Assignment No. 2

AIM: Assignment on Linear Regression

PREREQUISITE: Python programming

Objective:

- Understand the basic concept of Linear Regression.
- Implement Simple Linear Regression in Python.
- Analyze the relationship between independent and dependent variables.
- Evaluate model performance using error metrics.
- Visualize regression results for better interpretation.

Theory:

Linear Regression is one of the most fundamental techniques in Machine Learning used for predicting numerical values. It establishes a relationship between a dependent variable (target) and an independent variable (predictor) using a linear equation:

Where:

- is the dependent variable (output).
- is the independent variable (input feature).
- is the intercept (bias term).
- is the slope (coefficient) of the line.

The goal is to estimate the values of and such that the error between predicted and actual values is minimized. This is commonly done using the Least Squares Method, which minimizes the Sum of Squared Errors (SSE).

Error Measurement:

Model performance is evaluated using metrics such as:

1. Mean Absolute Error (MAE)
2. Mean Squared Error (MSE)
3. Root Mean Squared Error (RMSE)
4. R-squared Score (R^2)

Algorithm:

1. Start
2. Load the dataset.
3. Perform exploratory data analysis (EDA):
    - Check for missing values and handle them appropriately.
    - Visualize relationships between variables.
4. Split the dataset into training and testing sets.
5. Implement Simple Linear Regression:
    - Compute (slope) using:
    - Compute (intercept) using:
6. Make predictions using the regression model.
7. Evaluate model performance using RMSE and R^2 Score.
8. Visualize the regression line using a scatter plot.
9. End

Conclusion:

Linear Regression is an effective method for modeling relationships between numerical variables. By minimizing error metrics such as RMSE and optimizing the R^2 score, the model can be used for prediction tasks efficiently. Visualizing the regression line helps in understanding the model's accuracy and behavior.