

Introduction to Python

Computational Physiology for Medical Image Computing

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Goals

1. You are familiar with
 - ... python's syntax and its basic types.
 - ... the most important libraries for scientific computing.
2. You are able to perform basic manipulations and visualisations on neuroimaging data.
3. You know where you can find specific neuroimaging methods.

Disclaimer

- ▶ Slides and figures of the first part are mainly based on “Introduction to Scientific Computing in Python” by R. Johansson, 2016.
Accessible at <https://github.com/jrjohansson/scientific-python-lectures>

About Python

What is Python?

- ▶ Multi-paradigm high-level programming language

- ▶ Technical details:

- interpreted
- dynamically typed
- automatic memory management



- ▶ Advantages

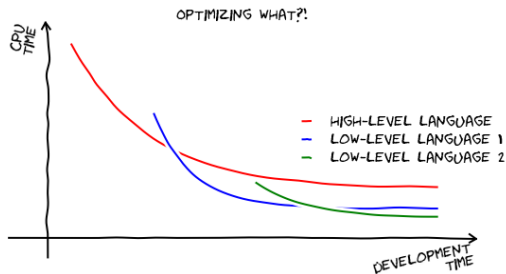
- Minimalistic syntax
- Expressive language
- Large standard library
- Well documented



- ▶ reduced development time for prototypes
- ▶ easy to maintain

Python for scientific computing

- ▶ Large scientific community
- ▶ Many libraries available
- ▶ Simple integration of optimized code written in compiled languages
- ▶ No license costs



Resources

- ▶ Package index: <https://pypi.python.org/pypi>
- ▶ Basic tutorials: <http://docs.python.org/2/tutorial>
- ▶ Wiki: <https://wiki.python.org>
- ▶ Environments:
 - IPython / IPython notebooks
 - Spyder
 - IDEs such as: PyCharm, Eclipse with PyDev, ...
- Many more at <https://wiki.python.org/moin/IntegratedDevelopmentEnvironments>

Basics

→ ipython notebook

Libraries for scientific computing

Libraries for scientific computing

Part I

“Core” libraries

- ▶ NumPy: <http://www.numpy.org/>
 - ▶ SciPy: <https://www.scipy.org/>
 - ▶ matplotlib: <http://matplotlib.org/>
- } Matlab-like functionality

Libraries for scientific computing

Part II

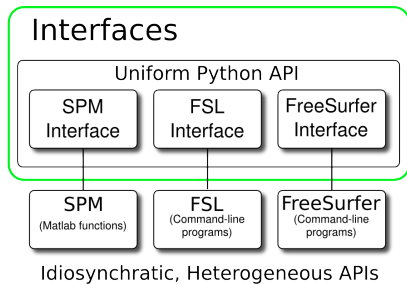
- ▶ Scikit-learn: <http://scikit-learn.org/>
- ▶ Caffe: <http://caffe.berkeleyvision.org/>
- ▶ Theano: <http://deeplearning.net/software/theano/>

- ▶ OpenCV: <http://opencv.org/>
- ▶ Insight Segmentation and Registration Toolkit:
<http://www.itk.org/> and <http://www.simpleitk.org/>
- ▶ Visualisation Toolkit: <http://www.vtk.org/>

- ▶ Neuroimaging tools nipy and nipy: <http://nipy.org/nipy/> and <https://github.com/nipy/nipype/>
- ▶ ...

Nipy and nipytype

- ▶ What is `nipy`?
 - A neuroimaging community maintaining several python libraries/packages
 - B library for structural and functional neuroimage data analysis
 - See `ipython` notebook
- ▶ ...and `nipytype`?
 - uniform interface to several neuroimaging toolkits



Getting started

→ `ipython notebook`