Training Day 12 Report

Date: 14 July 2025

Topic: Supervised and Unsupervised Machine Learning – Linear Regression Implementation

Objective: The objective of today's session was to develop a strong conceptual and practical understanding of **Supervised Machine Learning**, with a focus on **Linear Regression**. The session aimed to explain how machines learn from labeled data, how regression models are built, and how they can be applied to real datasets using Python and Scikit-learn.

Session Summary: The session began with a brief recap of Machine Learning fundamentals, followed by an interactive discussion between the trainer and students. The class explored the difference between Supervised and Unsupervised Learning, with real-world analogies and examples.

Key Points Discussed:

1. **Supervised Learning:** Models are trained on labeled datasets with input-output pairs. Algorithms include Regression and Classification.
2. **Unsupervised Learning:** Works with unlabeled data to identify patterns or clusters. Examples: K-Means, PCA.
3. **Features:** Measurable attributes of data such as age, income, or population.
4. **Types:** Regression (continuous output) and Classification (categorical output).

Linear Regression Overview: Mathematical form: $y = mx + c$

- y = dependent variable (target)
- x = independent variable (feature)
- m = slope
- c = intercept

Goal: Find the best-fit line that minimizes the error between predicted and actual values.
Mean Squared Error (MSE): $MSE = (1/n)\ \Sigma(y\_pred - y\_actual)^2$

Implementation (Python - Scikit Learn): Libraries: NumPy, Pandas, Matplotlib, Scikit-learn
Dataset: California Housing Dataset

- Input Feature: Median Income- Target Variable: Median House Value

Steps:

- Load dataset and split into training (80%) and testing (20%) sets.- Train model using LinearRegression().fit(X_train, Y_train) - Plot scatter and line of best fit.

Key Learnings: - Understood regression math and slope-intercept concepts.

- Learned to train and test ML models.
- Understood error minimization (MSE) and overfitting concepts.- Implemented Linear Regression using Scikit-learn.

Conclusion: The session provided both theoretical and practical exposure to Supervised Machine Learning. Understanding Linear Regression built a foundation for advanced ML algorithms like Polynomial Regression and Neural Networks.