Experiment-1.2

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Aim of the Experiment :

Write a program in Python to implement Multiple Regression Algorithm.

Theory :

Multiple Regression involves predicting a dependent variable based on two or more independent variable.

Multiple Regression is an extension of Linear Regression.

The equation for Multiple Regression for two independent variables is:

$$y = \alpha_0 + \alpha_1 x_1 + \alpha_2 x_2$$

where, y = dependent variable

x_1, x_2 = independent variable (predictors)

α_1, α_2 = coefficients of regression

α_0 = constant (intercept)

The equation for Multiple Regression for **n** independent variables is:

$$y = \alpha_0 + \alpha_1 x_1 + \alpha_2 x_2 + \ldots + \alpha_n x_n + \varepsilon$$

where, ε = error

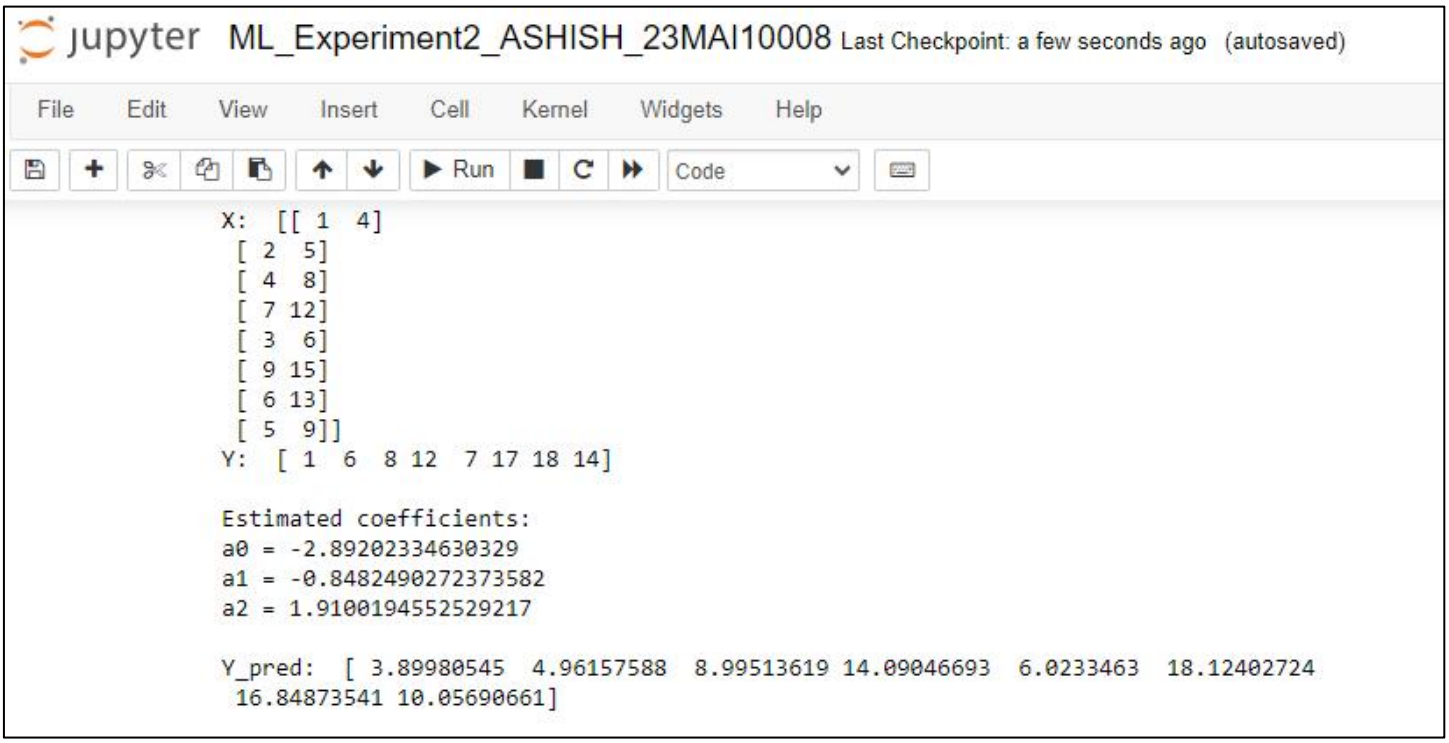
Code for Experiment :

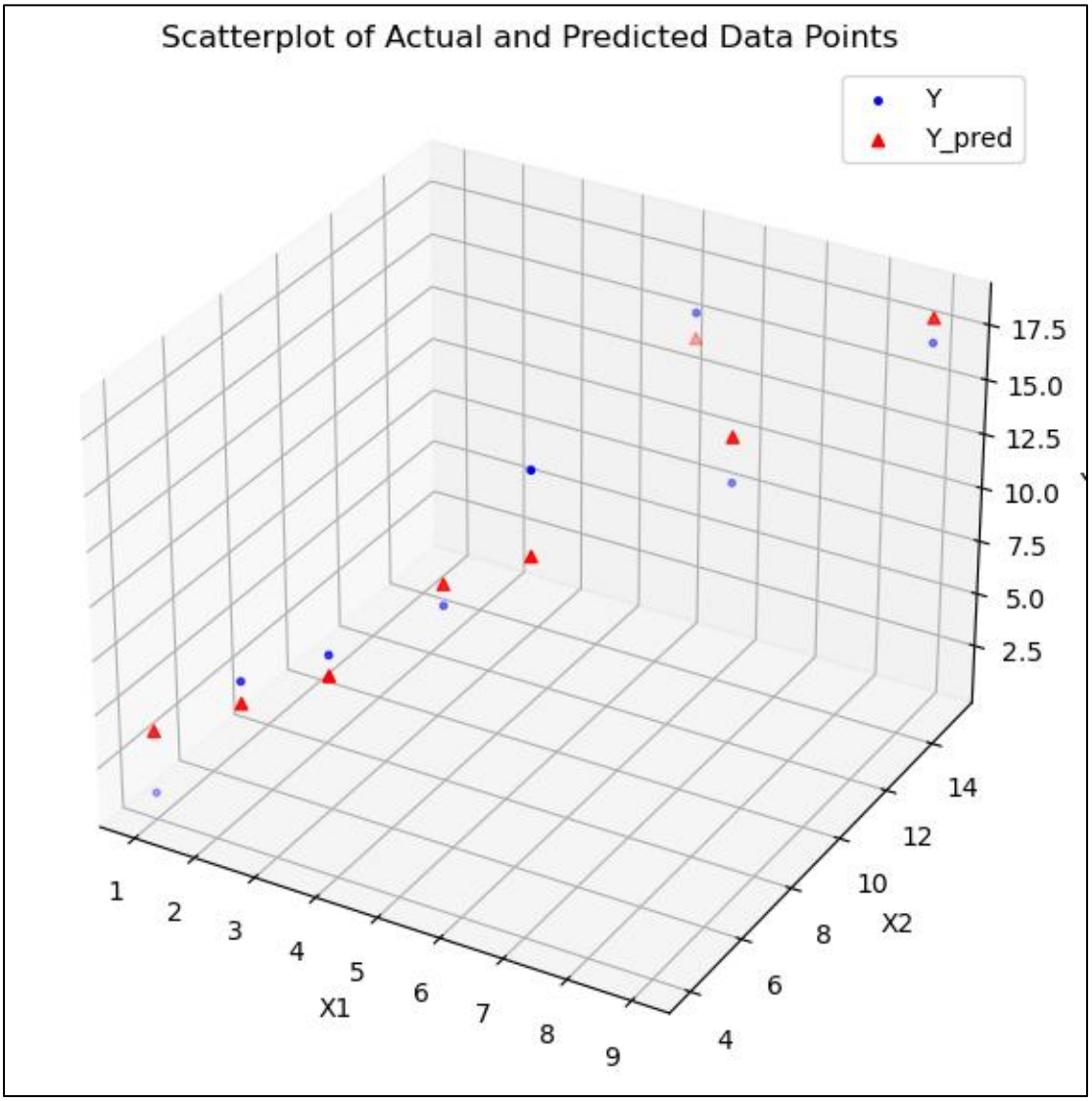
```
# Import Libraries
import numpy as np
import matplotlib.pyplot as plt
```

```
from mpl_toolkits.mplot3d import Axes3D

# Estimate Coefficients of Linear Regression Line
def estimate_coefficient(X, Y):
        # Create Matrix by adding bias
        X = np.concatenate((np.ones((len(X),1)),X),axis=1)

        # Calculating regression coefficients
        a = np.dot((np.linalg.inv(np.dot(X.T,X))), np.dot(X.T,Y))

        return (a)

# Plot the Regression Line and the Data Points
def plot_regression_line(x, y, a):
        # Plotting the actual points as scatter plot
        fig = plt.figure(figsize=(7,7))
        ax = fig.add_subplot(projection ='3d')

        ax.scatter(x[:, 0], x[:, 1], y, label ='Y', c='blue', s = 25, marker=".")
        ax.scatter(x[:, 0], x[:, 1], y_pred, label ='Y_pred', c='red', s = 20, marker="^")

        ax.legend()
        ax.set_xlabel('X1')
        ax.set_ylabel('X2')
        ax.set_zlabel('Y')

        plt.title("Scatterplot of Actual and Predicted Data Points")
        plt.show()


# Observations / Data
X = np.array([[1, 4], [2, 5], [4, 8], [7, 12], [3, 6], [9, 15], [6, 13], [5, 9] ])
```

```
Y = np.array([1, 6, 8, 12, 7, 17, 18, 14])
print("X: ",X)
print("Y: ",Y)

# Estimating the Coefficients
a = estimate_coefficient(X, Y)
print("\nEstimated coefficients:\na0 = {}\na1 = {}\na2 = {}".format(a[0],a[1],a[2]))

# Predicted response vector
y_pred = a[0] + a[1]*X[:, 0] + a[2]*X[:, 1]
print("\nY_pred: ",y_pred)

# Plotting Regression Line
plot_regression_line(X,Y,a)
```

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 Multiple Regression.
3. I learnt about the concatenate() and np.linalg.inv() function in Numpy.
4. I learnt about how to calculate the Regression coefficients.
5. I learnt about how to plot the 3D Scatter plot for Multiple Regression.