Theoriticual & mathamatical intution

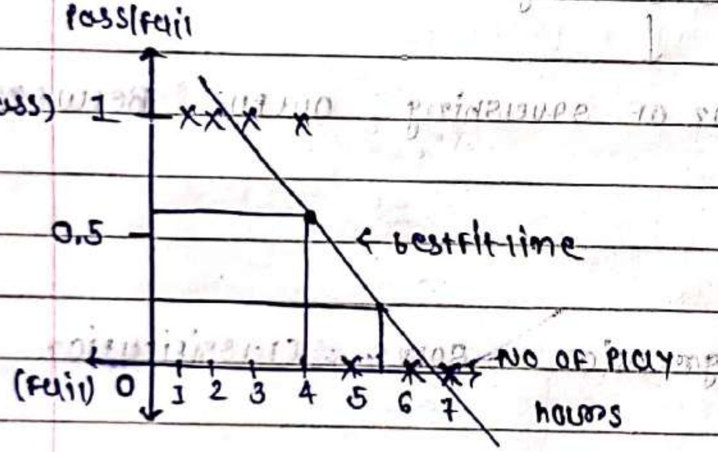
Of

Logistic Regression

* "To solve classification problem."

TRAIN
↓
NO OF Playing Hour → [model] → Pass/Fail
↓
Accuracy ↑↑

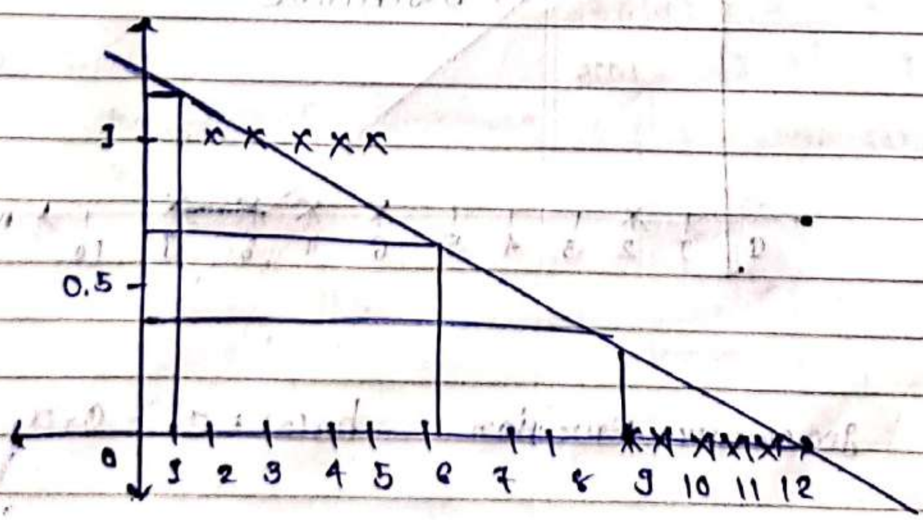
* Logistic Regression can be use for Binary Problem, solving.



0.5 Thresold value
Predicted point > 0.5
↳ Pass
P.P < 0.5
↳ Fail

In linear Regression model

→ what is the problem to solve Binary problem using linear Regression model.



Using logistic regression to predict height from weight might not be the most suitable choice. Logistic regression is a type of regression analysis that is generally used for binary classification problems, where the dependent variable is binary (e.g., yes/no, 1/0).

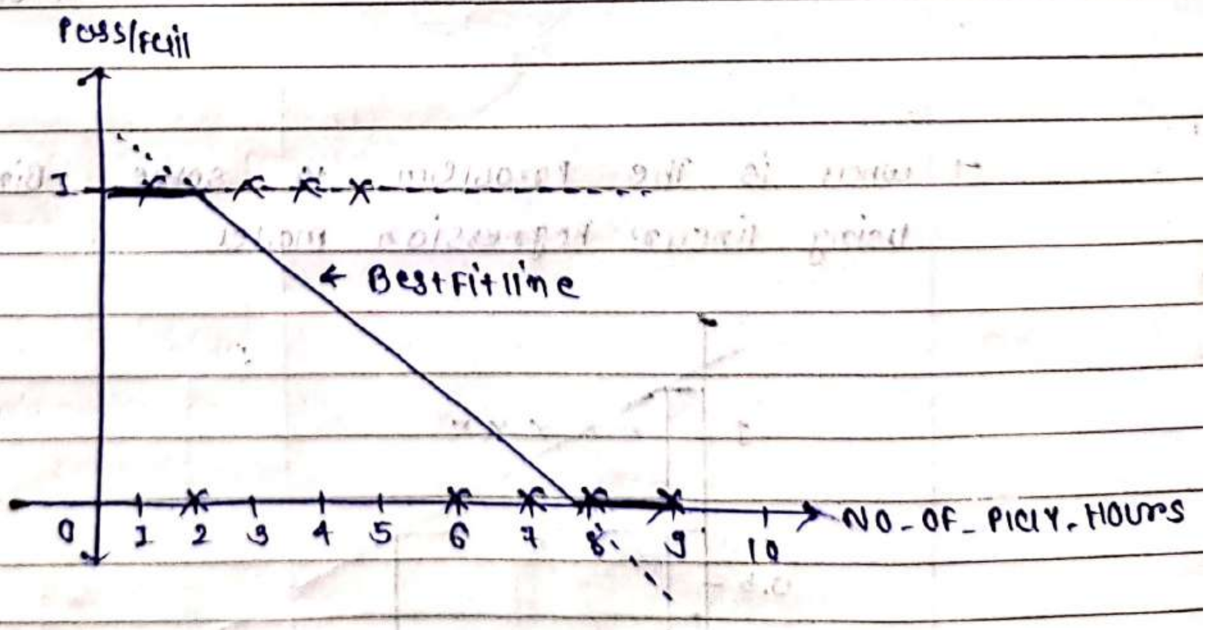
1) Best fit line changes Because of outliers That's why prediction goes wrong.

2) The outcomes comes >1 and <0.

* cuz of these problem we can't use linear Regression model.

* we make best fit line in logistic Regression model using squashing technique.
↓
cuz of squashing output Between 0 to 1.

→ How logistic Regression solve classification problem.



generally Equation $h_\theta(x) = \theta_0 + \theta_1 x_1$ for Best fit line.

use sigmoid function for 0 to 1 outcome.

"sigmoid Activation function Responsible for squashing"

$$\boxed{\sigma = \frac{1}{1+e^{-z}}} \Rightarrow \text{outcome between } 0 \text{ to } 1$$

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

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

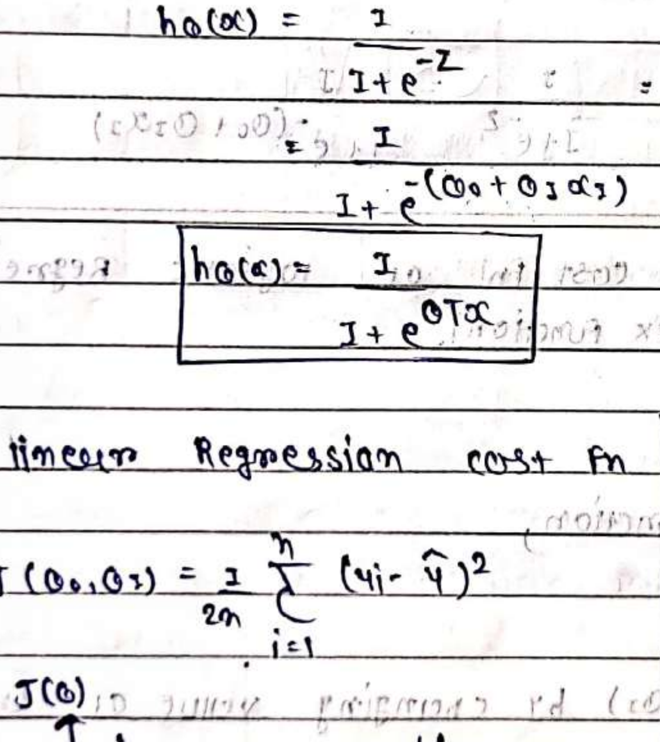
$$h_\theta(x) = \frac{1}{1+e^{-z}}$$

$$= \frac{1}{1+e^{-(\theta_0 + \theta_1 x_1)}}$$

$$\boxed{h_\theta(x) = \frac{1}{1+e^{\theta^T x}}}$$

→ linear Regression cost fn

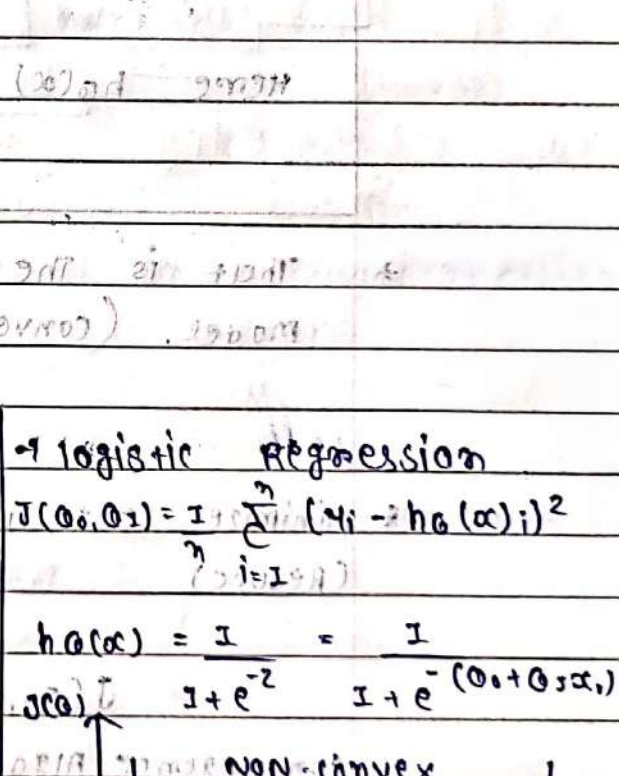
$$J(\theta_0, \theta_1) = \frac{1}{2n} \sum_{i=1}^{n} (y_i - \hat{y})^2$$



→ logistic Regression

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

$$h_\theta(x) = \frac{1}{1+e^{-z}} = \frac{1}{1+e^{-(\theta_0 + \theta_1 x_1)}}$$



That's why we don't use $J(\theta_0 \theta_1) = \frac{1}{n} \sum_{i=1}^{n} (y_i - h_\theta(x)_i)^2$

* we use "log loss" cost function.

$$J(\theta_0, \theta_1) = \begin{cases} -\log(h_\theta(x)) & \text{if } y = 1 \\ -\log(1 - h_\theta(x)) & \text{if } y = 0 \end{cases}$$

$$\boxed{\begin{array}{l} J(\theta_0, \theta_1) = -y \log(h_\theta(x)) - (1-y)(\log(1 - h_\theta(x)) \\ \text{Here } h_\theta(x) = \dfrac{1}{1+e^{-z}} = \dfrac{1}{1+e^{-(\theta_0 + \theta_1 x_1)}} \end{array}}$$

* That is the cost fn of logistic Regression model. (convex function).

* minimize cost function, (Reduce)

$J(\theta_0, \theta_1)$ by changing value of θ_0 & θ_1

convergence Algo

Repeate

$$\{$$

$$\theta_j : \theta_j - \alpha \frac{\partial}{\partial \theta} J(\theta_0 \theta_1)$$

$$\}$$