24/3/2025

Lab 4

* Linear Regresion

Algorithm

1) Initialigation
   - Start with a dataset containing the independent variables (x) and the independent (y)

   - Defining equation $y = b0 + b1 * x_1 + b_2 x_2 ---$

where
- y dependent variable.
- $x_1, x_2 --- x_n$ independent variables
- b_0 is intercept value
- $b_1, b_2, b_3 ---, b_n$ are the coefficient of relationship between dependent and independent variables.

2) Finding the Best Line which minimizes the sum of squared errors between predicted and actual values

$$\Sigma (y_i - \bar{y}_i)^2$$

3) Predict the value.

Ex TV_Sales Dataset where we can find relationship between number of sales vs cost spent

* Multiple learning Regression

Algorithm

1) Let $(x_{11}, x_{12} - - - x_{1n})$
$(x_{21}, \_\_\_\_ x_{2n})$
$\vdots \quad \vdots$ be the data points (~~dep~~ independent variable)

2) Let β_0 be intercept and $\beta_1, \beta_2 \_\_\_ \beta_n$ be the coefficient of independent variable

3) Let $Y = \begin{bmatrix} y_1 \\ \vdots \\ \vdots \\ y_n \end{bmatrix}$ be set of dependent variables

3) After rearranging

$$Y = \begin{bmatrix} 1 + x_1 + x_2 - & + x_{1n} \\ 1 + x_{21} + x_2 - & - x_{2n} \\ & \\ 1 + 1 & x_{mn} \end{bmatrix} \begin{bmatrix} \beta_0 \\ \beta_1 \\ \beta_2 \\ \beta_n \end{bmatrix} + \begin{bmatrix} \epsilon_1 \\ \epsilon_2 \\ | \\ \epsilon_n \end{bmatrix}$$

where $\beta = ((x^T \cdot x)^{-1} \cdot x^T) y$

4) obtain values of $\beta_0, \beta_1, \ldots \beta_n$

Ex:- Housing dataset where we have CRIM, ZN, INDUS, PTRATIO are ~~depen~~ independent upon which we calculate Medv

* Logistic Regression

Algorithm

- Define a sigmoid function to map the linear combination of independent and dependent variables.

$$y = b_0 + b_1 x_1 + \ldots b_n x_n$$

$$p = \frac{1}{1 + e^{-y}}$$

$b_0, b_1 \ldots b_n$ is coefficients.

- Maximum Likelihood Estimation
  Aims to find values of coefficients that maximize likelihood of observing the given data.

- Set a threshold, after calculation if $P >$ threshold classify as 1 else 0 for Binary classification.