Linear Regression

Task 1:

Given data points,

Weight, $X = [2, 4, 5, 3, 6, 5, 7]$

Price, $Y = [35, 60, 20, 50, 50, 55, 60]$

Mean of X and Y:

$$\bar{X} = \frac{2+4+5+3+6+5+7}{7} = 4.57$$

$$\bar{Y} = \frac{35+60+20+50+50+55+60}{7}$$

$$= 47.14$$

- Slope (m):

$$m = \frac{\Sigma (X-\bar{X})(Y-\bar{Y})}{\Sigma (X-\bar{X})^2}$$

$$= \frac{(2-4.57)(35-47.14) \times (4-4.57)(60-47.14) \times (5-4}{}$$

$$= \frac{46.49}{17.71}$$

$$= 2.62$$

Intercept, c :

$$c = \bar{Y} - m\bar{X}$$

$$= 47.14 - (2.62 \times 4.57)$$

$$= 47.14 - 11.97$$

$$= 35.17$$

For $X = 6$,

$$Y = mX + c$$

$$= (2.62 \times 6) + 35.17$$

$$= 50.89$$

Task 2:

Weight	Price	Predicted Price	Residual
2	35	40.41	-5.40
4	60	45.65	14.35
5	20	48.27	-28.26
3	50	43.03	6.97
6	50	50.89	-0.89
5	55	48.27	6.73
7	60	53.51	6.49

For X = 2:

$$Y = mX + C$$
$$= (2.62 \times 2) + 35.17$$
$$= 40.41$$

For X = 4:

$$Y = mX + C$$
$$= (2.62 \times 4) + 35.17$$
$$= 45.65$$

For X = 5:

$$Y = mX + C$$
$$= (2.62 \times 5) + 35.17$$
$$= 48.27$$

For $X = 3$:

$$Y = mX + C$$
$$= (2.62 \times 3) + 35.27$$
$$= 43.03$$

For $X = 6$:

$$Y = mX + C$$
$$= (2.62 \times 6) + 35.27$$
$$= 50.89$$

For $X = 5$:

$$Y = mX + C$$
$$= (2.62 \times 5) + 35.27$$
$$= 48.27$$

For $X = 7$:

$$Y = mX + C$$
$$= (2.62 \times 7) + 35.27$$
$$= 53.51$$

• Residual = Price − Predicted Price

For Y = 35:

$r = 35 - 40.41$

$= -5.40$

For Y = 60:

$r = 60 - 45.65$

$= 14.35$

For Y = 20:

$r = 20 - 48.27$

$= -28.26$

For Y = 50:

$r = 50 - 43.03$

$= 6.97$

For Y = 50:

$r = 50 - 50.89$

$= -0.89$

For Y = 55:

$r = 55 - 48.27 = 6.73$

For $Y = 60$:

$$n = 60 - 53.51$$

$$= 6.49$$

Task 3:

MAE:

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

~~$= \frac{1}{N}$~~

For the values of Y, the absolute errors are:

$|-5.40| = 5$
$|14.35| = 14$
$|-28.26| = 28$
$|6.97| = 6$
$|-0.89| = 0$
$|6.73| = 6$
$|6.49| = 6$

- sum of absolute errors = 65
- $N = 7$
- $MAE = \frac{65}{7} = 9.29$

MSE:

Mean squared Error $= \frac{1}{N} \sum_{i=1}^{N} (y_i - \hat{y}_i)^2$

- $N = 7$
- For the values of Y, the squared errors are:-

$(-5.40)^2 = 29.16$
$(14.35)^2 = 205.92$
$(-28.26)^2 = 798.63$
$(6.97)^2 = 48.58$
$(-0.89)^2 = 0.79$
$(6.73)^2 = 45.29$
$(6.49)^2 = 42.12$

- sum of the squared errors: 1270.49

$\therefore MSE = \frac{1270.49}{7} = 167.21$