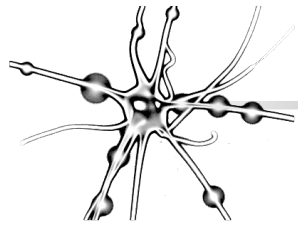
BASIC PYTHON TUTORIAL

FOR COMPUTATIONAL NEURODYNAMICS STUDENTS

Pedro Mediano Marta Garnelo



Computational Neurodynamics Group

Department of Computing

pmediano@ic.ac.uk **garnelo@ic.ac.uk**

INTRODUCTION

Completely legitimate question:

Completely legitimate question:

- **Why are we using Python?**

REASONS TO MOVE TO PYTHON

(Or at least our reasons to do it)

REASONS TO MOVE TO PYTHON

(Or at least our reasons to do it)

- ✓ It's free software.

REASONS TO MOVE TO PYTHON

(Or at least our reasons to do it)

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

REASONS TO MOVE TO PYTHON

(Or at least our reasons to do it)

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

PYTHON BASICS

PYTHON BASICS

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:

PYTHON BASICS

Classes

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

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

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

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:

First piece of advice:

- **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

BASIC COMMANDS

Most Matlab has direct correspondence in Python:

BASIC COMMANDS

Most Matlab has direct correspondence in Python:

- Variable declaration

BASIC COMMANDS

Most Matlab has direct correspondence in Python:

- Variable declaration
- Loops

BASIC COMMANDS

Most Matlab has direct correspondence in Python:

- Variable declaration
- Loops
- Flow control

BASIC COMMANDS

Most Matlab has direct correspondence in Python:

- Variable declaration
- Loops
- Flow control
- Function handles

BASIC COMMANDS

Most Matlab has direct correspondence in Python:

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

COMMON DATA STRUCTURES

PYTHON

Lists, dictionaries, arrays, . . .

MATLAB

Arrays, cells, structs, . . .

COMMON DATA STRUCTURES

PYTHON

Lists, dictionaries, arrays, . . .

MATLAB

Arrays, cells, structs, . . .

Python **Matlab**

COMMON DATA STRUCTURES

PYTHON

Lists, dictionaries, arrays, ...

MATLAB

Arrays, cells, structs, ...

Python **Matlab**

We recommend to use always **`np.array`**.

THE BIG QUESTION

Can I use Matlab?

THE BIG QUESTION

Can I use Matlab?

Yes, but:

THE BIG QUESTION

Can I use Matlab?

Yes, but:

- × The Matlab code is not maintained.

THE BIG QUESTION

Can I use Matlab?

Yes, but:

- ✗ The Matlab code is not maintained.
- ✗ Matlab makes the markers sad.

The big question

Can I use Matlab?

Yes, but:

- ✗ The Matlab code is not maintained.
- ✗ Matlab makes the markers sad.
- ✗ We provide limited support for Matlab questions.

THE BIG QUESTION

Can I use Matlab?

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

DEVELOPMENT TOOLS

- Editor + terminal

DEVELOPMENT TOOLS

- Editor + terminal
- Spyder

DEVELOPMENT TOOLS

- Editor + terminal
- Spyder
- iPython (notebook)

Development tools

- Editor + terminal
- Spyder
- iPython (notebook)

Remember to use a debugger!
$\rightarrow$ **pdb**

LOGISTICS AND INSTALLATION

- If you still don't have access to the DoC machines, talk with me ASAP!

LOGISTICS AND INSTALLATION

- 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`**:

VIRTUAL ENVIRONMENT

- To install Spyder:

- Using the **`virtualenv`**:

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`**