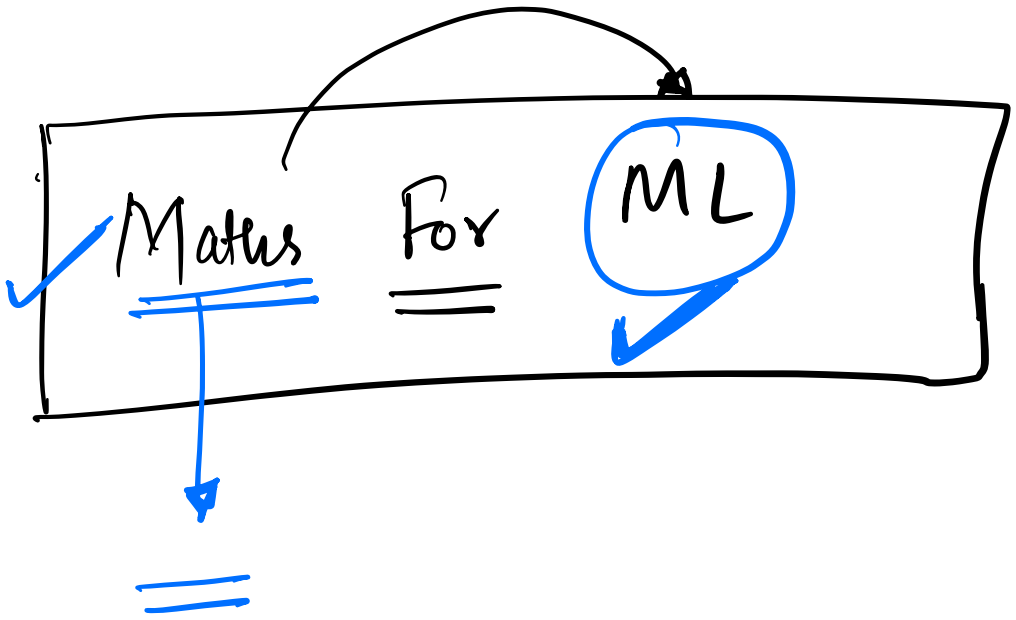
Linear Algebra I : The ML Context



(eg)

given data

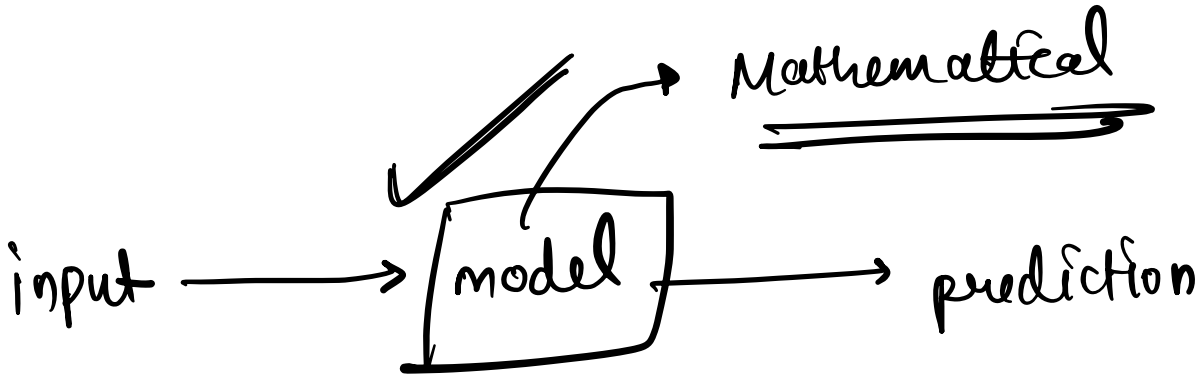
YOE	Salary
2	20K
4	40K
1	10K
6	60K

YOE: 8 ⟶ Salary

80K

predicted

Salary = 10K * YOE



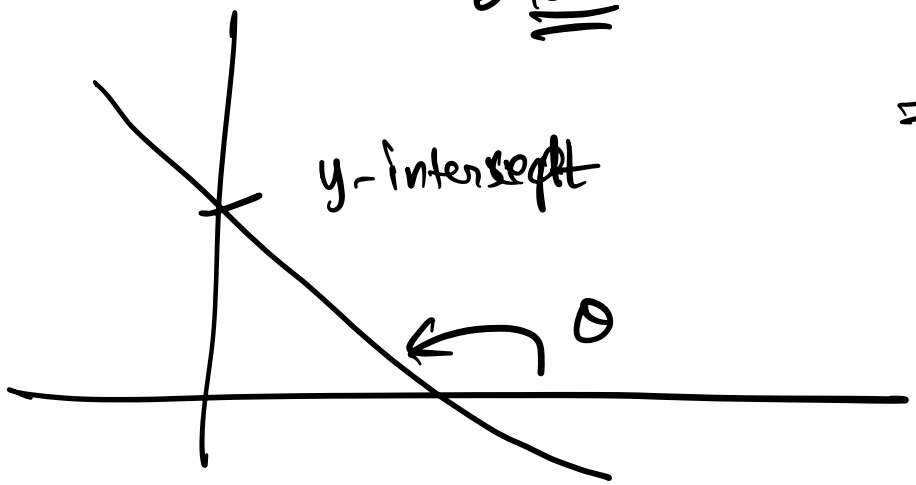
Salary = 10K * 40E

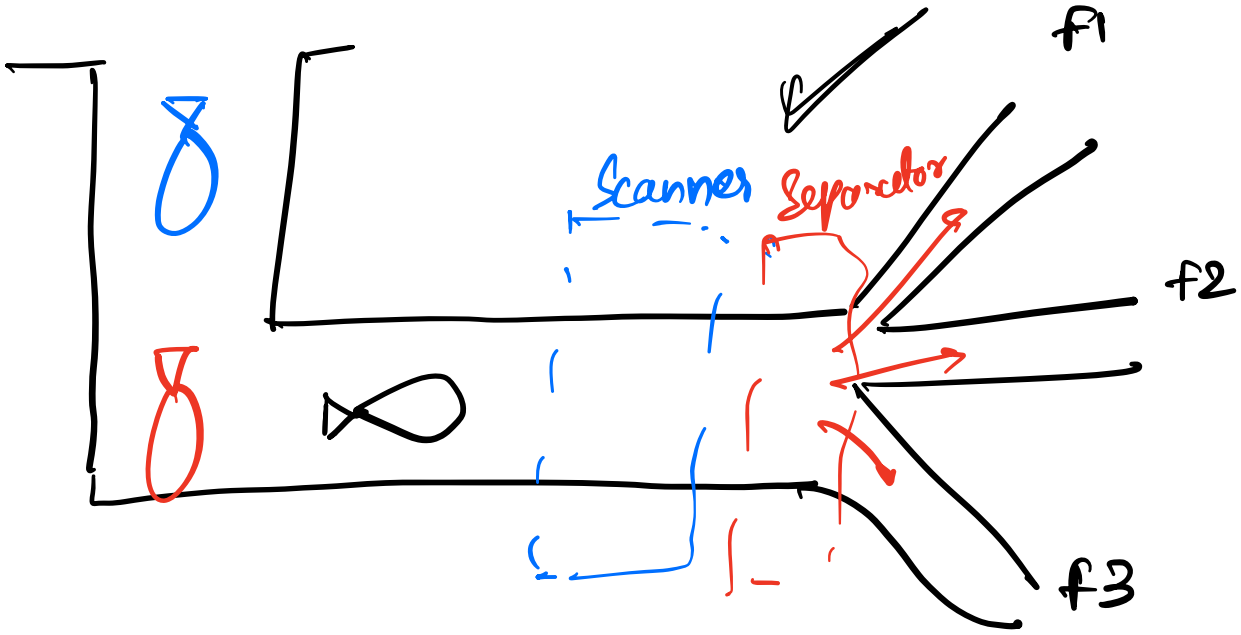
$y = mx + c$

equation of a line

Slope → 10K

y-intercept → 0





~ 40 varieties

Parameters :-

1. Size
2. Weight
3. Appearance
   - Colour
   - design / shape
   - Texture.

Size	weight	Colour	Type
20	10	brown	f1
25	12	white	f2
			⋮

given data

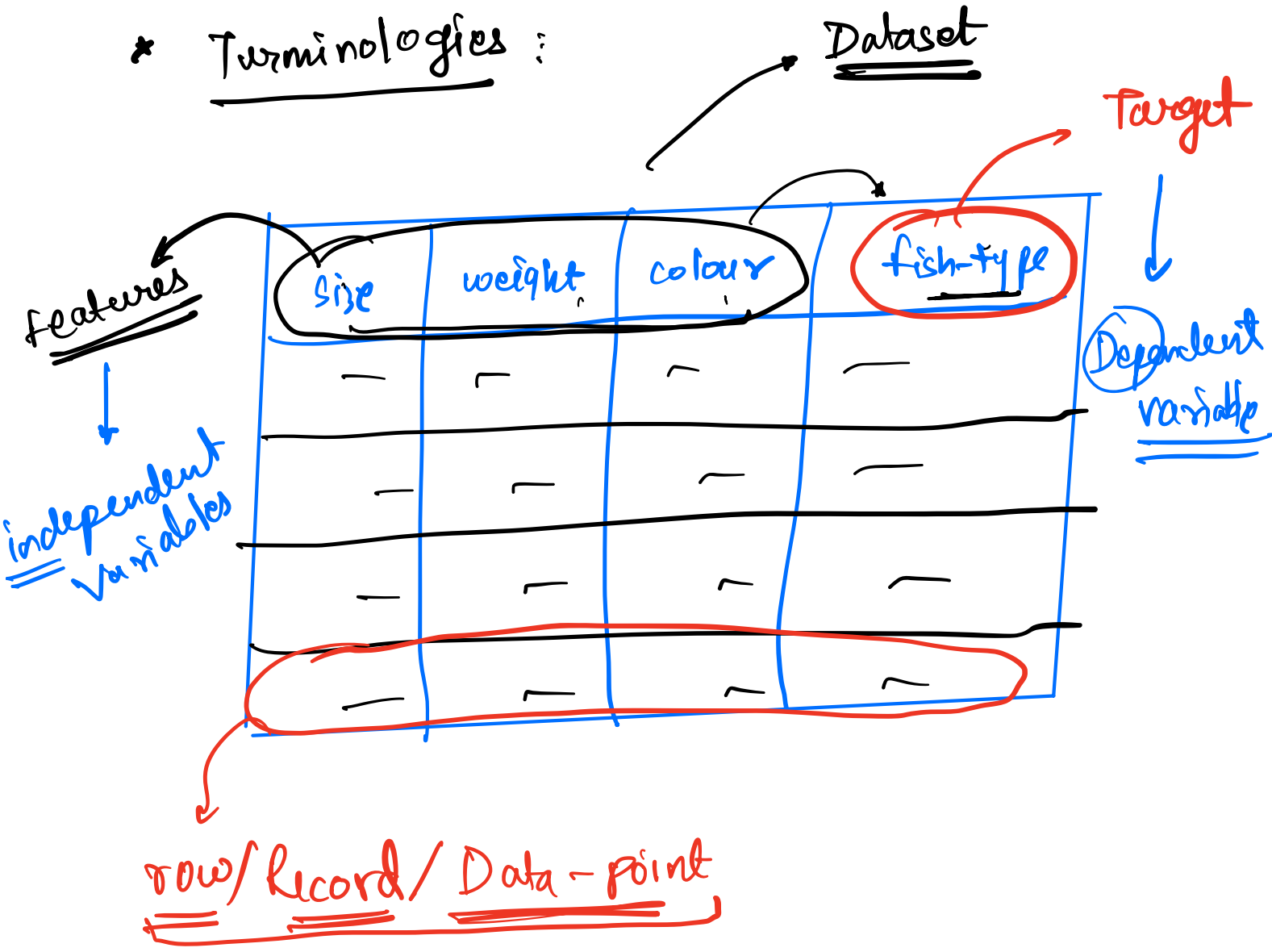
weight	fish-type
10	f1
10.2	f1
9.7	f1
8.4	f1
15	f2
15.4	f2
15.8	f2
16	f2

wt = 9.5 kg → f1

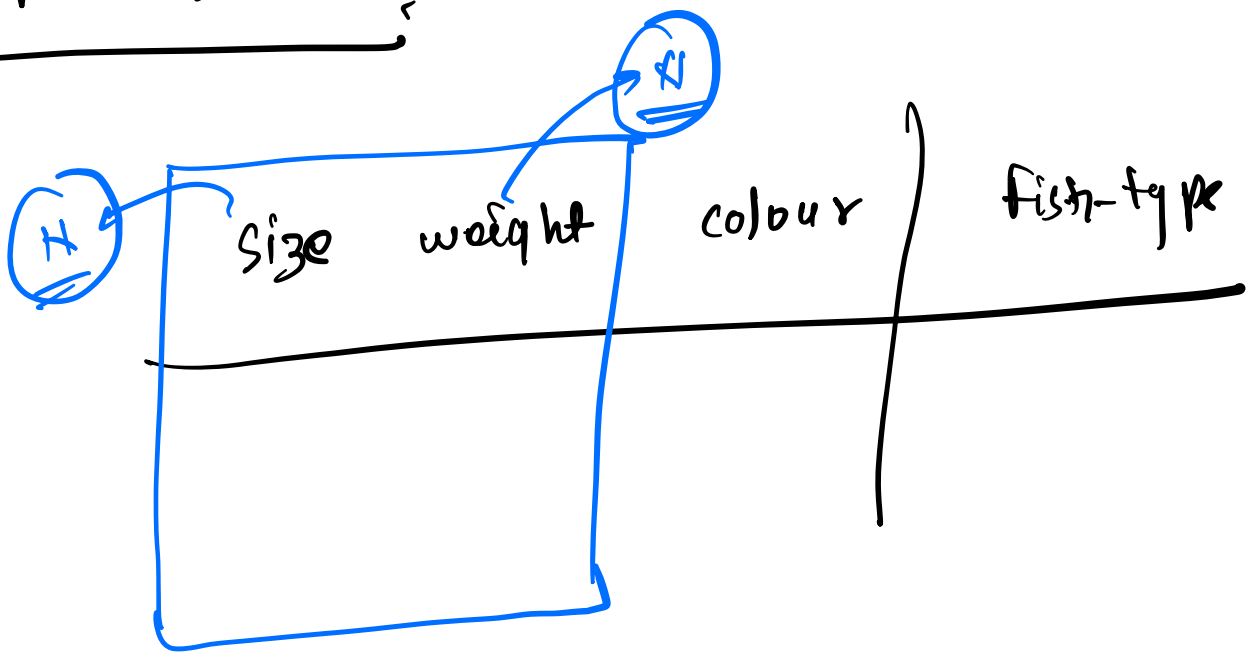
wt = 20kg → f2

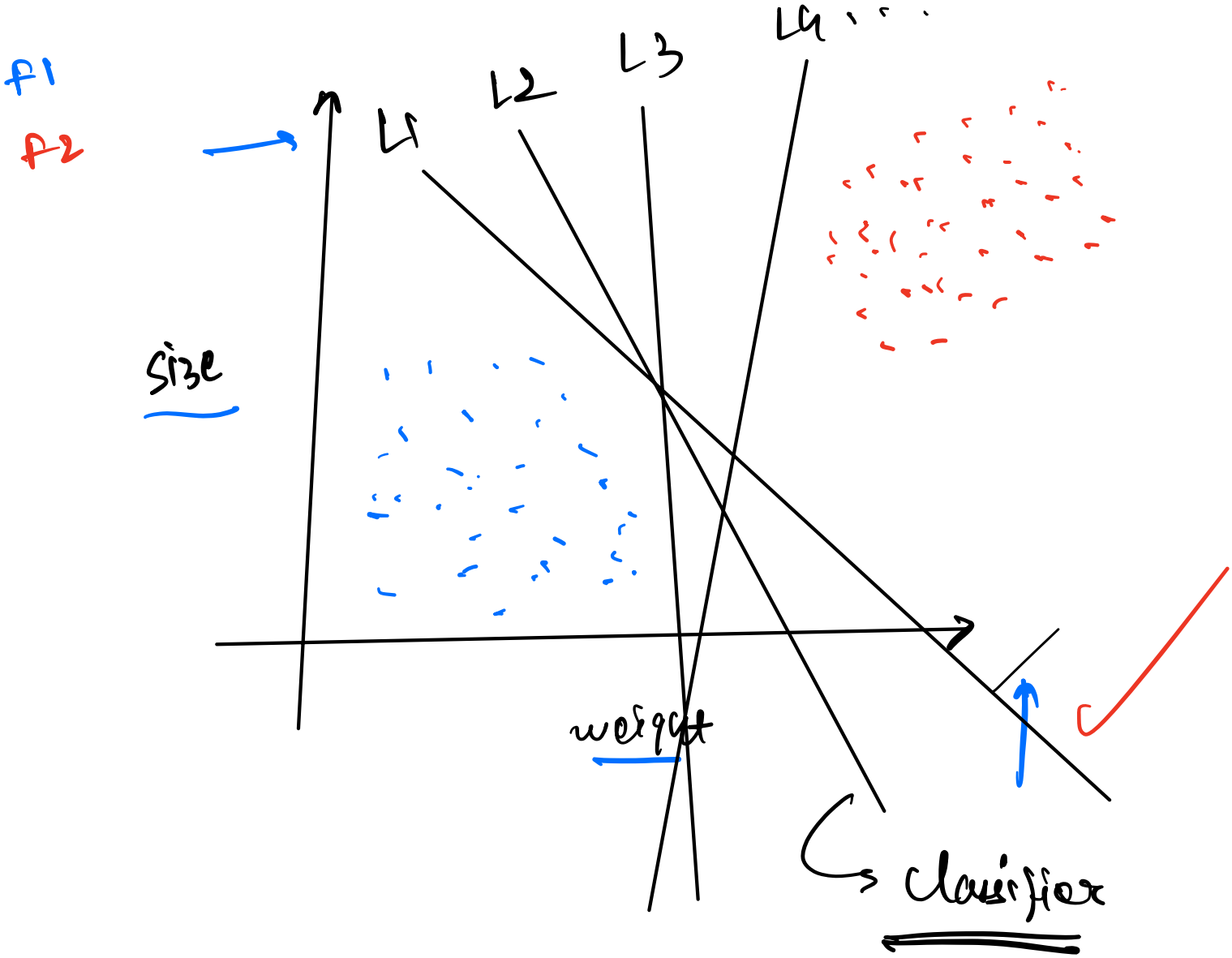
wt = 10.1 kg → f1

* Terminologies :



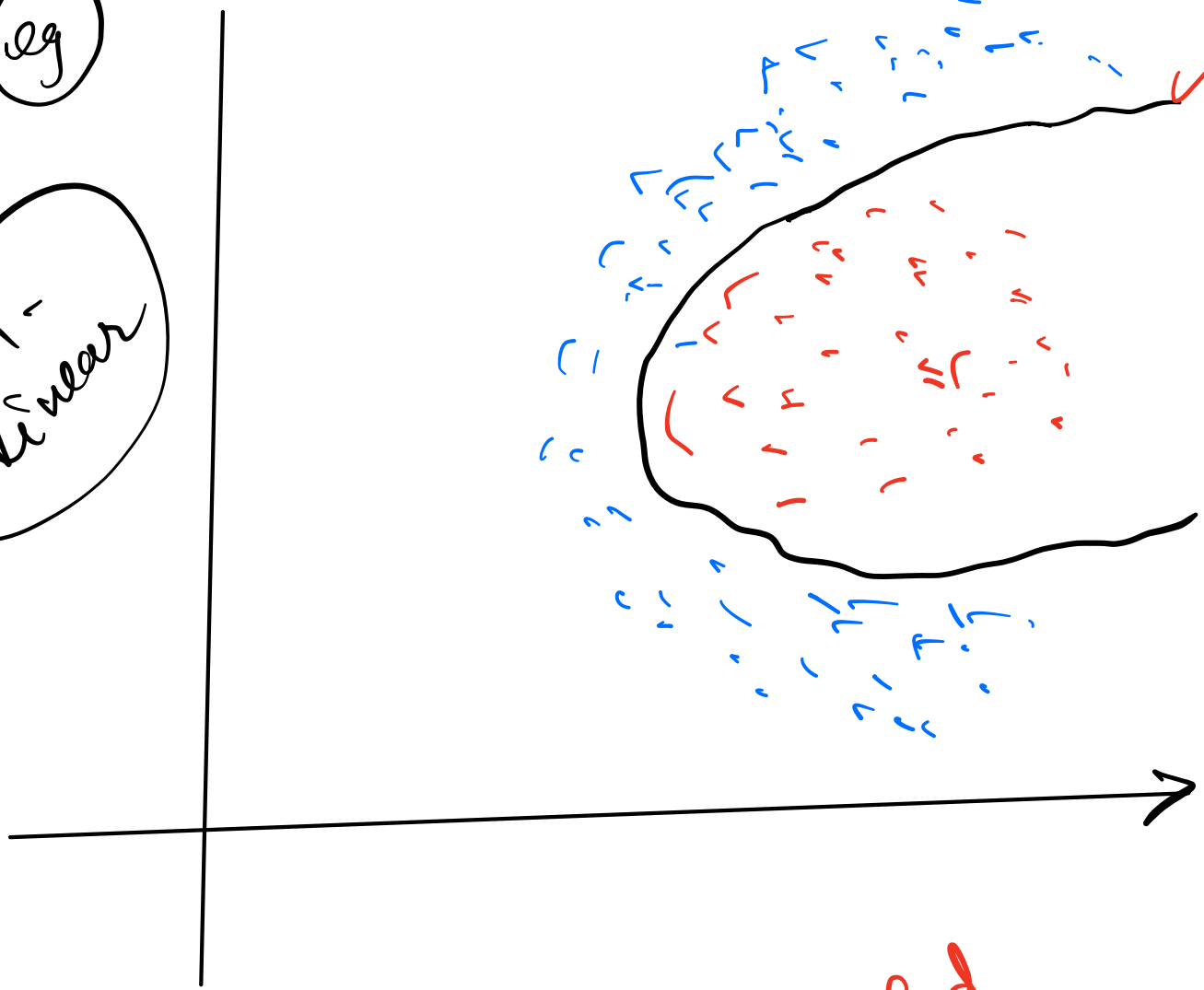
Visualization :



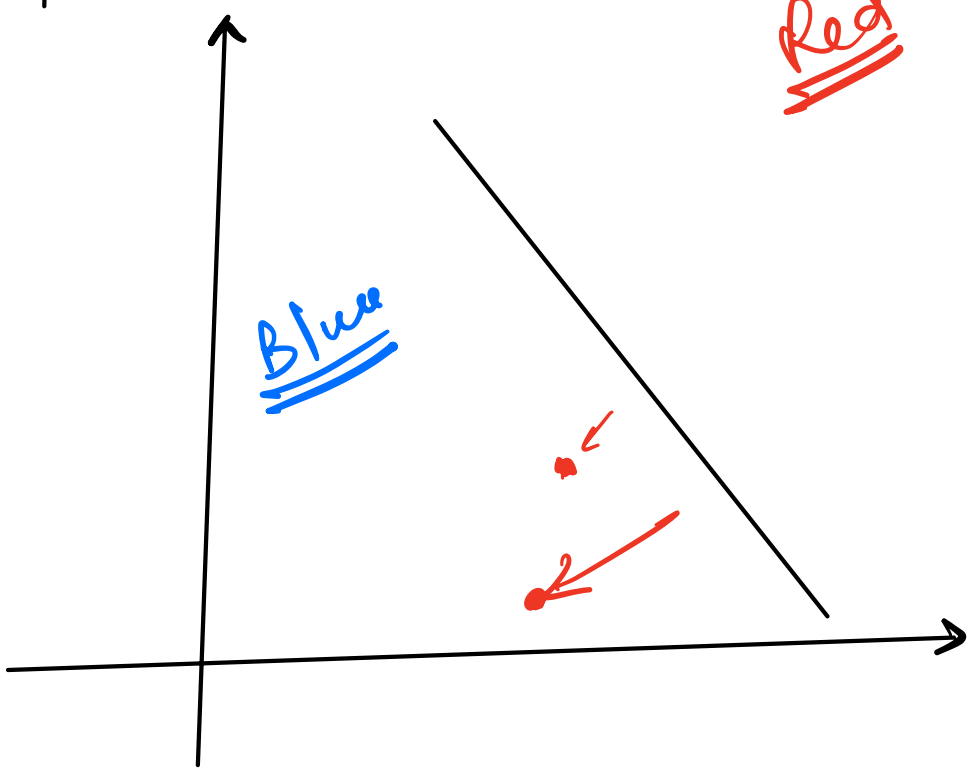


eg

non-linear



eg



* Process of Building a ML Algo

a) Data Collection

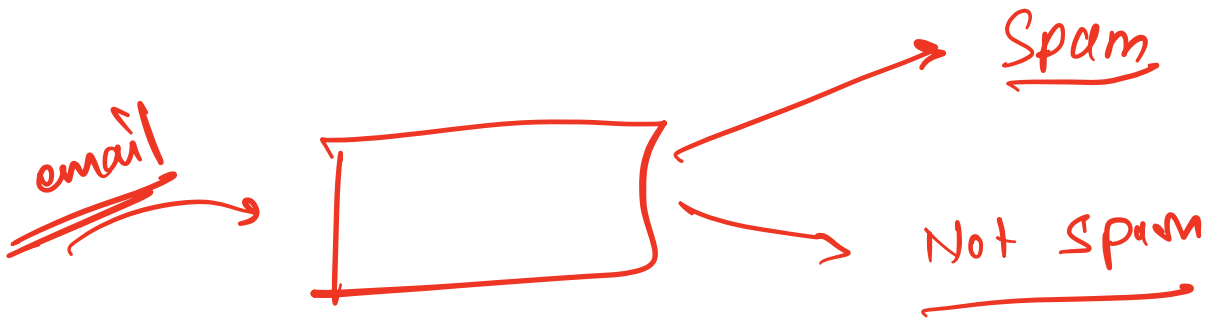
b) Data Visualization → PCA, tSNE

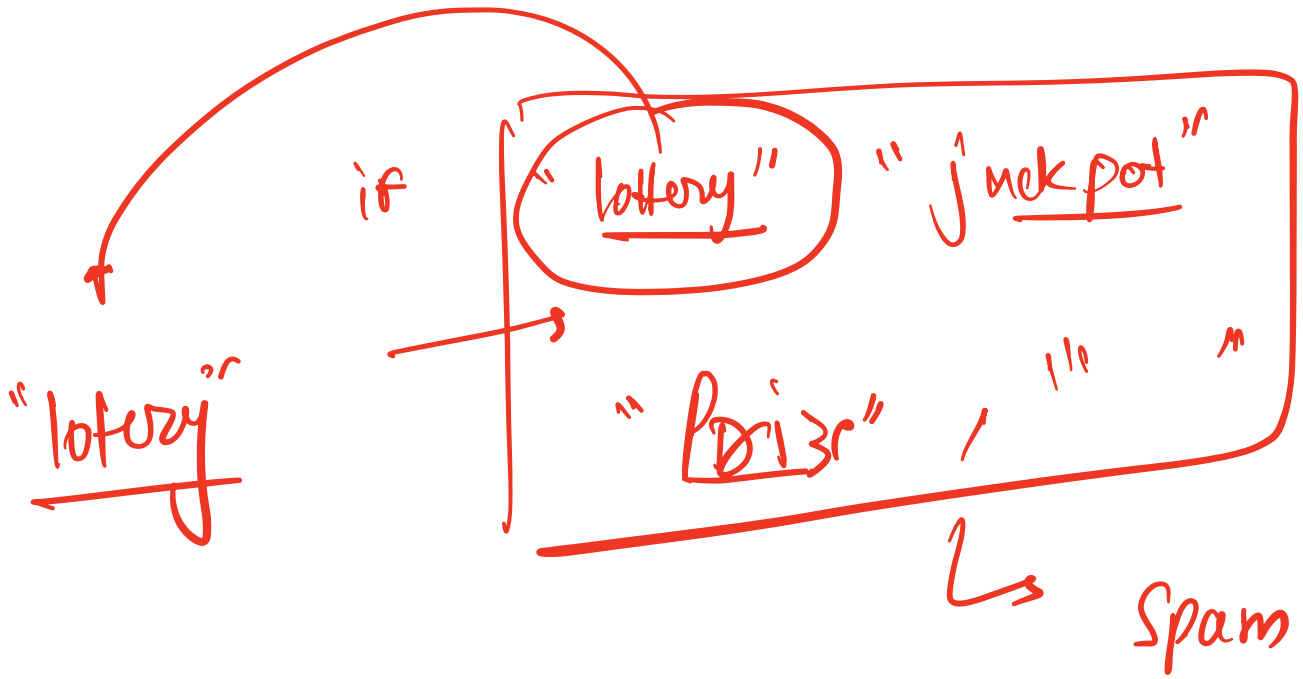
c) Choosing an appropriate geometrical structure to separate classes.

d) Choosing a Loss function which helps decide the 'best' structure.

e) Training / optimization.

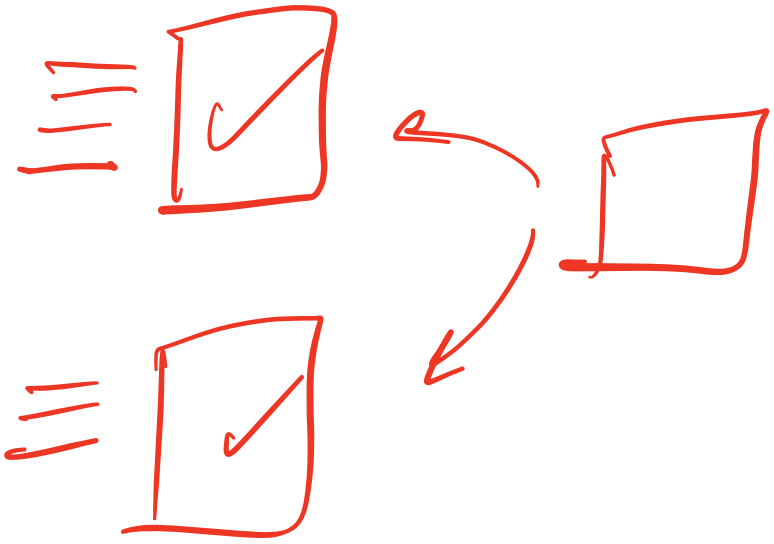
(9) Spam / Not - Spam





else

Not Spam.

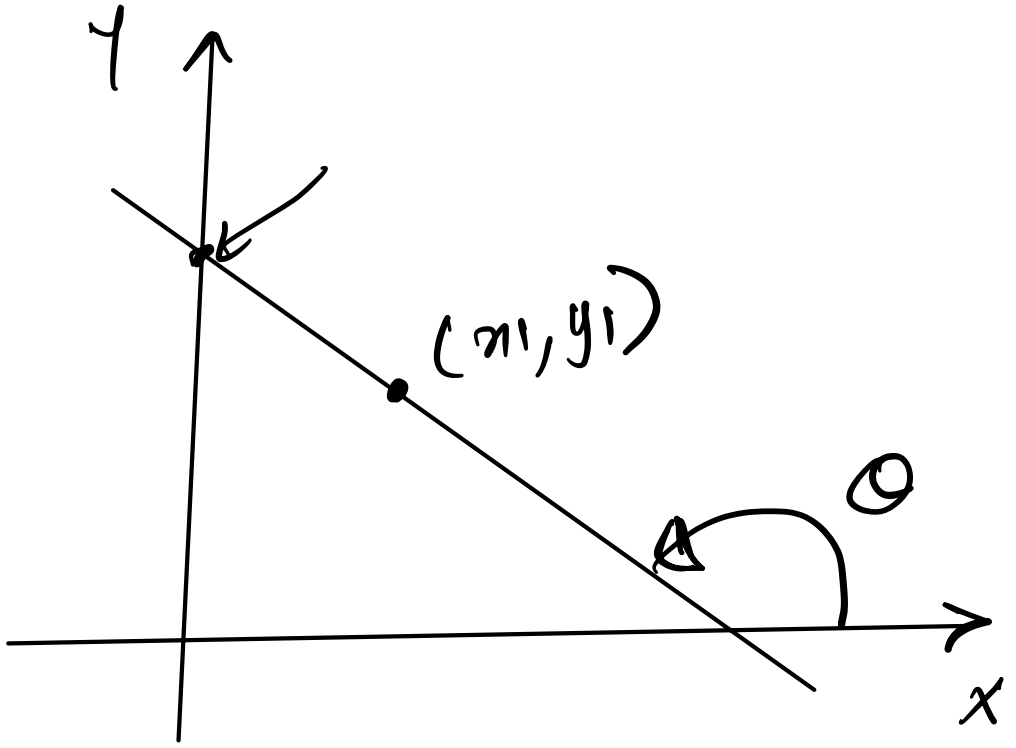


Co-ordinate Geometry

$y = mx + c$

$c \hookrightarrow$ y-intercept

$m \swarrow$ Slope



$l \quad l$

$y_1 = mx_1 + c$ ✓

$$m = \tan\theta$$

$$\tan(0) = 0$$

$$\tan(90^\circ) = \infty$$

$$-\infty < \tan\theta < \infty$$

$$y = mx + c$$

$$Ax + By + C = 0$$

$$\Downarrow$$

$$\left[w_1 x_1 + w_2 x_2 + w_0 = 0 \right] \Rightarrow \underline{\text{ML}}$$

weights

$$Ax + By + C = 0$$

$$\boxed{y = mx + c}$$

$$w_1 x + w_2 y + w_0 = 0$$

$$w_2 y = -w_1 x - w_0$$

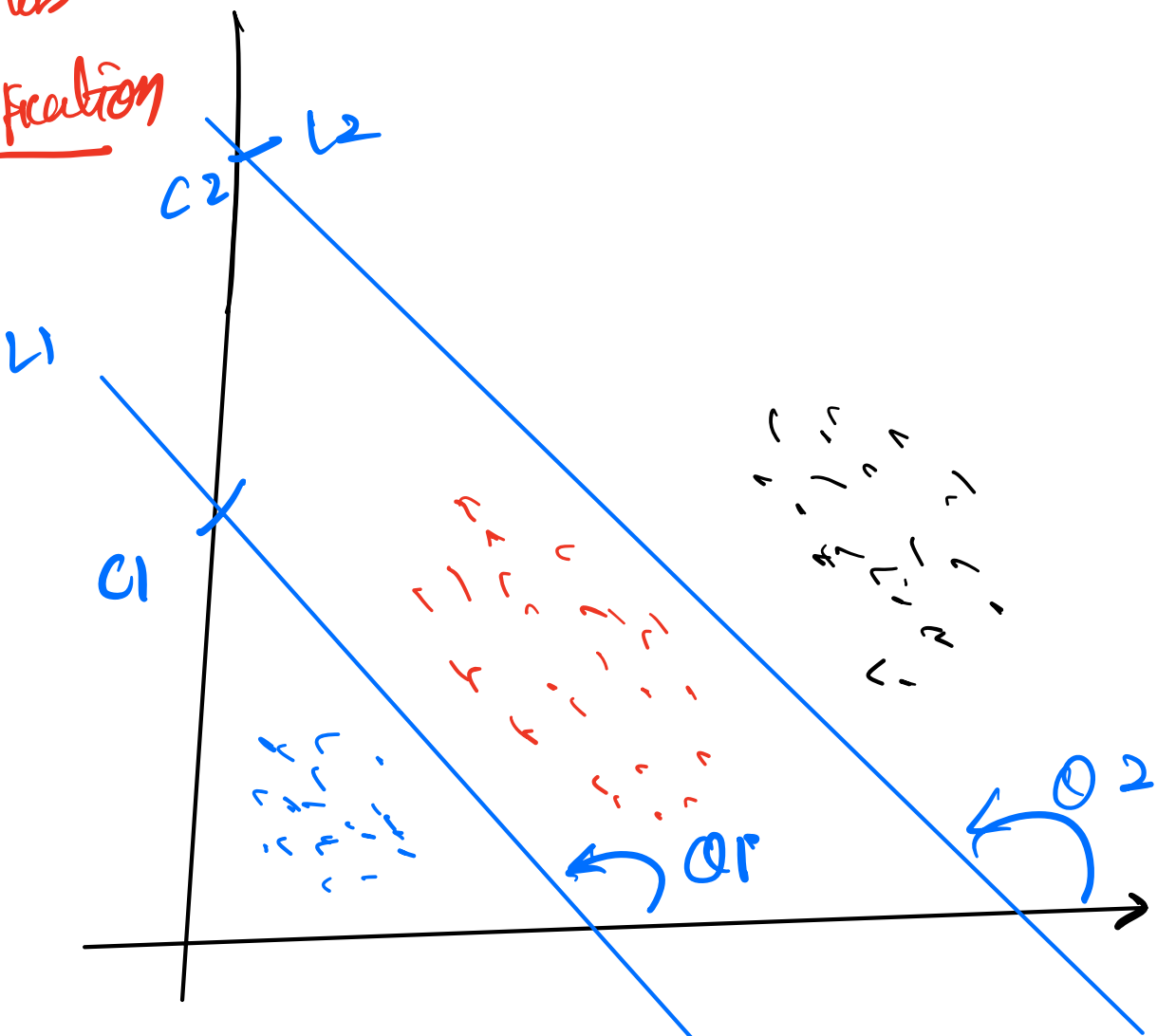
$$y = \left(\frac{-w_1}{w_2}\right) x + \left(\frac{-w_0}{w_2}\right)$$

m

y-intercept

$$m = \left(\frac{-w_1}{w_2}\right) \qquad c = \left(\frac{-w_0}{w_2}\right)$$

multi class classification



$L1 \Rightarrow y = m_1 x + c_1$

$L2 \Rightarrow y = m_2 x + c_2$

$m_1 = \tan(\theta_1)$

$m_2 = \tan(\theta_2)$

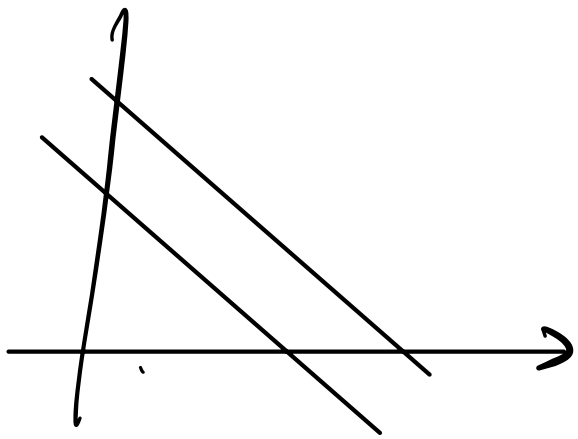
(*) (1) $\theta_1 = \theta_2$

$\Downarrow$

$m_1 = m_2$

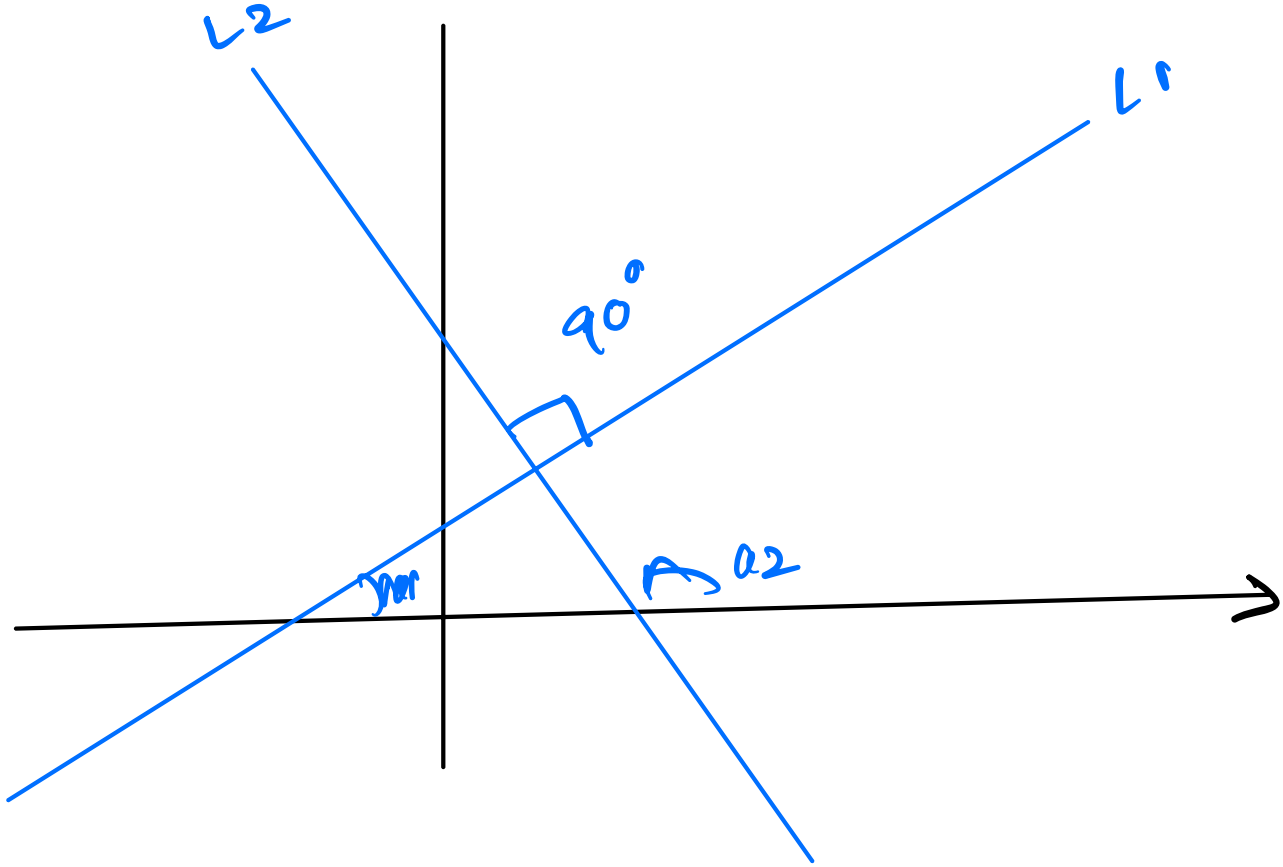
$\Downarrow$

Parallel lines



(2) If the lines are perpendicular to each other:

$$m_1 * m_2 = -1$$ ✓


L2
L1
90°
α2

2D ⟶ line

3D ⟶ plane

Hyperplane

2D: $w_1 x_1 + w_2 x_2 + w_0 = 0$

↳ 2D Hyperplane

3D: $w_1 x_1 + w_2 x_2 + w_3 x_3 + w_0 = 0$

↳ 3D Hyperplane.

nD: $w_1 x_1 + w_2 x_2 + \cdots + w_n x_n + w_0 = 0$

$\rightarrow x \rightarrow$ nD hyperplane

weight vector

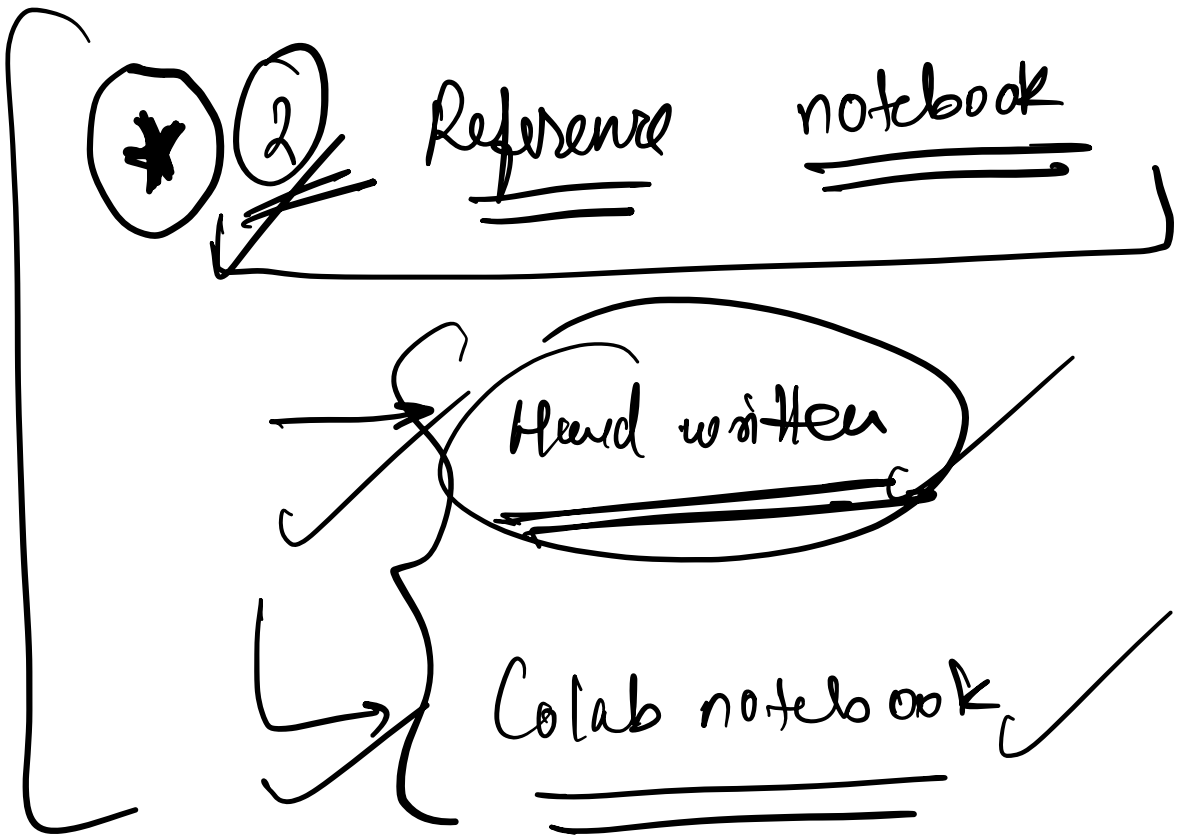
$w = [w_1 \; w_2 \; \cdots \; w_n]$

$x = [x_1 \; x_2 \; \cdots \; x_n]$

feature vector

* Logistics :-

① 7:05 AM



Module ~ 1 Month