2_Arrays_and_matrices

September 29, 2016

In [1]:
```
# Python has built-in 'lists':
x = [1,2,3]
print(x)
```

```
[1, 2, 3]
```

In [2]:
```
# But they don't work as you would expect
x*2
```

Out[2]:
```
[1, 2, 3, 1, 2, 3]
```

In [3]:
```
# And most vector-operations fail
x*2.3
```

```
---------------------------------------------------------------------------

TypeError                                 Traceback (most recent call last)

<ipython-input-3-c4e56f154bc0> in <module>()
  1 # And most vector-operations fail
----> 2 x*2.3


TypeError: can't multiply sequence by non-int of type 'float'
```

In [4]:
```
# Numpy: The module for scientific computing with python
import numpy as np
x = np.array([1,2,3])
print(x)
```

```
[1 2 3]
```

In [5]:
```
x.dtype
```

Out[5]:
```
dtype('int64')
```

In [6]:
```
# Now you can manipulate your array in every way thinkable:
x*2.3
```

Out[6]:
```
array([ 2.3,  4.6,  6.9])
```

In [7]:
```
x/100.
```

Out[7]:
```
array([ 0.01,  0.02,  0.03])
```

```
In [8]: # numpy arrays can be combined with lists
        y = [10.,10,10]
        x+y

Out[8]: array([ 11.,  12.,  13.])

In [9]: x/y

Out[9]: array([ 0.1,  0.2,  0.3])

In [10]: x**2

Out[10]: array([1, 4, 9])

In [12]: # The dot (or scalar) or cross product
         np.cross(x,y)

Out[12]: array([-10.,  20., -10.])

In [13]: # Setting up a matrix
         z = np.array([[2,3,5],[4,3,7],[9,4,5]])
         print(z)

[[2 3 5]
 [4 3 7]
 [9 4 5]]

In [14]: z*z

Out[14]: array([[ 4,  9, 25],
                [16,  9, 49],
                [81, 16, 25]])

In [15]: k = np.array([3,2,1])
         np.dot(z,k)

Out[15]: array([17, 25, 40])

In [16]: # Note: np.dot(z,k) is not the same as z*k:
         z*k

Out[16]: array([[ 6,  6,  5],
                [12,  6,  7],
                [27,  8,  5]])

In [17]: # How to access an element in an array:
         k

Out[17]: array([3, 2, 1])

In [18]: k[0]

Out[18]: 3

In [19]: # Normal parentheses are for callable functions only:
         k(0)
```

```
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TypeError                                 Traceback (most recent call last)

<ipython-input-19-fd2060e904c3> in <module>()
----> 1 k(0)


TypeError: 'numpy.ndarray' object is not callable
```

```
In [23]: # A dictionary can contain a combination of lists and arrays:
         x = {'a':[1,2,3],'z':z}

In [24]: x['a']

Out[24]: [1, 2, 3]

In [25]: x['z']

Out[25]: array([[2, 3, 5],
                [4, 3, 7],
                [9, 4, 5]])
```