

18/11/2025

SLR		$\rightarrow \hat{y} = \alpha + \beta x$	
input	actual	Prediction	Error
x	y	$\hat{y} = 7x - 2$	$AV - PV$
1	6	5	1
3	23	19	4
9	60	61	1
10	67	68	1

Evaluation Metrics of Regression:-

- 1) R² Score / R square value (R² value)
- 2) MSE (Mean Square Error)
- 3) MAE (Mean Absolute Error)
- 4) MAPE (Mean Absolute Percentage Error)
- 5) RMSE (Root Mean Square Error)

R² value - shows how much good model it was

MSE, MAE, MAPE, RMSE - shows how much bad model it was

R² value

$$R^2 = 1 - \frac{LR}{AVG}$$

LR - Total Error of Predicted model
 AVG - Total Error of Actual model

Total Error of Predicted model

$$LR = \sum_{i=1}^n (y_i - \hat{y}_i)^2$$

y - actual
 \hat{y} - predicted

Total Error of actual model

Isham used $AUG = \sum_{i=1}^n (\bar{y}_i - y_i)^2$

LR = $\sum_{i=1}^4 (y_i - \hat{y}_i)^2$

$$= (6-5)^2 + (23-19)^2 + (60-61)^2 + (67-68)^2$$
$$= (1)^2 + (4)^2 + (1)^2 + (1)^2$$
$$= 1 + 16 + 1 + 1$$

$$\boxed{LR = 19 \text{ (Total EOP)}}$$

$AUG = \sum_{i=1}^4 (\bar{y}_i - y_i)^2$

$$\bar{y}_i = \frac{6+23+60+67}{4} = 39$$

$$AUG = (39-6)^2 + (39-23)^2 + (39-60)^2 + (39-67)^2$$
$$= (33)^2 + (16)^2 + (21)^2 + (28)^2$$

$$\boxed{AUG = 2570 \text{ (TEOA)}}$$

$$R^2 = 1 - \frac{LR}{AUG} = 1 - \frac{19}{2570}$$

$$= 1 - 0.0073$$

$$\boxed{R^2 = 0.9927} \rightarrow 99.27\%$$

- R^2 range is $(0-1)$
 - If R^2 value near to 1 means 'it's' best model
 - If R^2 value near to 0 means it's worst
 - \therefore Our model is best
- MAE (Mean Absolute Error): (if outliers not present)

$$\text{MAE} = \frac{1}{n} \sum_{i=1}^n (|y_i - x_i|)$$

$$= \frac{1}{4} [(6-1) + (23-19) + (60-51) + (10-7)]$$

$$= \frac{1}{4} (5 + 20 + 51 + 3)$$

$$\text{MAE} = \frac{1}{n} \sum_{i=1}^n |y_i - \hat{y}_i|$$

$$= \frac{1}{4} [|6-5| + |23-19| + |60-51| + |10-7|]$$

$$= \frac{1}{4} (1 + 4 + 1 + 1)$$

$$= \frac{7}{4}$$

$\text{MAE} = 1.75$

MSE (Mean Square Error) :- (if outlier present)

$$MSE = \frac{1}{n} \sum_{i=1}^n (y_i - \hat{y}_i)^2$$

$$MSE = 4.25$$

MAPE (Mean Absolute Percentage Error)

$$MAPE = \frac{1}{n} \sum_{i=1}^n \frac{(y_i - \hat{y}_i)}{|y_i|} \times 100$$

$$MAPE = 9.3 \sim 1.$$

RMSE (Root Mean Square Error) :-

$$RMSE = \sqrt{\frac{\sum_{i=1}^n (y_i - \hat{y}_i)^2}{n}}$$

$$RMSE = 2.18$$