

Tensors

Q Why do we study tensors?

Every ML - library uses a basic datastructure called tensor. You deal with every time.

Q What is tensor? [Are basically n-dimensional arrays]

Is a data structure (the way you store data), or we can say a container where we store data scalar. Vectors or Matrix are all termed generally as tensor.

`np.array(4)` → 0-D
Tensor

0-D Tensor [Scalar] → This has no dimension
(1) (3) (4) → These are 0-D Tensor.

1-D Tensor [Vector] → Has 1 Axis. . , list of numbers. Axis is also called dimension
`np.array([1, 2, 3, 4, 5])` → 1-D Tensor

→ But this vector has 4 dimensions

The amount of numbers a Vector has are counted as the dimension of that Vector but remember a 1-D Tensor is called a vector.

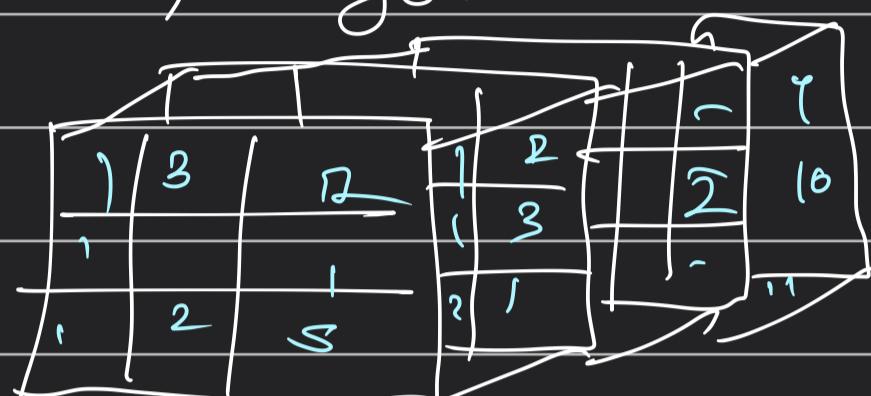
* Adding scalar & more scalar you get a vector.

Add " vector & more vector you get matrices

2-D Tensor [Matrix] \rightarrow collection of vectors
 is, ~ list of list. $\left[\begin{array}{cccc} 1, 2, 3, 4 \\ 5, 6, 7, 8, 9 \end{array} \right]$

matrix = np.array (Paste)

N-D Tensor \rightarrow when you join such multiple matrices together



mostly in ML we just deal between
 0 - 5D Tensor

- Rank, Axes & Shape

1, 2, 3, 4, 5, 6

No of Axes = Rank = No of Dimension

Shape \Rightarrow No of columns, rows, give
 you shape

Size \Rightarrow No of elements inside a Tensor
 multiply shape (columns, rows, etc) with
 each other you get size of Tensor.

Understanding Dimensions in vector.

For Ex 1000 Students Data

CNRP | Ev | state | placement

Considering 1 student we will get a vector

$$\begin{bmatrix} 81 & 91 & w_B & 1 \end{bmatrix}$$

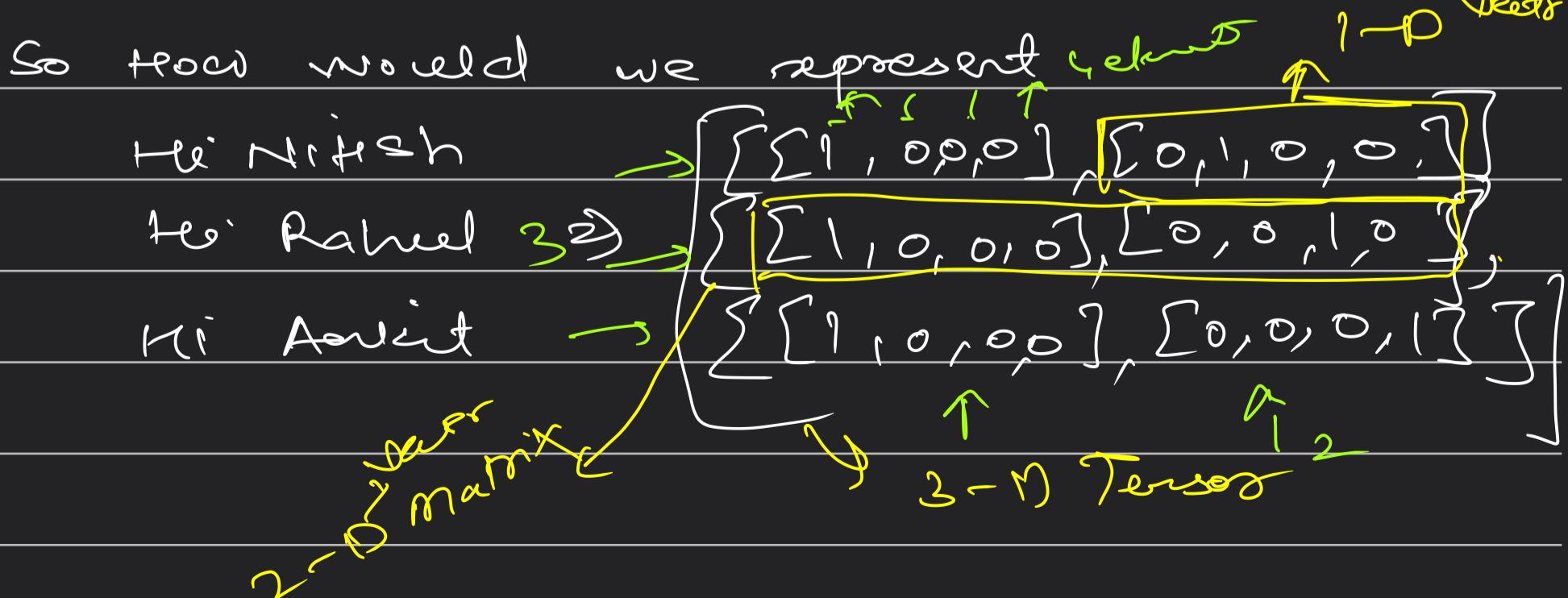
All these individual values represent something and can be used to represent in Dimensional space. So this vector has 4 dimensional space.

Similarly a single column can be considered as 1-D tensor.

Example of 2D vectors

Vectorization of words in NLP is very good example

He	Nitish	Rahul	Amit
1	0	0	0
0	1	0	0
0	0	1	0
0	0	0	1

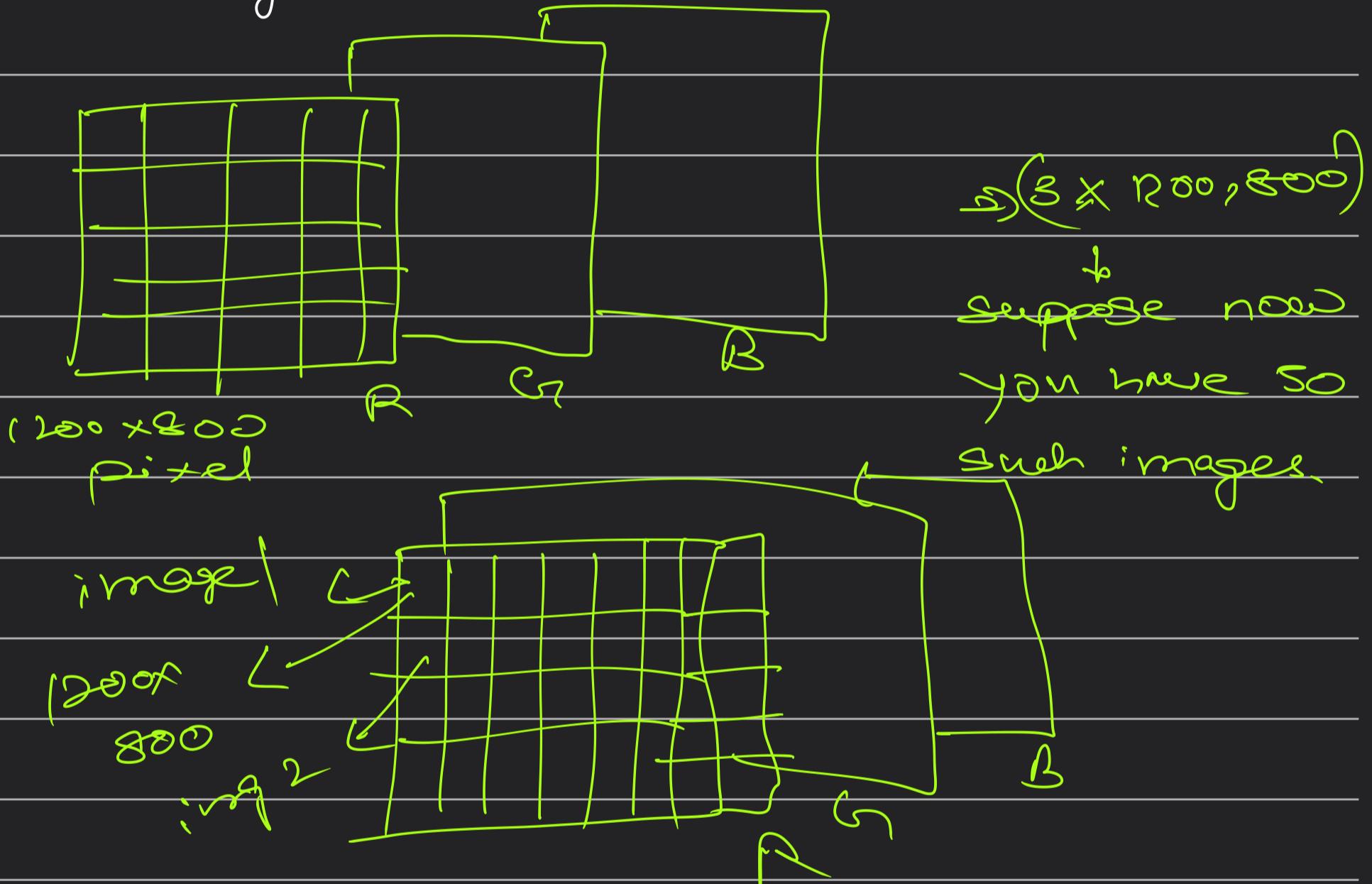


What could be shape $\Rightarrow [3, 2, 4] = 24$ tiffs

Another example is Time Series Data for 3-D Tensor.

- Example of 4-D Tensors

Used in image processing & computer vision so, mostly image, color related data gets used in 4-D Tensor.



$$2) 50 \times 3 \times 200 \times 200$$

So "Batches" of images are example of 4-D Tensor

- Example of 5-D Tensor

Videos are basically a collection of images. With frames of images travel per second. 1 sec you get 30 images in 20 FPS. 1 min = 1800 images.

