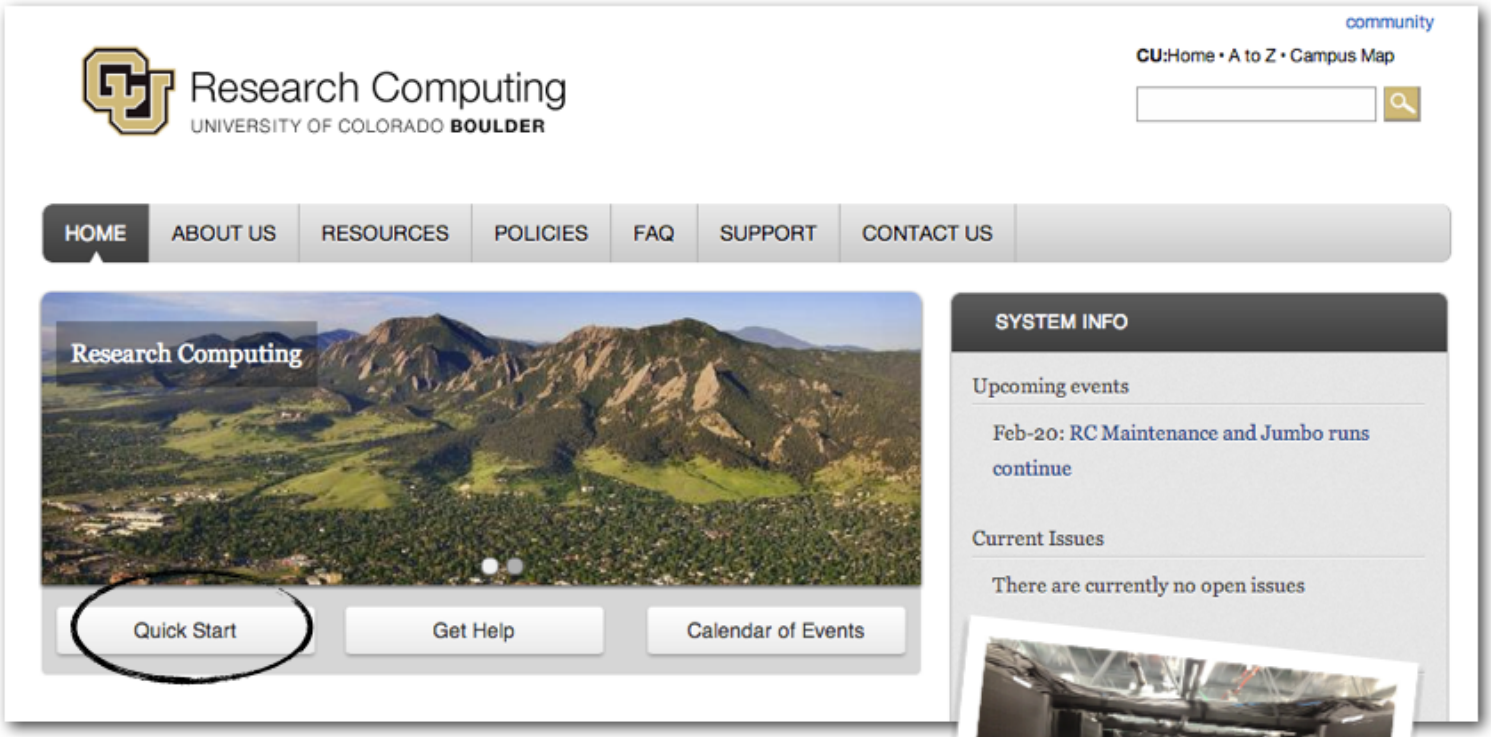
Python for Matlab Users

Thomas Hauser
Director of Research Computing
thomas.hauser@colorado.edu

Monte Lunacek
HPC Application Specialist
monte.lunacek@colorado.edu

Who are we?



- www.rc.colorado.edu
- JANUS ~16000 cores

What is Python?

What is Python?

- Flexible, powerful programming language
  - Object oriented
  - Runs everywhere
  - Testing framework
- Easy, clean syntax
- Very readable code
- Balanced high level programming with low-level optimization
  - Pyrex, Cython
  - F2py
- Large community of support
  - Modular system, large number of libraries
- Free as in **free beer**
- Free as in **free speech**

Minimum packages for computational science

- python: the base language
- numpy: arrays, fast operations on arrays
- scipy: higher level computational routines
- matplotlib: plotting
- ipython: notebooks, flexible shell, and **parallel**
- pandas: data analysis

What can you do with Python?

- OS support: manage files and directories
- Glue existing applications
- LAPACK and BLAS: access powerful C and Fortran libraries
- Parallel
- Data Analysis
- Visualization
- GUI programming
- Scrape websites
- Build websites
- **Anything!**

Outline

Part One

- Python Overview (30 minutes)
  - IPython and Notebook
  - Functions, lists, and Dictionaries
- Lab (10 minutes)
- Break (10 minutes)

Part Two

- Numpy (20 minutes)
- Plotting with Matplotlib (10 minutes)
- Lab (10 minutes)
- Data Analysis (20 minutes)

Python Overview

- Test driving three ways to interact with Python
- Functions, lists, dictionaries

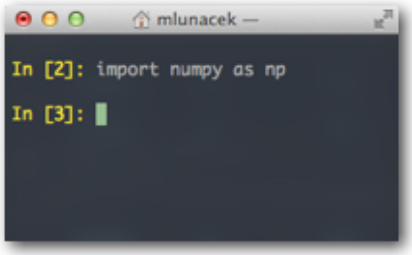
Hello World

```PYTHON
#!/Users/mlunacek/anaconda/bin/python

def say_hello():
    print 'hello world'

say_hello()
```

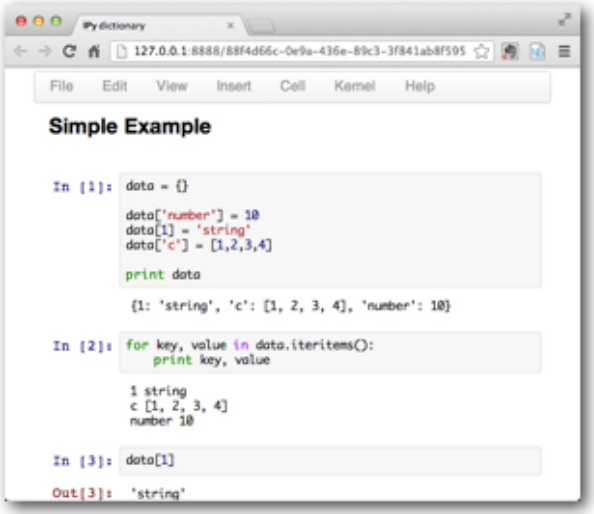
What do you notice about this code?

Three ways to run

1. text editor + terminal



2. text editor + IPython



3. IPython Notebook

Terminal

```BASH
$ ls hello_world.py
hello_world.py
$ python hello_world.py
hello world
$ ./hello_world.py
hello world
bash-mac$
```

IPython shell

- OS support
- Formatted print
- Tab Completion
- `%run`
  - Persistence
- History
- Introspection (`?,??`)
- `%paste` and `%cpaste`

Quick Introduction to Python

- Functions
- Lists
- Dictionaries

How

- IPython terminal
- Notebook

IP[y]: Notebook

To import a notebook, drag the file onto the listing below or **click here**.

/Users/mlunacek/Documents/tutorials/python/python_hpc/Python4Matlab
data_analysis
dictionary_and_lab
functions_and_lists
matplotlib
numpyTutorial
python4matlab

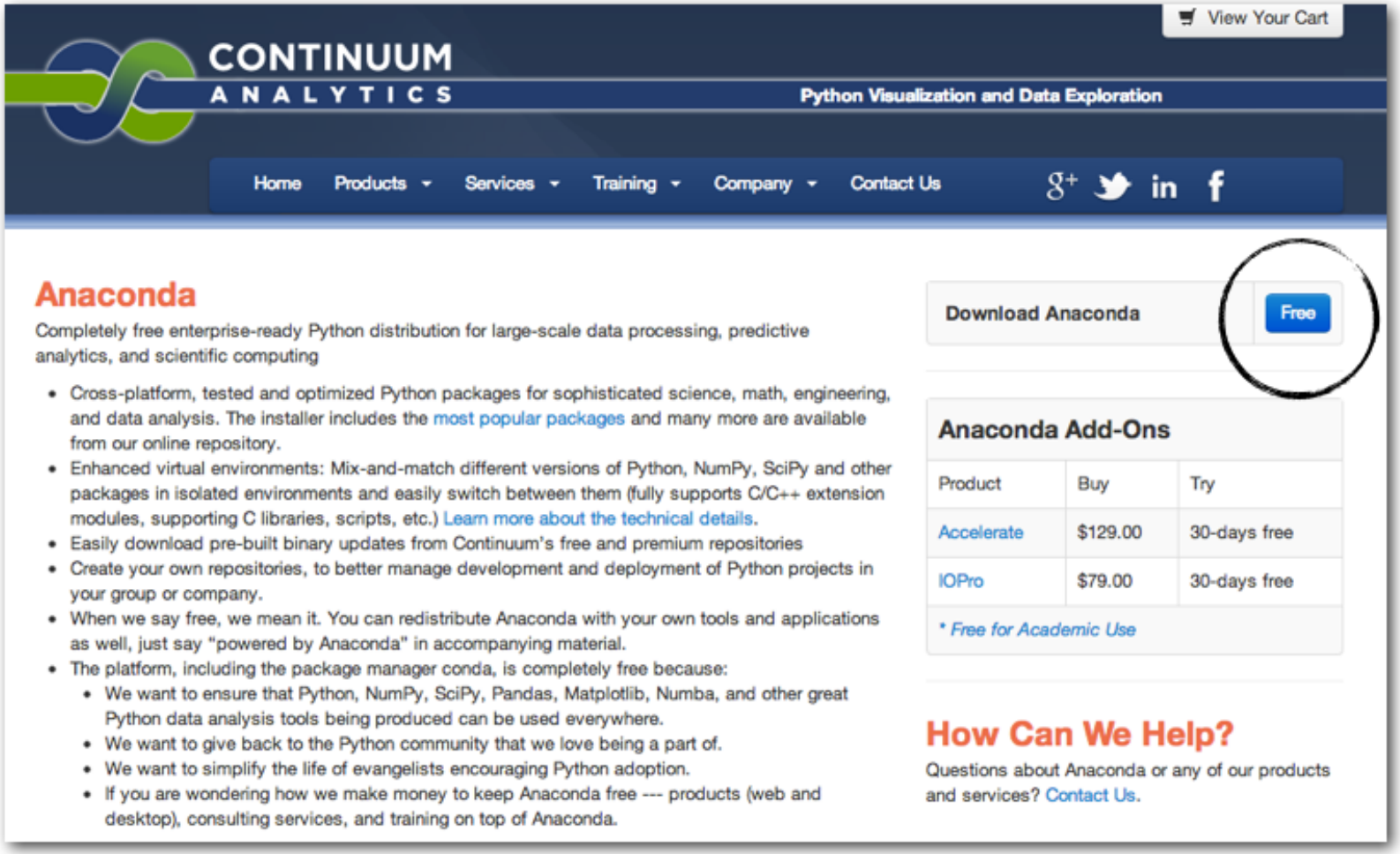
Lab and Break

Dictionaries

Endthought

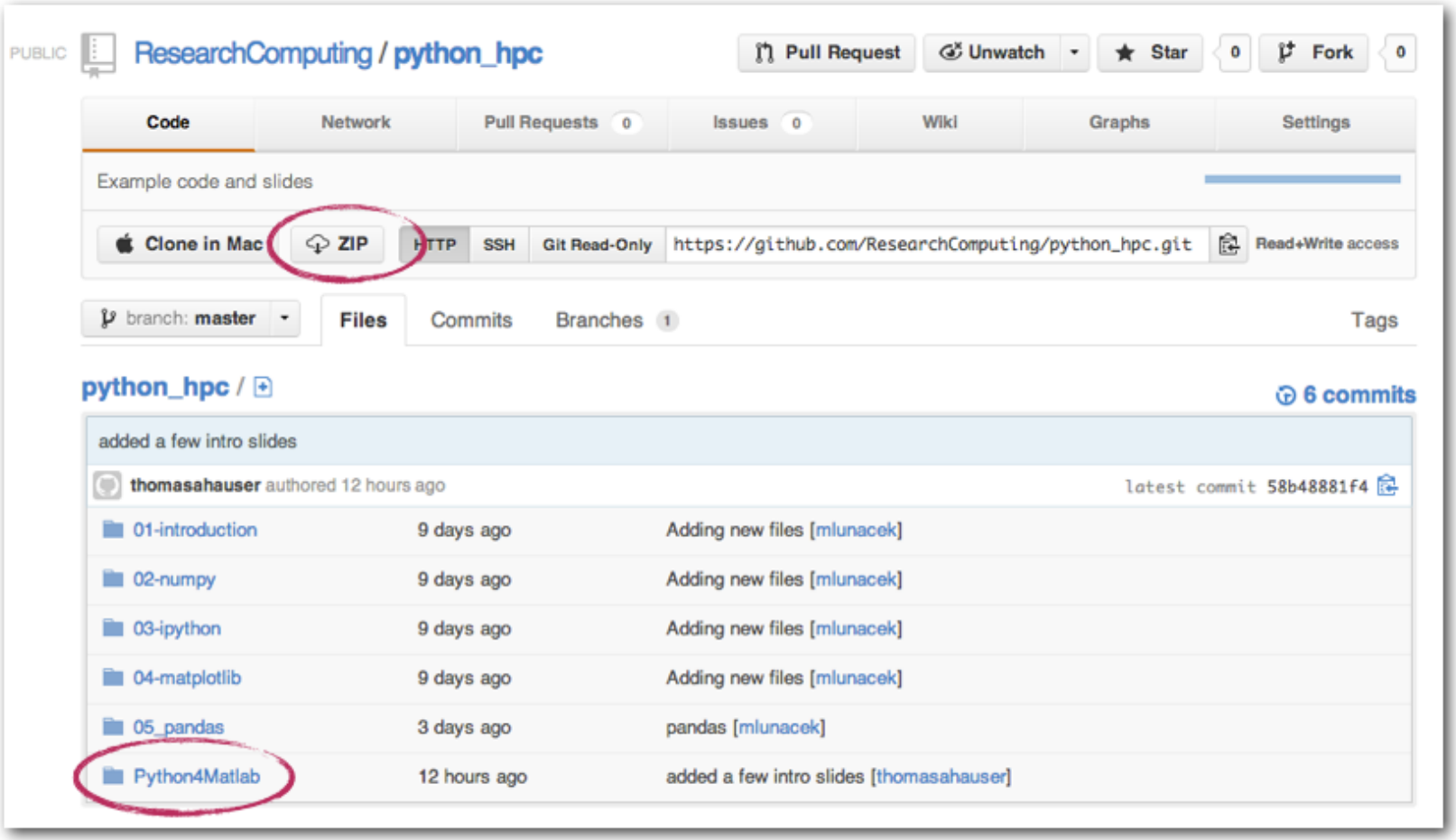
http://www.enthought.com/

Anaconda



https://store.continuum.io/cshop/anaconda

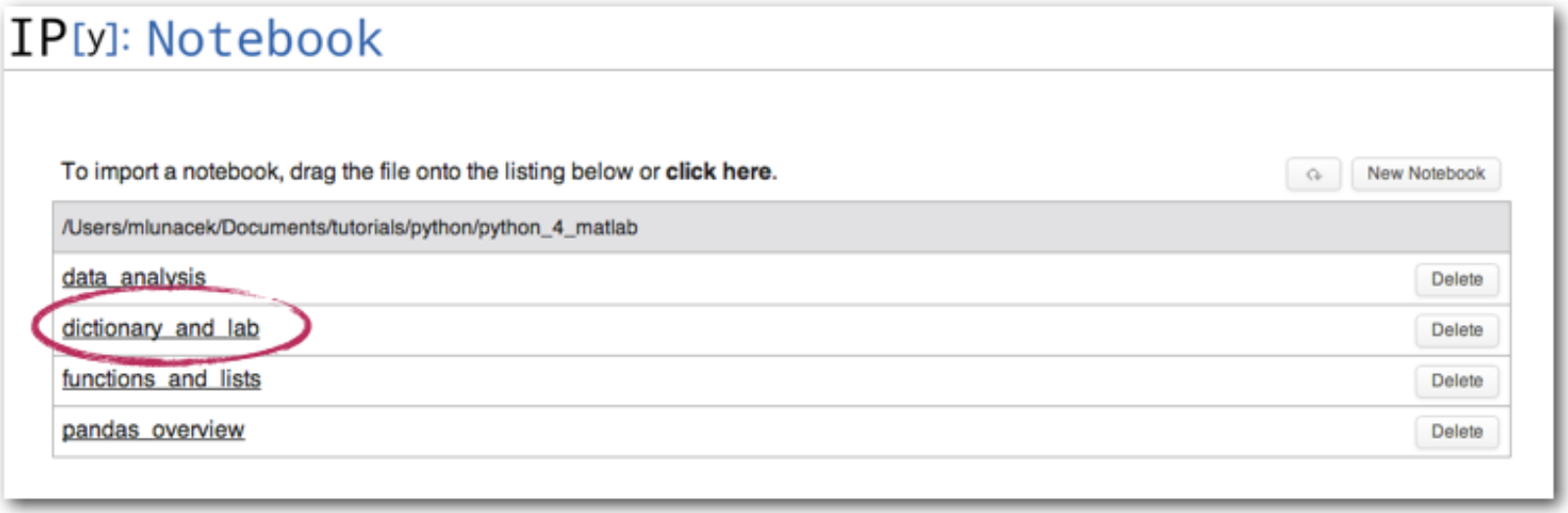
Github



https://github.com/ResearchComputing/python_hpc

Lab

- Go to the directory where you dowloaded the code
- `unzip` the file
- Navigate to **Python4Matlab**
- Launch IPython Notebook
  - `ipython notebook`
  - `dictionary_and_lab`



IP[y]: Notebook

To import a notebook, drag the file onto the listing below or **click here**.

/Users/mlunacek/Documents/tutorials/python/python_hpc/Python4Matlab
data_analysis
dictionary_and_lab
functions_and_lists
matplotlib
numpyTutorial
python4matlab

Numpy and Matplotlib

IP[y]: Notebook

To import a notebook, drag the file onto the listing below or **click here**.

/Users/mlunacek/Documents/tutorials/python/python_hpc/Python4Matlab
data_analysis
dictionary_and_lab
functions_and_lists
matplotlib
numpyTutorial
python4matlab

Lab 2

Numpy and Matplotlib

IP[y]: Notebook

To import a notebook, drag the file onto the listing below or **click here**.

/Users/mlunacek/Documents/tutorials/python/python_hpc/Python4Matlab
data_analysis
dictionary_and_lab
functions_and_lists
matplotlib
numpyTutorial
python4matlab

Pandas

Data Analysis

IP[y]: Notebook

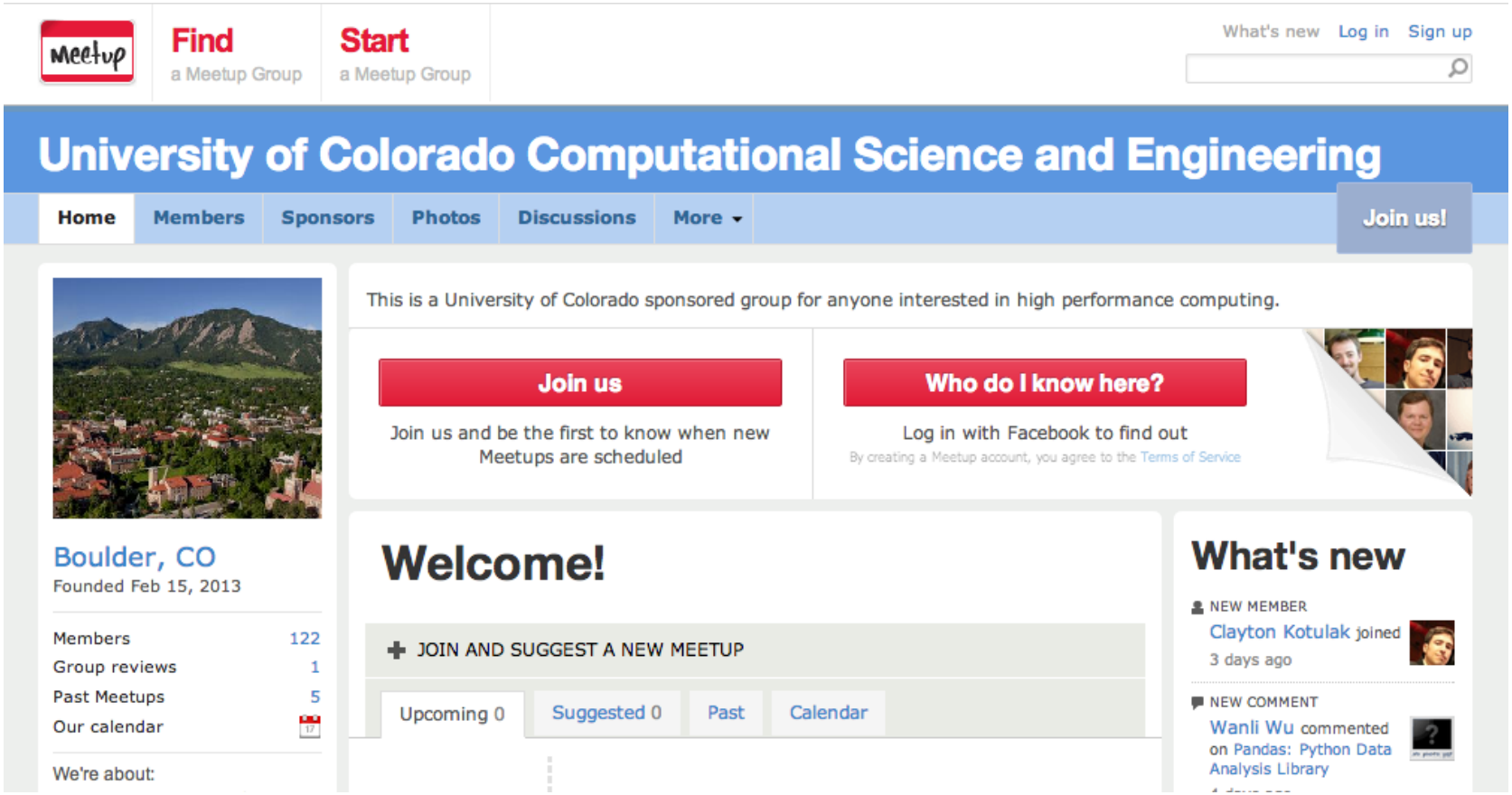
To import a notebook, drag the file onto the listing below or **click here**.

/Users/mlunacek/Documents/tutorials/python/python_hpc/Python4Matlab
data_analysis
dictionary_and_lab
functions_and_lists
matplotlib
numpyTutorial
python4matlab

What did we learn?

- Python's syntax is clean
- Notebook, IPython terminal
- **Data** structures
  - Lists, dictionaries,
  - numpy `arrays`
  - pandas `DataFrame`
- Ways to act on these containers
- Plotting with matplotlib

What's next?


Find
a Meetup Group
Start
a Meetup Group
What's new
Log in
Sign up
University of Colorado Computational Science and Engineering
Home
Members
Sponsors
Photos
Discussions
More
Join us!
This is a University of Colorado sponsored group for anyone interested in high performance computing.
Join us
Join us and be the first to know when new Meetups are scheduled
Who do I know here?
Log in with Facebook to find out
By creating a Meetup account, you agree to the Terms of Service
Boulder, CO
Founded Feb 15, 2013
Members 122
Group reviews 1
Past Meetups 5
Our calendar
We're about:
Welcome!
JOIN AND SUGGEST A NEW MEETUP
Upcoming 0
Suggested 0
Past
Calendar
What's new
NEW MEMBER
Clayton Kotulak joined
3 days ago
NEW COMMENT
Wanli Wu commented on Pandas: Python Data Analysis Library

Links

- Scientific Programming: scipy
- Parallel Computing
  - IPython Parallel
  - mpi4py
- Performance
  - profiling
  - f2py
  - cython
  - ctypes
- Templates: jinja2
- SQL database: sqlalchemy
- Websites: django
- Hardware Raspbery Pi

References

- Python Scripting for Computational Science
- Python Snakes Its Way Into HPC
- Andy Terrel: Getting Started with Python in HPC
- Python Tutorial
- Think Python
- Enthought
- Anaconda
- Data Analysis with Python

Thank you!