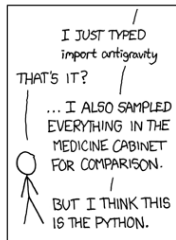
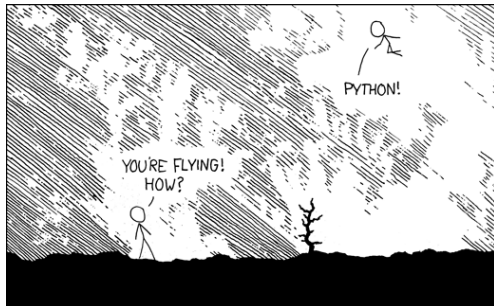


Programming with Python

EOAS Software Carpentry Workshop

September 24nd, 2015



Getting started

For our Python introduction we're going to pretend to be a researcher studying inflammation in patients who have been given a new treatment for arthritis.

You need to download some files to follow this lesson:

1. Make a new folder in your Desktop called `python-novice-inflammation`.
2. Download `python-novice-inflammation-data.zip` and move the file to this folder.
3. If it's not unzipped yet, double-click on it to unzip it. You should end up with a new folder called `data`.
4. You can access this folder from the Unix shell with:

```
$ cd && cd Desktop/python-novice-inflammation/data
```

Launching Ipython (Jupyter) Notebook

There are several ways that we can use Python. We're going to start with a tool called Python Notebook that runs in the browser. In a shell window enter these commands:

```
$ cd  
$ cd Desktop/python-novice-inflammation/data  
$ ipython notebook
```

The shell window is now running a local web server for you. Don't close it. You will need to open another shell window to do other command line things. Your browser should open to an "Jupyter: Notebook" page showing a list of directories.

Analyzing patient data

1. Explain what a library is, and what libraries are used for.
2. Load a Python library and use the things it contains.
3. Read tabular data from a file into a program.
4. Assign values to variables.
5. Select individual values and subsections from data.

- `import numpy`
- `numpy.loadtxt(fname=
delimiter=)`
- `weight_kg = 55`
- `print('weight in kg:',
weight_kg)`
- `weight_lb = 2.2 *
weight_kg`
- `type(data)`
- `data.shape`
- `data[0,0], data[0:1,0:1]`
- `data[0:10:2,1]`
- `data[:,3,36:]`

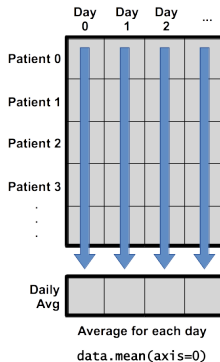
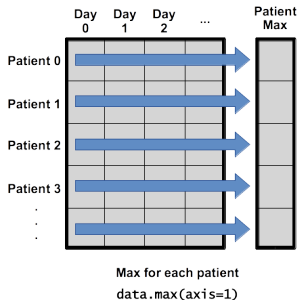
Analyzing Patient Data cont'd

6. Perform operations on arrays of data.

7. Display simple graphs.

- `data.mean()`
- `data.std()`
- `data.mean(axis=0)`
- `%matplotlib inline`
- `from matplotlib import pyplot`
- `pyplot.imshow(data)`
- `pyplot.show()`
- `pyplot.plot(ave_inflammation)`
- `import matplotlib import pyplot as plt`
- `plt.subplot(1,3,1)`
- `plt.ylabel('average')`
- `plt.show()`

Operations across an axis



Exercise

Create a single plot showing 1) the mean for each day and 2) the mean + 1 standard deviation for each day and 3) the mean - 1 standard deviation for each day.

Repeating actions with loops

1. Explain what a for loop does.
2. Correctly write for loops to repeat simple calculations.
3. Trace changes to a loop variable as the loop runs.
4. Trace changes to other variables as they are updated by a for loop.

- for char in word:

- len('aeiou')

Python has a built-in function called `range` that creates a list of numbers: `range(3)` produces `[0, 1, 2]`, `range(2, 5)` produces `[2, 3, 4]`, and `range(2, 10, 3)` produces `[2, 5, 8]`. Using `range`, write a loop that prints the first three natural numbers:

```
1  
2  
3
```

Python has a built-in function called `range` that creates a list of numbers: `range(3)` produces `[0, 1, 2]`, `range(2, 5)` produces `[2, 3, 4]`, and `range(2, 10, 3)` produces `[2, 5, 8]`. Using `range`, write a loop that prints the first three natural numbers:

One solution:

```
for num in range(1,4,1):  
    print(num)
```

Exponentiation is built into Python:

```
print(5**3)  
125
```

Write a loop that calculates the same result using multiplication (without exponentiation).

Exponentiation is built into Python:

```
print(5**3)  
125
```

Write a loop that calculates the same result using multiplication
(without exponentiation)

One possible answer:

```
ans=1  
for ii in range(1,4,1):  
    ans=ans*5  
print(ans)
```