Introduction to Numpy

(Vectors, Matrices and Linear Algebra)

By Gideon and Sandra

#TeachResearchInnovate

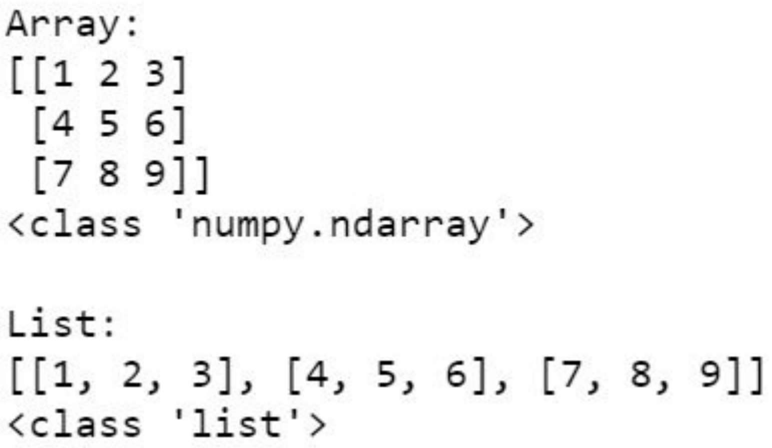
AI6

“aimed at getting you to kickass in AI”

What is Numpy?

NumPy is an open-source library for data science that stands for ‘Numerical Python’. It is used to work with arrays. NumPy is a really fast library and it is easy and fun to use compared to Lists or Dictionary as it provides a large number of functions to work with arrays.

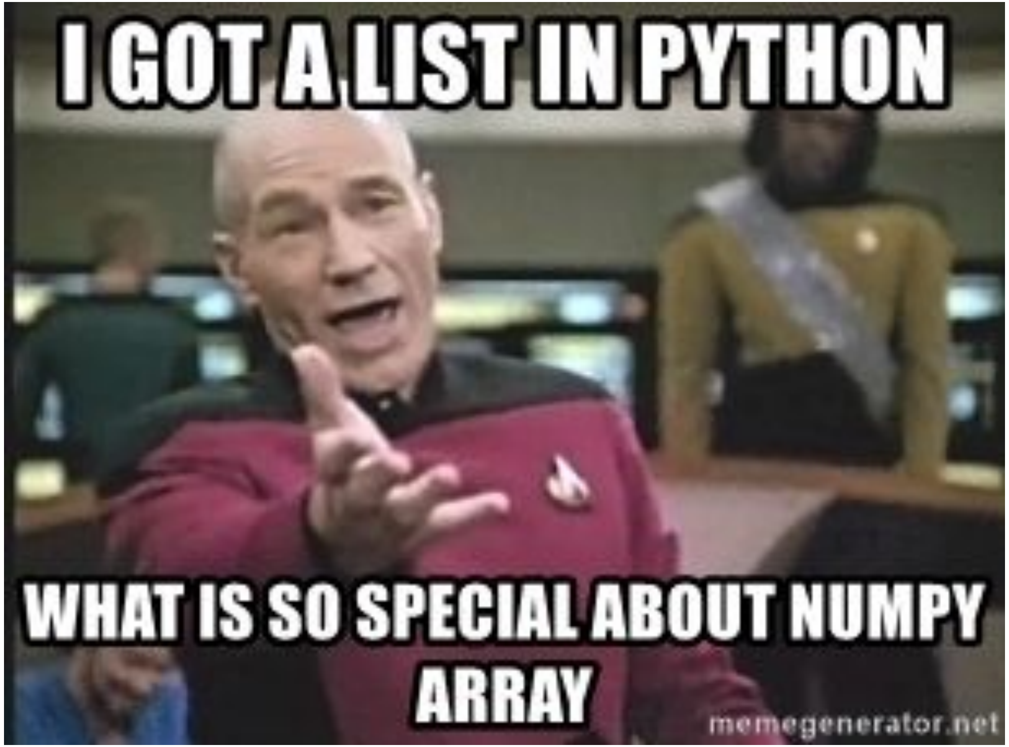
Source



```
Array:
[[1 2 3]
 [4 5 6]
 [7 8 9]]
<class 'numpy.ndarray'>

List:
[[1, 2, 3], [4, 5, 6], [7, 8, 9]]
<class 'list'>
```

Why Numpy?



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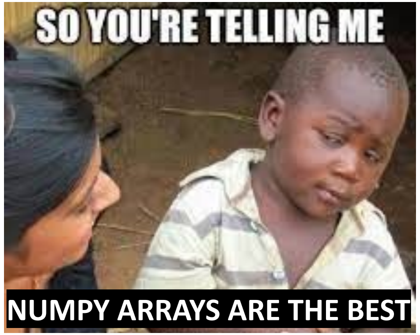
Why Numpy?

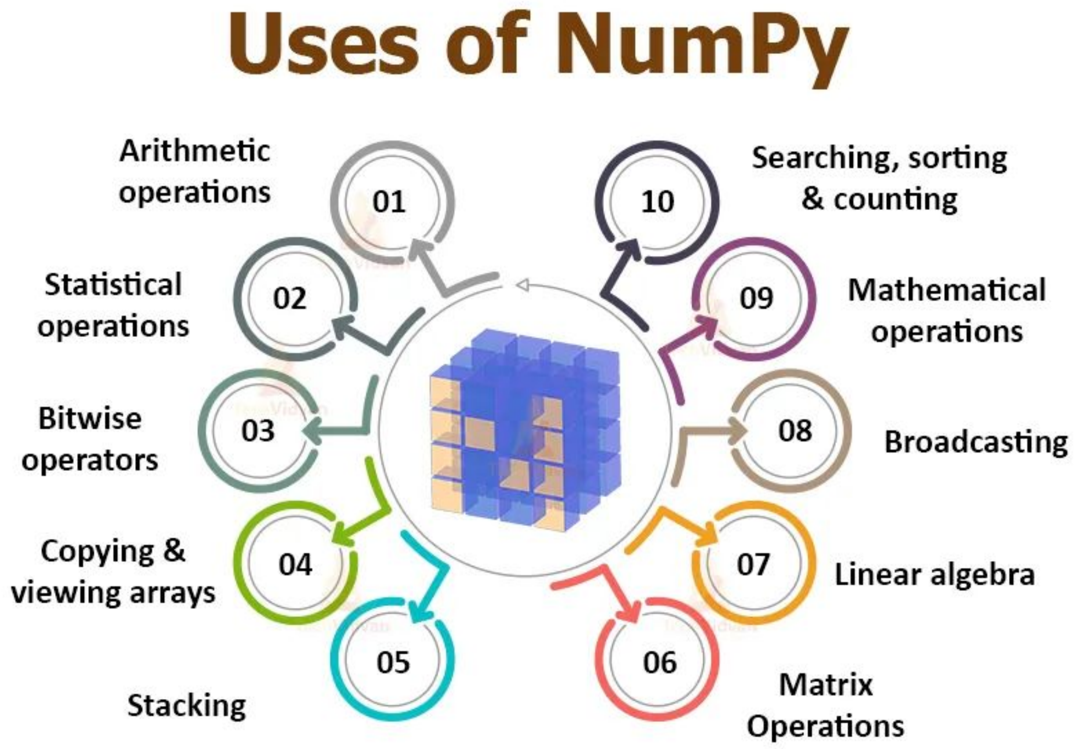
- NumPy arrays are **faster and more compact than Python lists**.
- An array consumes less memory and is convenient to use.
- NumPy uses much less memory to store data.
- It provides a mechanism of specifying the data types.

Numpy Array vs Python List

NumPy gives you an enormous range of fast and efficient ways of creating arrays and manipulating numerical data inside them. While a Python list can contain different data types within a single list, all of the elements in a NumPy array should be homogeneous. Arrays are great for numerical operations; lists cannot directly handle math operations. For example, you can divide each element of an array by the same number with just one line of code.



Numpy Uses


Uses of NumPy
01
Arithmetic operations
02
Statistical operations
03
Bitwise operators
04
Copying & viewing arrays
05
Stacking
06
Matrix Operations
07
Linear algebra
08
Broadcasting
09
Mathematical operations
10
Searching, sorting & counting

Arrays

An array is the data structure of the NumPy library. An array contains information about the raw data, how to locate an element, and how to interpret an element. The elements are all of the same type, referred to as the array dtype.

To Learn more about numpy see this   https://www.w3schools.com/python/numpy/default.asp

Why Numpy Array Matters

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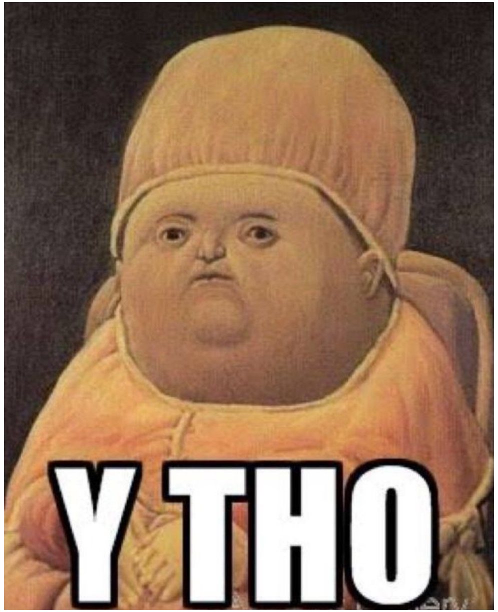
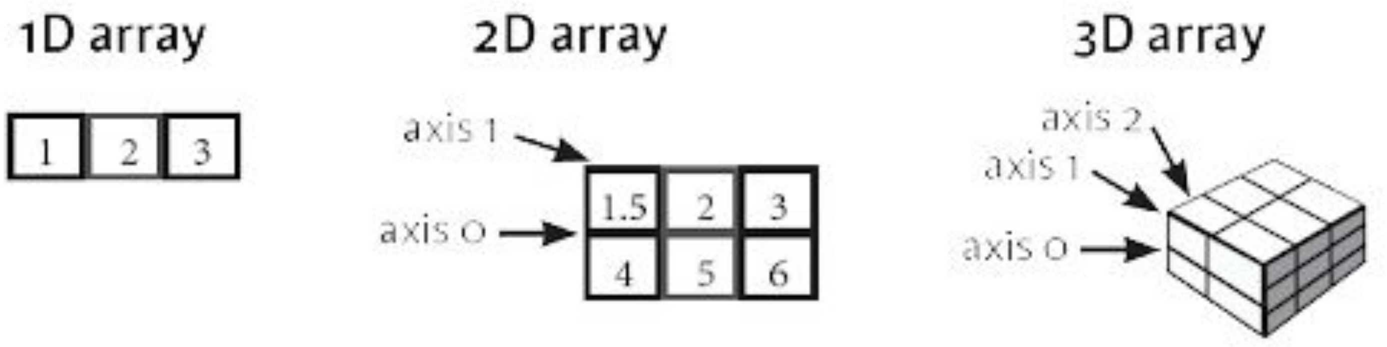
- Keeping data close together results in faster access times.
- It's easier to figure out the location of the data
- The data is more likely to fit in the processor's *cache*



More about Arrays

You might occasionally hear an array referred to as a “ndarray,” which is shorthand for “N-dimensional array.” An N-dimensional array is simply an array with any number of dimensions.

- 1-D arrays represent vectors (an array with a single dimension)
- 2-D arrays represent matrices (an array with two dimensions)
- 3-D or higher dimensional arrays represent tensors



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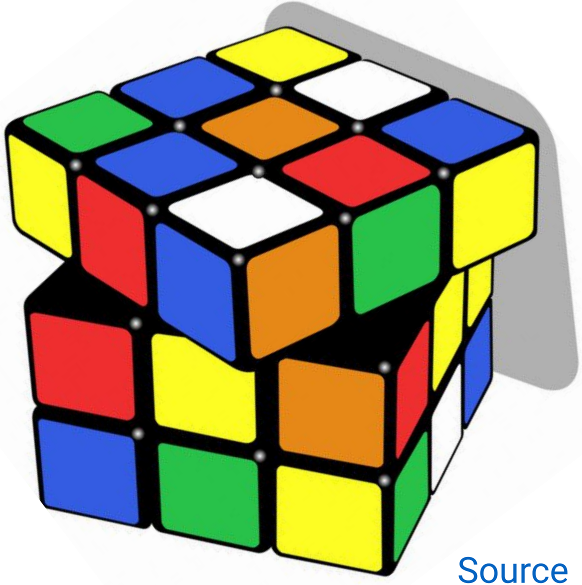
Paint a picture of arrays with Rubic Cube



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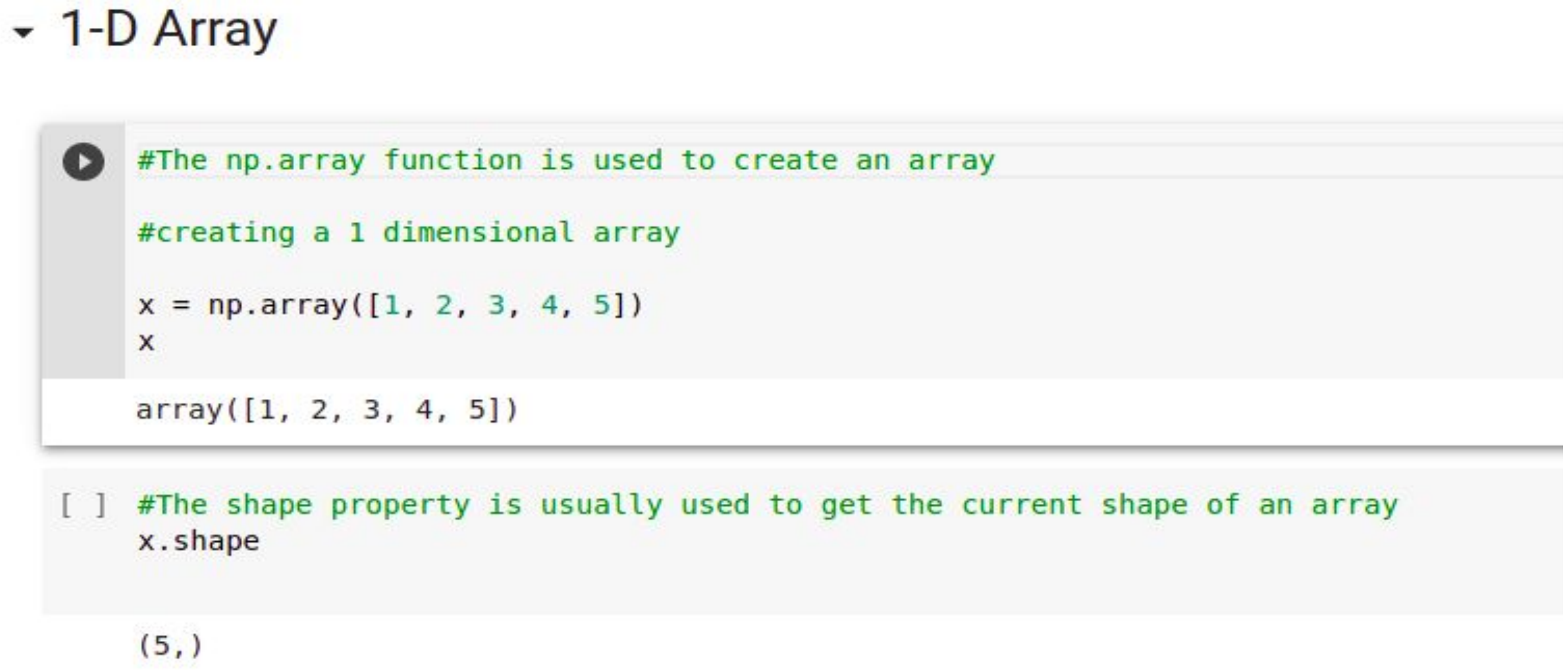
Let's Create Numpy Arrays

Vectors



1-D Array

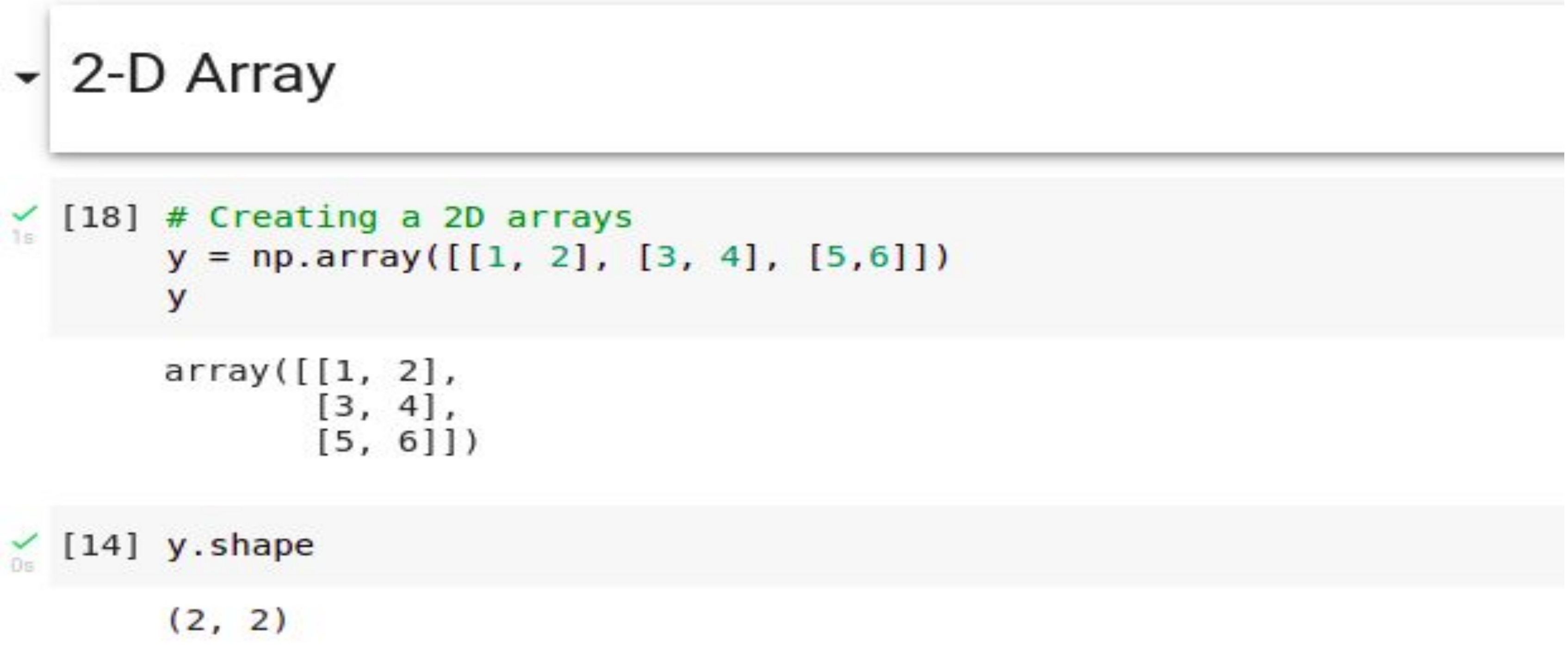
```
#The np.array function is used to create an array

#creating a 1 dimensional array

x = np.array([1, 2, 3, 4, 5])
x
```

```
array([1, 2, 3, 4, 5])
```

```
[ ] #The shape property is usually used to get the current shape of an array
    x.shape
```

```
(5,)
```

Matrices



2-D Array

```
[18] # Creating a 2D arrays
     y = np.array([[1, 2], [3, 4], [5,6]])
     y
```

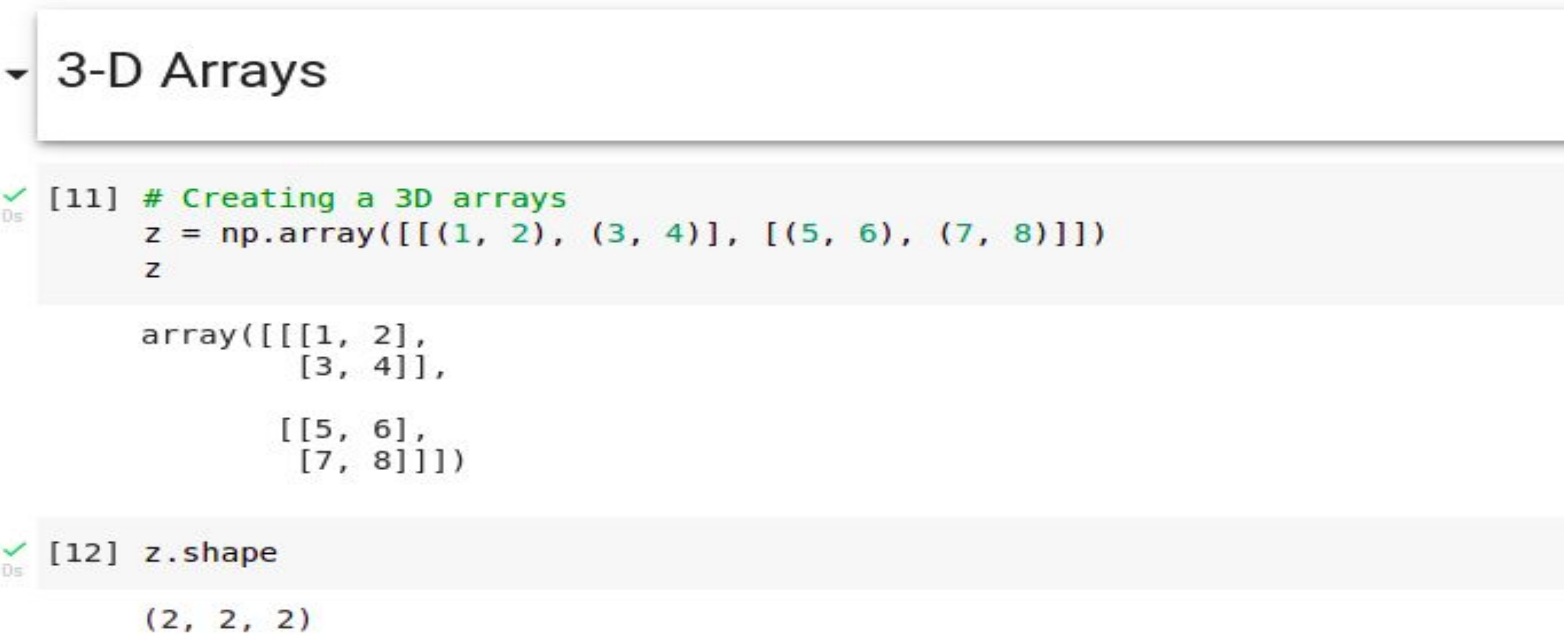
```
array([[1, 2],
       [3, 4],
       [5, 6]])
```

```
[14] y.shape
```

```
(2, 2)
```

Tensors

- tensors are **linear transformations**, the objects we study in linear algebra.
- A linear transformation is **a function from one vector space to another**
- Linear algebra **deals with vectors and matrices**, generally, with vector spaces and linear transformations



3-D Arrays

```
[11] # Creating a 3D arrays
     z = np.array([[(1, 2), (3, 4)], [(5, 6), (7, 8)]])
     z

array([[[1, 2],
        [3, 4]],

       [[5, 6],
        [7, 8]]])
```

```
[12] z.shape

(2, 2, 2)
```

Surprise Time

Source

More Numpy Array Operations

It's time to Switch to

Jupyter Notebook

Source

Link to Jupyter Notebook

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[Numpy Notebook]

Thank YOU!

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