BASIC PYTHON TUTORIAL

FOR COMPUTATIONAL NEURODYNAMICS STUDENTS

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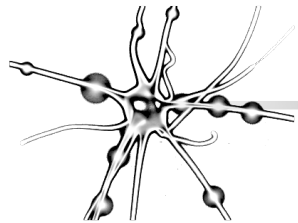

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INTRODUCTION

Completely legitimate question:

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- **Why are we using Python?**

REASONS TO MOVE TO PYTHON

(Or at least our reasons to do it)

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- ✓ It's free software.
- ✓ We know Python better than Matlab.
- ✓ We made the code better.

PYTHON BASICS

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The import system

- Often the definitions (e.g. functions) we want to use might be stored in a different script, i.e. another *module*.
- In order to use definitions from other modules we need to import these modules at the beginning of our script.
- This is done via the *import* command:

```
import numpy

import numpy as np

from scipy import *
from matplotlib import pyplot
```

PYTHON BASICS

Classes

- Classes can contain *members* and *methods*.
- The constructor is the reserved method `__init__`

```
class Shape:
    def __init__(self, x , y):
        self.x = x
        self.y = y

    def area(self):
        return self.x * self.y

rectangle = Shape(100, 45)
print rectangle.area()
```

PYTHON BASICS

Indentations in python

- Indentations mark the blocks of code within script
- Each line of a block must be indented by the same amount

```
if some_condition:
    if the_number == 4:
        do_something(fancy)
else:
    do_something(different)
```

- Mind that beginnings of blocks are indicated with a colon ":"

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0 - indexing

- The index of the first element in python is 0
- Tip: "-1" refers to the last element

FOR MATLAB FANS

First piece of advice:

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- **Don't panic.**

GENERAL COMMENTS

Replacing Matlab with python

- Overall Matlab and python are very similar in terms of syntax
- **Similarities:**
  1. Both are *dynamically typed* (every variable can contain data of any type)
  2. Both are *interpreted*, they do not need to be compiled (almost)
- **Differences**
  1. Python files can contain unlimited functions that can all be accessed
  2. Python does not have a matrix engine but there are useful packages with similar functionalities
     - **Numpy**: enables basic matrix arithmetic on arrays
     - **Scipy**: advanced mathematical routines
     - **Matplotlib**: plotting

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- Loops
- Flow control
- Function handles
- That's it!

COMMON DATA STRUCTURES

PYTHON

Lists, dictionaries, arrays, . . .

MATLAB

Arrays, cells, structs, . . .

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Python

```
A = [1,3,2,4]
B = {'a': 0.2,
     'b': 0.02}
C = np.array([10,20])
```

Matlab

```
A = [1,3,2,4];
B.a = 0.1;
B.b = 0.02;
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We recommend to use always **`np.array`**.

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Yes, but:

- ✗ The Matlab code is not maintained.
- ✗ Matlab makes the markers sad.
- ✗ We provide limited support for Matlab questions.
- ✓ Come on, use Python.

TOOLS

DEVELOPMENT TOOLS

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Remember to use a debugger!

→ **pdb**

LOGISTICS AND INSTALLATION

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- If you still don't have access to the DoC machines, talk with me ASAP!
- No mortal is allowed to install programs on the DoC machines, so we'll use Python's **virtualenv**.
  - A *virtual environment* is a small Python bubble.
  - You can **`pip install`** packages inside without requiring permissions.

VIRTUAL ENVIRONMENT

- Setting up your **`virtualenv`**:

```
virtualenv venv
cd venv
source bin/activate
pip install scipy
pip install matplotlib
pip install jpype1
```

VIRTUAL ENVIRONMENT

- To install Spyder:

```
pip install PySide
pip install spyder
```

- Using the **`virtualenv`**:

```
source /<PATHTOVENV>/bin/activate
python EulerDemo.py
spyder
```

USEFUL LINKS

- NumPy for Matlab users:

  `http://mathesaurus.sourceforge.net/matlab-numpy.html`

- Using Vim as a Python IDE:

  `https://www.youtube.com/watch?v=YhqsjUUHj6g`

  `http://blog.dispatched.ch/2009/05/24/vim-as-python-ide/`

- The Python tutorial:

  `https://docs.python.org/2/tutorial/`

LIVE EXAMPLE

Let's go through **`IzNeuronDemo.py`**