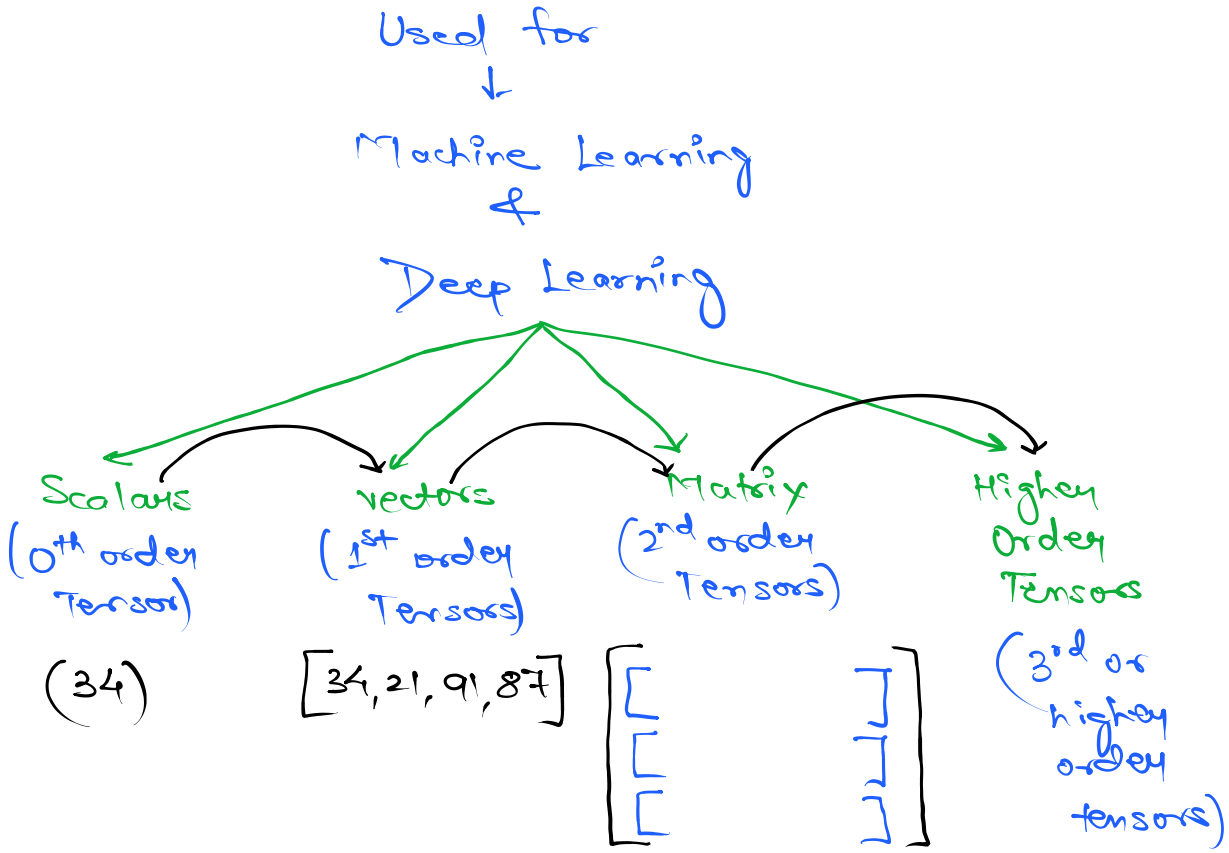
Linear Algebra 20 June

Friday, 20 June 2025 21:00



Uses of Linear Algebra in Machine Learning →

① Generalize/represent the relationship b/w input & output cols in higher dimension data.

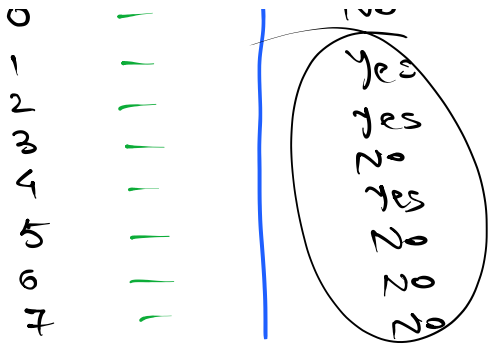
② Helps us in data representation numerically

- → Tabular
- → Images
- → Audio
- → video
- → Text
- → Signal

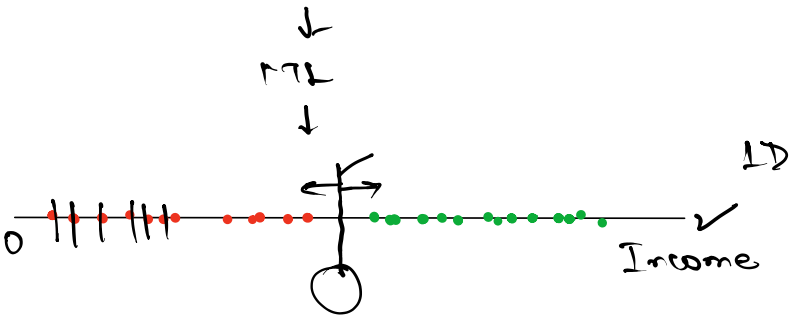
→ Help us represent all these data numerically → Then these numerical data can be given to ML/DL.

Bank → ML

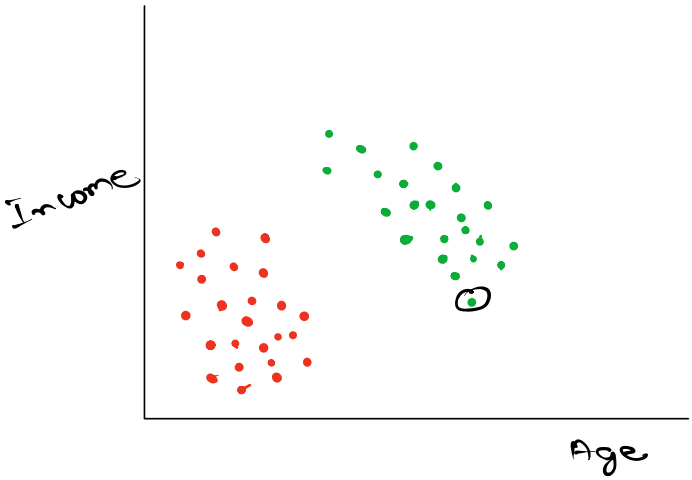
I/P → Income | O/P → Loan Approved?



I/P → O/P



	Age	Income	Loan Approved ?
0	—	—	No
1	—	—	Yes
⋮			



Maximum number of cols we can represent as a graph visually is 3.

3 input cols
↓

3D

	Rooms	Floors	Age	Area	Price
0					
1					
2					
3					
4					
5					

↓

ML

↓

$\text{Price} = 0.98 * \text{Rooms}^2 + 0.87 * \text{Floors}^2 + (-1.2) * \text{Age} + 1.35 * \text{Area} + 1.8$

1.8 ↑ Base Price

Linear

$y = m_1x_1 + m_2x_2 + m_3x_3 + m_4x_4 + c$

↓

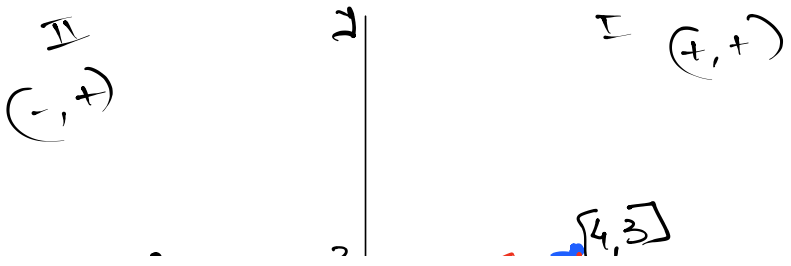
Equation of a line

$y = mx + c$

Scalars → 38 47.9 63.98 211.137

vectors → [38, 47.9, 63.98, 211.137]

vectors : Mathematical Approach

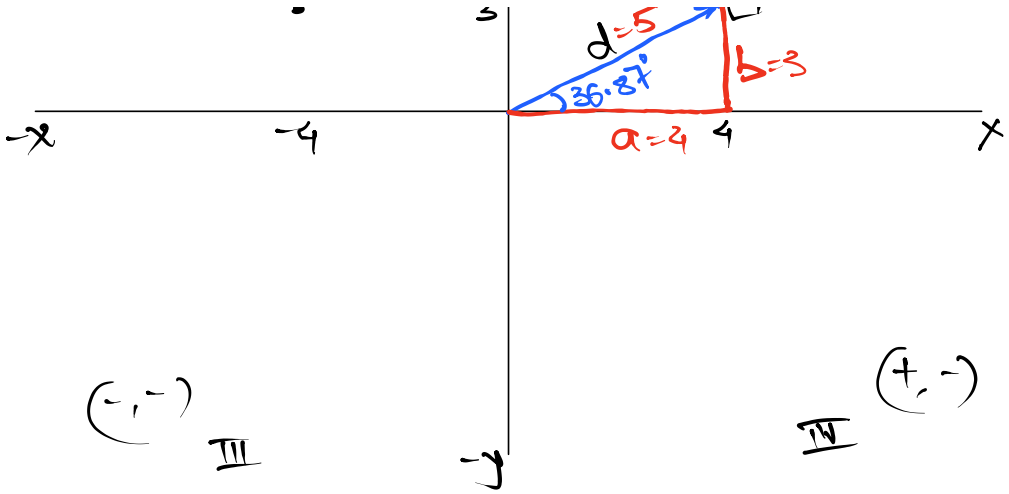


vector

[4, 3]

↓ ↓

x y



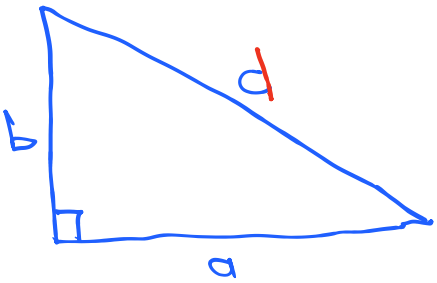
[-4, 3]

5 units

vectors have magnitude & direction

Magnitude of a vector →

Pythagoras theorem



$$d^2 = a^2 + b^2$$

$$d = \sqrt{a^2 + b^2}$$

↓

$$d = \sqrt{3^2 + 4^2}$$

$$= \sqrt{25}$$

$$d = 5$$

Direction of the vector $[4, 3]$ is :

$$\tan\theta = \frac{b}{a}$$

$$\tan\theta = \frac{3}{4}$$

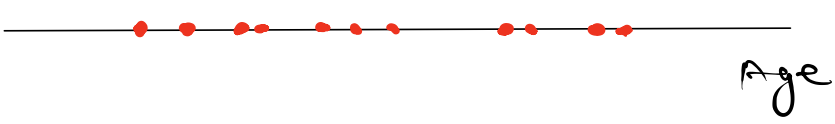
$$\theta = \tan^{-1}\left(\frac{3}{4}\right)$$

$$= 36.87^\circ$$

Dimensions of a vector →

	Age
H_1	[2]
H_2	[3.5]
H_3	[4.8]
H_4	[1.7]

1D vector

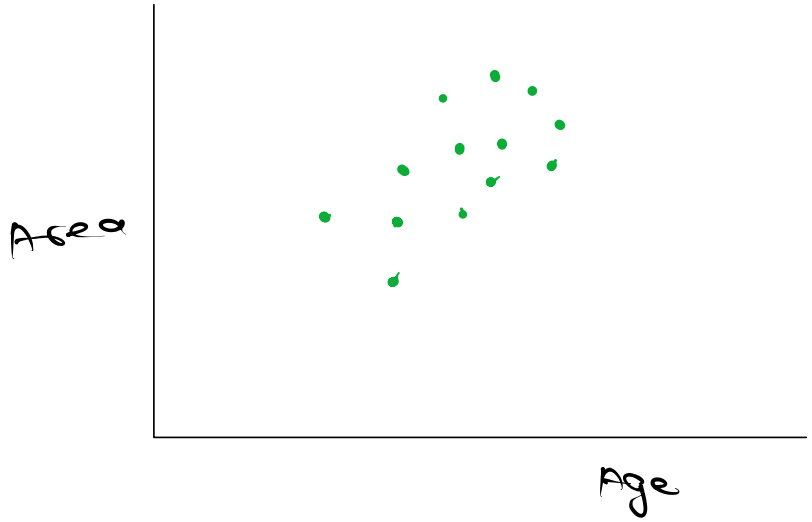


	Area	Age
H_1	[2200	3] ←
H_2	[1000	2]

2D vectors

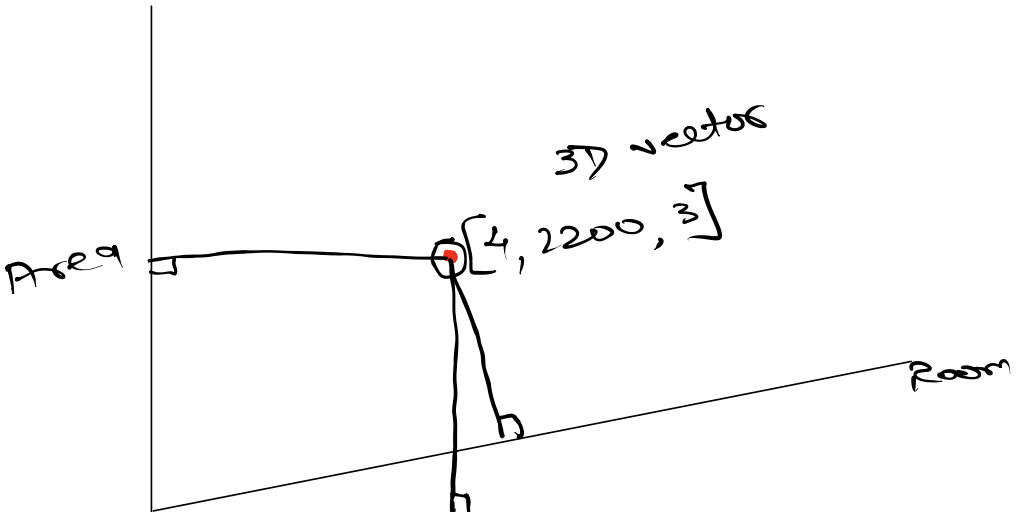
H_2 [... | ...]

H_3 [1700 | 1.5]



	Area	Age	Rooms
$H_1 \to 0$	[2200	3	4]
$H_2 \to 1$	[4000	2	8]
$H_3 \to 2$			
$H_4 \to 3$			
4			

3D vector

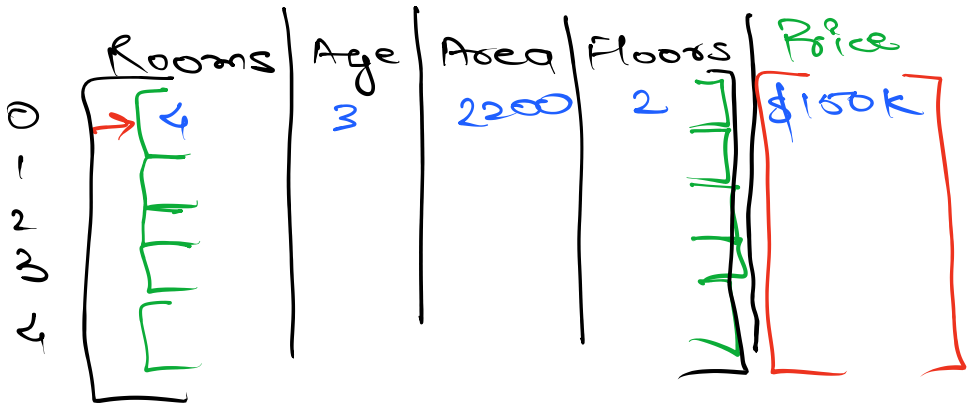


Age

How do we represent a vector →

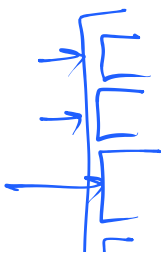
1. Row vectors
2. Column vectors

House Prices Dataset

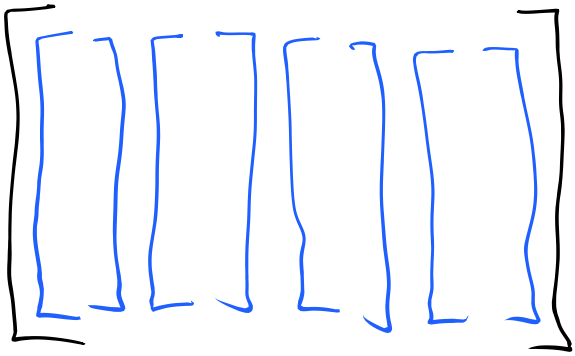


vector1(H1) = [4 3 2200 2]

Matrix = [[v_1] [v_2] [v_3] ⋮]



Matrices



1. Multiplications, additions, divisions, subtractions
2. Transpose
3. Inverse
4. Determinant
5. Rank of a matrix
6. Eigenvectors & eigenvalues