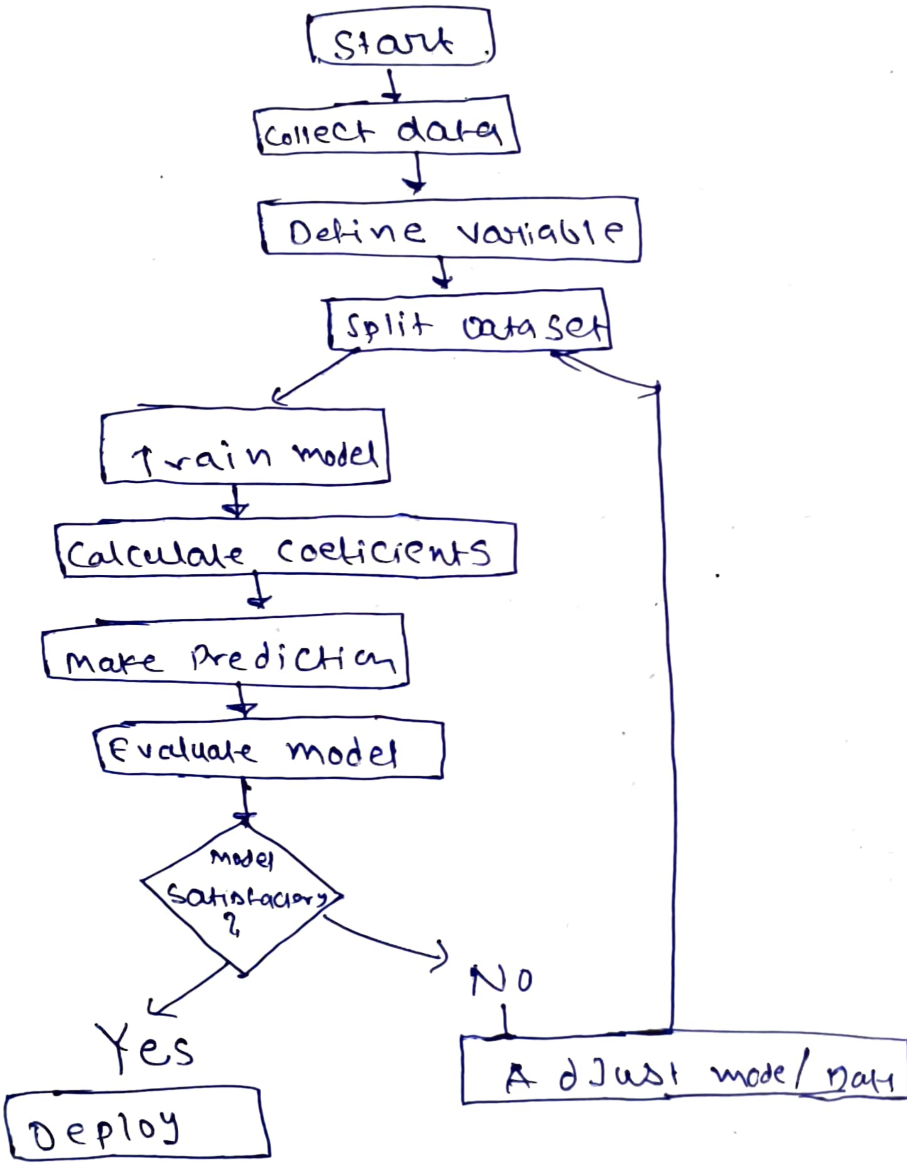
Q. what is regressions?

Regression is a way to predict a number. It help us find out how one thing changes when something else changes.

Step chart for model creation.



Regression [illegible]

Imagine you're running a lemonade stand.
You've been keeping track of:

- How many glasses you sell each day.
- And what the temperature was that day.

After a while, you notice:

"The hotter the day, the more lemonade I sell"

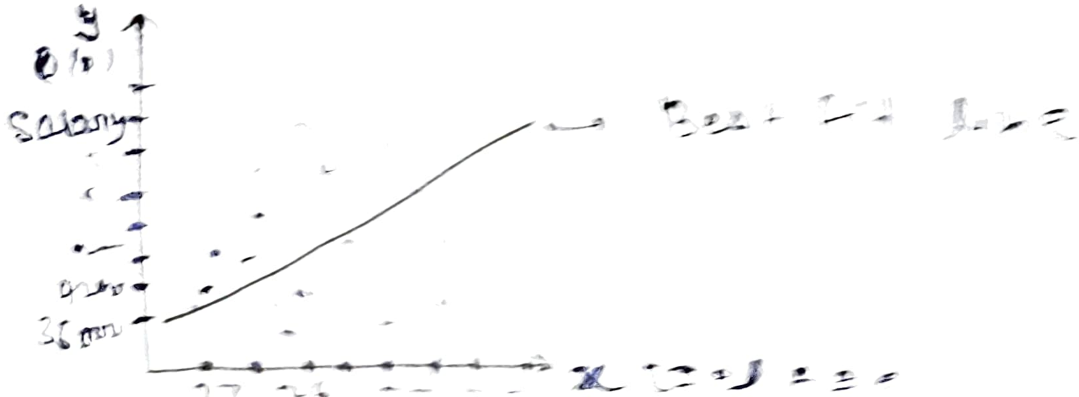
"Regression is about finding patterns in numbers so we can make smart predictions."

# LINEAR REGRESSION

Problem Statement

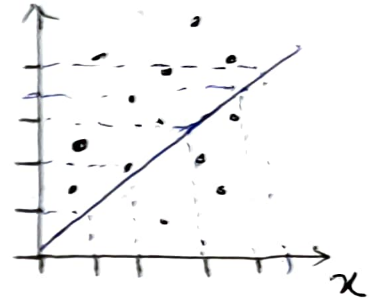
Input ← | Age | Salary | → Output
|---|---|
| 22 | 28000 |
| 26 | 35000 |
| 28 | 40000 |
| 34 | 48000 |
| 39 | 52000 |
| 42 | : |
| 41 | |
| : | |

Scatter Plot

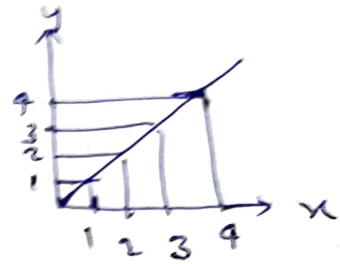


From scatter plot, we predict other outputs :-

m - slope
b - Intercept
x - Datapoint
y - Prediction




$m = 1,\ b = 0$ ↳



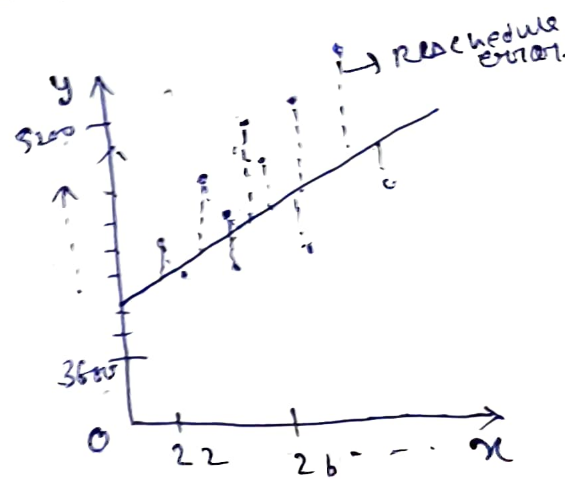

In short, $\boxed{y = mx + c}$

$h\theta(x) = \theta_0 + \theta_1 x$

$\theta_0$ = Intercept

$\theta_1$ = Slope

- I have to find the perfect value of $\theta_0$ and $\theta_1$.



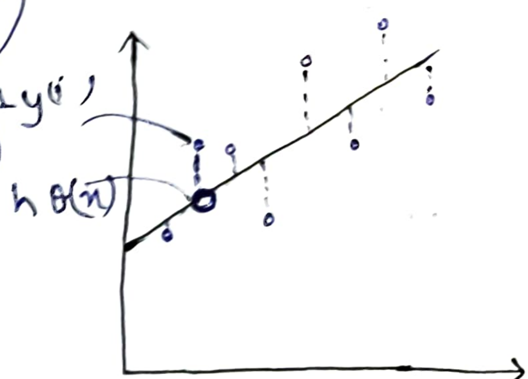

Rescheduled Error :

the distance from actual data point & best fit line.

## Cost function

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

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



Linear Regression

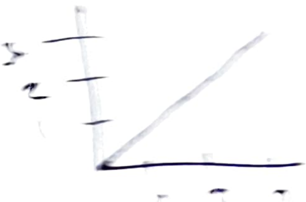
# Cost Function:

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

you have to minimize the cost function by changing the value of $\theta_0, \theta_1$

# Gradient Descent:

Example



| x | y |
|---|---|
| 1 | 1 |
| 2 | 2 |
| 3 | 3 |

$\theta_0 = 0, \quad \theta_1 = 1$

$h_\theta(x) = \theta_0 + \theta_1 x$

$h_\theta(1) = 0 + 1(1) = 1$

$h_\theta(2) = 0 + 1(2) = 2$

$h_\theta(3) = 0 + 1(3) = 3$

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

$$= \frac{1}{6} \sum \left[(1-1)^2 + (2-2)^2 + (3-3)^2\right]$$

$$= 0$$

② $\theta_1 = 0.5, \quad \theta_0 = 0$

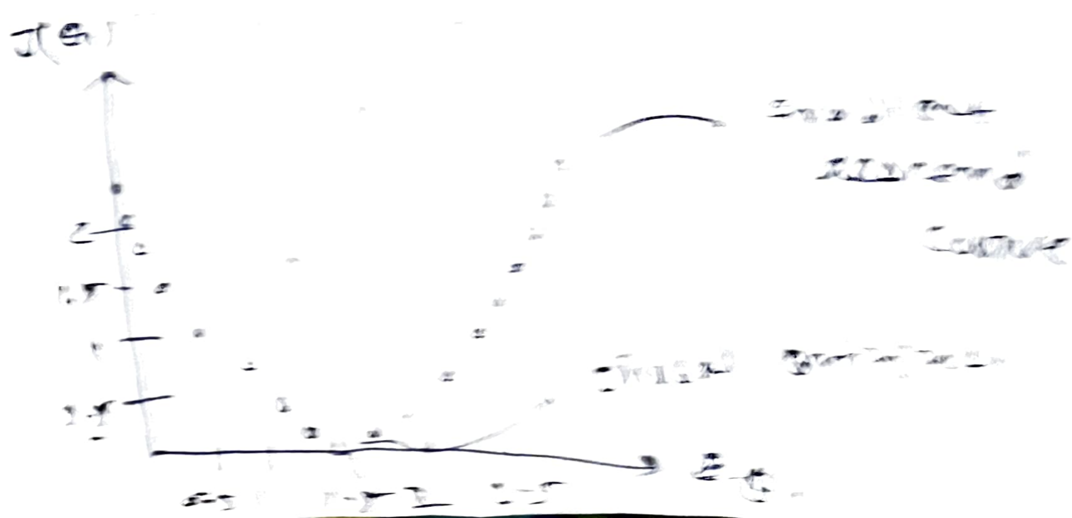
$h(\theta) = \theta_0 + \theta_1 x$

$= 0 + 0.5(1) = 0.5$

$= 0 + 1.0 = 1.0$

$0 + 1.5 = 1.5$

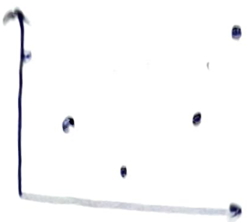
$$J(\theta) = \frac{1}{6} \left[(1-0.5)^2 + (2-1)^2 + (3-1.5)^2\right] = 0.58$$



Global minima → Give least error.

## Repeat Convergence theorem

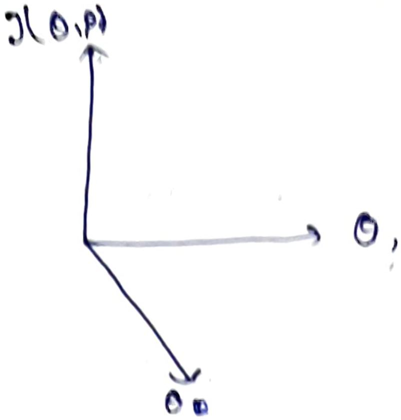
• Learning Rate ($\alpha$)



high LR ($\alpha$)

Low ($\alpha$)

→ Low LR is good as we will not miss Global minima.




* Gradient descend is 3d Graph.

$y = mx + b$

Single var ⇒ $h(\theta) = \theta_0 + \theta_1 x_1$

Mult. var ⇒ $h(\theta_i) = \theta_0 + \theta_1 x_1 + \theta_2 x_2 + \theta_3 x_3 + \dots \theta_n x_n$

⇒ we use hyper plane to visualize.