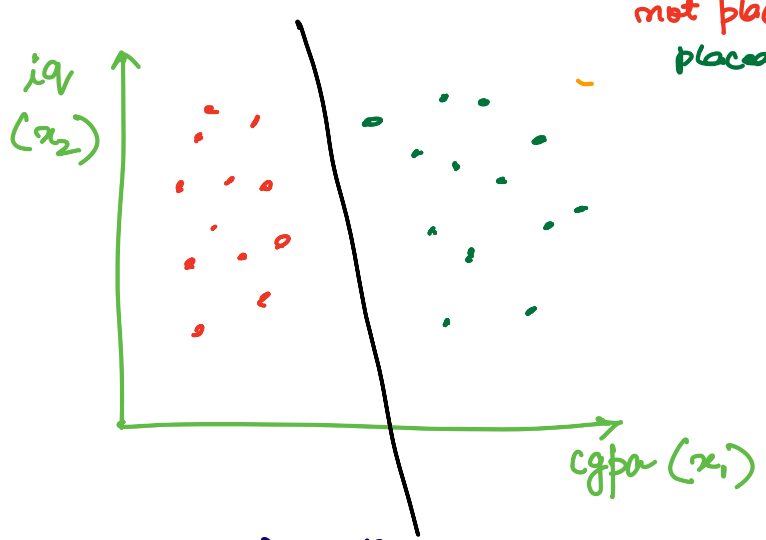
Final Rule:

$$w_j := w_j - \eta \cdot \frac{1}{m} \sum_{i=1}^{m} \left(\hat{y}^{(i)} - y^{(i)}\right) x_j^{(i)}$$

ML

- Supervised — y label
  - Regression — y continuous number
    - Linear Regression
  - Classification — y discrete
    - Logistic Regression
- Unsupervised
- Reinforcement

Logistic Regression



not placed → $y = 0$

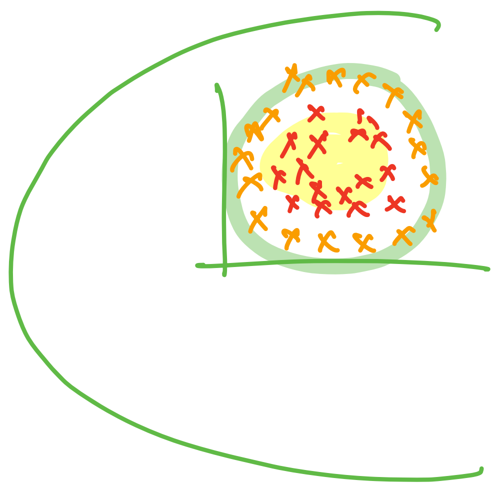
placed → $y = 1$

new student → p ? ✗

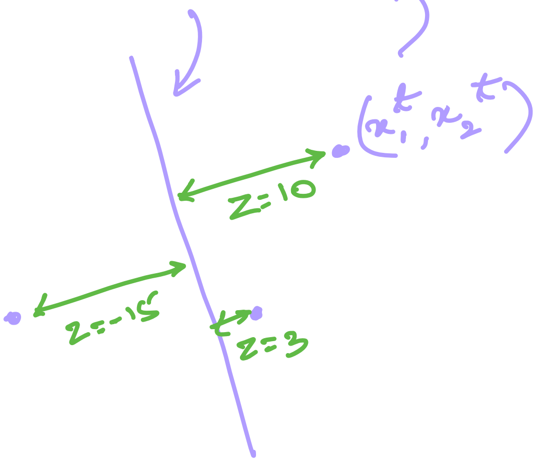
Linearly Separable : Logistic Regression

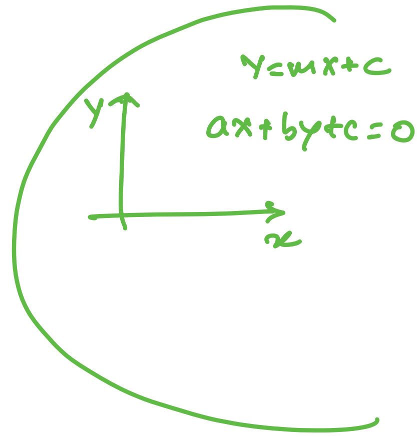
line eq^n?

$ax_1 + bx_2 + c = 0$



$w_0 + w_1 x_1 + w_2 x_2 = 0$

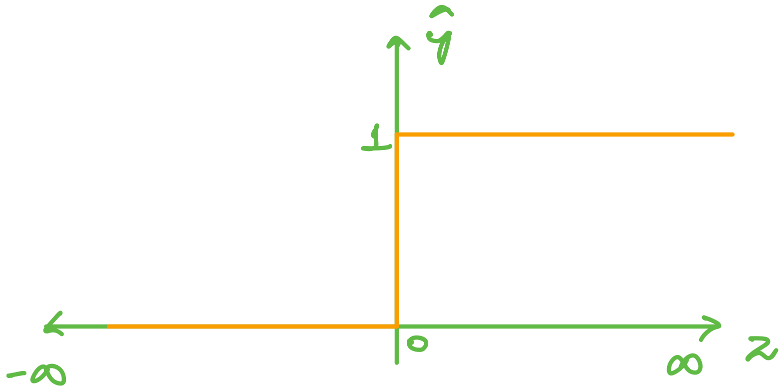




$z = w_0 + w_1 x_1^* + w_2 x_2^*$ $\longrightarrow$ distance b/w point & line

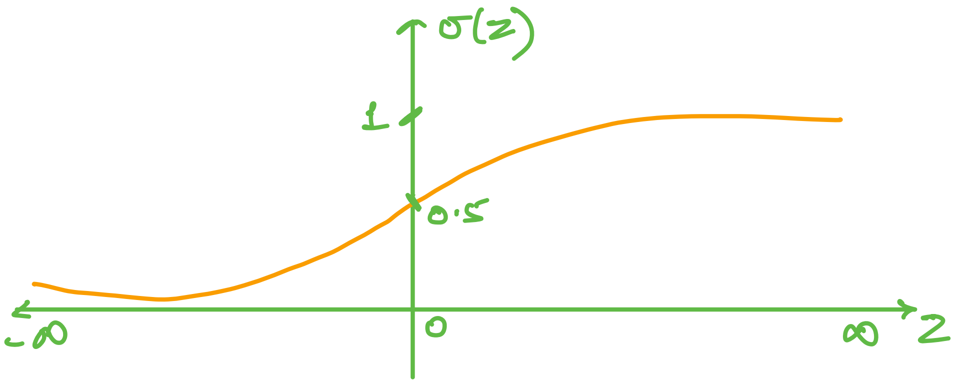
$z \geq 0$: Placed : $\hat{y} = 1$ Placed?

$z < 0$: Not Placed : $\hat{y} = 0$ Not Placed?



Step fxn

(z is not getting importance)



sigmoid function

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

$$\sigma(z) = \frac{1}{1+e^{-z}} \qquad z = +\infty$$

$$= \frac{1}{1+\frac{1}{e^{z}}} \;\; \infty \;\; 0 \qquad = 1$$

$$\sigma(z) = \frac{1}{1+e^{-z}} \qquad z = -\infty$$

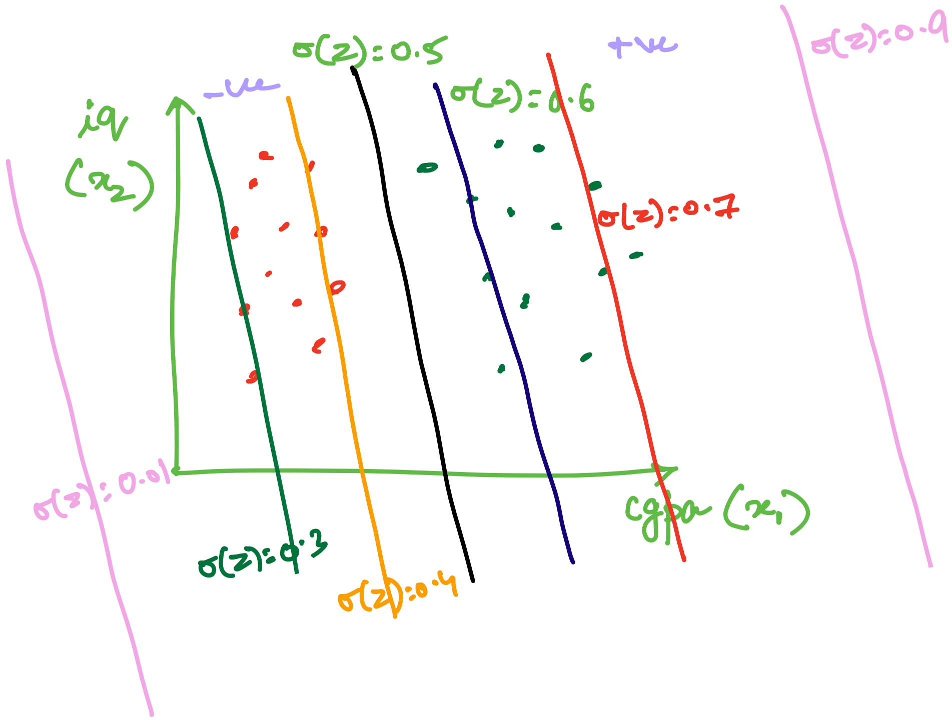
$$= \frac{1}{1+e^{\infty}} = 0$$

∞

$$\sigma(z) = \frac{1}{1+\frac{1}{e^{z}}} \qquad z = 0$$

1

$$= \frac{1}{1+1} = \frac{1}{2} = 0.5$$



Sigmoid:

Point probability to belong to the class.

$$h_w(x) = \sigma(z) = \sigma(w_0 + w_1x_1 + w_2x_2) = \frac{1}{1+e^{-(w_0+w_1x_1+w_2x_2)}}$$

x_0	cgpa x_1	iq x_2
1		
1		
1		
1		

$$w_0 + w_1x_1 + w_2x_2 = 0$$

$$w_0x_0 + w_1x_1 + w_2x_2 = 0 \qquad x_0 = 1$$

$$\underbrace{\sum_{i=1}^{m} w_ix_i}_{z} = 0$$

$$w = \begin{bmatrix} w_0 \\ w_1 \\ w_2 \end{bmatrix} \quad x = \begin{bmatrix} 1 \\ x_1 \\ x_2 \end{bmatrix} \qquad w^T x = \begin{bmatrix} w_0 & w_1 & w_2 \end{bmatrix} \begin{bmatrix} 1 \\ x_1 \\ x_2 \end{bmatrix}$$

$$z = w^T x = w_0 + w_1 x_1 + w_2 x_2$$

$$\boxed{\begin{aligned} h_w(x) &= \sigma(z) = \sigma(w^T x) = \frac{1}{1+e^{-w^T x}} \\ \hat{y} &= 1 \quad \text{if } h_w(x) \geq 0.5 \\ &= 0 \quad \text{if } h_w(x) < 0.5 \end{aligned}}$$

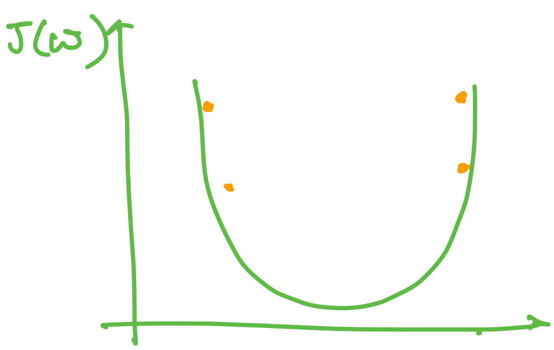
Objective fxn

$$J(w) = MSE = \frac{1}{m} \sum_{i=1}^{m} \left(\hat{y}^{(i)} - y^{(i)}\right)^2$$

Linear Regression

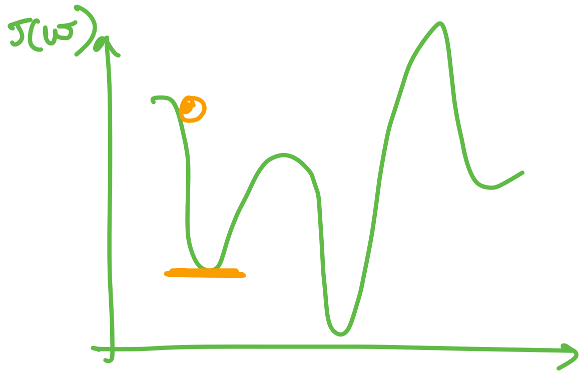
$$\hat{y}^{(i)} = w_0 + w_1 x_1 + w_2 x_2 \ \dots \ w_n x_n$$

$$\frac{1}{1+e^{-w^T x}}$$



Convex fxn

local minima = global minima



non convex fxn