PYTORCH

BASICS

VISUAL LEARNERS

RANK, AXES AND SHAPE

Rank, Axes And Shape

The concepts of rank, axes, and shape are the tensor attributes that will concern us most in deep learning.

- Rank
- Axes
- Shape

These concepts build on one another starting with rank, then axes, and building up to shape, so keep any eye out for this relationship between these three.

Rank Of A Tensor

The rank of a tensor refers to the number of dimensions present within the tensor. Suppose we are told that we have a rank-2 tensor. This means all of the following:

- We have a matrix
- We have a 2d-array
- We have a 2d-tensor

We are introducing the word rank here because it is commonly used in deep learning when referring to the number of dimensions present within a given tensor.

Rank And Indexes

The rank of a tensor tells us how many indexes are required to access (refer to) a specific data element contained within the tensor data structure.

A tensor's rank tells us how many indexes are needed to refer to a specific element within the tensor.

Axes Of A Tensor

If we have a tensor, and we want to refer to a specific dimension, we use the word axis in deep learning.

An axis of a tensor is a specific dimension of a tensor.

If we say that a tensor is a rank 2 tensor, we mean that the tensor has 2 dimensions, or equivalently, the tensor has two axes.

Elements are said to exist or run along an axis. This running is constrained by the length of each axis.

Length Of An Axis

The length of each axis tells us how many indexes are available along each axis.

Suppose we have a tensor called **t**, and we know that the first axis has a length of three while the second axis has a length of four. (3,4)

Since the first axis has a length of three, this means that we can index three positions along the first axis like so:

t[0]
t[1]
t[2]

Length Of An Axis

All of these indexes are valid, but we can't move passed index 2.

Since the second axis has a length of four, we can index four positions along the second axis. This is possible for each index of the first axis, so we have

t[0][0]	t[0][1]
t[1][0]	t[1][1]
t[2][0]	t[2][1]

t[0][2]	t[0][3]
t[1][2]	t[1][3]
t[2][2]	t[2][3]

Shape Of A Tensor

The shape of a tensor is determined by the length of each axis, so if we know the shape of a given tensor, then we know the length of each axis, and this tells us how many indexes are available along each axis.

The shape of a tensor gives us the length of each axis of the tensor.

The shape of 3 x 3 tells us that each axis of this rank two tensor has a length of 3 which means that we have three indexes available along each axis.

Reshaping A Tensor

Reshaping changes the shape but not the underlying data elements.

One thing to notice about reshaping is that the product of the component values in the shape must equal the total number of elements in the tensor.

For example:

3 * 3 = 9

1 * 9 = 9