Maths for ML

Lecl: Linear Algebra I : The ML Context

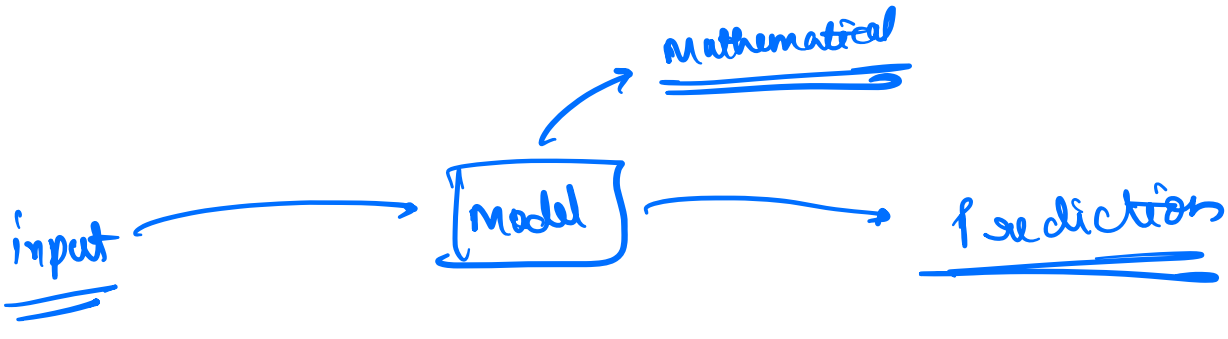
eg :

given data

YOE	Salary
1	10K
2	20K
4	40K
3	30K

YOE : 6 → Salary → 60K ✓ (prediction)

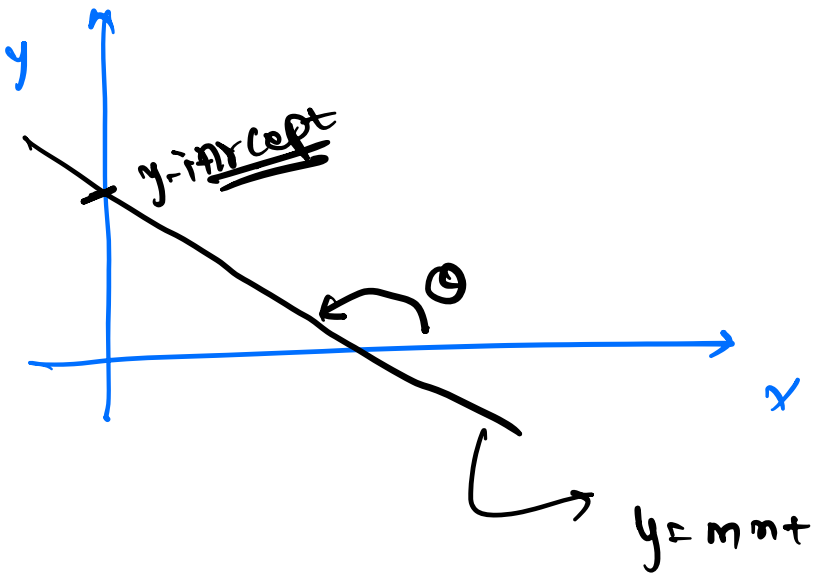
Salary = 10K * YOE

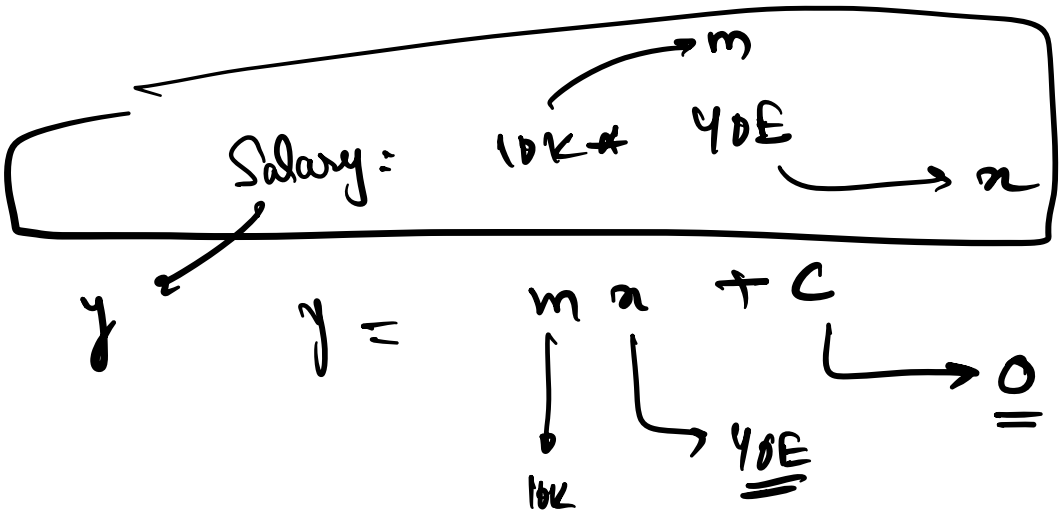


Salary = 10K * 40E

$y = mx + c$

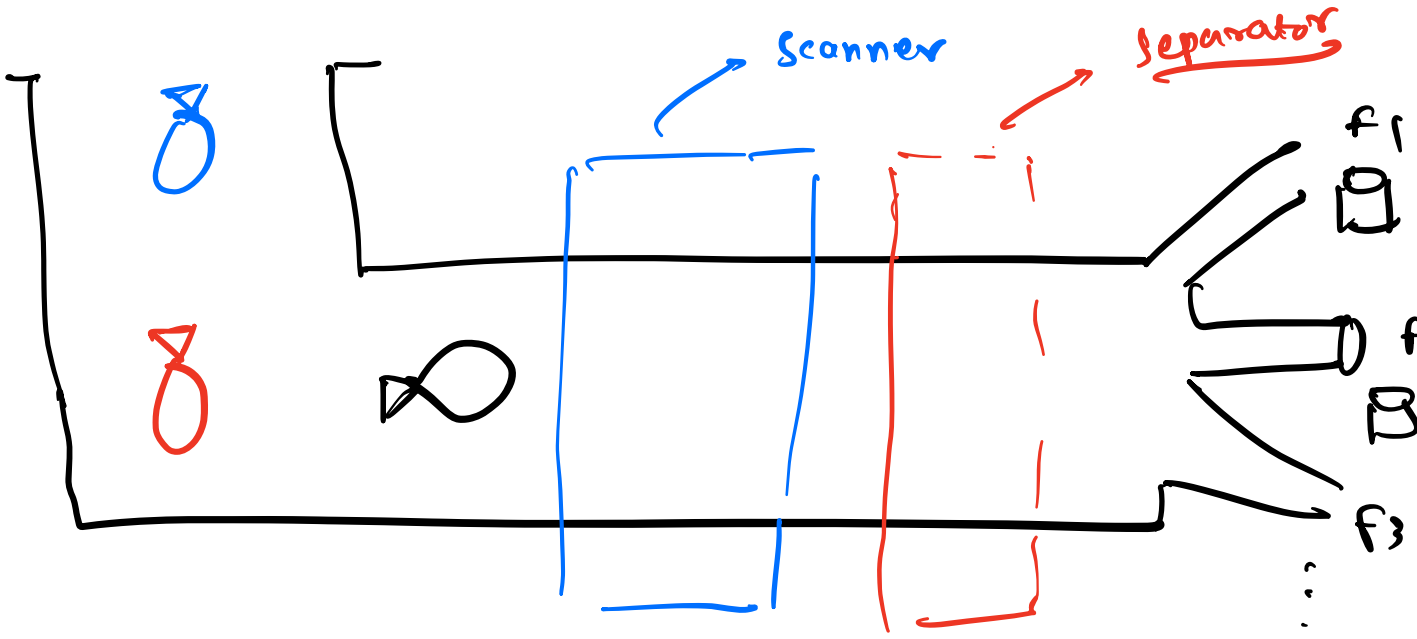
- m → slope
- c → y-intercept





9

~ 40 variants



Parameters :- (features)

1. Size
2. Weight
3. Appearance
   - Color
   - Texture
   - Shape / design
   - ⋮

Size	weight	Color	fish-type
20	10	brown	f1
—	—	—	—
—	—	—	—

given data

weight (kg)	fish-type
10	f1
10-2	f1
9.7	f1
8-4	f1
15	f2
15.4	f2
15-8	f2
16	f2

unknown

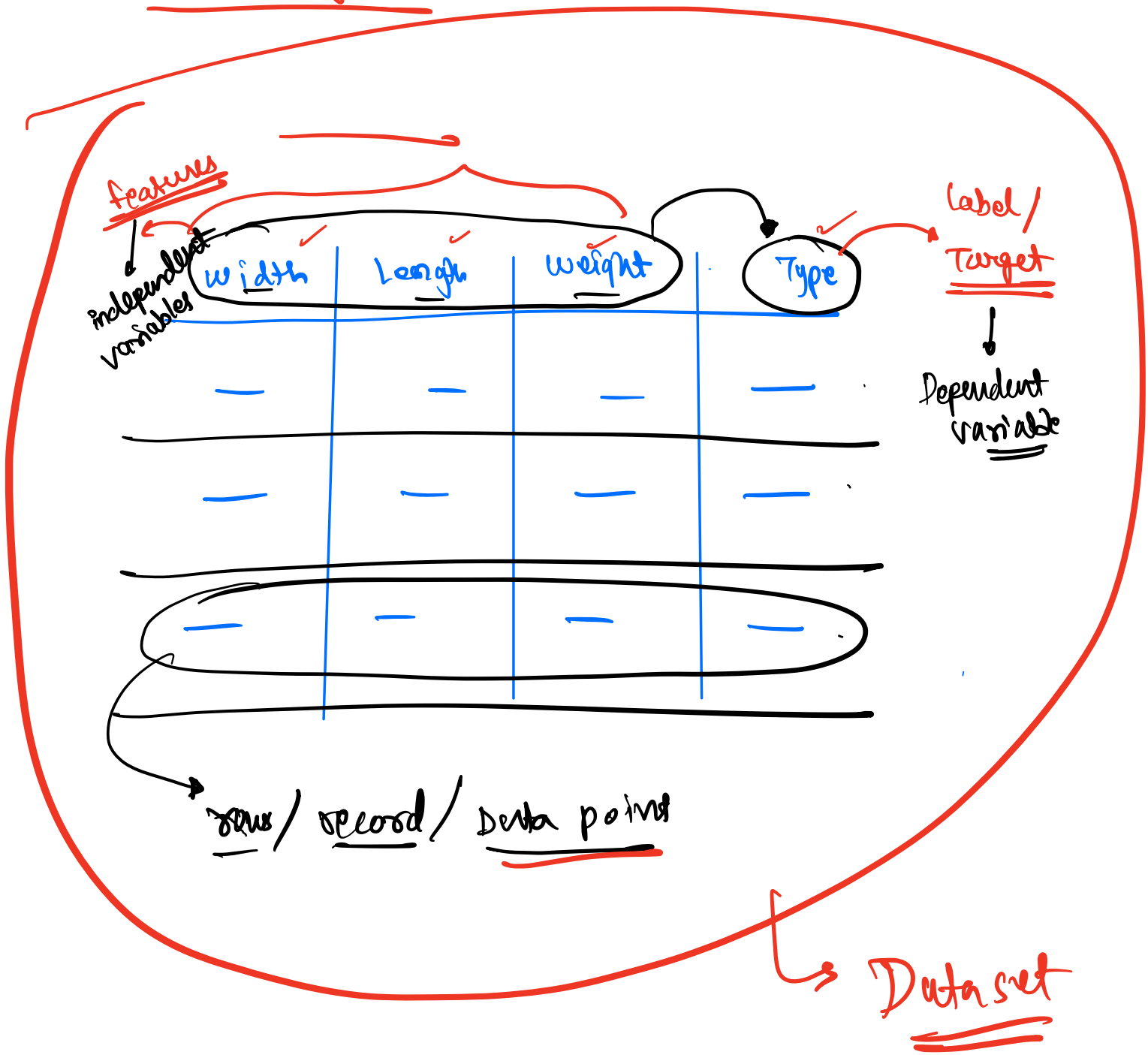
9.5 kg → f1

20 kg → f2

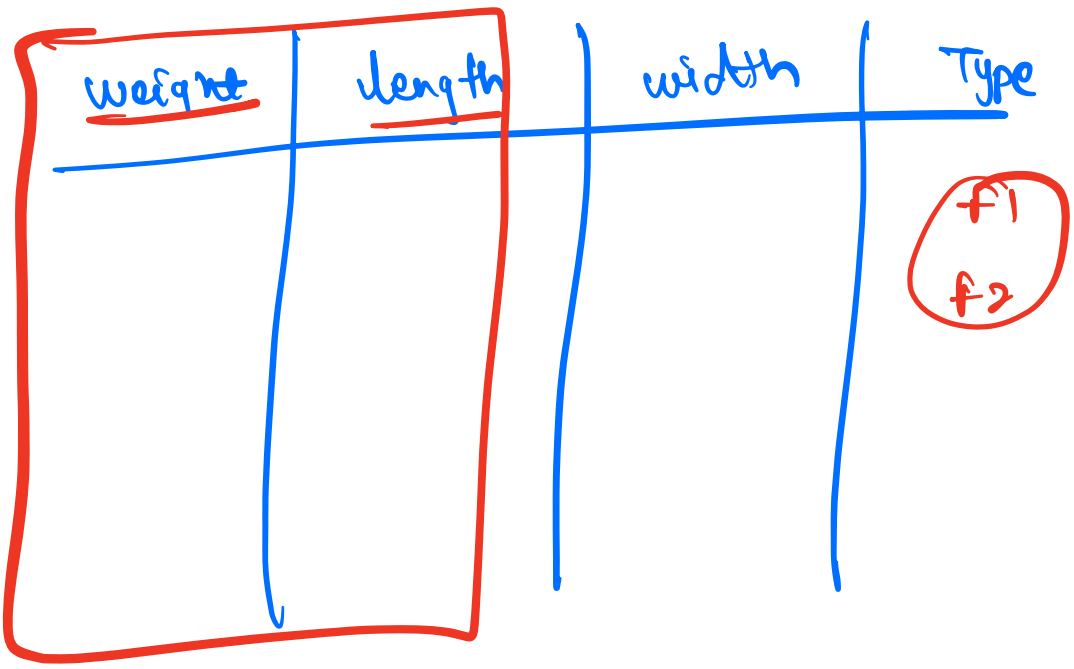
10.1 kg → f1

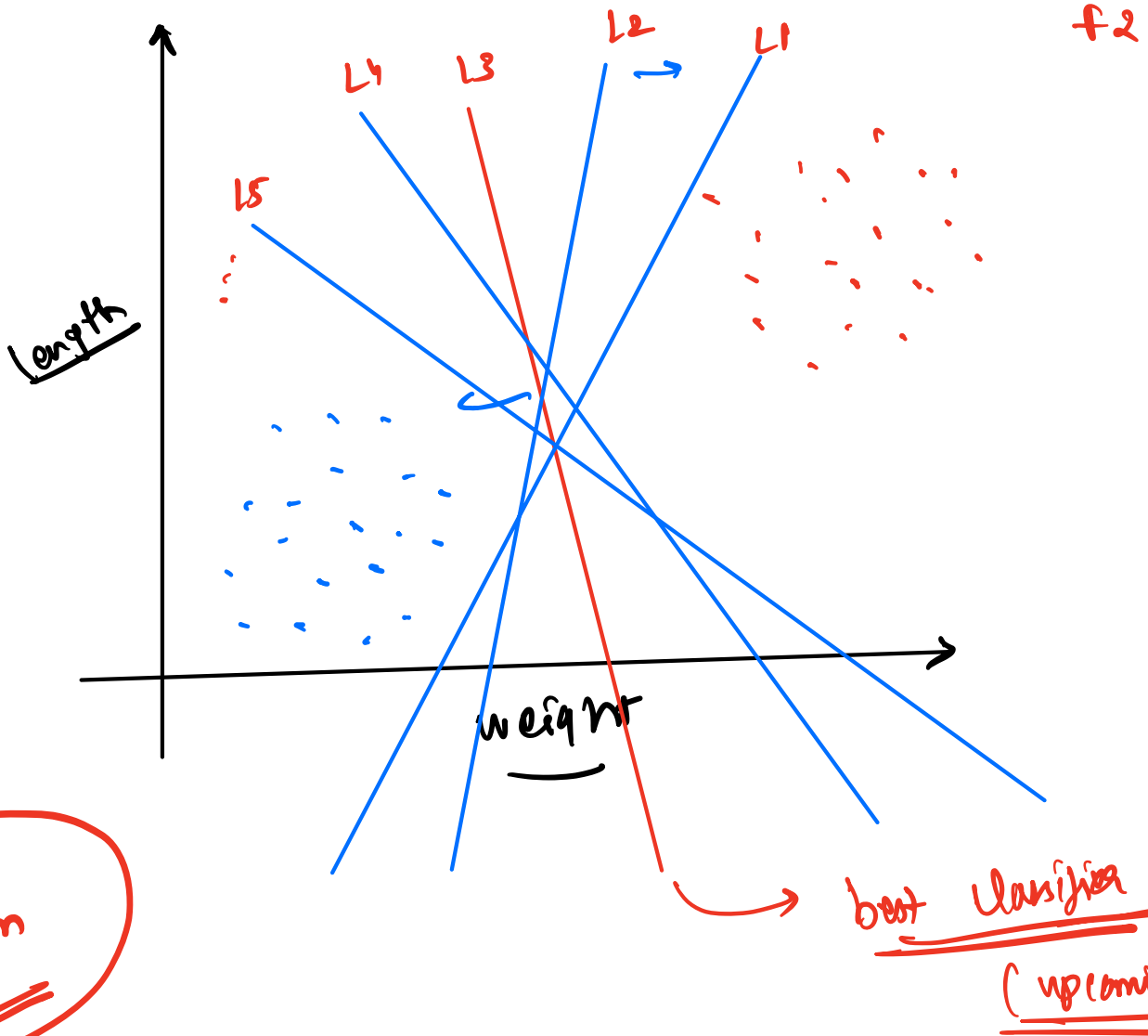
⋮

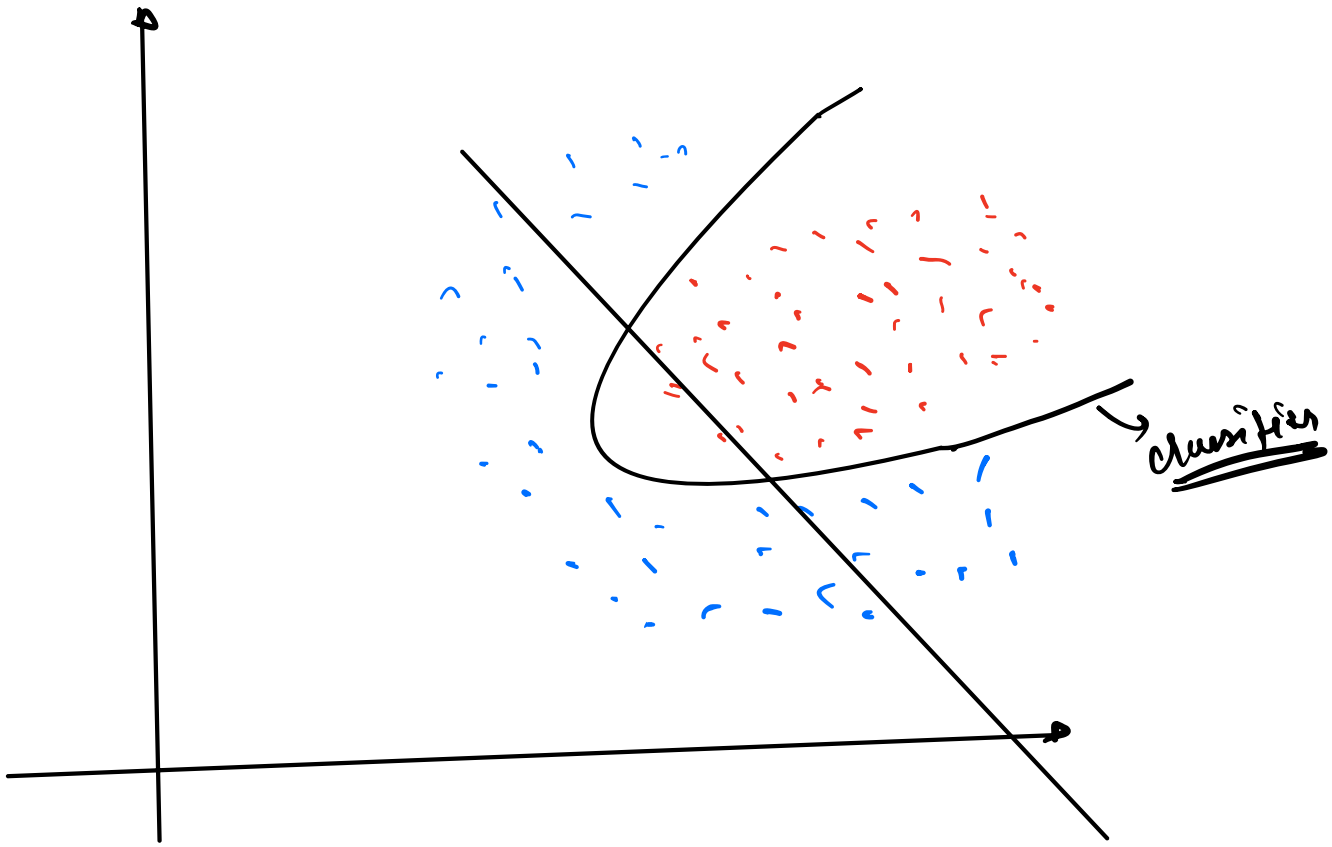
Terminologies

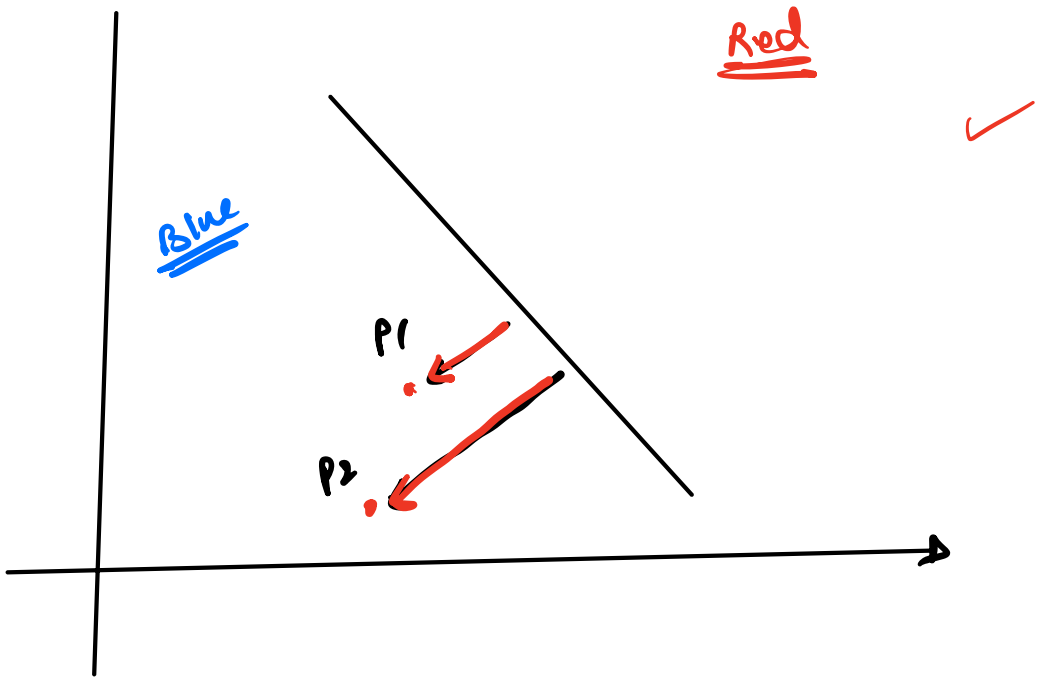


* Visualization






classifier


Red
Blue
P1
P2

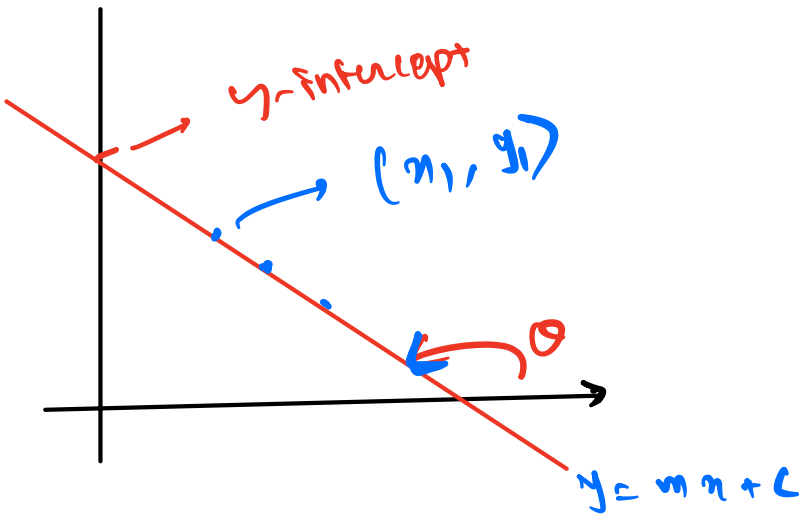
* Process involved in ML Algorithms :-

1. Data Collection.
2. Data Visualization
3. Choose an appropriate geometrical Structure to separate the classes.
4. Choosing a "Loss" function which helps decide the best structure.
5. Training / Optimization

* Co-ordinate Geometry

$y = mx + c$ (eqn of a line)

- m → Slope
- c → y-intercept



$$y_1 = mx_1 + c$$

$$m = \tan(\theta)$$

$\tan(0^\circ) = 0$

$\tan(90) = \infty$

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

$$y = mx + c$$

$$Ax + By + C = 0$$

$$\Downarrow$$

$$\left[w_1 x + w_2 y + w_0 = 0 \right] \rightarrow \underline{\underline{ML}}$$

weight

feature

$$\times \boxed{A} x + By + C = 0$$

$$\downarrow \times$$

$$y = mx + c$$

$$Ax + By + C = 0$$

$$By = -Ax - C$$

$$y = \left(\frac{-A}{B}\right) x - \left(\frac{C}{B}\right)$$

m $\quad$ c

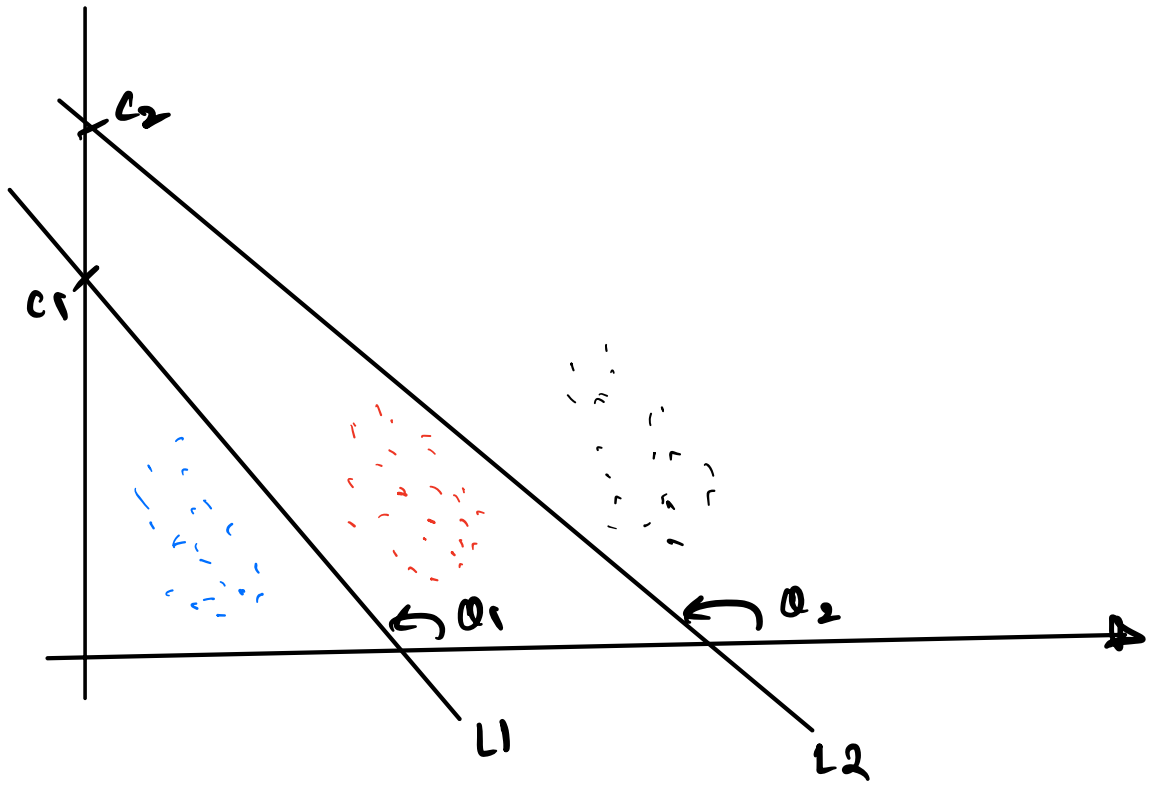
$$w_1 x + w_2 y + w_0 = 0$$

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

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

$$y = m x + c$$

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



L1: $y = m_1 x + c_1$

L2: $y = m_2 x + c_2$

$m_1 = \tan(\theta_1)$

$m_2 = \tan(\theta_2)$

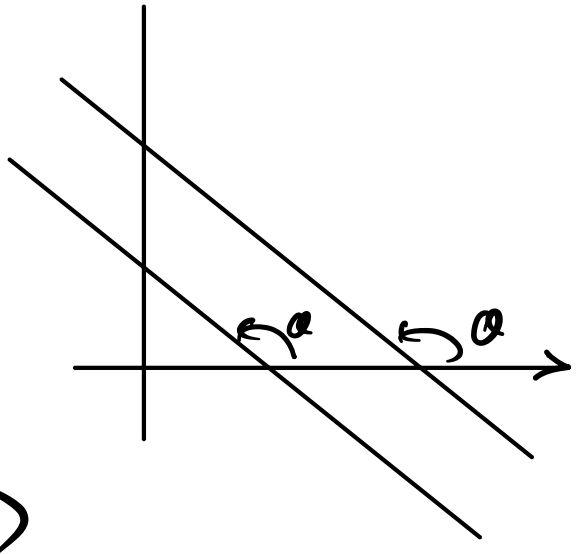
* Results

① $\theta_1 = \theta_2$

$\Downarrow$

$m_1 = m_2$

(lines are parallel)



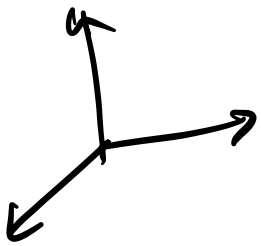
② If lines are perpendicular to each other:

$$m_1 * m_2 = -1$$

$w_1 x + w_2 y + w_0 = 0$ → 2D hyperplane

$$w_1 x_1 + w_2 x_2 + w_3 x_3 + w_0 = 0$$

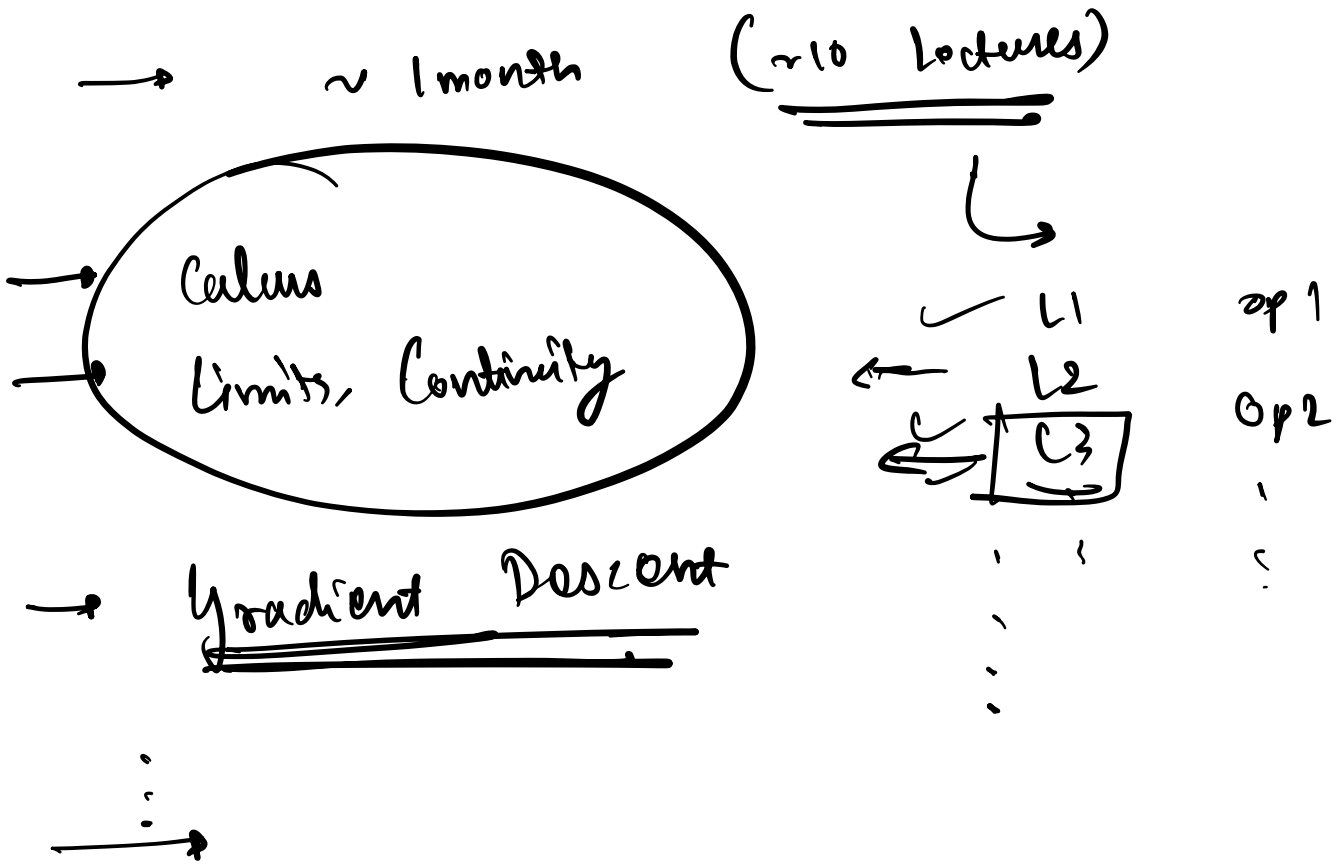
↳ 3D Hyperplane.



$$w_0 x_1 + w_2 x_2 + w_3 x_3 + w_4 x_4 + w_0 = 0$$

⋮

* Logistics :-


~ 1 month
(~10 Lectures)
Calculus
Limits, Continuity
L1
L2
L3
Op 1
Op 2
Gradient Descent