

## **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 of the course 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 11- Aug 13 2021

Friday 1 – 4PM

zoom, optional in person

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 ( <a href="#">ten simple rules</a> ); git and version control
Week 2 – language fundamentals	Functions; Objects and Classes; Workspaces Typical data formats: working with tabular data, images, and time series. NeurodataWithoutBorders format
Week 3 – workflow management and outputs	Importing and exporting Plotting and visualization - from bar charts to 3D animation
Week 4 – usability	Troubleshooting and debugging; unit testing
Week 5 – scaling	Iteration and code profiling; parallel computing. Code quality-of-life topics
Week 6 – collaboration	Cloud-based tools: AWS, GCC, Colab, jupyterhub, deepnote. Overview of some available SAAS tools, python focused.
Week 7 – applications/flex topic	Group programming time Applications: image processing (ES)
Week 8 – applications/flex topic	Group programming time Applications: spike sorting (DD)
Week 9 – applications/flex topic	Group programming time Applications: flex
Week 10 – Final presentations and code review	Group programming time Final pres. and code review Final pres. and code review

### **Evaluation**

Students will be evaluated on lecture attendance, participation, and effort towards completing their final project. Weekly progress reports on the final coding project are expected to be uploaded to the project GitHub repository.