X_1	X_2	Y
Sub.	hours	Result
math	5	Pass
phy	3	fail
chem	4	pass
BTO	2	Pass
commerc	1	fail

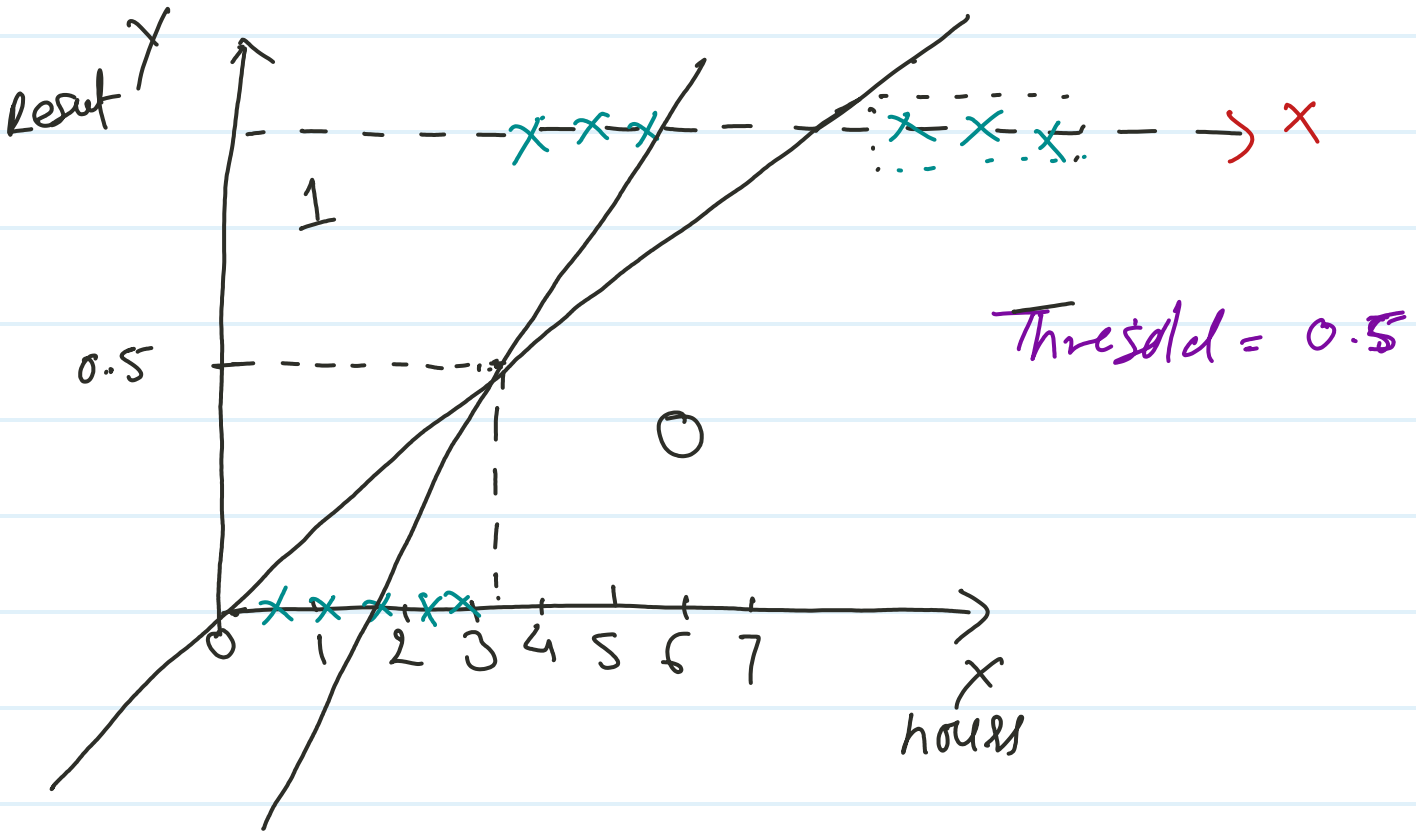
A
B
C
D

Binary classification

multi class classification

Logistic Regression

classification supervised learning.



linear Regression $h_\theta(x) = \theta_0 + \theta_1 x_1$

In logistic Regression we will transform linear eqn into "sigmoid function"

step-I $z = h_\theta(x)$

$z = \theta_0 + \theta_1 x_1$

☆ step - II

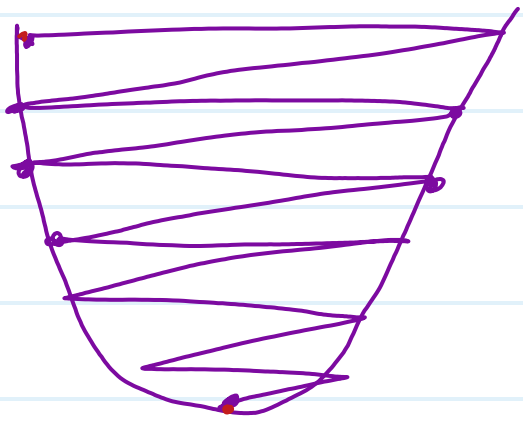
sigmoid function (σ) $= \frac{1}{1+e^{-z}}$

Always get value after applying this formula is 0 to 1.

linear cost function -

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

This convex function.



logistic cost function -

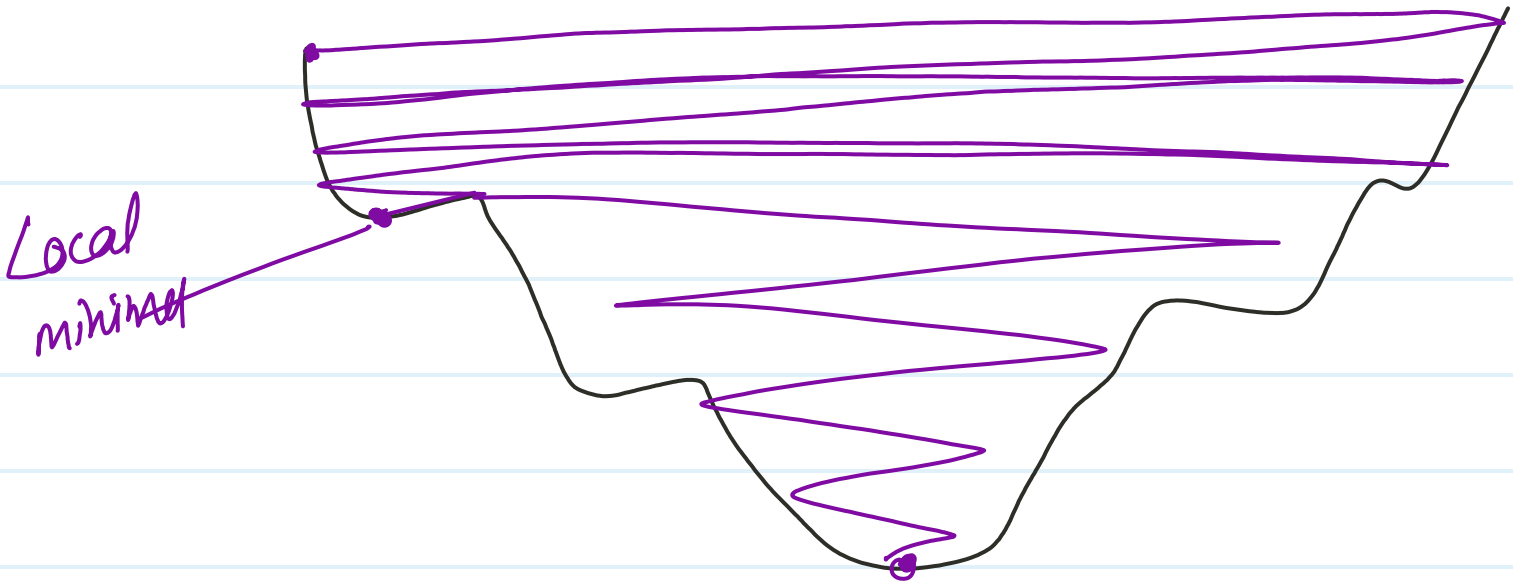
$$J(\theta_0, \theta_1) = \frac{1}{m} \sum_{i=1}^{m} (h_\theta(x)^i - y^i)^2$$

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

$$\sigma(z) = \sigma$$

$$= \frac{1}{1+e^{-z}} = \frac{1}{1+e^{-(\theta_0+\theta z)}}$$

Non convex function.



✱ log loss cost function -

$$\text{cost}(h_\theta(x), y) = -y \log(h_\theta(x)) - (1-y) \log(1-h_\theta(x))$$

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

Repeat conversion theorm

$$\theta_j = \theta_j - \alpha \frac{\partial}{\partial \theta_j} j(\theta_0, \theta_1)$$

α learning rate

θ_0 and θ_1 values change

Important note about logistic Regression

① Logistic Regression can be binary and multiclass classification

binary = 1/0, T/F, P/F

multiclass = 1/2/3/4, m/f/T,

② sigmoid function is key of logistic Regression

$$a = \frac{1}{1 + e^{-z}}$$

$$z = h_\theta(x) = \theta_0 + \theta_1 x_1$$

③ Logistic Regression work well with binary class classification.

Example -

student → P/F, according to their study hours

2 study — F

6 study — P

Loan ⇒ Pass / Reject

x_1	x_2	x_3	x_4	y
+	−	−	−	P
+	+	−	−	Reject.