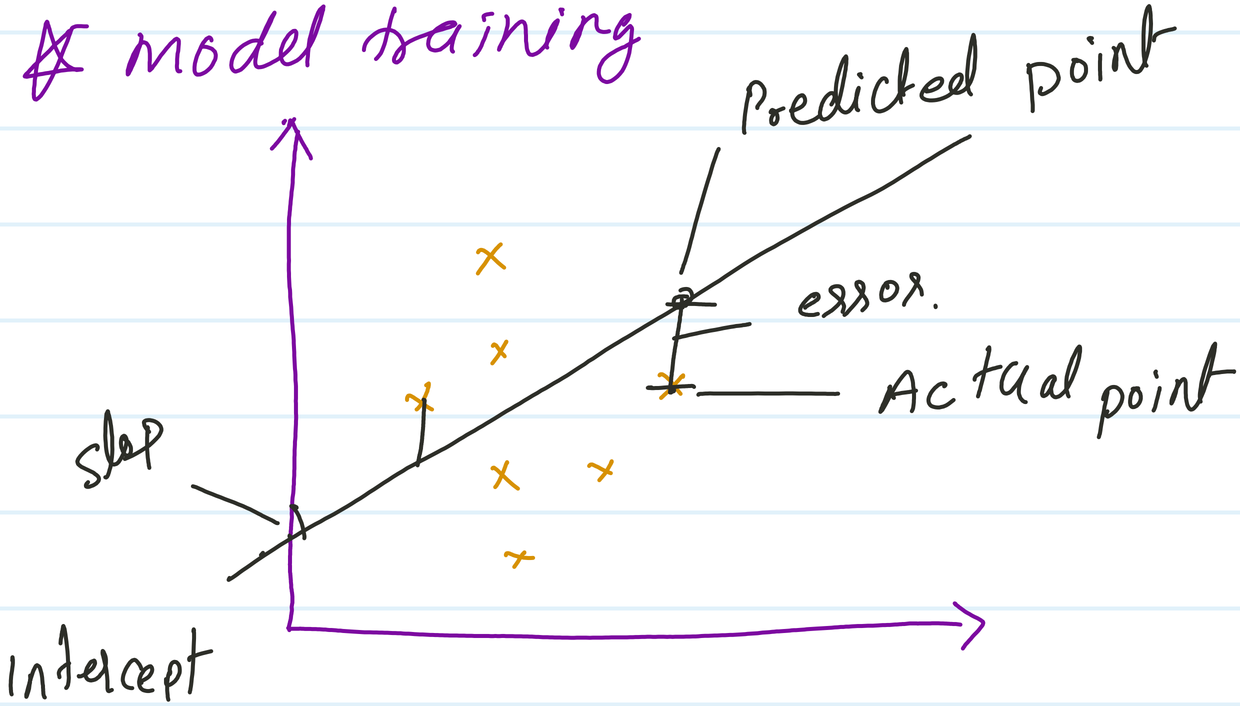
✡ Linear Regression

✡ model training



y = Actual data

$$Y = mx + c$$

$\hat{y}$ = Predicted data

y = Dependent variable

x = Independent variable

m = slop

c = Intercept

$y - \hat{y}$ = Residual error

Base eqn line

$$y = mx + c$$

$x \; x \; x \quad y$

OR

$$y = h_\theta(x)$$

$\theta_0 = c$

$m = \theta_1$

$x_1 = x$

or

$$\boxed{h_\theta(x) = \theta_0 + \theta_1 x_1}$$

or

$$h_\theta(x) = \theta_0 + \theta_1 x_1 + \theta_2 x_2 + \theta_3 x_3 - - - - - \theta_n x_n$$

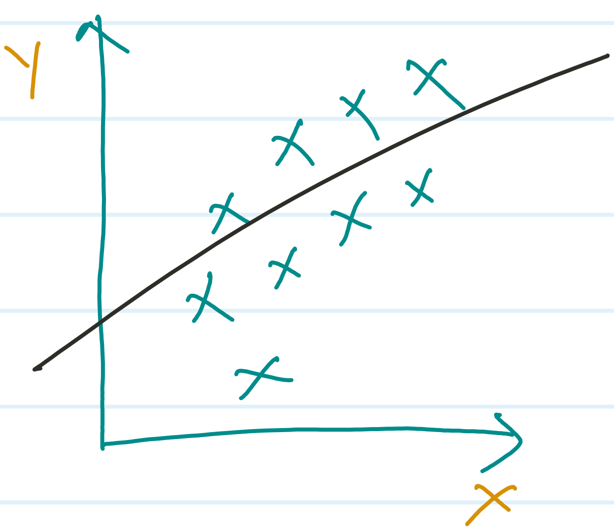
Cost function

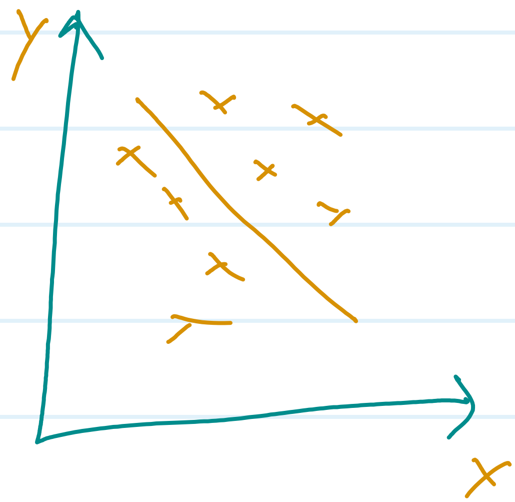
$$J = y = h_\theta(x)$$

$$J = J(\theta_0, \theta_1)$$

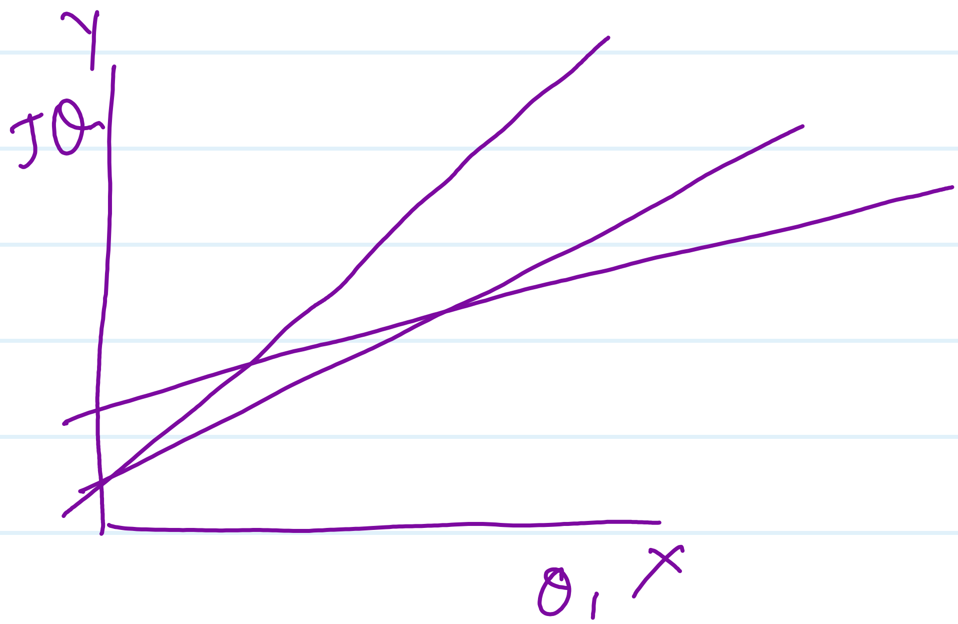
$$J(\theta_0, \theta_1) = \frac{1}{m} \sum_{i=1}^{m} (h_\theta(x) - y)^2$$

This is cost function to min. error by changing value of θ_0, θ_1





(θ_0, θ_1)



Repeat conversion Therom

$$\theta_j = \theta_j - \alpha \boxed{\frac{d}{d\theta_j} \left[J(\theta_1) \right]}$$

$\alpha = 0.05, \; 0.025, \; 0.1$

$$\theta_0 = \theta_0 - \alpha \frac{1}{m} \sum_{i=1}^{m} (h_\theta(x^i) - y^i)$$

$$\theta_1 = \theta_1 - \alpha \frac{1}{m} \sum_{i=1}^{m} (h_\theta(x^i) - y^i) x^i$$

Model evaluation or performance metrix

1. MSE (mean squared error)
2. RMSE (Root mean square error)
3. MAE (Mean Absolute error)
4. R^2
5. Adj. R^2

(i) MSE

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

↓ lower

② RMSE

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

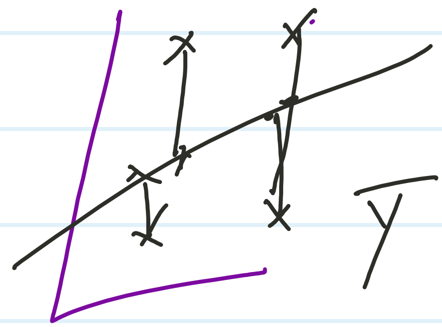
y
2.
3.5
4
6.
7.1

③ MAE

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

lower value better.

Accuracy matrix



① R^2

$$R^2 = 1 - \frac{RSS}{TSS}$$

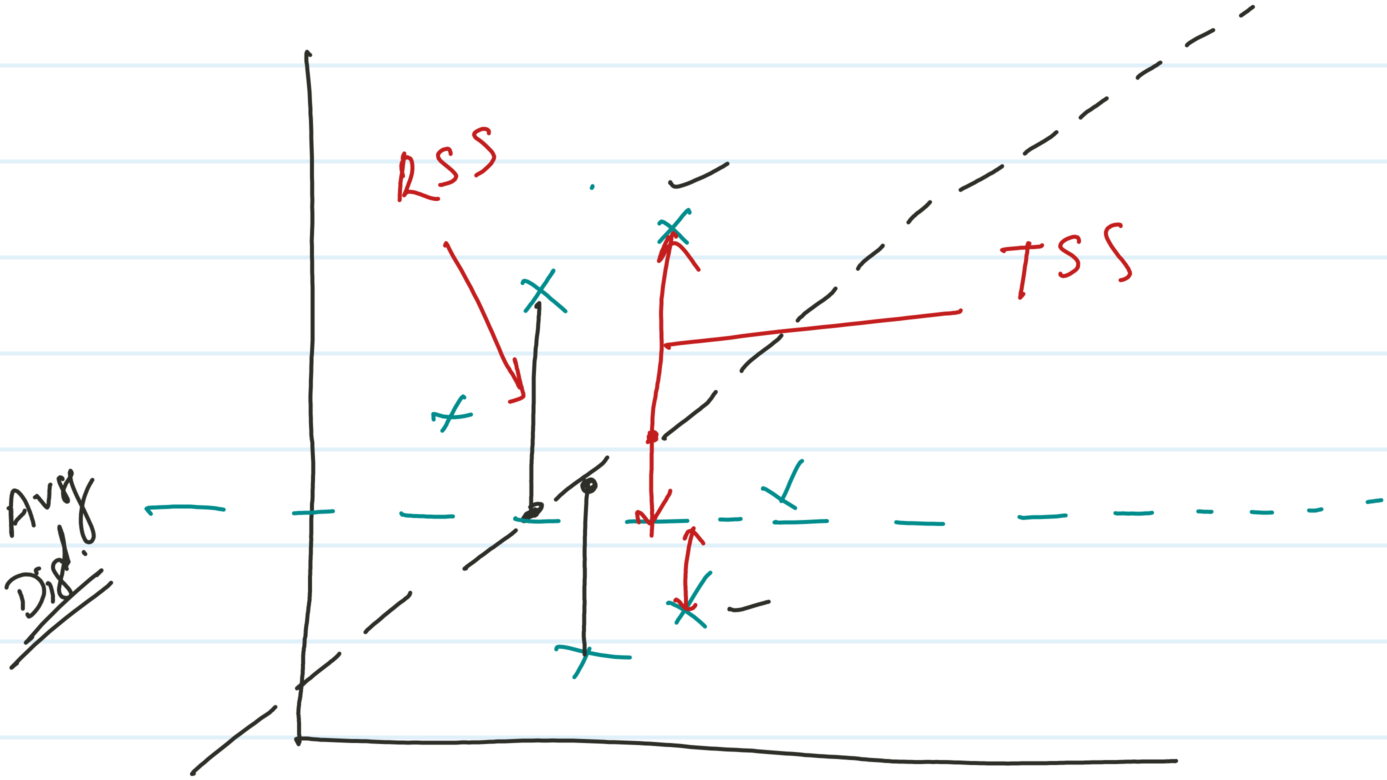
0 – 1

R^2 = coeff. of determination

RSS = sum of square of residual

RSS = Distance b/w y and $\hat{y}$

TSS = Distance b/w y and $\bar{y}$



$$RSS = \sum (y - \hat{y})^2$$

$$TSS = \sum (y - \bar{y})^2$$

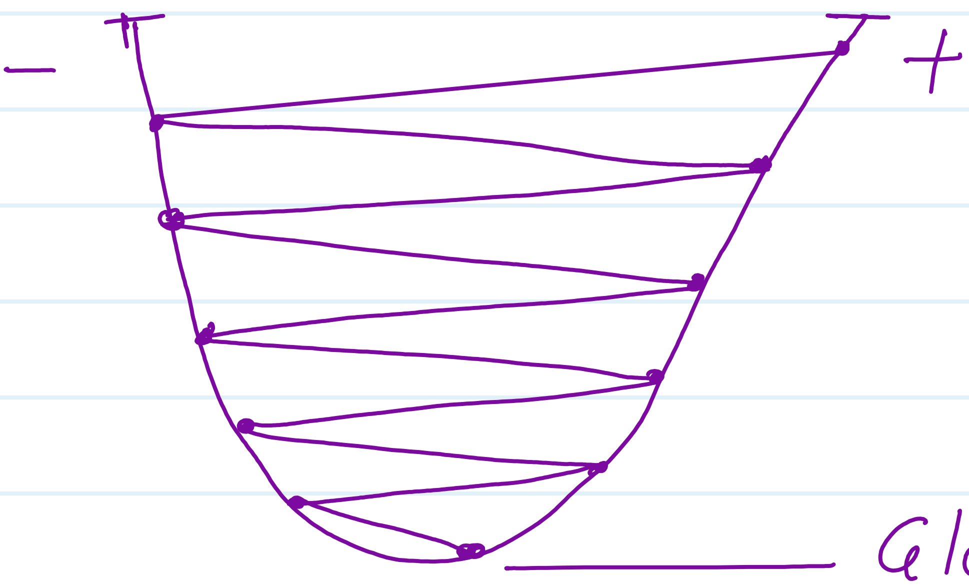
TSS Avg distance

② Adj. R^2

$$\text{Adj. } R^2 = 1 - \frac{(1 - R^2)(N - 1)}{N - P - 1}$$

N = no. of datapoint in our dataset

P = no. of independ variable (x_1, x_2 x_3 - - - -)



Global minima

To find multi co-linearity

X_1	X_2	X_3	X_4	Y

VIF (variance inflation factors)

$$VIF = \frac{1}{1-R^2}$$

VIF = start 1 and it has no limit

If 1 or less than 5 so no. multicolinearity

If > 5 so there will be co-linearity b/w inde. Feature.