

$$\text{Sigmoid} = \frac{1}{1 + e^{-x}}$$

Element wise multiplication:

$$a = \begin{bmatrix} x_1 & x_2 & x_3 \end{bmatrix}$$

$$b = \begin{bmatrix} y_1 & y_2 & y_3 \end{bmatrix}$$

$$[x_1 * y_1, x_2 * y_2, x_3 * y_3]$$

↑            ↑            ↑

Matrix Multiplication or Dot product

$$a = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix} \quad b = \begin{bmatrix} 5 & 6 \\ 7 & 8 \end{bmatrix}$$

$\begin{matrix} 2 \times 2 \\ R & C \end{matrix}$                        $\begin{matrix} 2 \times 2 \\ R & C \end{matrix}$   
a x b

1x5, 2x6, 3x7, 4x8 (Element wise multiplication)

Rules:

\* columns of first matrix = rows of second matrix  
   2        =        2

if yes:

result shape = rows of first matrix, column of second

$$= (2, 2)$$

12, 2, 2, 34

if true ~ false :

12, 34

$$a = \begin{bmatrix} \boxed{1} & \boxed{2} \\ \boxed{3} & \boxed{4} \end{bmatrix}$$

$$b = \begin{bmatrix} \boxed{5} & \boxed{6} \\ \boxed{7} & \boxed{8} \end{bmatrix}$$

2, 2

-  $1 \times 5 + 2 \times 7 = 19$  - 1 row, column 1  $\rightarrow$  val 1

-  $1 \times 6 + 2 \times 8 = 22$  - 1 row, column 2  $\rightarrow$  val 2

-  $3 \times 5 + 4 \times 7 = 43$  - 2 row, column 1  $\rightarrow$  val 3

-  $3 \times 6 + 4 \times 8 = 50$  - 2 row, column 2  $\rightarrow$  val 4

$$a = \begin{bmatrix} x_1 & x_2 & x_3 \\ 1 \times 3 \end{bmatrix} \quad b = \begin{bmatrix} y_1 & y_2 & y_3 \\ 1 \times 3 \end{bmatrix}$$

dot

$\rightarrow x_1 \times y_1 + x_2 \times y_2 + x_3 \times y_3$

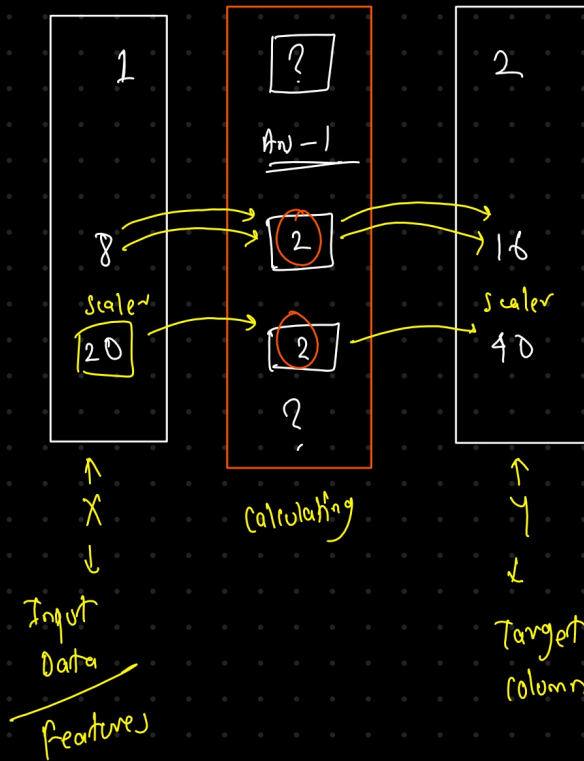
$\rightarrow$  value

$b \cdot T$

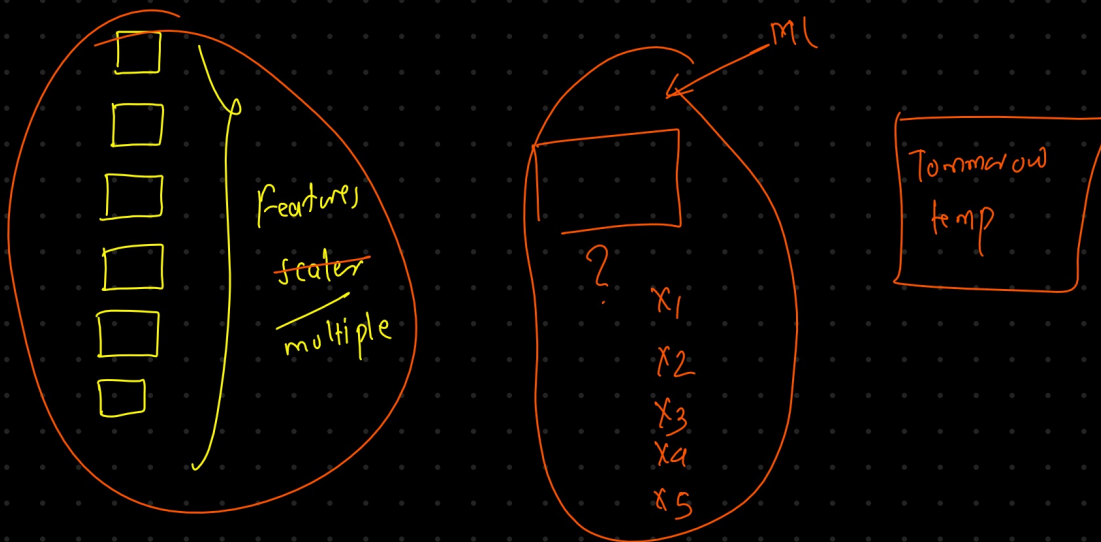
$$\begin{bmatrix} y_1 \\ y_2 \\ y_3 \end{bmatrix}$$

$3 \times 1$

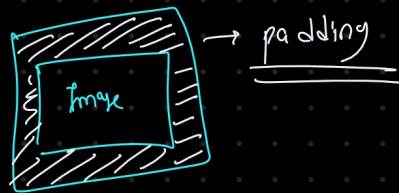
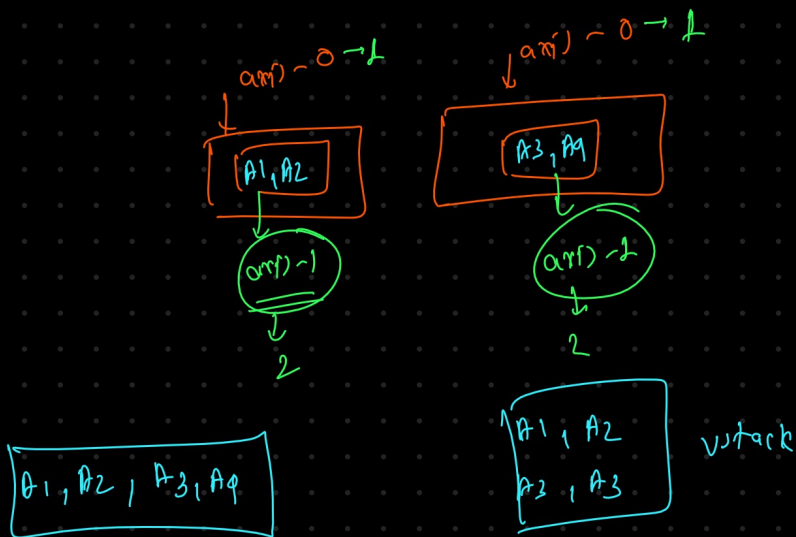
## Task



## weather forecasting



dot product  $\rightarrow$  multiplication + sum across column  
optimized



Mean  $\rightarrow$  Average

$[28, 45, 60, 50, 55, \dots]$   
 $\uparrow$   
10 patients

C1  
 P1  $\rightarrow$  1.5k\$  
 P2  $\rightarrow$  2k\$  
 P3  $\rightarrow$  4k\$

C2  
 P1  $\rightarrow$  4k\$  
 P2  $\rightarrow$  8k\$  
 P3  $\rightarrow$  10k\$  
average age of patients

C1 C2 >>>>  
 $\downarrow$   $\downarrow$   
 avg avg

Median :- middle value

[ 1k, 2k, 8k, 3k, 1k, 10k, 9k ]

↓  
sort

g1  
[ 1k, 1k, 2k, 3k, 6k, 9k, 10k ]

↑  
median

value reps  
count

[ 1k, 1k, 1k, 1k, 1k ] [ 6k, 9k ]

percent & percentile

↓  
indicates the value below certain percentage of observation.

[ 65, 42, 87, 90, 98 ] → sort → [ 42, 65, 87, 90, 98 ]  
20% 20% 20% 20% 20%  
↓ ↓ ↓ ↓ ↓  
[ 42, 65 ] 87, 90, 98  
→ index = student-id

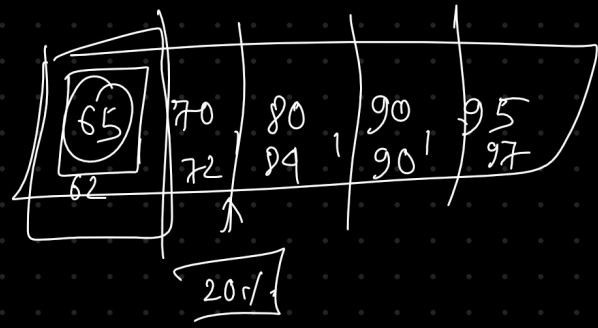
20%

65/100 → 65

5 ← 50%  
all ← 100%  
10

[ 01 02 03 04 05 ]  
06 07 08 09 10

1.46 →



65/100  
↓  
65

$a = \begin{bmatrix} [1, 2], \\ [3, 4] \end{bmatrix}$

1	2					
3	4					

1, 2, 3, 4  
↓  
b = a.view()  
→ shares new data

same memory reference, no physical storage

$c = a.copy()$  → does not share any data