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BATCH- 4 (AIML-NON HONS.)

PREDICTIVE ANALYTICS LAB- 6

1. Definition:

- **Linear Regression:** Predicts a continuous outcome based on the relationship between the dependent variable and one or more independent variables.
 - **Example:** Predicting house prices based on factors like size, number of rooms, etc.
- **Logistic Regression:** Predicts a binary or categorical outcome by estimating the probability of a class label.
 - **Example:** Predicting whether a student will pass or fail an exam based on study hours, attendance, etc.

2. Dataset Compatibility:

- **Linear Regression:** Works with continuous numeric data where the target variable is continuous.
 - **Scenario:** Predicting a car's price based on its features like mileage, horsepower, and age.
- **Logistic Regression:** Works with categorical target variables, typically for classification tasks (binary or multiclass).
 - **Scenario:** Classifying emails as spam or not spam based on features like word frequency, sender, etc.

3. Model:

- **Linear Regression:** The model finds the best-fitting straight line ($y = mx + c$) that minimizes the sum of squared differences between actual and predicted values (least squares method).
- **Logistic Regression:** The model uses the logistic (sigmoid) function to model probabilities. Instead of a straight line, it maps values to a probability range between 0 and 1.

Key Equation:

- Linear Regression: $y = \beta_0 + \beta_1 X$

- Logistic Regression: $P(y=1|X) = \frac{1}{1+e^{-(\beta_0 + \beta_1 X)}}$

4. Validation Metrics:

- **Linear Regression:**
 - Common metrics: Mean Squared Error (MSE), Root Mean Squared Error (RMSE), and R^2 .
 - **Scenario Example:** Predicting a company's quarterly revenue based on past data.
- **Logistic Regression:**
 - Common metrics: Accuracy, Precision, Recall, F1-score, and Area Under the ROC Curve (AUC-ROC).
 - **Scenario Example:** Predicting customer churn.

5. Visualization:

- **Linear Regression:** Visualization involves plotting the independent variable on the x-axis and the dependent continuous variable on the y-axis. The best-fit straight line (regression line) represents the model's prediction.
 - **Graph Example:** House price prediction where house size is plotted against house price, showing a line representing the predicted prices.



- **Logistic Regression:** Visualization often involves plotting the sigmoid curve, with probabilities on the y-axis and the predictor variable on the x-axis. ROC curves are also common to assess model performance.
 - **Graph Example:** Predicting whether a customer will churn based on the number of support calls, where a sigmoid curve maps values to probabilities, and a threshold defines the class boundary.

