Porting code from Matlab to Python
Introduction to the course and motivation

October 9th, 2017 | Sandra Diaz
Agenda

• Introduction to the course
• Scientific computing
• Motivation to use Python
• Review of the course schedule and topics
Introduction to the course

• Who are we?
  - SimLab Neuroscience
  - Link between neuroscientists and HPC
  - Help port code to the supercomputers
  - Help in the development of scalable and maintainable code
  - Support best software development practices
  - Support during the application for computation time
# Our course

## Day 1

<table>
<thead>
<tr>
<th>Time</th>
<th>Topic</th>
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</thead>
<tbody>
<tr>
<td>09:00 – 09:15</td>
<td>Motivation</td>
</tr>
<tr>
<td>09:15 – 10:00</td>
<td>Introduction to Python from the Matlab perspective</td>
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<tr>
<td>10:00 – 10:15</td>
<td>Example Python I/O</td>
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<tr>
<td>10:15 – 10:30</td>
<td>Introduction to Matplotlib</td>
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<tr>
<td>10:30 – 10:45</td>
<td>Coffee Break</td>
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<tr>
<td>10:45 – 11:15</td>
<td>Introduction to Numpy</td>
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<tr>
<td>11:15 – 11:30</td>
<td>Example of Numpy and Matplotlib</td>
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<tr>
<td>11:30 – 12:00</td>
<td>Introduction to unit testing, version control and debugging</td>
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<tr>
<td>12:00 – 13:00</td>
<td>Lunch</td>
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<tr>
<td>13:00 – 13:45</td>
<td>Image processing</td>
</tr>
<tr>
<td>13:45 – 14:15</td>
<td>Statistical analysis</td>
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<tr>
<td>14:15 – 14:30</td>
<td>Workflow to port scripts from Matlab to Python</td>
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<tr>
<td>14:30 – 14:45</td>
<td>Coffee Break</td>
</tr>
<tr>
<td>14:45 – 16:30</td>
<td>Hands on Session I</td>
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</table>
## Our course

### Day 2

<table>
<thead>
<tr>
<th>Time</th>
<th>Topic</th>
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<tbody>
<tr>
<td>09:00 – 09:30</td>
<td>Introduction to classes and iterators</td>
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<tr>
<td>09:30 – 10:15</td>
<td>Introduction to MPI in Python</td>
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<tr>
<td>10:15 – 10:30</td>
<td>Example with MPI</td>
</tr>
<tr>
<td>10:30 – 10:45</td>
<td>Coffee Break</td>
</tr>
<tr>
<td>10:45 – 11:15</td>
<td>Numerical integration</td>
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<tr>
<td>11:15 – 12:00</td>
<td>Machine learning</td>
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<td>12:00 – 13:00</td>
<td>Lunch</td>
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<tr>
<td>13:00 – 14:00</td>
<td>Questions pannel</td>
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<tr>
<td>14:00 – 14:30</td>
<td>Hands on Session II</td>
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<tr>
<td>14:30 – 14:45</td>
<td>Coffee Break</td>
</tr>
<tr>
<td>14:45 – 16:30</td>
<td>Hands on Session III</td>
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Logistics

- Test accounts
- Git repository
- Coffee Breaks
- Lunch
What is Python?

- Python is a modern, general-purpose, object-oriented, high-level programming language.
- General characteristics of Python:
  - clean and simple
  - expressive
- Technical details:
  - dynamically typed
  - automatic memory management
  - interpreted
What is Python?

• Advantages:
  - ease of programming, minimizing the time required to develop, debug and maintain the code.
  - modular and object-oriented programming
  - large standard library
  - portable
  - easy to extend and link to optimized code
  - “Python is powerful... and fast; plays well with others; runs everywhere; is friendly & easy to learn; is Open”. (www.python.org)

• Disadvantages:
  - interpreted and dynamically typed programming language
  - decentralized
Why Python for scientific computing?

• Large community of users
• Scientific libraries and environments
  - numpy: http://numpy.scipy.org - Numerical Python
  - scipy: http://www.scipy.org - Scientific Python
  - matplotlib: http://www.matplotlib.org - graphics library
• Support for
  - Parallelism with threads and interprocess communication (MPI)
  - GPU computing (OpenCL and CUDA)
• HPC
• No license costs
I LEARNED IT LAST NIGHT! EVERYTHING IS SO SIMPLE!
HELLO WORLD IS JUST print "Hello, world!"

I DUNNO...
DYNAMIC TYPING?
WHITE SPACE?
COME JOIN US!
PROGRAMMING IS FUN AGAIN!
IT'S A WHOLE NEW WORLD UP HERE!
BUT HOW ARE YOU FLYING?

I JUST TYPED
import antigravity
THAT'S IT?

... I ALSO SAMPLED EVERYTHING IN THE MEDICINE CABINET FOR COMPARISON.

BUT I THINK THIS IS THE PYTHON.
When not to port from Matlab to Python

• Heavily rely on a complex, specialized and well tested toolbox like Simulink and no alternatives are available.
References

(1) Based on the work by J.R. Johansson http://jrjohansson.github.io