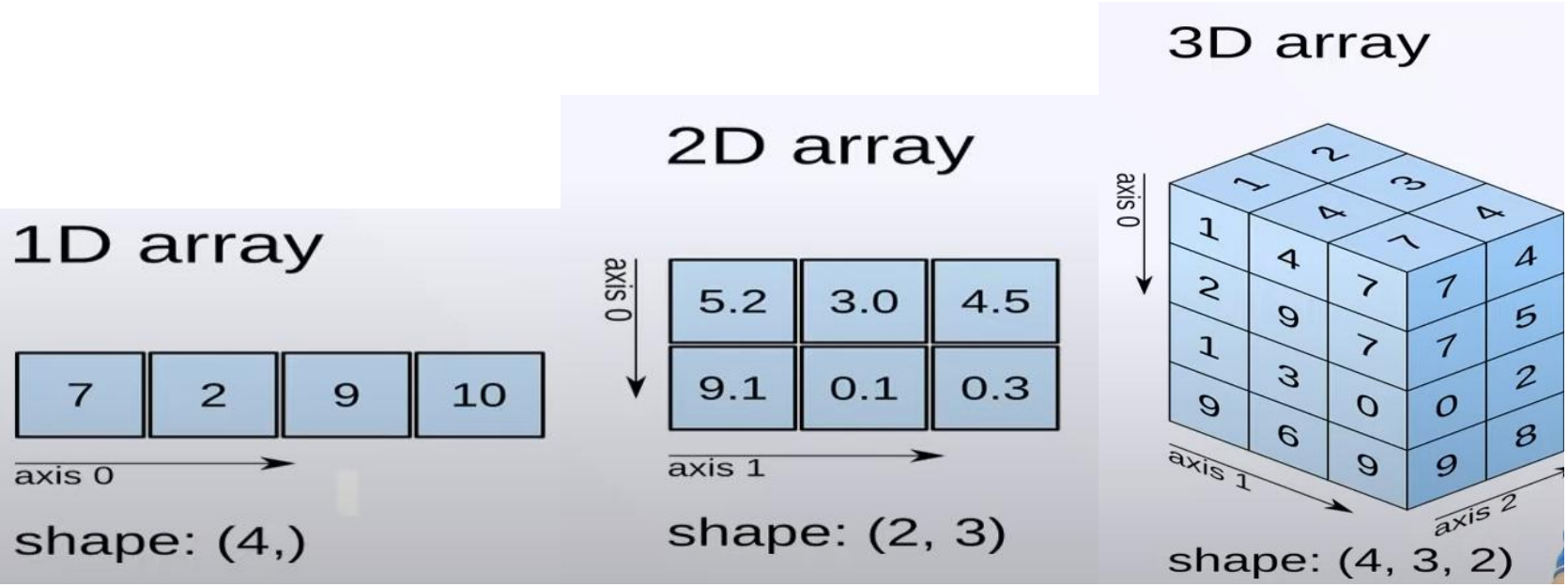
NumPy

What is NumPy?

- NumPy is the fundamental package for scientific computing in Python.
- NumPy is a Python library that provides a multidimensional array object, various derived objects

What is NumPy Array?

- An array is a grid of values and it contains information about the raw data, how to locate an element, and how to interpret an element.



NumPy vs Python List

- **Advantages of using Numpy Arrays Over Python Lists:**
  - consumes less memory.
  - fast as compared to the python List.
  - convenient to use.

Installation & Import NumPy

- **Installation NumPy**
  - pip install numpy

- **Import NumPy**
  - Import numpy as np

Importance of NumPy in Python

- wide variety of mathematical operations on arrays.
- It supplies an enormous library of high-level mathematical functions that operate on these arrays and matrices.
- mathematical, logical, shape manipulation, sorting, selecting, I/O, discrete Fourier transforms, basic linear algebra, basic statistical operations, random simulation and much more.

Difference Between NumPy Array and List in Python

- Data types storage
- Importing module
- Numerical operation
- Modification capabilities
- Consumes less memory
- Fast as compared to the python list
- Convenient to use

Creating NumPy Arrays

- To create a NumPy array, you can use the function np.array().

```
import numpy as np
a = np.array( [1, 2, 3] )
print( a )
```

Command

```
np.array([1,2,3])
```

NumPy Array

Dimensions in Arrays

- **“ndim”** can be used to find the dimension of an array:

Create NumPy Array Using NumPy Functions

Spacial NumPy Array

- Array filled with 0's
- Array filled with 1's
- Create an empty array
- An array with a range of elements
- Array diagonal element filled with 1's
- Create an array with values that are spaced linearly in a specified interval

Creating NumPy Arrays with Random Numbers

- rand( ) : the function is used to generate a random value between 0 to 1.
- randn( ) : the function is used to generate a random value close to zero . This may return positive or negative numbers as well.
- ranf( ) : the function for doing random sampling in numpy. It returns an array of specified shape and fills it with random floats in the half-open interval [0.0, 1.0]
- randint( ) : the fuction is used to generate a random number between a given range

Arithmetic Operation in NumPy Arrays

a+b	np.add(a,b)
a-b	np.subtract(a,b)
a*b	np.multiply(a,b)
a/b	np.divide(a,b)
a%b	np.mod(a,b)
a**b	np.power(a,b)
1/a	np.reciprocal(a)

Arithmetic Functions

- np.min(x)
- np.max(x)
- np.argmin(x)
- np.sqrt(x)
- np.sin(x)
- np.cos(x)
- np.cumsum(x)

Shape & Reshaping in NumPy Arrays

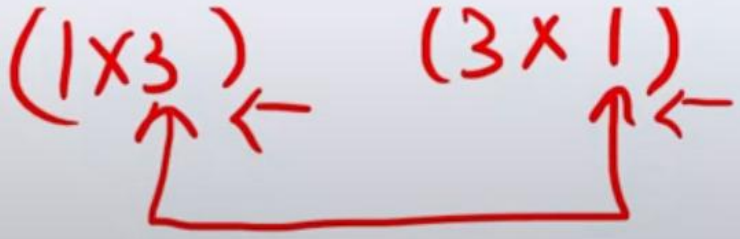
Broadcasting NumPy Arrays

$V = [1 \quad 2 \quad 3]$ (1×3)

$V1 = \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}$ (3×1)

(1) Same Dimension

(2)



Indexing & Slicing in NumPy Arrays

Iterating NumPy Arrays

nditer() function

ndenumerate() function

Copy vs View in NumPy Arrays

Copy vs View in NumPy Arrays

The Difference Between Copy and View :

The copy owns the data.	The view does not own the data .
The copy of an array is a new array.	A view of the original array.
The changes made in the copy data does not reflect in the original array.	any changes made to the view will affect the original array, and any changes made to the original array will affect the view.

NumPy Arrays
Functions

- **Join Array :** Joining means putting contents of two or more arrays in a single array.

Stack Function(Merging Arrays)

- **Split Array :** Splitting breaks one array into multiple.

- **Search Array :** Search an array for a certain value, and return the indexes that get a match.

NumPy Arrays Functions

- **Search Sorted Array :** which performs a binary search in the array, and returns the index where the specified value would be inserted to maintain the search order.

- **Sort Array :** Ordered sequence is any sequence that has an order corresponding to elements, like numeric or alphabetical, ascending or descending.

- **Filter Array :** Getting some elements out of an existing array and creating a new array out of them.

NumPy Arrays Functions

(Insert and Delete Function)