W.K.T

Error = Y' (Predicted) - Y (Actual)

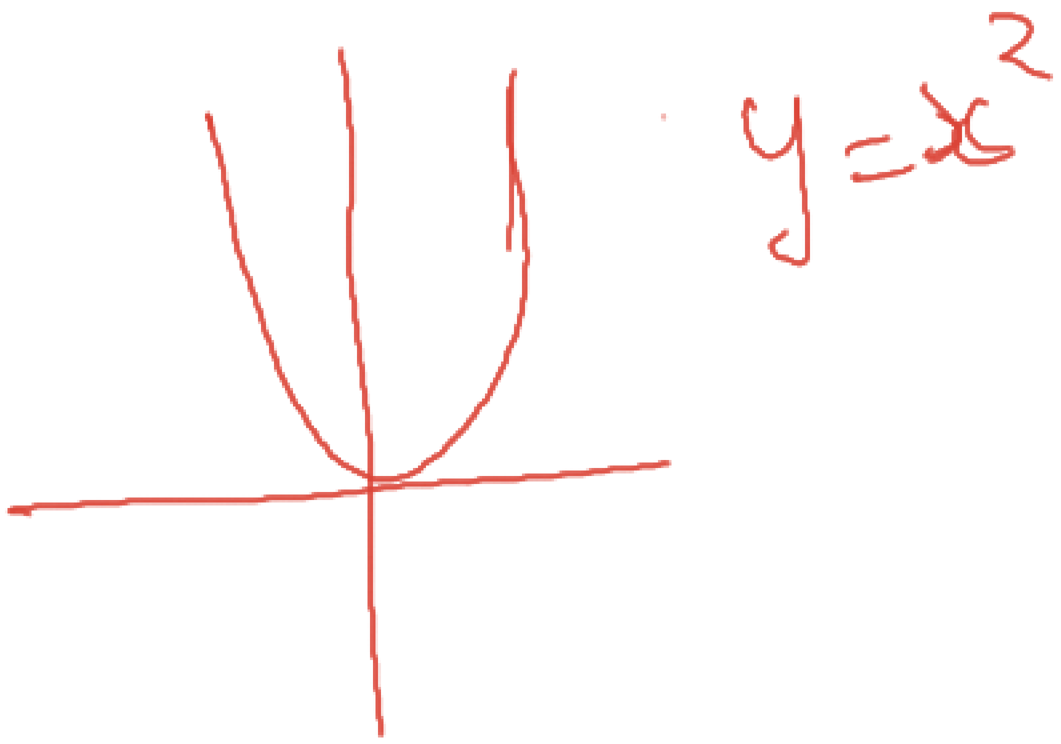
loss function $\Rightarrow$ Error Calculated for single datapoint.

cost function $\Rightarrow$ Average of Errors Calculated for whole training dataset.

$$\text{Cost} = \frac{1}{N} \sum_{i=1}^{N} (y' - y)^2$$

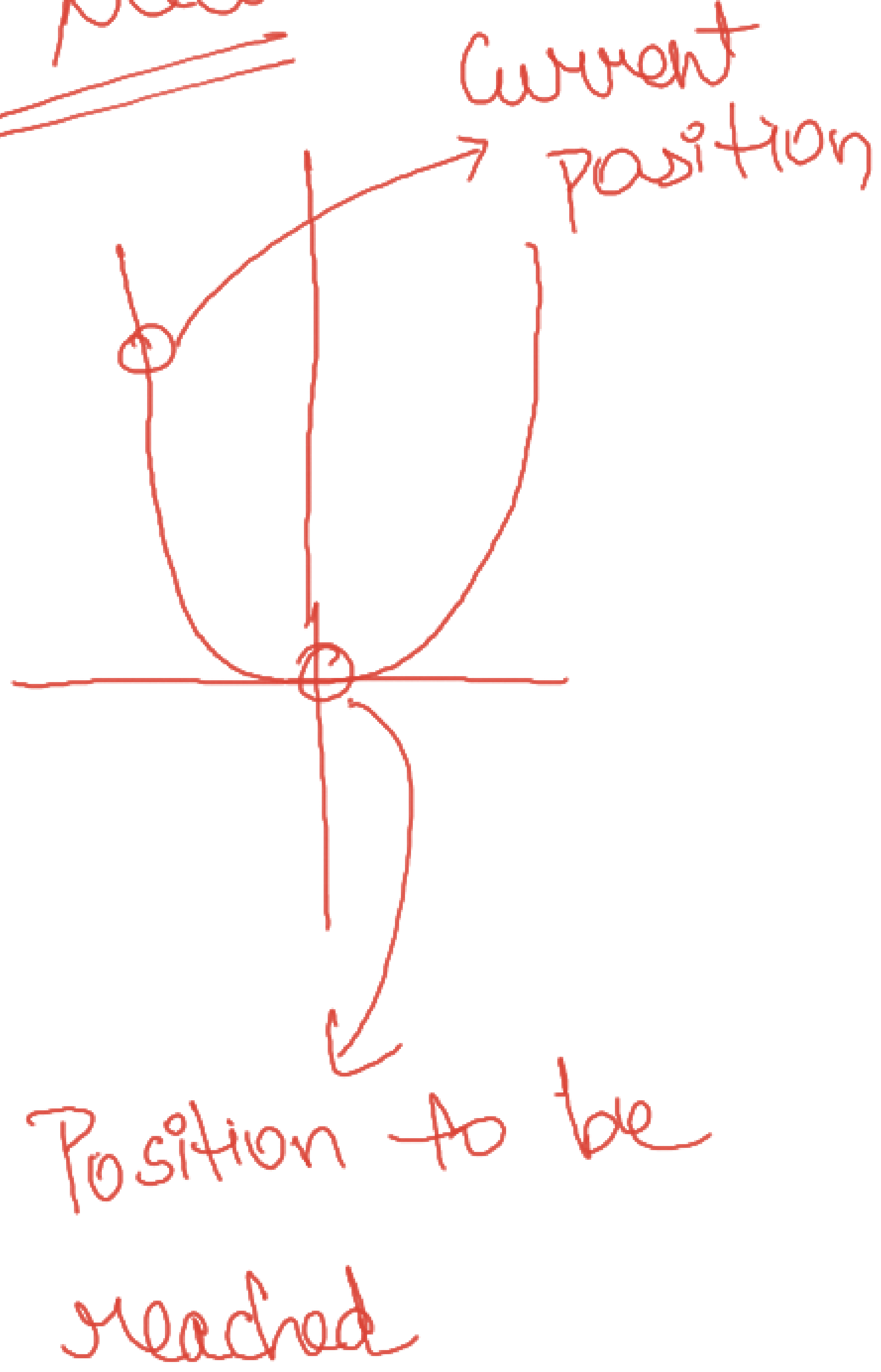
$N \rightarrow$ Data points — Squaring to Eliminate negative values

Objective - visually



To find the value of x that gives lowest y value.

Needs



Find

→ Which direction to move

→ How much big step to be taken in the direction.

Eq $y = mx + c$

m ↓ direction

c ↳ Size of Step

Cautions

If Slope = Large → take big Steps
Slope = Small → Take Small steps

Steps Taken } = Learning rate
- Big – overshooting
- Small – Time will increase.

updations to be made at each step

Eq

$$y = mx + b$$

$\delta \rightarrow$ Small change

$$m = m - \delta m$$

$$b = b - \delta b$$

Maths Needed

- Power rule (univariate)
- Chain rule (Multivariate)

Power Rule

Eg f function $\rightarrow f(x) = x^n$

$$\downarrow$$

$$\frac{\partial f(x)}{x} = nx^{n-1}$$

Chain Rule

Eg

$$Z \xrightarrow{\text{depends}} Y \xrightarrow{\text{depends}} Z$$

$$\frac{\partial z}{\partial x} = \frac{\partial z}{\partial y} \cdot \frac{\partial y}{\partial z}$$

Sample

$y = x^2$, $x = z^2$

$$\frac{\partial y}{\partial x} = 2x$$

$$\frac{\partial x}{\partial z} = 2z$$

$$\frac{\partial y}{\partial z} = 2x \cdot 2z$$

So let's take $y = mx + b \longrightarrow (1)$

To update (m, b)

$b \longrightarrow$ bias

$m \longrightarrow$ weight

$$\partial K_{(m,b)} = \frac{1}{N} \sum_{i=1}^{N} (\text{Error})^2$$

$$
\begin{cases}
\dfrac{\partial K}{\partial m} = \underline{2 * \text{Error}} * \underline{\dfrac{\partial}{\partial m}}(\text{Error}) \longrightarrow \cancel{2} & 5 \\[2em]
\dfrac{\partial K}{\partial b} = 2 * \text{Error} * \dfrac{\partial}{\partial b}(\text{Error}) \longrightarrow \cancel{3} & 6
\end{cases}
$$

Calc on 2

$$\frac{\partial}{\partial m} Error = \frac{\partial}{\partial m}(y' - y)$$

$$= \frac{\partial}{\partial m}(\underline{m}x \underbrace{+b -y}_{\text{Constant}})$$

$$\boxed{\frac{\partial}{\partial m} Error = x}$$

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Calc on 3

$$\frac{\partial}{\partial b} Error = \frac{\partial}{\partial b}(y' - y)$$

$$\frac{\partial}{\partial b} Error = \frac{\partial}{\partial b}(mx + \underline{b} - y)$$

constant

$$\boxed{\frac{\partial}{\partial b} Error = 1}$$

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$m' = m_0 - \text{Error} * X * LR$

$\downarrow$ m from ① $\qquad \downarrow$ ④

$b' = b_0 - \text{Error} * 1 * LR$

$\downarrow$ b from ① $\qquad \downarrow$ ⑤

Error – Direction

LR – How big Step

$\downarrow$ next Evolution

m' – Direction

b' – How big step

$y' = m'x + b'$ → New update

→ Iterate it until

minima or lowest cost function

is found.