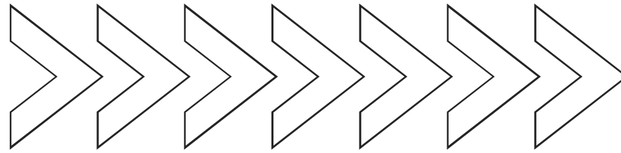


PYTORCH

BASICS

VISUAL LEARNERS

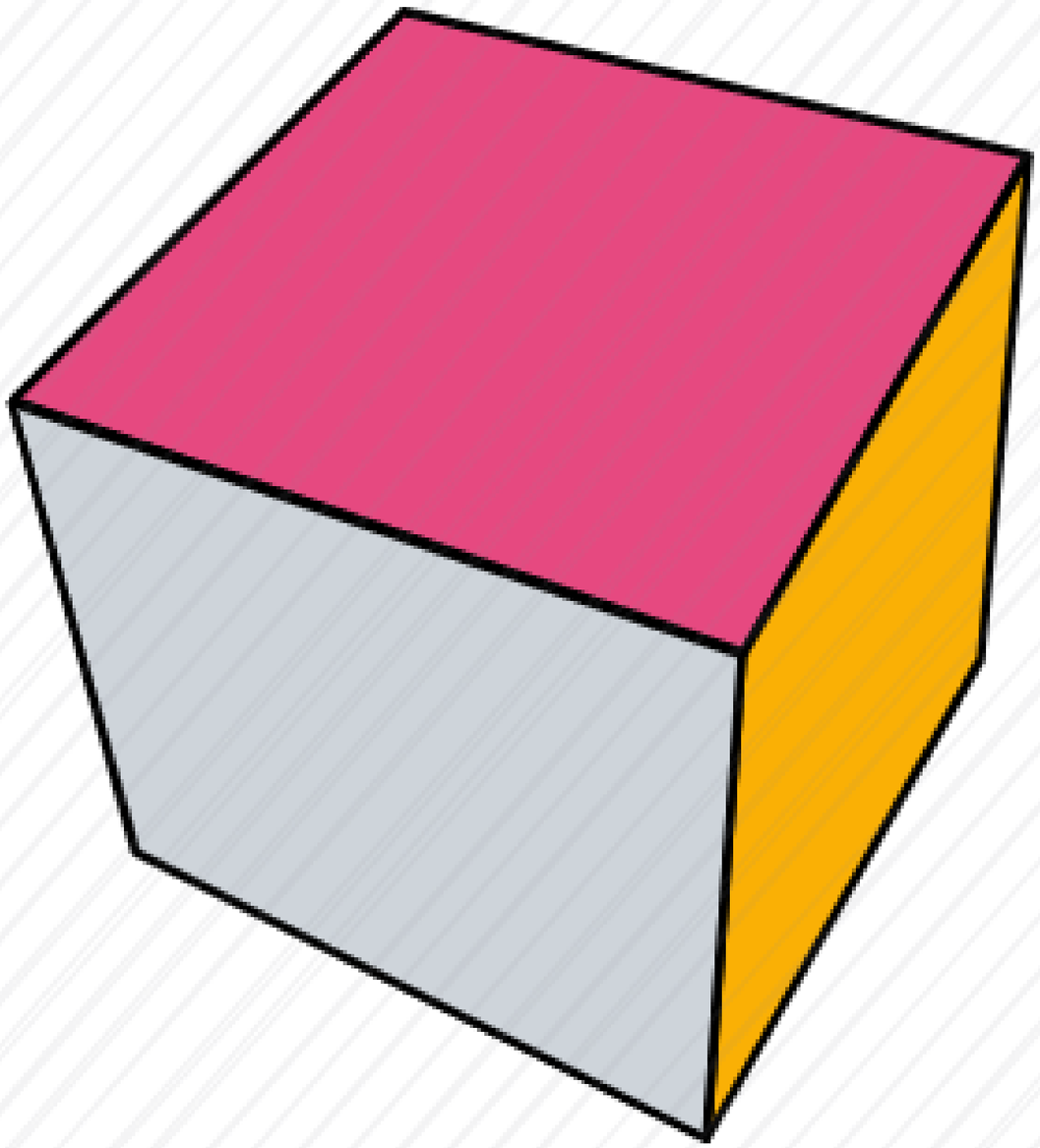
SCALARS, ARRAYS AND MATRIX

WHAT IS A TENSOR?

THE **INPUTS**, **OUTPUTS**, AND **TRANSFORMATIONS** WITHIN NEURAL NETWORKS ARE ALL REPRESENTED USING TENSORS.

AS A RESULT, NEURAL NETWORK PROGRAMMING UTILIZES TENSORS HEAVILY.

A **TENSOR** IS THE PRIMARY **DATA STRUCTURE** USED BY NEURAL NETWORKS.



Specific Instances Of Tensors

Each of these examples are specific instances of the more general concept of a tensor:

- number
- scalar
- array
- vector
- 2d-array
- matrix

Let's organize the above list of example tensors into two groups:

- number, array, 2d-array (Computer Science)
- scalar, vector, matrix (Mathematics)

The first group of three terms **(number, array, 2d-array)** are terms that are typically used in **computer science**, while the second group **(scalar, vector, matrix)** are terms that are typically used in **mathematics**.

Indexes Required To Access An Element

The relationship within each of these pairs is that both elements require the same number of indexes to refer to a specific element within the data structure.

Indexes required	Computer science	Mathematics
0	number	scalar
1	array	vector
2	2d-array	matrix

MATHEMATICS

In mathematics, we stop using words like **scalar**, **vector**, and **matrix,** and we start using the word **tensor** or **nd-tensor**.

The **n** tells us the **number of indexes** required to access a specific element within the structure.

COMPUTER SCIENCE

In computer science, we stop using words like, **number**, **array**, **2d-array**, and start using the word **multidimensional array** or **nd-array**.

The **n** tells us the **number of indexes** required to access a specific element within the structure.

Indexes required	Computer science	Mathematics
n	nd-array	nd-tensor

Let's make this clear. For practical purposes in neural network programming, tensors and nd-arrays are one in the same.

Tensors and nd-arrays are the same thing!

So tensors are multidimensional arrays or nd-arrays for short. The reason we say a tensor is a generalization is because we use the word tensor for all values of n like so:

- A scalar is a 0 dimensional tensor
- A vector is a 1 dimensional tensor
- A matrix is a 2 dimensional tensor
- A **nd-array** is an **n dimensional tensor**

Tensors allow us to drop these specific terms and just use an **n** to identify the number of dimensions we are working with.