

# Lesson 15

What are Tensor?

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Wikipedia:

A **tensor** is an algebraic object that describes a multilinear relationship between sets of algebraic objects related to a vector space.

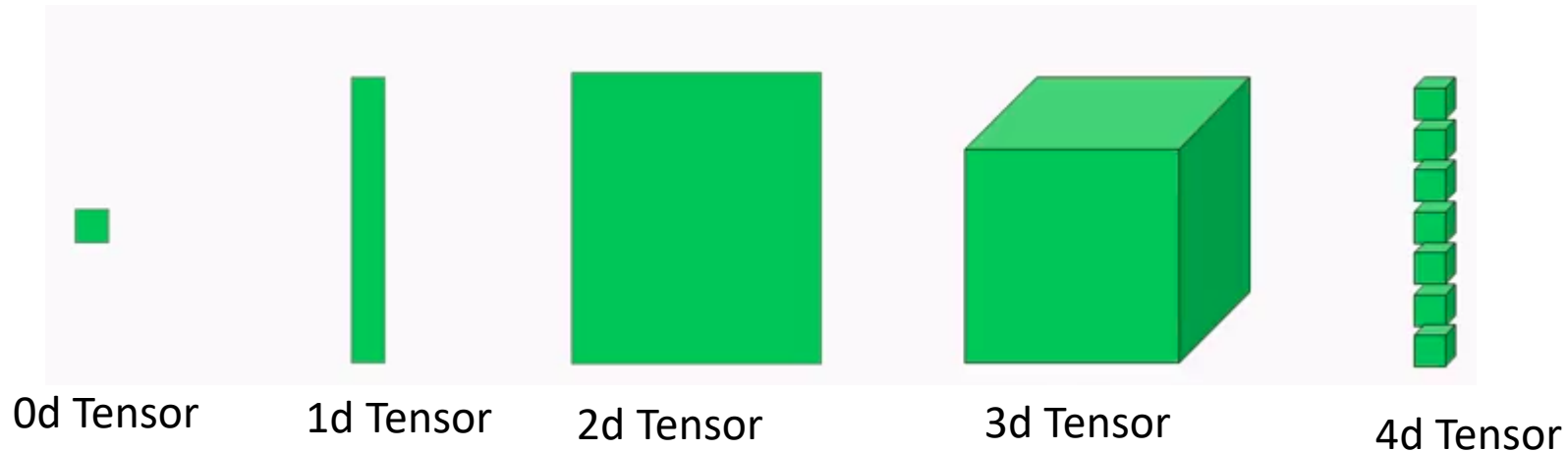
In short, tensors are generalization of scalars and vectors

# What are Tensors?

Wikipedia:

A **tensor** is an algebraic object that describes a multilinear relationship between sets of algebraic objects related to a vector space.

In short, tensors are generalization of scalars data and vectors.



# Types of Tensors?

(10)

Scalar

Rank = 0

Shape = (0)

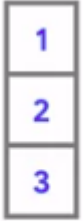
# Types of Tensors?

(10)

Scalar

Rank = 0

Shape = (0)



Vector

Rank = 1

Shape = (3)

# Types of Tensors?

(10)

Scalar

Rank = 0

Shape = (0)

1  
2  
3

Vector

Rank = 1

Shape = (3)

3 number of Rank 0 tensors

# Types of Tensors?

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

Matrix

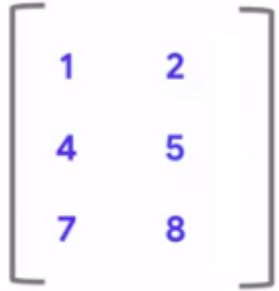
Rank = 2

Shape = (3x2)

3 number of Rank 1 tensors of shape 2



# Types of Tensors?



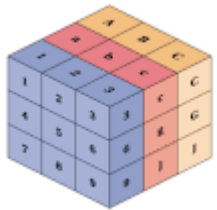
1	2
4	5
7	8

Matrix

Rank = 2

Shape = (3x2)

3 number of Rank 1 tensors of shape 2



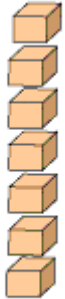
1	2	3	4	5	6
7	8	9	10	11	12
13	14	15	16	17	18

Rank = 3

Shape = (3x3x3)

3 number of Rank 2 tensors of shape 3x3

# Types of Tensors?



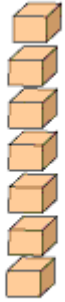
4 d -Tensor

Rank = 4

Shape = (7x3x3x3)

7 number of Rank 3 tensors of shape 3x3x3

# Types of Tensors?

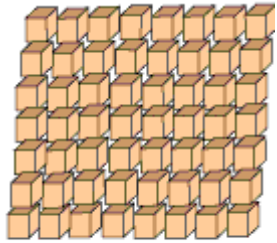


4 d -Tensor

Rank = 4

Shape = (7x3x3x3)

7 number of Rank 3 tensors of shape 3x3x3



5 d -Tensor

Rank = 5

Shape = (7x8x3x3x3)

7 number of Rank 4 tensors of shape 8x3x3x3

# Tensors in TensorFlow

```
import tensorflow as tf
```

```
t = tf.constant( 4 )
```

```
print( t )
```



```
tf.Tensor( 4, shape=(), dtype=int32 )
```

# Tensors in TensorFlow

```
import tensorflow as tf
```

```
t = tf.constant( 4 )
```

```
print( t )
```



```
tf.Tensor( 4, shape=(), dtype=int32 )
```

```
import tensorflow as tf
```

```
t = tf.constant( [2.0, 3.0, 4.0] )
```

```
print(t)
```



```
tf.Tensor([2. 3. 4.], shape=(3,), dtype=float32)
```

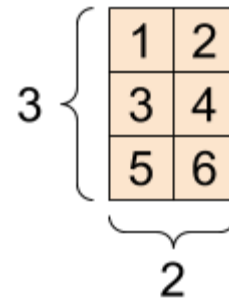
# Tensors in TensorFlow

```
import tensorflow as tf

t = tf.constant( [ [1, 2],
                  [3, 4],
                  [5, 6]
                ])

print(t)
```

```
tf.Tensor( [[1 2] [3 4] [5 6]], shape=(3, 2),
dtype=float16
```



No. of rows = 3

No. of Columns = 2

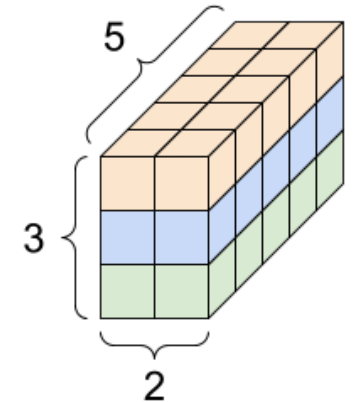
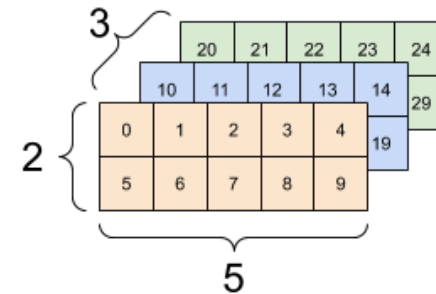
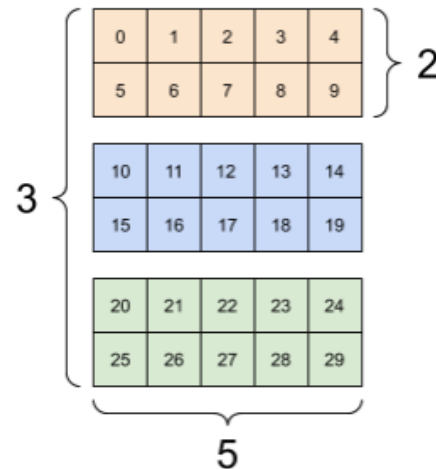
# Tensors in TensorFlow

```
import tensorflow as tf

t = tf.constant([
    [0, 1, 2, 3, 4],
    [5, 6, 7, 8, 9] ],
    [ [10, 11, 12, 13, 14],
      [15, 16, 17, 18, 19] ],
    [ [20, 21, 22, 23, 24],
      [25, 26, 27, 28, 29] ]
])

print(t)
```

```
tf.Tensor( [[[ 0  1  2  3  4] [ 5  6  7  8  9]] [[10 11 12 13
14] [15 16 17 18 19]] [[20 21 22 23 24] [25 26 27
28 29]]], shape=(3, 2, 5), dtype=int32)
```



# Components of a Tensor?

```
import tensorflow as tf  
  
t = tf.constant( [2.0, 3.0, 4.0] )  
print(t)
```



```
tf.Tensor([2. 3. 4.], shape=(3,), dtype=float32)
```

Values

Shape (Rank)

Data type



# Summary

- What are Tensors?
- Different types of Tensors
- Rank of a Tensor
- Shape of a Tensor
- Components of a Tensor