mathematics → ML | Quantum

DL → Neural Netwn

{ Linear Algebra
  Calculus →
  Stats ↳ Prob.

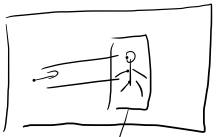
ML → computer Vision

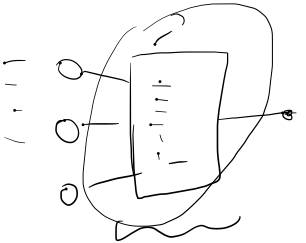
↓

images → RGB → Red

↓

pixel → [ ] G
[ ] B
[ ]





Calcn

↳ d/dt

Linear Algebra

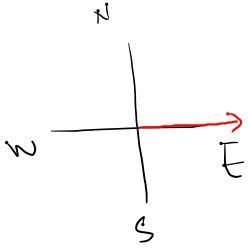
Vectors

1. Physics
   - ↳ mag.
   - dire

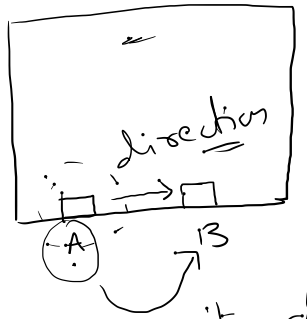
→ Speed → 60 km/hr.
- 60 → magnitude
- km/hr → unit
- 60 km/hr ↙ Scalar

→ weight → 72 kg
- 72 → Scalar
- kg → unit

Velocity ↓

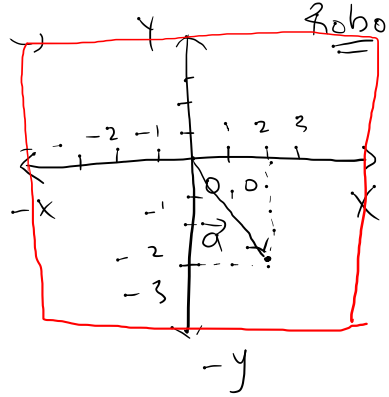


Velocity → Vector



$\vec{V}$ = 30 km/hr. East
- 30 → mag.
- km/hr → unit
- East → direct.

$\vec{a} = \begin{bmatrix} 2 \\ -2 \end{bmatrix}$ → x, → y



Point → (2, -2)

$\vec{a}$ → (0,0) → (2, -2)

Vector

$a = \begin{bmatrix} \vdots \end{bmatrix}$

Set of Ordered

row matrix

CPU | GPU

image

R, G, B

Prediction of house prices

Array (collection)

$\begin{bmatrix} x_1 & x_2 & \cdots \\ \vdots & \vdots & \ddots \end{bmatrix}$

$p_1 = 3$ —

$p_2 = 4$ —

$p_3 = 7$

Rs

Features

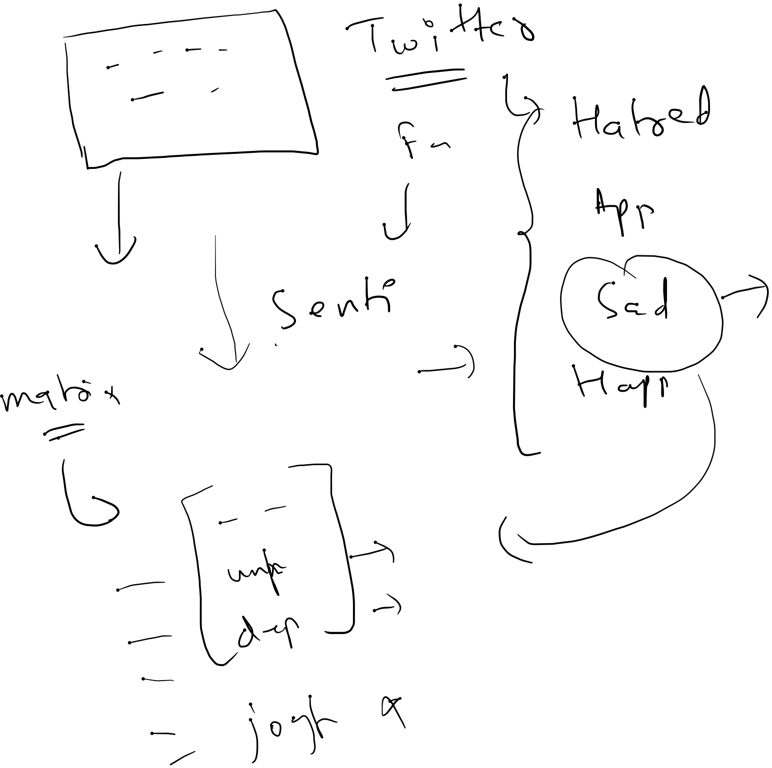
↳ List

1. sq. ft.
2. no. of bed
3. Garage
4. lawn

$a = \begin{bmatrix} \text{sq. ft.} \\ \text{no. of bed} \\ \text{Garage} \\ \text{lawn} \\ \text{price} \end{bmatrix}$ → x_1, → x_2

$x_1, \ldots = \text{Price}$

$\begin{bmatrix} \quad \end{bmatrix}$ $\frac{\text{Rs}}{\text{million}}$


Twitter
Senti
Hatred
App
Sad
matrix

Vectors → Colum matrices row → $\begin{bmatrix} 1 & 1 & 2 \\ 2 & 0 & 3 \\ 1 & 4 & 7 \end{bmatrix}$ ← array of nos

↳ column

$\begin{bmatrix} 1 \\ 2 \\ 1 \end{bmatrix}$

column

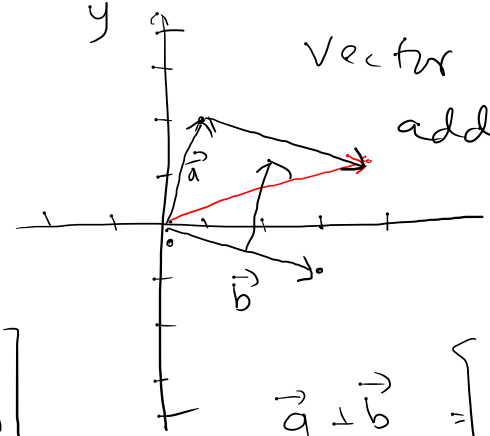
3×3

2-d → $\begin{bmatrix} x \\ y \end{bmatrix}$ x → first, y → below

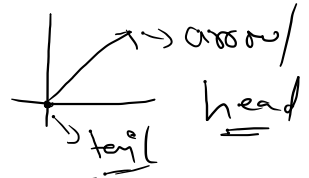
$\vec{a} \mid a = \begin{bmatrix} \quad \\ \quad \end{bmatrix}$

$\vec{c} = \begin{bmatrix} 4 \\ 1 \end{bmatrix}$

1. Addition of
   - Vectors



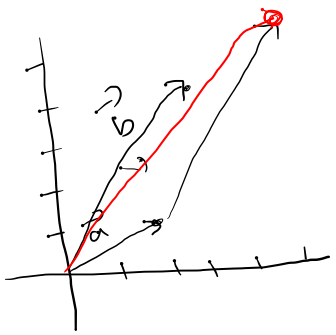
Vector addition



$\vec{a} = \begin{bmatrix} 1 \\ 2 \end{bmatrix}$ $\vec{b} = \begin{bmatrix} 3 \\ -1 \end{bmatrix}$

$\vec{a} + \vec{b} = \begin{bmatrix} 1 \\ 2 \end{bmatrix} + \begin{bmatrix} 3 \\ -1 \end{bmatrix} = \begin{bmatrix} 1+3 \\ 2+(-1) \end{bmatrix} = \begin{bmatrix} 4 \\ 1 \end{bmatrix}$

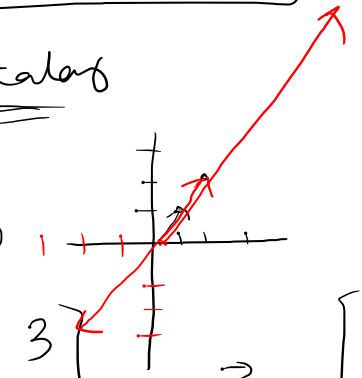
$\vec{a} = \begin{bmatrix} 2 \\ 1 \end{bmatrix}$ $\vec{b} = \begin{bmatrix} 3 \\ 4 \end{bmatrix}$ $\vec{c} = \vec{a} + \vec{b} = \begin{bmatrix} 2 \\ 1 \end{bmatrix} + \begin{bmatrix} 3 \\ 4 \end{bmatrix} = \begin{bmatrix} 5 \\ 5 \end{bmatrix}$



2. Multiplication by Scalar

$2\vec{a}$

$\rightarrow \vec{a} = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$



$\vec{b} = \begin{bmatrix} 3 \\ -1 \end{bmatrix}$, $p\vec{b} = \begin{bmatrix} 3p \\ -p \end{bmatrix}$

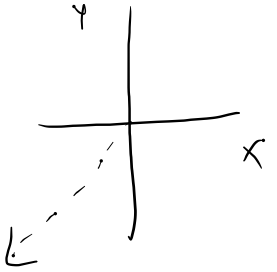
Scalar ← 2|3 → not change

$2\vec{a} = \begin{bmatrix} 2 \\ 2 \end{bmatrix}$ $p\vec{a} = \begin{bmatrix} p \\ ? \end{bmatrix}$

$p = -3$

Vectors Stack $\vec{a}, \vec{b}, \vec{c}$

$$\begin{bmatrix} \vec{a} \\ \vec{b} \\ \vec{c} \end{bmatrix} \rightarrow$$ Stacked Block Vectors



Vectors $\vec{a} = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$ $\vec{b} = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$

↳ Zero Vectors

image

2mp → 2 million

$\rightarrow$

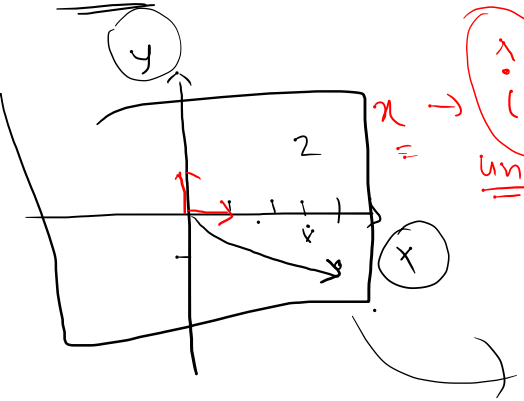
R

$$\begin{bmatrix} 0 \\ \vdots \\ 0 \end{bmatrix} \rightarrow$$ Sparse Vectors

millions

Unit Vector

$\vec{a} = \begin{bmatrix} 4 \\ -1 \end{bmatrix}$ $\vec{a} = \begin{bmatrix} 3 \\ 2 \end{bmatrix}$ ✓



$\vec{a} = 3\hat{i} + 2\hat{j}$ → one more way ✓

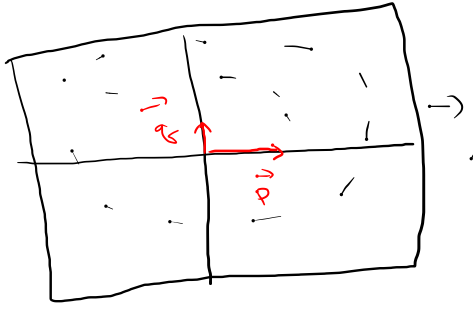
x y

unit vector

$\vec{p} = \begin{bmatrix} 2 \\ 0 \end{bmatrix}$

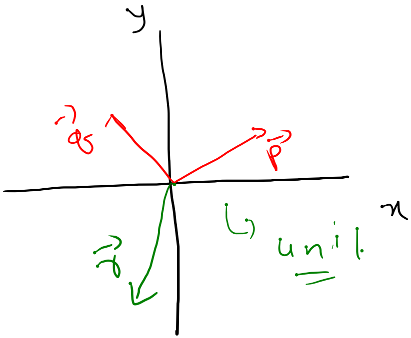
space Basis Vectors $\vec{p}, \vec{q}$

$\vec{q} = \begin{bmatrix} 0 \\ 1 \end{bmatrix}$



→ repr

$\vec{p}$ $\vec{q}$ $\alpha_1\vec{p} + \alpha_2\vec{q}$



↳ unit

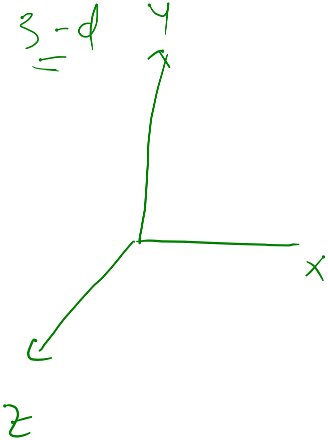
$\vec{m} \rightarrow 1m$

2

1

alone $\vec{b}$

3-d



$\alpha_1 \vec{P} + \alpha_2 \vec{r} \rightarrow$ entire room plan

$\vec{P}, \vec{r} \rightarrow$ Basis Vectors

unit

$x \rightarrow \hat{i}$

$y \rightarrow \hat{j}$

$z \rightarrow \hat{k}$

$\vec{a} = 3\hat{i} + 2\hat{j} + 4\hat{k}$

$\vec{b} = 3\hat{i} - \hat{j} - 3\hat{k}$

unit ve

↳