

NRSC 7657 Workshop in Advanced Programming for Neuroscientists

Course Description

The goal of this course is to provide neuroscience students with practical skills in modern programming to facilitate their research and understand technical development in the field. It is project-based mixed with practical pedagogy in computational tools and techniques for a broad range of topics within neuroscience. The course will cover concepts in programming, data types, workflow, data and code management, and collaboration tools. Students are expected to have completed some very basic introduction to programming prior to this course, or have previous experience with scientific computing in either MATLAB or Python. Students are expected to complete an independent project using Python or (/and) MATLAB, using data from their own work or publicly available datasets. The course will use both Python and MATLAB for didactic sessions, with the goal of providing basic familiarity in both widely used platforms in neuroscience. The course is taught over 10 weeks, with one 3 hour session per week. Each session is divided between lecture and active programming of examples or independent coding. Several sessions in the latter half are dedicated to group programming time, and students are expected to attend these sessions and encouraged to work openly during these times. All students will create and maintain a GitHub repository for their final project.

Schedule

June 13- Aug 22 2022 (no class July 4)

Monday 9AM –12PM P18-1004, Computer Lab outside Hensel Phelps Auditorium

June 13	Week 1 – overview / review	Course overview: theory of computing, landscape of computing options. Basic usage in python and MATLAB; basic data types; environments Style guidelines (ten simple rules); git and version control
June 20	Week 2 – language fundamentals	Functions; Objects and Classes; Workspaces Typical data formats: working with tabular data, images, and time series. NeurodataWithoutBorders format
June 27	Week 3 – workflow management and outputs	Importing and exporting Plotting and visualization - from bar charts to 3D animation
July 11	Week 4 – usability	Troubleshooting and debugging; unit testing
July 18	Week 5 – scaling	Iteration and code profiling; parallel computing. Code quality-of-life topics
July 25	Week 6 – collaboration	Cloud-based tools: AWS, GCC, Colab, jupyterhub, deepnote. Overview of some available SAAS tools, python focused. Group programming time
August 1	Week 7 – applications/flex topic	Applications: image processing (ES) Group programming time
August 8	Week 8 – applications/flex topic	Applications: spike sorting (DD) Group programming time
August 15	Week 9 – applications/flex topic	Applications: DeepLabCut and cloud ML Group programming time
August 22	Week 10 – Final presentations and code review	Final pres. and code review Final pres. and code review

Evaluation

Students will be evaluated on lecture attendance, participation, and effort towards their final project.

Weekly progress reports on the final coding project are expected to be uploaded to the project GitHub repository.