

18/11/2025

SLR  $\rightarrow \hat{y} = \alpha x + \beta$

| 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)  $R^2$  Score / R Square value ( $R^2$  value)
- 2) MSE (Mean Square Error)
- 3) MAE (Mean Absolute Error)
- 4) MAPE (Mean Absolute Percentage Error)
- 5) RMSE (Root Mean Square Error)

$R^2$  value - shows how much good model it was

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

### $R^2$ 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

from test  $AVG = \sum_{i=1}^n (\bar{y}_i - y_i)^2$

from train  $LR = \sum_{i=1}^4 (y_i - \bar{y}_1)^2$

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

$$= (1)^2 + (4)^2 + (1)^2 + (1)^2$$

$$= 1 + 16 + 1 + 1$$

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

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

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

$$AVG = (39-6)^2 + (39-23)^2 + (39-60)^2 + (39-67)^2$$

$$= (33)^2 + (16)^2 + (21)^2 + (28)^2$$

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

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

$$= 1 - 0.0073$$

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

- $R^2$  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 m
- $\therefore$  Our model is best

MAE (Mean Absolute Error): (if outlier <sup>not</sup> present)

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

~~$$= \frac{1}{4} [(6-1) + (23-3) + (9-60) + (10-10)]$$~~

~~$$= \frac{1}{4} (5 + 20 + 51 + 57)$$~~

~~$$= \frac{133}{4}$$~~

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

$$= \frac{1}{4} [|6-5| + |23-19| + |60-61| + |67-67|]$$

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

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

$MAE \approx 1.75$

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

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

$$MSE = 4.75$$

MAPE (Mean Absolute Percentage Error)

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

$$MAPE = 9.3\%$$

RMSE (Root Mean Square Error) :-

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

$$RMSE = 2.18$$