Linear regression

Date :

Given:

$x = [2, 4, 5, 3, 5, 7]$

$y = [35, 60, 20, 50, 55, 60]$

$\bar{x} = \frac{\Sigma x}{n} = \frac{2+4+5+3+5+7}{6} = 4.33$

$\bar{y} = \frac{\Sigma y}{n} = \frac{35+60+20+50+55+60}{6} = 46.66$

$\therefore m = \frac{\Sigma (x-\bar{x})(y-\bar{y})}{\Sigma (x-\bar{x})^2}$

calculate:

$\Sigma (x-\bar{x})(y-\bar{y})$

$x=2, y=35 \Rightarrow (2-4.33)(35-46.66) = 27.16$

$x=4, y=60 \Rightarrow (4-4.33)(60-46.66) = 4.40$

$x=5, y=20 \Rightarrow (5-4.33)(20-46.66) = -17.86$

$x=3, y=50 \Rightarrow (3-4.33)(50-46.66) = -4.44$

$x=5, y=55 \Rightarrow (5-4.33)(55-46.66) = 5.58$

$x=7, y=60 \Rightarrow (7-4.33)(60-46.66) = 35.61$

$\Sigma (x-\bar{x})(y-\bar{y}) = 27.16 + 4.40 - 17.86 - 4.44 + 5.58 + 35.61$

$\Rightarrow 41.66$

calculate

$$\Sigma (x-\bar{x})^2$$

$x = 2$ then $(2 - 4.33)^2 = 5.42$

$x = 4$ then $(4 - 4.33)^2 = 0.10$

$x = 5$ then $(5 - 4.33)^2 = 0.44$

$x = 3$ then $(3 - 4.33)^2 = 1.76$

$x = 5$ then $(5 - 4.33)^2 = 0.44$

$x = 7$ then $(7 - 4.33)^2 = 7.12$

$$\Sigma (x-\bar{x})^2 = 5.42 + 0.10 + 0.44 + 1.76 + 0.44 + 7.12$$

$$= 15.28$$

Now,

Slope $M = \dfrac{\Sigma (x-\bar{x})(y-\bar{y})}{\Sigma (x-\bar{x})^2} = \dfrac{41.66}{15.28}$

$= 2.72$

For,

Intercept $c = \bar{y} - m\bar{x}$

$= 46.66 - [2.72 \times 4.33]$

$= 34.88$

finally, predict the value,

$y = mx + c$

$= 2.72 \times 6 + 34.88$

$= 51.20$

price

predict

Date :

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

Squared diff →

1. $(35 - 40.403226)^2 = 29.19$
2. $(60 - 45.645161)^2 = 206.06$
3. $(20 - 48.266129)^2 = 798.98$
4. $(50 - 43.024194)^2 = 48.66$
5. $(50 - 50.887097)^2 = 0.79$
6. $(55 - 48.266129)^2 = 45.35$
7. $(60 - 53.508065)^2 = 42.15$

Sum of squared difference:

$$\sum 29.19 + 206.06 + 798.98 + 48.66 + 0.79 + 45.35 + 42.15$$

$$= 1171.18$$

$$MSE = \frac{1171.18}{7} = 167.3099078$$

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

Squared differences:

- $|35 - 40.403226| = 5.403226$
- $|60 - 45.645161| = 14.354839$
- $|20 - 48.026419| = 28.266229$
- $|50 - 43.024194| = 6.975806$
- $|50 - 50.887097| = 0.887097$
- $|55 - 48.266129| = 6.733871$
- $|60 - 53.508065| = 6.491935$

Sum of absolute differences:

$$\Sigma = 5.403226 + 14.354839 + 28.266229 + 6.975806 + 0.887097 + 6.733871 + 6.491935$$

$$\Rightarrow 69.112003$$

$$MAE = \frac{69.112003}{7}$$

$$= 9.87$$