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# Introduction

NumPy is numerical Python. It works heavily on multi-dimensional arrays. It has many functions to manipulate such arrays. NumPy is good with packages like **SciPy** (Scientific Python) and **Mat−plotlib** (plotting library).

You can create, manipulate, change rows to columns and vice versa, change dimensions and many more operations on array.

pip install numpy installs it.

# Insight

## ndarray

ndarray is most important object in numpy. It is multi-dimensional array, collection of items of same type. Each element in the array is of type **dtype**.

import numpy as np

a = np.array([1,2,3]

print(a)

a = np.array([1,2,3,4], ndmin=2) # minimum dimension is 2

a = np.array([1,2,3,4,5], dtype=’float’) # data type is float. If it is not, then it is converted to float.

## Array attributes

### shape

a = np.array([[1, 2, 3], [2, 3, 4])

print(a.shape) # two rows and three columns

(2, 3)

a.shape = (3,2) # change the rows form 2 to 3 by using (3,2) tuple

print(a)

[[1 2]

[3 2]

[3 4]]

### reshape

import numpy as np

a = np.array([[1,2,3],[4,5,6]])

b = a.reshape(3,2)

print b

output is

[[1, 2]

[3, 4]

[5, 6]]

### ndim

a.ndim gives dimension of array

Create a one-dimension array with **arange** and **reshape** it.

a = np.arange(30)

a = a.reshape(2,5,3)

print(a)

output

[[[ 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]]]

Note that 2 \* 5 \* 3 = 30 which is the total size of array from arrange function.

### empty

a = np.empty([2,3], dtype=float)

creates an empty array of 2 rows and 3 columns with data type as float. This is an uninitialized array and can have random value.

Create an array with prefilled values (0 or 1) of required shape and type. Remember that shape is (n1, n2, n3) where n1 = rows, n2= columns and ne = dimension

### ones, zeros

a = np.ones((2, 3, 3), dtype=int)

This creates an array with 2 rows, 3 columns and 3 dimensions all 1’s.

dtype as ‘S1’ is string of length 1. ‘S’ is capital.

### frombuffer

It assumes buffer as one-dimensional array.

## Iterators

For n dimension array an iterator can be defined which traverses each element of array in n dimension.

Some numpy function return copy while others return view. Copy is at another memory location which means separate object. View means a different view of the same object.

## Matrix

numpy has matrix library matlib.

## Linear Alzebra

Numpy provides a library for linear algebra.

## Matplotlib

pip install matplotlib

This library can be used with numpy for plotting graphs. I tested it, it draws wonderful graphs on independent screen in windows. These graphs can be saved as svg files and seen in browser.

Plot a straight line

import numpy as np

from matplotlib import pyplot as plt

x = np.arange(1,11)

y = 2 \* x + 5

plt.title("Matplotlib demo")

plt.xlabel("x axis caption")

plt.ylabel("y axis caption")

plt.plot(x,y)

plt.show()