

Multi-Dimensional Arrays

MCLA

Computer Science Department

Mark A. Cohen, Ph.D

Array Arithmetic Useful in ML

4	8	$\times 2 =$	8	16	4	8	$/ 2 =$	2	4
2	1		4	2	2	1		1	0.5

4	8	$== 2 =$	False	False
2	1		True	False


4	8	$>$	7	1	$=$	False	True
2	9		3	2		True	False

4	8	$*$	2	1	$=$	8	8
2	1		3	2		6	2


NOTE: Not matrix multiplication!

Arrays (lists) in Python

Dimensions	Syntax
1 x 4 array	<code>myAry = [7, 3, 8, 2]</code>
2 x 2 array	<code>myAry = [[3, 7], [2, 1]]</code>
3 x 2 array	<code>myAry = [[1, 3], [2, 5], [8, 2]]</code>
3 x 3 array	<code>myAry = [[1, 3, 7], [2, 5, 9], [8, 2, 1]]</code>



1	3	7
2	5	9
8	2	1




3	7
2	1

The Trouble With Python Lists of Lists


- When printed they look like lists of lists instead of multi-dimensional arrays.
- They don't support array arithmetic.
- Slicing lists of lists is troublesome.

```
a = [[1, 2, 3], [4, 5, 6], [7, 8, 9]]  
print(a)
```



```
[[1, 2, 3], [4, 5, 6], [7, 8, 9]]
```

```
a = [[1, 2, 3], [4, 5, 6], [7, 8, 9]]  
b = [[2, 2, 2], [2, 2, 2], [2, 2, 2]]  
c = a * b
```



```
Traceback (most recent call last):  
  File "arrays.py", line 3, in <module>  
    c = a * b
```

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

NumPy Arrays

They Print Nice!

```
a =  
[[1 2 3]  
 [4 5 6]  
 [7 8 9]]
```

Slicing Works Great!

```
a =  
[[1 2 3]  
 [4 5 6]  
 [7 8 9]]  
  
a[0:3, 1] = [2 5 8]
```

They Support Array Arithmetic!

```
a =  
[[1 2 3]  
 [4 5 6]  
 [7 8 9]]  
  
b =  
[[1 1 1]  
 [1 1 1]  
 [2 2 2]]  
  
a - b =  
[[0 1 2]  
 [3 4 5]  
 [5 6 7]]
```

More On Slicing

a[row-start : up-to-row-end, col-start : up-to-col-end]

a[0, 0]

4	8
2	1

a[0, 0:2] or a[0, :]

4	8
2	1

a[1, 0:2] or a[1, :]

4	8
2	1

a[0:2, 0] or a[:, 0]

4	8
2	1

a[0:2, 1] or a[:, 1]

4	8
2	1

a[0:2, 0:2]

4	8	7
2	1	3
9	5	6

a[1:3, 0:2]

4	8	7
2	1	3
9	5	6

a[0:2, 1:3]

4	8	7
2	1	3
9	5	6

a[:, 0:2]

4	8	7
2	1	3
9	5	6

a[1:3, :]

4	8	7
2	1	3
9	5	6

More On Slicing

a

4	8	7
2	1	3
9	5	6
2	3	4

a[1:3, 0:3] * 2

4	8	7
4	2	6
18	10	12
2	3	4

a[:, 1:3] > 4

4	True	True
2	False	False
9	True	True
2	False	False

a[1, 1:3] * a[3][0:2]

4	8	7
2	2	9
9	5	6
2	3	4