

Siddhardhan

# Matrix – Basics (Linear Algebra)

Math for Machine Learning

$$\begin{bmatrix} 1 & 4 & 5 \\ 2 & 7 & 3 \\ 8 & -3 & 1 \end{bmatrix}$$

## Matrix - Basics

1. Scalars; Vectors; Matrix
2. Shape of a Matrix
3. Different Types of Matrix
4. Transpose of a Matrix
5. Role of Matrix in Machine Learning

$$\begin{bmatrix} 1 & 4 & 5 \\ 2 & 7 & 3 \\ 8 & -3 & 1 \end{bmatrix}$$

# Scalars; Vectors; Matrix

Scalar

24

Vector

$[2 \ -8 \ 7]$

row

or

column

$\begin{bmatrix} -6 \\ -4 \\ 27 \end{bmatrix}$

Matrix

$\begin{bmatrix} 1 & 4 & 5 \\ 2 & 7 & 3 \\ 8 & -3 & 1 \end{bmatrix}$

## Shape of a Matrix

$$\begin{bmatrix} 2 & 5 \\ 4 & 8 \end{bmatrix}$$

2 x 2 Matrix

$$\begin{bmatrix} 8 & 6 & 1 \\ 2 & 9 & 2 \\ 3 & 4 & 3 \end{bmatrix}$$

3 x 3 Matrix

$$\begin{bmatrix} 2 & 3 \\ 6 & 4 \\ 7 & 8 \end{bmatrix}$$

3 x 2 Matrix

General Matrix Notation :

$$\begin{bmatrix} a_{1,1} & a_{1,2} & a_{1,3} & \dots \\ a_{2,1} & a_{2,2} & a_{2,3} & \dots \\ a_{3,1} & a_{3,2} & a_{3,3} & \dots \\ \vdots & \vdots & \vdots & \ddots \end{bmatrix}$$

m x n Matrix

$a_{ij}$   $\longrightarrow$  Matrix element  
 $i$   $\longrightarrow$  Row number  
 $j$   $\longrightarrow$  Column number

# *Different Types of Matrices*

Null Matrix or Zero Matrix :

$$\begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$$

2 x 2

$$\begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$$

3 x 3

$$\begin{bmatrix} 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

4 x 4

Identity Matrix :

$$\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

2 x 2

$$\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

3 x 3

$$\begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

4 x 4

## *Transpose of a Matrix*

Transpose of a matrix is formed by turning all the rows of a given matrix into columns and vice-versa

$$A = \begin{bmatrix} 2 & 5 \\ 4 & 8 \end{bmatrix}$$

$$A^T = \begin{bmatrix} 2 & 4 \\ 5 & 8 \end{bmatrix}$$

$$B = \begin{bmatrix} 8 & 6 & 1 \\ 2 & 9 & 2 \\ 3 & 4 & 3 \end{bmatrix}$$

$$B^T = \begin{bmatrix} 8 & 2 & 3 \\ 6 & 9 & 2 \\ 1 & 4 & 3 \end{bmatrix}$$

# Matrix in Machine Learning

House Price Dataset

crim	zn	indus	chas	nox	rm	age	dis	rad	tax	ptratio	b	lstat	price
0.00632	18	2.31	0	0.538	6.575	65.2	4.09	1	296	15.3	396.9	4.98	24
0.02731	0	7.07	0	0.469	6.421	78.9	4.9671	2	242	17.8	396.9	9.14	21.6
0.02729	0	7.07	0	0.469	7.185	61.1	4.9671	2	242	17.8	392.83	4.03	34.7
0.03237	0	2.18	0	0.458	6.998	45.8	6.0622	3	222	18.7	394.63	2.94	33.4

4 x 14 Matrix