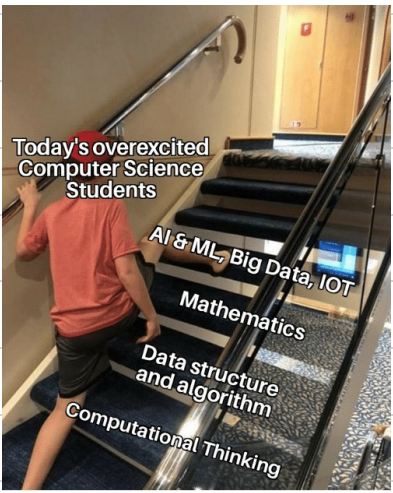
Session-1 Intro To Linear Algebra

Jan 27, 2024



Reality is often disappointing

Overview

* We'll do 10 Lectures

1. Linear algebra
2. Calculus
3. Coordinate geometry
4. Optimization

} w.r.t. ML

Aim: Automate tasks using Human Intelligence

→ So what's the How:?

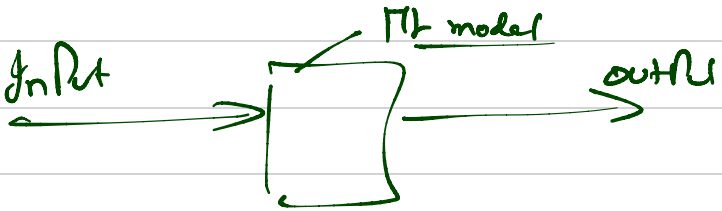
1. Prob - stats
2. Hypothesis testing
3. Calculus
4. Linear Algebra
5. Coordinate geometry
6. Optimization

→ How this class will be structured??

1. Concept → Visualize → Maths → Code
2. RePeat
3. Ask specific doubts
4. Then in doubts Session

Machine Learning Application

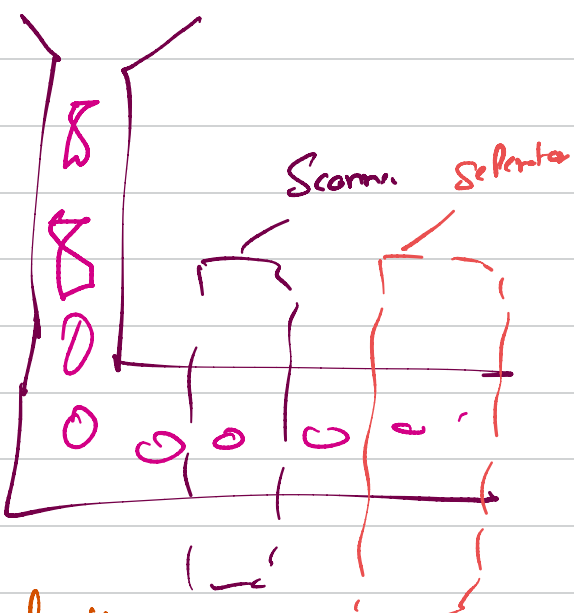
Q. What is a model??



Example 1 Fish Sorting algo

What attributes

1. Weight
2. Colour
3. Length
4. Width



Big Fishes: Rohu, catla

Small Fishes: bombay duck
sardine.

Feature

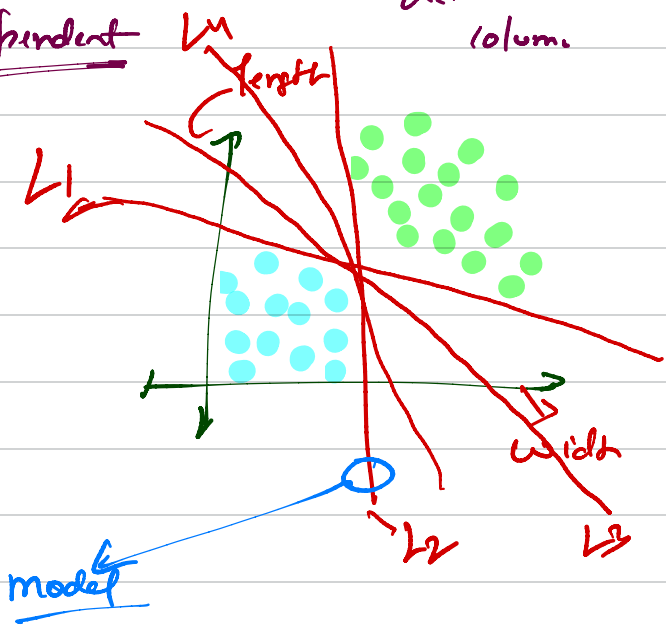
target column / label

Width	Length	Weight	Type
30	50	80	1 → Rohu
11	23	28	2 → Sardine
27	43	72	1
16	31	36	2

samples / Records / data Points

dependent column

Feature → independent



* All ML model → mathematical model

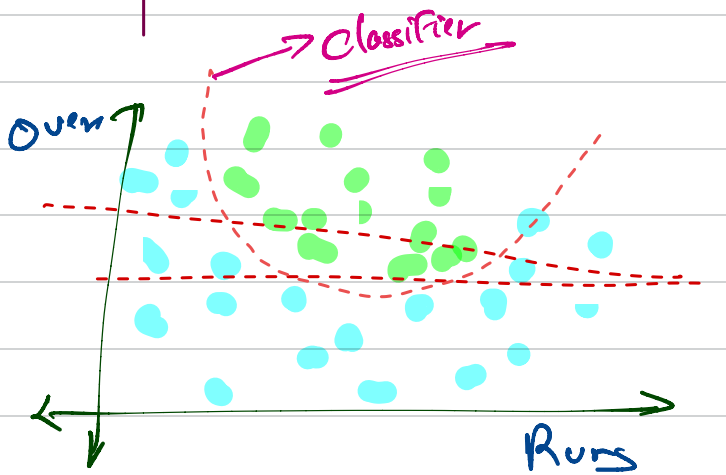
$$y = mx + c$$

Example 2: IPL Win prediction

Runs	Overs	Outcome
90	6	Win
90	15	Loss
18	1	Win
36	7	Loss

● → loss

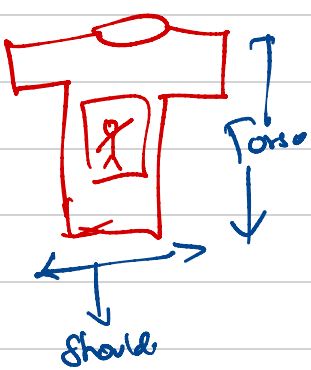
● → win

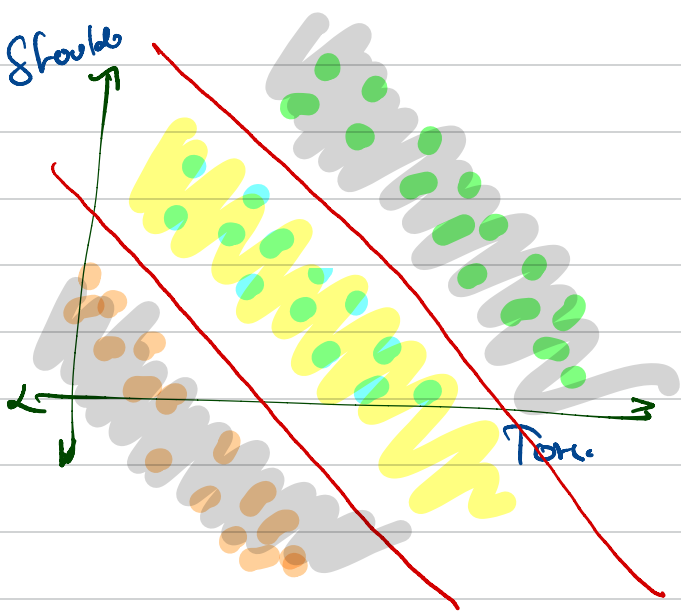


* It doesn't always have to be st. line

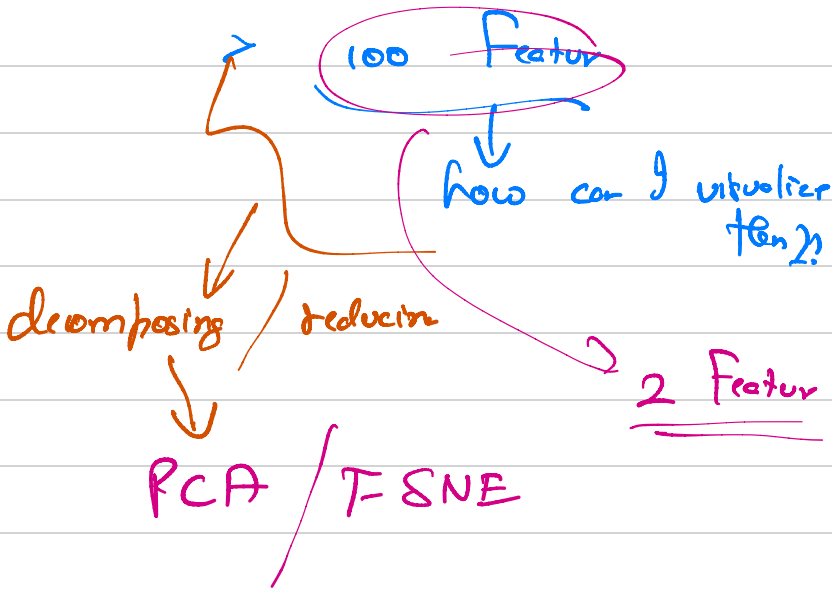
Example 3: T-Shirt Size prediction

Torso	Shoulder	Size
61	40	S
63	42	M
64	44	L
62	41	S
64	43	M
69	45	L





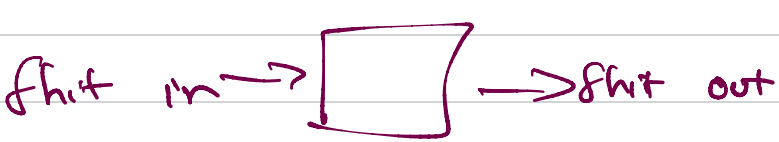
→ What if my dataset > 3 dim



- labelled dataset → You've label for each row of Featur
- Un labelled " → You don't

→ labelling → manually } → V.V. expensive

Classification → by a model.

→ 

This is the first class of Nasa's

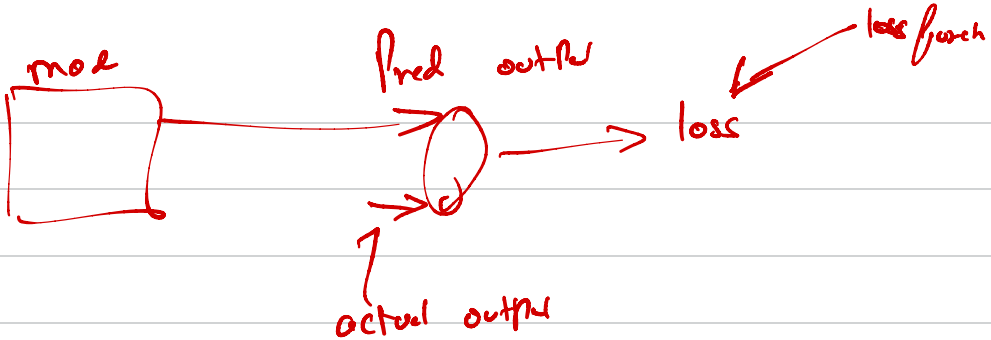
labelled data → Supervised training

unlabelled data → Unsupervised training,

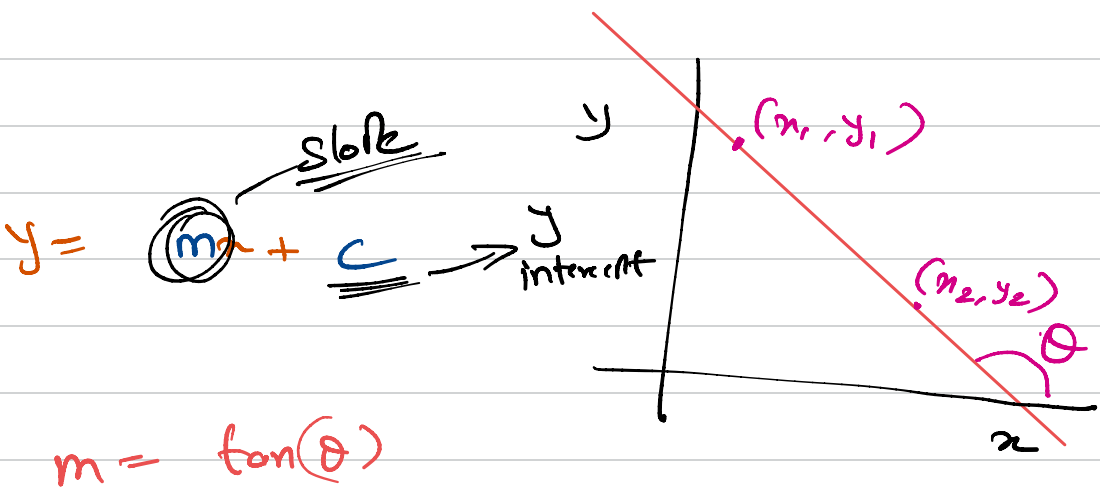
Reinforcement learning

→ Process of building ML algorithm

1. Data Collection → labelled data
2. Data Visualization → Plot
   → t-SNE, PCA
3. Use an appropriate geometrical structure to seperate class
4. Using a loss function
5. Training / optimization.



CO-ORDINATE GEOM



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

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

$$\tan(0) = 0$$

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

$$\tan(\theta) = \frac{y_2 - y_1}{x_2 - x_1}$$

$y = mx + c$ x_1 y ?!!

$y_1 = m \times x_1 + c$

$x \rightarrow$ independ

y is depends on x

$y = mx + c$

In ML we typically use a generic expression

$$ax + by + c = 0$$

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

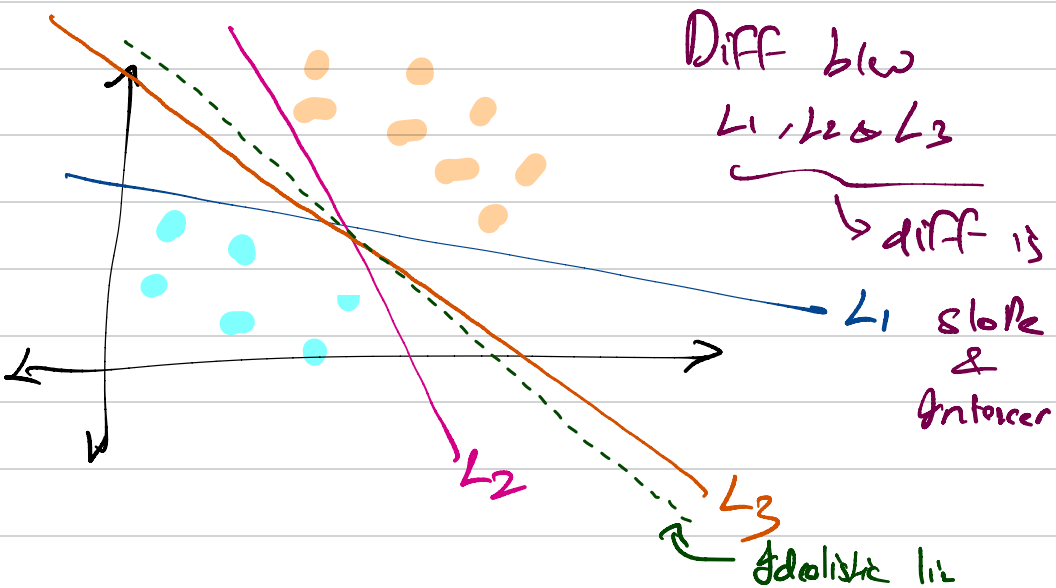
$$\hookrightarrow y = \frac{-w_0}{w_2} - \frac{w_1}{w_2} x$$

$$m = \frac{-w_1}{w_2}, \quad c = \frac{-w_0}{w_2}$$

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

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

Parameters

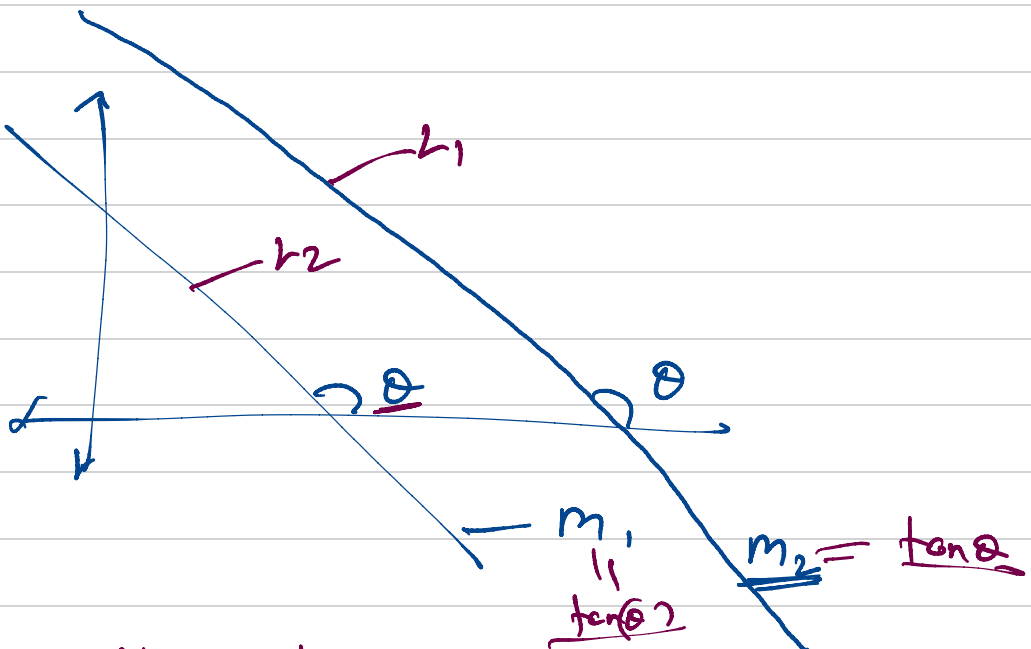


$$\text{Slope} = \frac{-w_1}{w_2}, \quad \text{Intercept} = \frac{-w_0}{w_2}$$

Falcon - 7B

7B → RTX 3080 → 16 GB VRA

14B



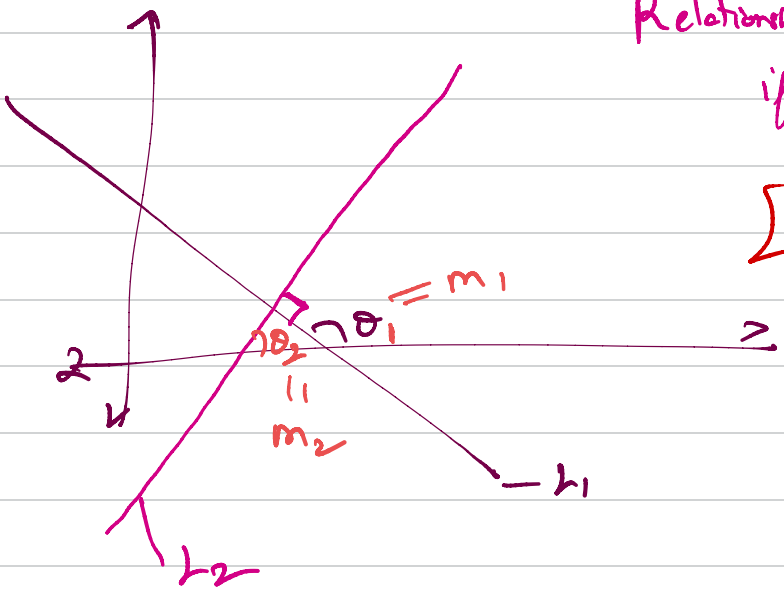
If $L_1 \| L_2$ then m_1, m_2 ??

$m_1 = m_2$

Relationship b/w m_1 & m_2

if $L_1 \perp L_2$

$$m_1 \times m_2 = -1$$



→ With two dimensions,

Parameters

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

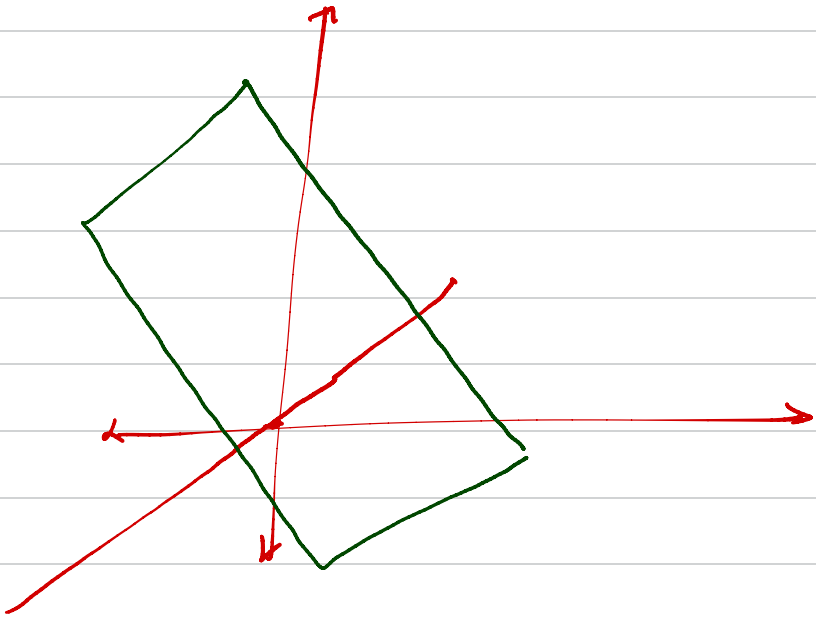
Features

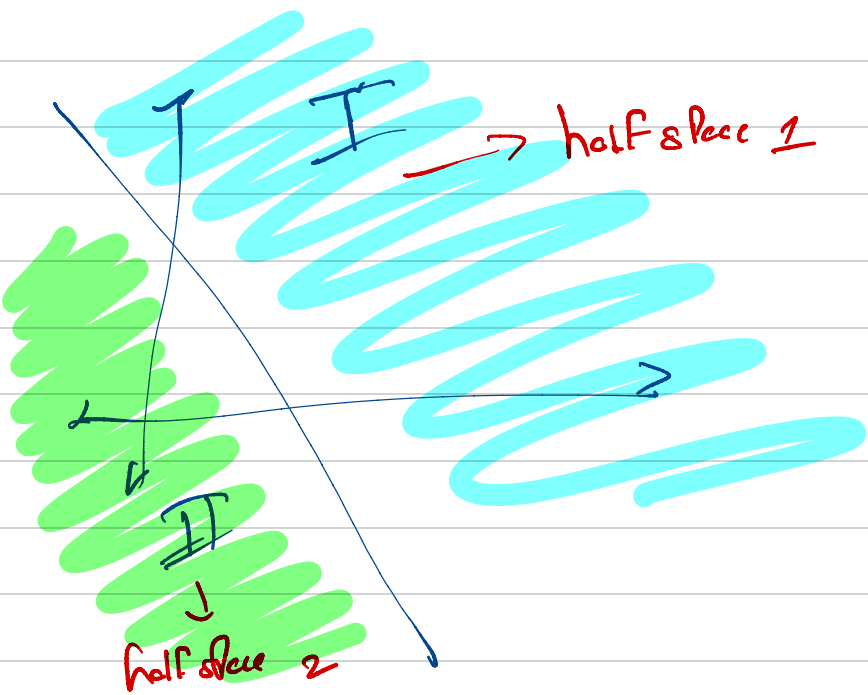
$$w_1 x + w_2 x_2 + w_0 = 0$$

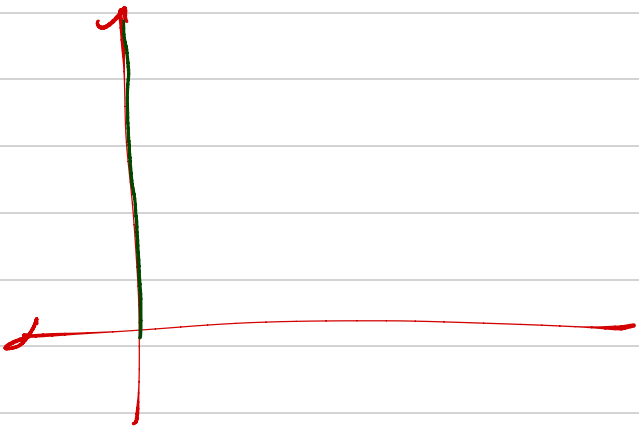
3D / hyperplane → extend this to 3d dimension

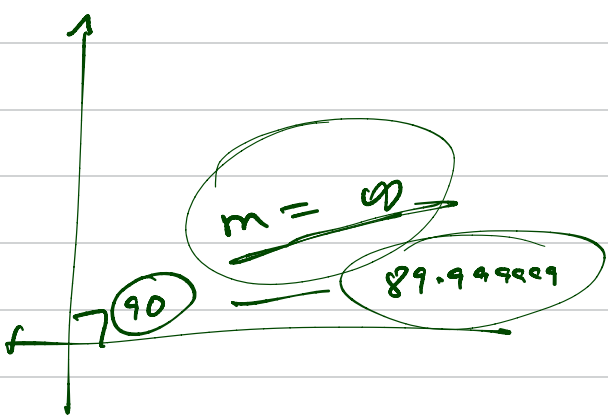
$$w_1 x_1 + w_2 x_2 + w_3 x_3 + w_0 = 0$$

$$w_1 x_1 + w_2 x_2 + w_3 x_3 + w_4 x_4 + w_0 = 0$$




I
half space 1
II
half space 2




m = ∞
90
89.999999