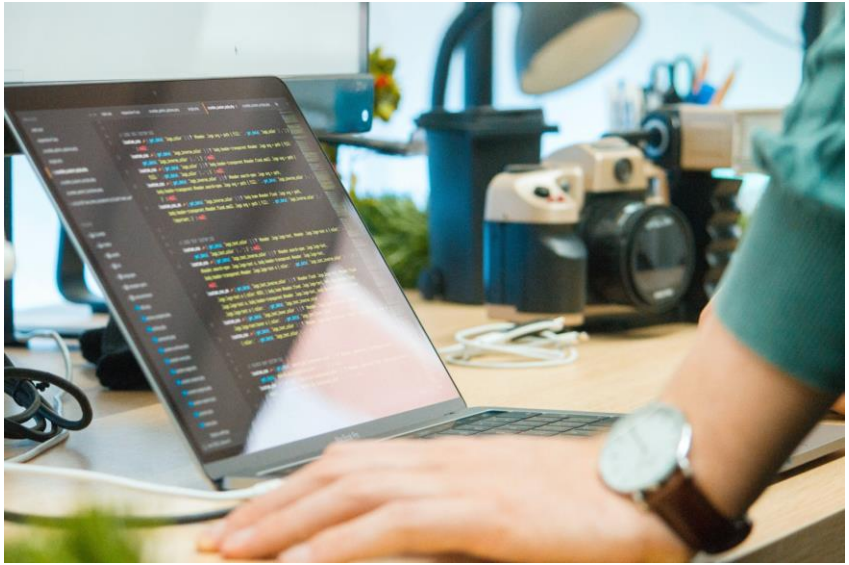

Numpy

What is Numpy?

NumPy is the fundamental package needed for scientific computing with Python.

It contains:

- a powerful N-dimensional array object
- basic linear algebra functions
- basic Fourier transforms
- sophisticated random number capabilities
- tools for integrating Fortran code
- tools for integrating C/C++ code

What is Numpy?

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- Lists ok for storing small amounts of one-dimensional data

```
>>> a = [1,3,5,7,9]
>>> print(a[2:4])
[5, 7]
>>> b = [[1, 3, 5, 7, 9], [2, 4, 6, 8, 10]]
>>> print(b[0])
[1, 3, 5, 7, 9]
>>> print(b[1][2:4])
[6, 8]
```

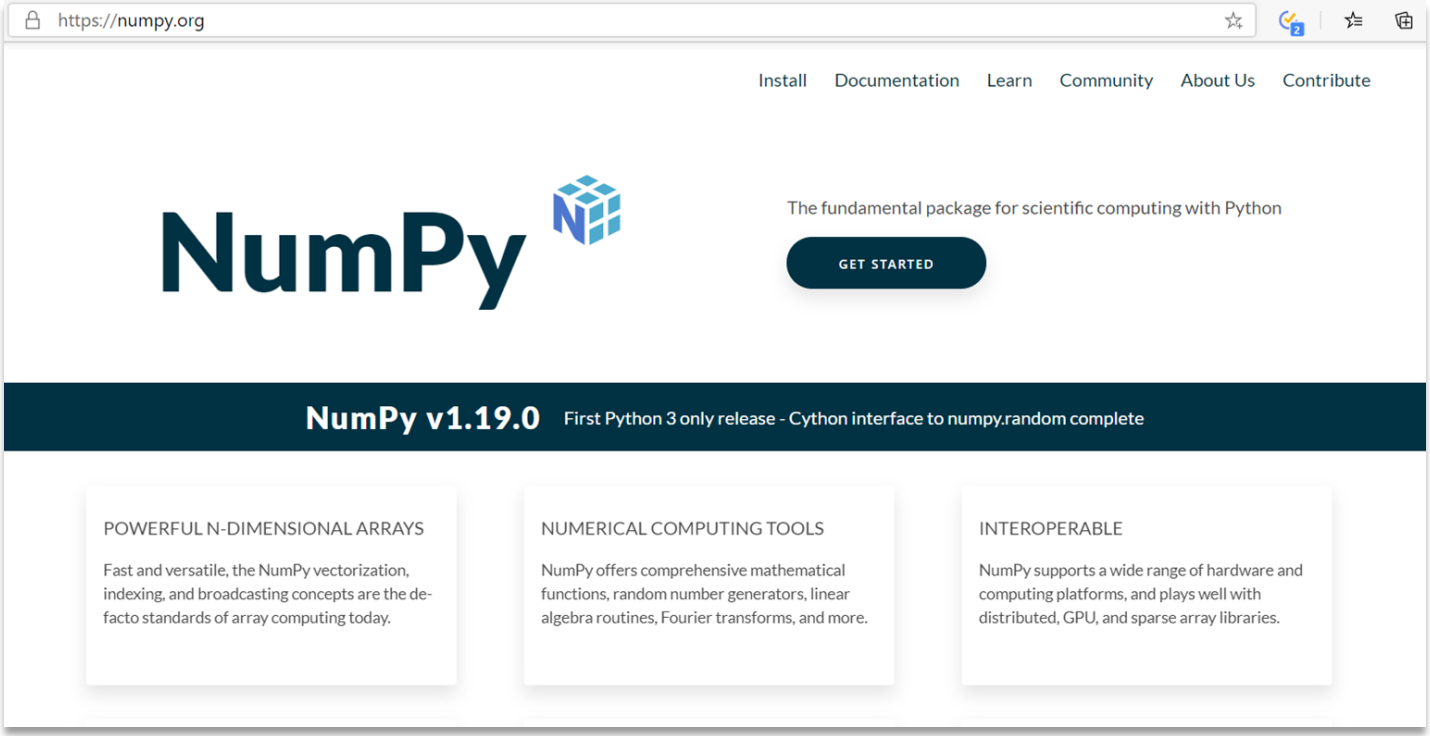
```
>>> a = [1,3,5,7,9]
>>> b = [3,5,6,7,9]
>>> c = a + b
>>> print c
[1, 3, 5, 7, 9, 3, 5, 6, 7, 9]
```

- But, can't use directly with arithmetic operators (+, -, *, /, ...)
- Need efficient arrays with arithmetic and better multidimensional tools

Why Numpy?

- **Size –** NumPy data structures take up less space
- **Performance –** Faster than lists
- **Functionality –** SciPy and NumPy have optimized functions such as linear algebra operations built in

Content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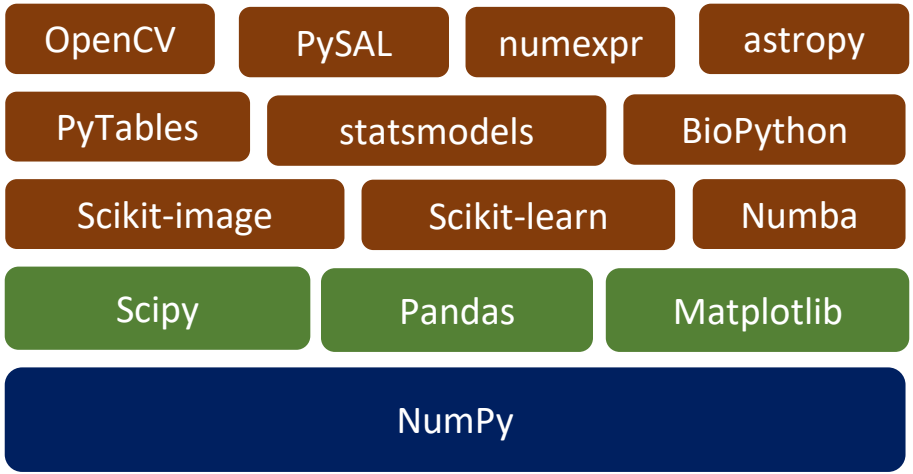
NumPy
The fundamental package for scientific computing with Python
GET STARTED
NumPy v1.19.0
First Python 3 only release - Cython interface to numpy.random complete
POWERFUL N-DIMENSIONAL ARRAYS
Fast and versatile, the NumPy vectorization, indexing, and broadcasting concepts are the de-facto standards of array computing today.
NUMERICAL COMPUTING TOOLS
NumPy offers comprehensive mathematical functions, random number generators, linear algebra routines, Fourier transforms, and more.
INTEROPERABLE
NumPy supports a wide range of hardware and computing platforms, and plays well with distributed, GPU, and sparse array libraries.

Numpy Ecosystem



Quick Start

```
In [1]: import numpy as np

In [2]: a = np.array([1,2,3,4,5,6,7,8,9])

In [3]: a
Out[3]: array([1, 2, 3, 4, 5, 6, 7, 8, 9])

In [4]: b = a.reshape((3,3))

In [5]: b
Out[5]:
array([[1, 2, 3],
[4, 5, 6],
[7, 8, 9]])

In [6]: b * 10 + 4
Out[6]:
array([[14, 24, 34],
[44, 54, 64],
[74, 84, 94]])
```

Array Shape

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One dimensional arrays have a 1-tuple for their shape

Shape: (8,)

Array Shape

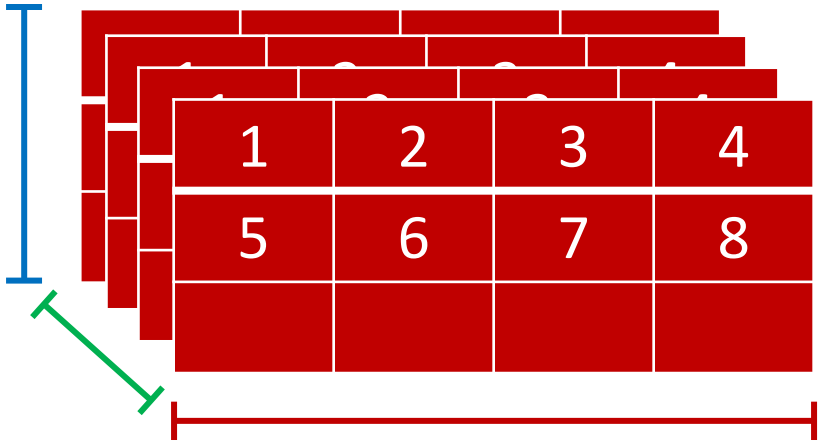
2 dimensional arrays

1	2	3	4
5	6	7	8
9	10	11	12

Shape: (3, 4)

Array Shape

And so on...



Shape: (3, 4, 4)

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Terima Kasih!

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