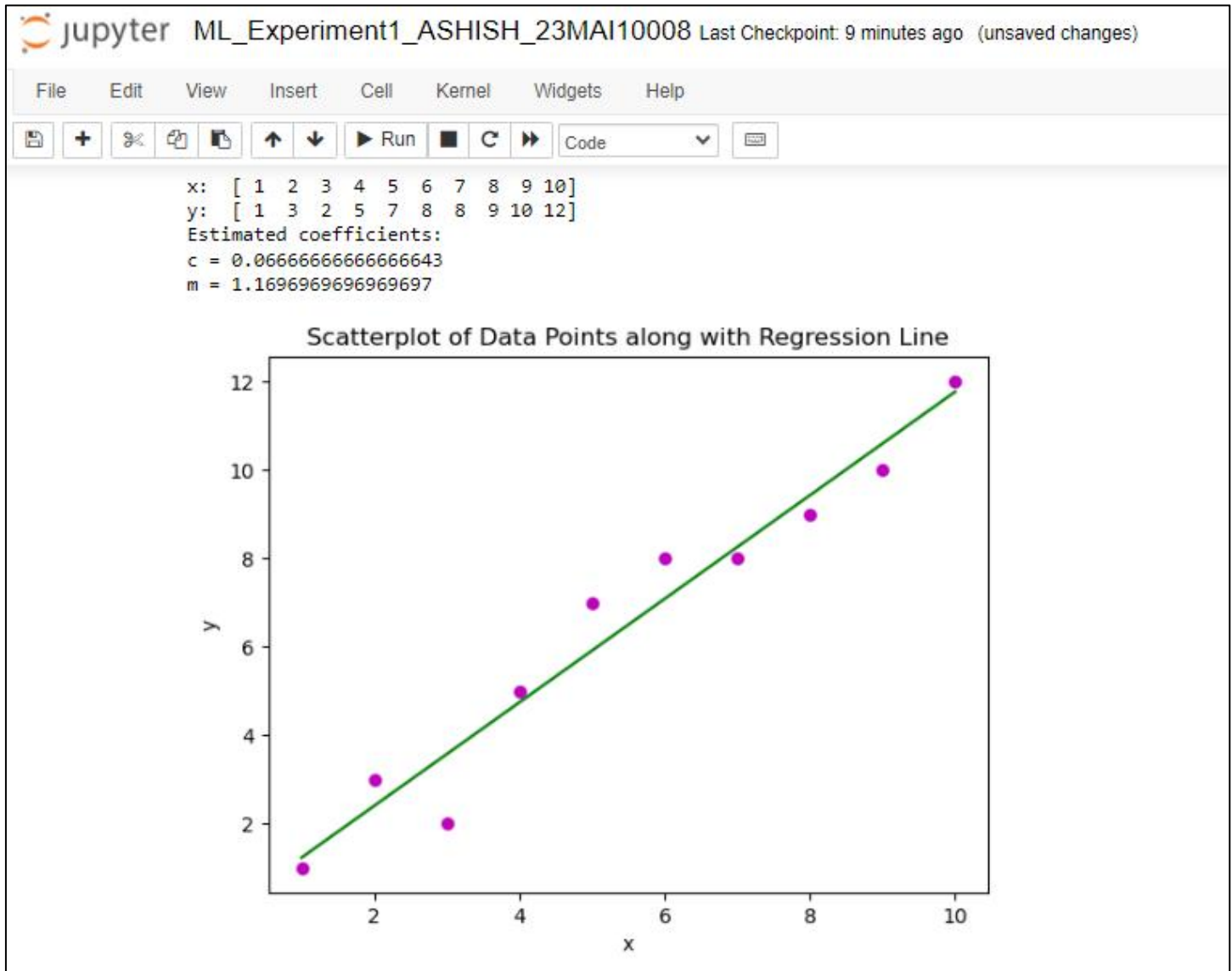
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Result/Output :

Learning outcomes (What I have learnt):

1. I learnt about various python libraries like numpy, matplotlib.

2. I learnt about the concept of Linear Regression.

3. I learnt about the dependent and independent Variables.

4. I learnt about how to calculate the Regression coefficients.

5. I learnt about how to plot the Regression line and Scatter plot.