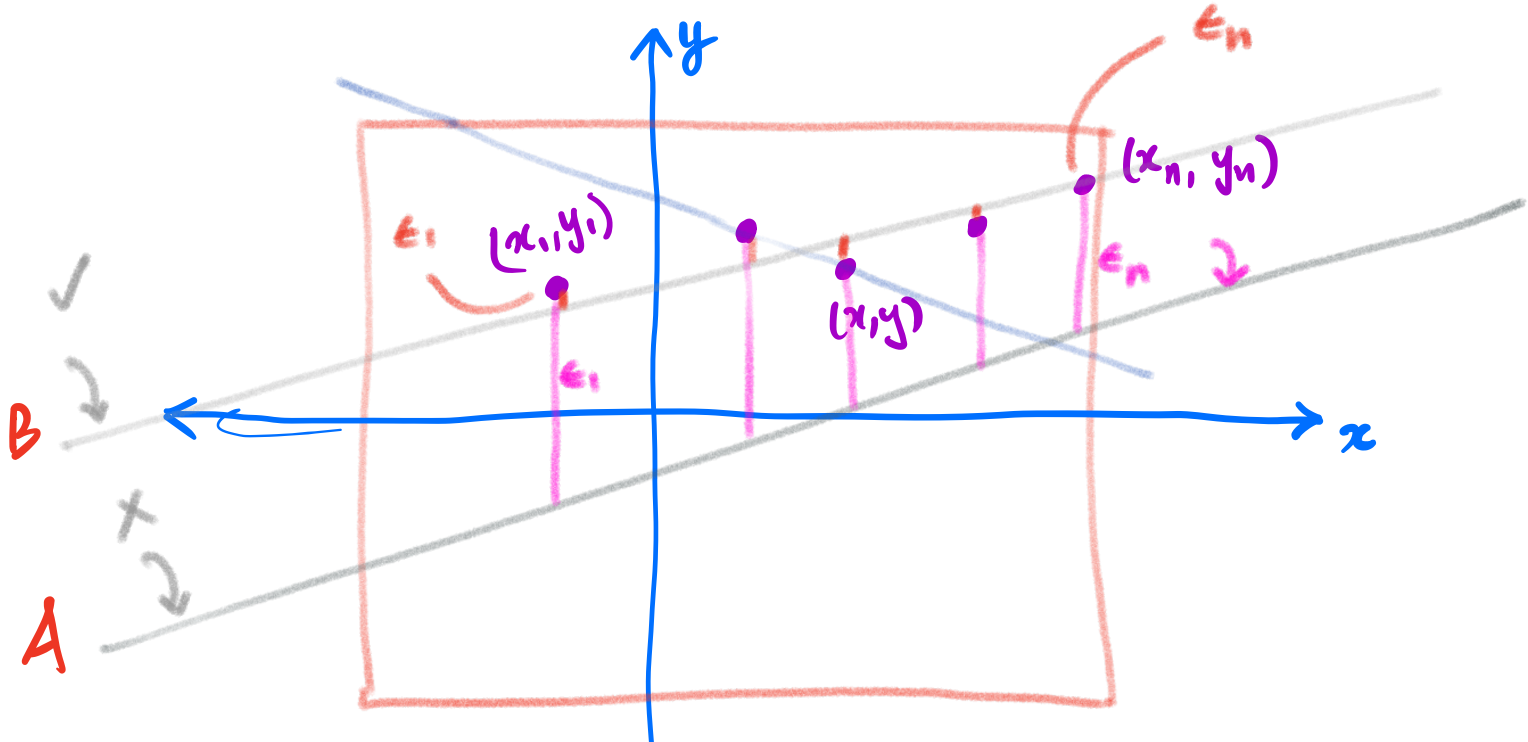


IDEA: FIT A LINE.

$y = mx + c$

↑ ? ↑ ?

At least two points.

Model Fitting: find the model parameters (m, c) that leads to smallest distance.

x	y	Model
x_1	y_1 ← ground truth.	$\hat{y}_1 = mx_1 + c$
x_i	y_i	$\hat{y}_i = mx_i + c$
x_n	y_n	$\hat{y}_n = mx_n + c$

input ↗ (x_n)

↑ Training data.

Use the ground truth & model predictions to compute the error (model fit).

$$\epsilon_i = y_i - \hat{y}_i$$
$$= y_i - m x_i - c$$

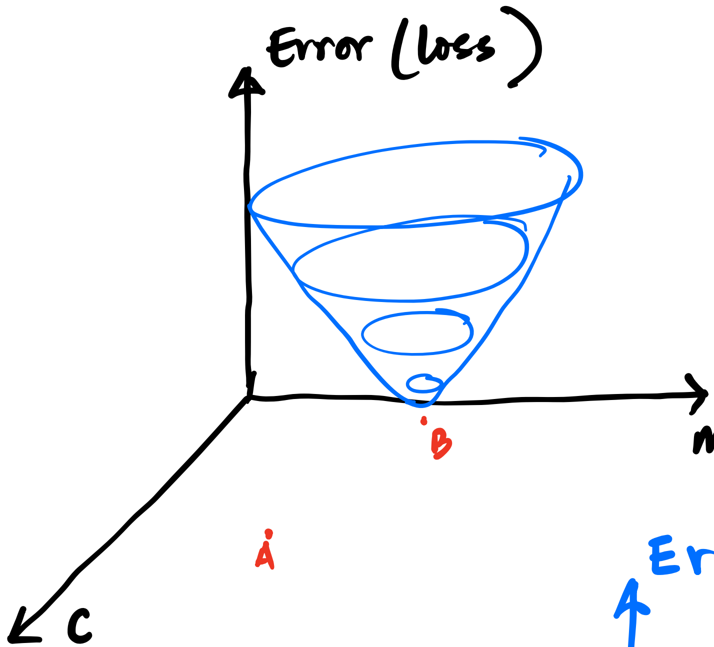
Total error (MSE) $= \frac{1}{n}\sum_{i=1}^{n} \epsilon_i^2$

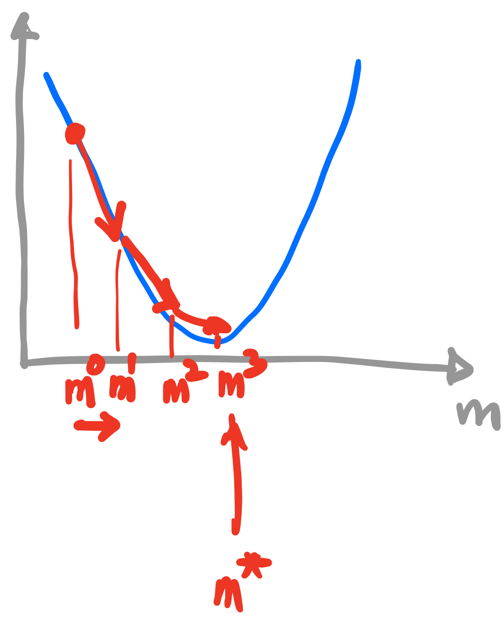
Mean Squared Error

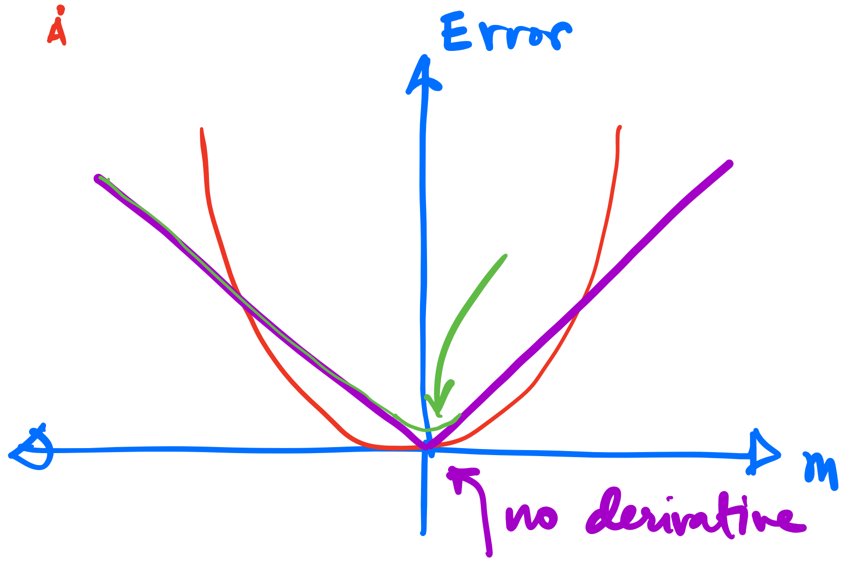
Contender: Sum of absolute differences

$$= \sum_{i=1}^{n} |\epsilon_i|$$

Loss : How to minimize loss?







$$MSE = \frac{1}{n}\sum_{i=1}^{n}(y_i - mx_i - c)^2 = \epsilon$$

we need to compute derivatives w.r.t. both m & c.

$$\frac{\partial \epsilon}{\partial m} = \frac{1}{n}\sum_{i=1}^{n} 2(y_i - mx_i - c)(-x_i)$$

$$= -\frac{1}{n}\sum_{i=1}^{n} 2x_i(y_i - mx_i - c)$$

$$\frac{\partial \epsilon}{\partial c} = -\frac{1}{n}\sum_{i=1}^{n} 2(y_i - mx_i - c)$$

To solve analytically set to ∅ and solve for m & c.

Gradient of the error surface:

$$\begin{bmatrix} \frac{\partial \epsilon}{\partial m} \\ \frac{\partial \epsilon}{\partial c} \end{bmatrix}$$

Good news: For this problem, we are dealing with a quadratic surface.

So, we have a global minima (unique solution).