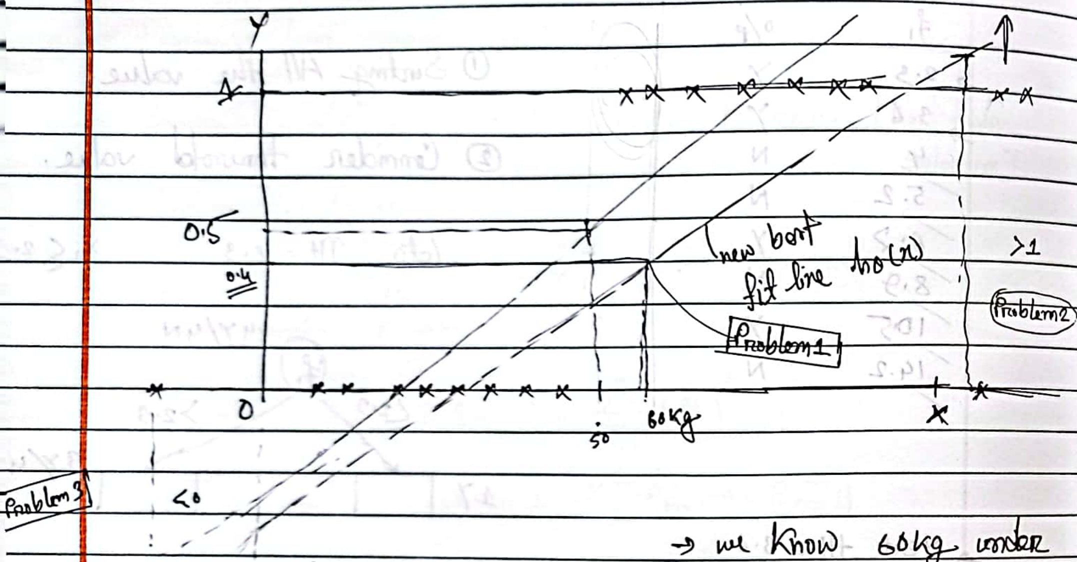
If there is outlier.



→ we know 60kg under obese

→ but for the new best fit line it's not obese

→ So, Occured "High Error Rate"

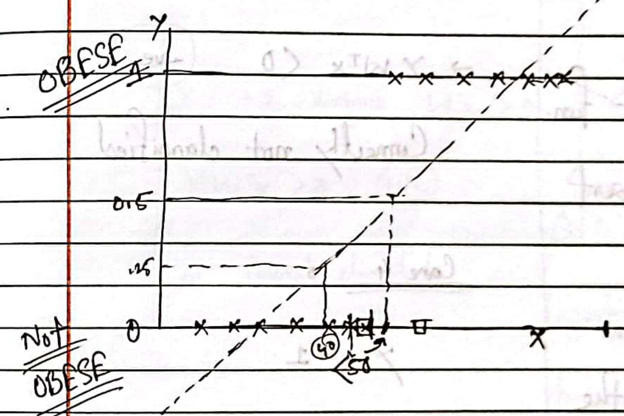
→ Problem High Error Rate, this way.

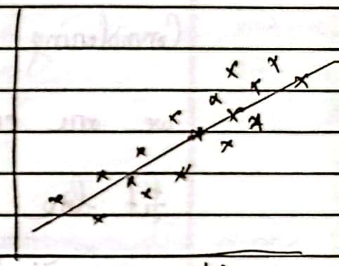
So, for that we should Never use linear Regression for this Particular binary classification.

"Logistic Regression" (Lined)

→ Classification Problem. → Binary classification

So why it's called Regression. → Multi-class classification





$Y = mx + c$ — slope — intercept

Can we solve this using Linear Reg?

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

$= \beta_0 + \beta_1 x$

$= W^T x + b$

$h_\theta(x) > 0.5 \rightarrow 1 \rightarrow$ obese (25 kg)

$h_\theta(x) < 0.5 \rightarrow 0 \rightarrow$ not obese

let's 40kg → so it's not obese

→ with this help of best fit line : can classify easily.

→ So, what is the use Logistic " Regression ?

→ why we need this?

Cost function/optimizer

$$\max \sum_{i=1}^{n} y_i W_i^T x_i$$

Considering this cost fun.
we are creating best
fit line.

$y_i \; x_i$ given:

→ we are updating the
Co-efficient (W^T) or
(m) unless, untill i
get the maximum
of the summation.

Case 3 ×

$Y = -1$

$W^T x > 0$

→ $Y W^T x < 0$ (−ve)

Correctly not classified

Case 4 o

$Y = +1$

$W^T x < 0$

→ $Y W^T x < 0$ (−ve)

Correctly not classified

Co-efficient (W^T) ভিন্ন ভিন্ন মানের জন্য ভিন্ন ভিন্ন best
line পাওয়া যাবে। But which is best, W^T যে মানের
জন্য maximum optimizer value পাওয়া যাবে. that
is the best fit line to classify.

Y_i = +ve = +1

Y_i = −ve = −1 (not 0)

① Case-1

$Y = +1$ distance $W^T x > 0$

$Y W^T x > 0$ (+ve)

Properly classified.

② Case-2

$Y = -1$

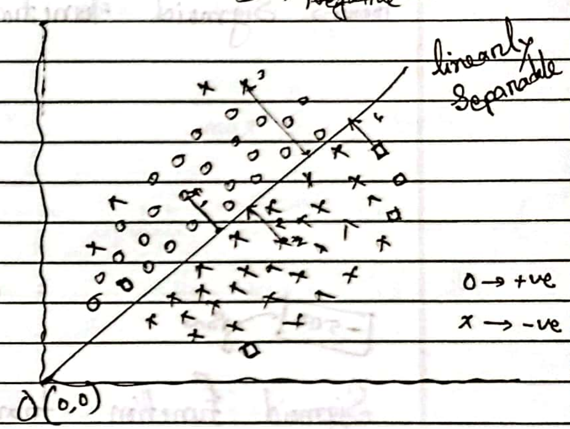
$W^T x < 0$

$Y * W^T x > 0$ (+ve)

× classified correctly.

× → Positive point

o → Negative



o → +ve

× → −ve

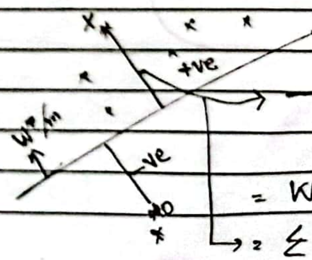
Logistic Regression usually apply
for a problem statement where
two classification Problem can be
"linearly separable."

$Y = mx + c$ c = 0 intercept.

$Y = mx$

$= W^T x$

Distance ⟶



$\frac{W^T x + b}{\|W\|}$ unit V

$= W^T x$

$= \sum W^T x$

focus → Sigmoid function.

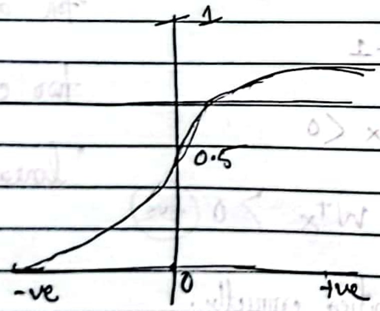
$$\max \sum_{i=1}^{n} f(\underbrace{y_i W^T x_i}_{z})$$

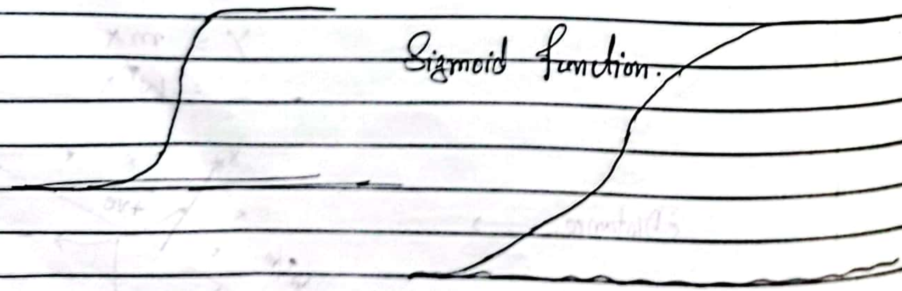
$$= \frac{1}{1+e^{-z}}$$

$\boxed{-500}$ → form

Sigmoid function transform the value [0, 1]

Removing the effect of outlier.



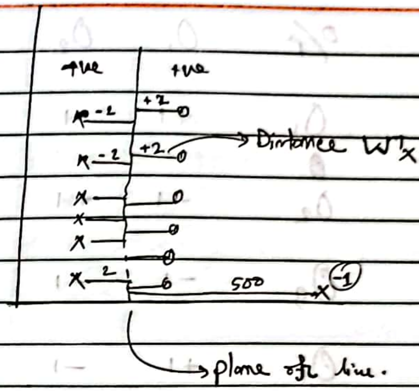


Sigmoid function.

focus → $\max \sum_{i=1}^{n} y_i W^T x_i$

$$\max \sum_{i=1}^{n} y_i W^T x_i$$

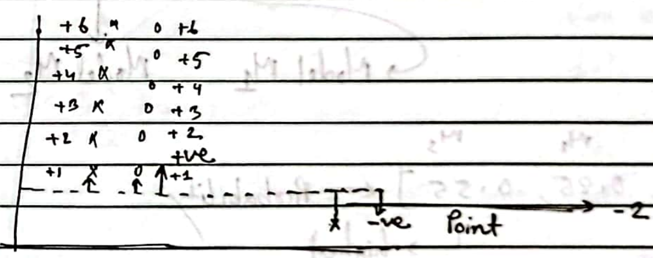
update w_i untill we get the best fit line



o → y = +1

x → y = -1

$\sum y.W^T x \rightarrow 2+2+2+2+2+2$
$+2+2+2+2+2-500 = 22-500$
$= -478$



x → -ve Point

o → +ve Point

$-6-5-4-2-1$
$+6+5+4+2+1 = 0+2 = 2$ → Selected

impact of outlier.
how do we prevent this?

Sigmoid function.

$$= \max \sum_{i=1}^{n} f(y_i W^T x_i)$$

$$= \max \sum_{i=1}^{n} f(y_i W^T x_i)$$

f_1	f_2	f_3	O/P	O_1	O_2	O_3
I_1	I_2	I_3	O_1	+1	−1	−1
I_4	I_5	I_6	O_2	−1	+1	−1
I_7	I_8	I_9	O_3	−1	−1	+1
I_{10}	I_{11}	I_{12}	O_1	+1	−1	−1
I_{13}	I_{14}	I_{15}	O_2	−1	+1	−1

→ Model M_1 Model M_2 Model M_3

M_1 M_2 M_3

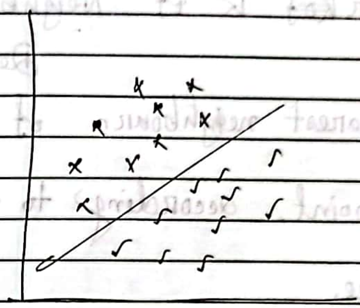
[0.20, 0.25, 0.55] ← Probability

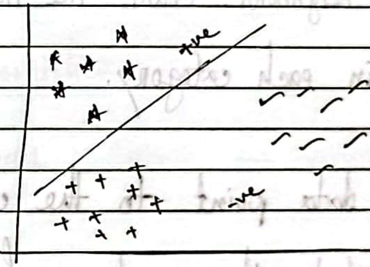
(→ highest)

The new test data belongs to O_3 category

→ Logistic Regression Multiclass Classification.

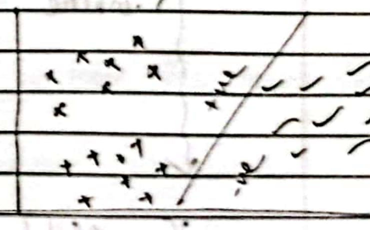
[One vs Rest
One vs All]





Can be solve with the help of logistic Reg?

Yes by one vs rest



Model → M_1

Model → M_2

Model → M_3