NUMPY

9.14.2020

PYTHON + NUMBERS

* Plain python = bad with lots of numbers

* Because it’s slow

* & annoying w/ multidimensional arrays (have fun on the homework)

NUMPY

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* **import numpy as np**

* numpy has the **ndarray** (n-dimensional array) class

  * much easier (binary funcs & ufuncs)

  * much faster (sequential memory)

* *but:* arrays have fixed size, fixed type

SIGH MATLAB

* if you know *sigh* MATLAB, then a lot of numpy will be familiar
* you should read “numpy for [*sigh*] MATLAB users”: https://docs.scipy.org/doc/numpy/user/numpy-for-matlab-users.html

READING!

* Before **Friday** (9/18),

* read Ch. 5 of “Inferential Thinking”: https://www.inferentialthinking.com/chapters/05/Sequences

* read Ch. 2 of “Python Data Science Handbook”: https://jakevdp.github.io/PythonDataScienceHandbook/02.00-introduction-to-numpy.html

NDARRAYS

* Let’s say **arr** is an ndarray

* arr.shape => array dimensions

  * shape is not a function, **don’t** try to use arr.shape()!

* arr.dtype => array type (int, float, etc)

  * dtype is also not a function!

CREATING NDARRAYS

* from a list:
  >>> np.array(some_list)

* a range:
  >>> np.arange(length)

* all zeros or ones:
  >>> np.zeros((nrows,ncols,…))
  >>> np.ones((nrows,ncols,…))

CREATING NDARRAYS

* linearly spaced values:
  >>> np.linspace(start, end, steps)

* logarithmically spaced values:
  >>> np.logspace(start, end, steps)

CREATING NDARRAYS

* random (uniform):
  >>> np.random.rand(nrows, ncols, …)

* random (gaussian):
  >>> np.random.randn(nrows, ncols, …)

BASIC OPERATIONS

* arithmetic with ndarrays and numbers

* >>> arr1 + 1
  >>> arr1 - 1
  >>> arr1 * 2.2
  >>> arr1 / 7
  >>> arr1 ** 2

BASIC OPERATIONS

* arithmetic with ndarrays and ndarrays

*
```
>>> arr1 + arr2
>>> arr1 - arr2
>>> arr1 * arr2 # elementwise product!
>>> arr1 / arr2 # also elementwise
>>> arr1 ** arr2 # weird
```

BASIC INDEXING

* indexing into ndarrays is fast and awesome

* >>> arr1.shape
  (100, 35, 3)

  >>> arr1[12,23,0]

BASIC INDEXING

* `>>> arr1.shape`
`(100, 35, 3)`

`>>> arr1[:10].shape`
`(???)`

BASIC INDEXING

*
```
>>> arr1.shape
(100, 35, 3)

>>> arr1[:10].shape
(10, 35, 3)
```

BASIC INDEXING

* multiple dimensions can be sliced at the same time

* >>> arr1[:10,23:29,:2]
  * *(still has 3 dimensions)*
* >>> arr1[:10,23:29,0]
  * *(only has two dimensions!)*

BASIC INDEXING

* skip dimensions in indexing using :

* >>> arr1[:,23:29,:2]

* >>> arr1[:,:,1]

UFUNCS

* np.sin(arr), np.cos(arr), …

* np.exp(arr), np.log(arr), …

* np.sqrt(arr), np.abs(arr), …

THAT'S IT