

**UNIVERSITY OF FLORIDA**  
**COLLEGE OF MEDICINE SYLLABUS**  
**NEUROSCIENCE**  
**GMS7795 Computational Skills for Neuroscience**  
**(2 credit)**

Spring 2024

Delivery Format: In person at MBI L1-101. Time: Thursdays 3-5pm

Instructors:

Dr. Nancy Padilla-Coreano

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Office Hours: 5-530pm after class

Graduate Assistant: Albert Li

Preferred Course Communications:

Teams

Prerequisites: Doctoral students or  
permission my instructor

**Course Description:**

Teaches basic software skills for neuroscience graduate students and how computing can enhance and accelerate neuroscience research. Students will learn to use basic programming skills for quantitative analyses of datasets, as well as edit and understand code done by others. Students will also be exposed to basic concepts in Artificial Intelligence as they relate to neuroscience.

**Purpose and Outcome:**

The purpose of this course is to prepare students to use basic computational tools with direct relevance to neuroscience research. At the end of this course, students should be able to adapt their basic programming skills to do quantitative analyses of their own datasets, as well as edit and understand code done by other lab members. Students will also be exposed to basic concepts in Artificial Intelligence as they relate to neuroscience.

**Course Overview:**

Computational skills are becoming more necessary for all biomedical research, including neuroscience. Computational proficiency can facilitate multiple facets of graduate student research and education including facilitating statistical analyses, analysis of large data sets, use of

the high-performance computer on campus and adapting existing open-source tools for the needs of a scientific project. Programming skills particularly can automate data processing and decrease human bias in scientific projects. However, computer programming is not incorporated in the predoctoral education of all biological science or neuroscience degrees. Therefore, the purpose of this course is to take a novice student and provide them with the basics of Python programming, gradually working through more complex exercises with relevance to data analysis skills. Students will be required to bring their own computer to every class to do the exercises.

**Relation to Program Outcomes:** This course fulfills the requirements for Academic Credits for graduate students in the Neuroscience program.

**Course Objectives and/or Goals:**

By the end of each semester, students will be able to:

- Understand the basics of Python
- Read and edit basic programming scripts
- Be able to create scripts to transform and visualize datasets
- Become aware of Artificial Intelligence tools utilized for neuroscience.
- Experience using common packages to perform machine learning analyses.

**Instructional Methods:**

As programming is often “trial and error”, this class will provide both instruction and time to apply the concepts real time in class. Students are expected to come to class with their laptops charged and prepared to work through exercises and additional supplementary problems. In the first half of each lecture the instructors will explain the concepts necessary, and in the second part of the lecture students will dive into programming exercises. Instructors will be present to explain, facilitate and help with problems that emerge as students complete their programming exercises. Through the course students will workshop scripts to improve good general coding habits and reproducibility of science. In addition, at the end of the semester students will complete a data analysis project and present their projects. Although the class is focused on Python, students have the choice to do their homework in their preferred programming language, such as MATLAB and resources for the differences between MATLAB and python will be provided via the textbook.

**Description of Course Content:**

**Topical Outline**

Module	Topic	Homework due
Class 1	Introduction to class, installing important software and basics 1: <b>Variables, indexing, types, libraries</b>	In class: start P-set 1
Class 2	Basics 2: Functions, loops and conditionals, working with numpy (splicing, mean)	<b>P-set 1 Due (assignment 1)</b>

		In class: Start p-set 2 problems 1-8
Module 2 Class 3	Pandas dataframes, classes and plotting	Prior to class read chapter 3 until page 72, pay attention to how you can plot data from pages 52-72, write the code to along with the book  In class: P-set 2 9-12
Module 2 Class 4	Making your first script	<b>P-set 2 due (assignment 2)</b> <b>Important: Bring csv or excel file with your own data to visualize in your first script</b>  In class: Make pseudo code and plan for your first script to load the data, do some basic transformation or descriptive statistics and visualize data
Module 3 Class 5	Reading other people's scripts and improving other people's code  Common code bugs	In class: assign classmate script to provide feedback.  <b>Your first script due (assignment 3)</b>  <b>Important: Bring a script from your lab that you could use for your data for lab code improvement project</b>  In class: Finding bugs on scripts p-set.  In class: Description of improving code project
Module 3 Class 6	Reading each other's code for improving our first scripts  Present your lab code improvement project plan	In class: Finding bugs on scripts p-set.
Module 4 Class 7	Fundamentals of artificial intelligence	<b>Finding bugs on scripts p-set due (assignment 4)</b>
Module 4 Class 8	Fundamentals of artificial intelligence	

Module 4 Class 9	Correlations and linear and logistic regressions	Read chapter 7 prior to class and identify functions to use for correlations and regressions.  In class: write a script to use correlations and regressions on your selected dataset
Module 4 Class 10	Time series Fourier transformations with Dr. Drew Maurer	Read chapter 5 prior to class  In class: Make a script with code from chapter 5
Class 11	Presentations on lab code improvement project  Demo of hipergator	<b>Improved lab code due (assignment 5)</b>
Module 4 Class 12	Dimensionality reduction and clustering methods lecture	Read pages 75-98 prior to class  In class: run a script to perform dimensionality reduction or clustering method
Class 13	In class final project work time	
Class 14	Present your final project code and results to class	<b>Final project code due</b>

## Resources

Chapters mentioned in the outline refer to this textbook: Neural Data Science: A Primer with MATLAB and Python, Erik Lee Nysten, Pascal Wallisch (2017)

<https://www.sciencedirect.com/book/9780128040430/neural-data-science>

ChatGPT your personal assistant

- How ChatGPT can help you in grad school:

<https://neuraljojo.medium.com/how-i-use-chatgpt3-as-a-scientist-12832caf5048>

Preparing our environments to code

- Downloading Python and JupyterLab Notebooks  
<https://www.python.org/downloads/>
- Make GitHub account and demonstrate usage
- Make ChatGPT account and google colab account

When avoiding loops may be better for speed

<https://medium.com/analytics-vidhya/day-1-making-matlab-fun->

[ad850eaffbde  
https://medium.com/python-pandemonium/never-write-for-loops-again-91a5a4c84baf](https://medium.com/python-pandemonium/never-write-for-loops-again-91a5a4c84baf)

Avoiding ugly plots please!

- <https://medium.com/analytics-vidhya/day-7-where-does-my-data-go-and-matlabs-most-useful-hidden-plotting-property-d00d9d12045e>
- <https://medium.com/geekculture/create-beautiful-graphs-with-python-4235f50b2adb>

Fundamentals of machine learning

- Useful book pdf [DEUSCHLE-SENIORTHESIS-2019.pdf \(harvard.edu\)](#)
- Mathematical and visual explanation of PCA <https://www.visual-design.net/post/linear-algebra-for-ml-part2-principal-component-analysis>
- Machine learning applications in neuroscience <https://www.jneurosci.org/content/jneuro/38/7/1601.full.pdf>
- All about regressions [3.1-Regression-BasisFns \(buffalo.edu\)](#)

**Lab code improvement project** description: *The goal of this project is for you to read and ideally improve someone else's code. This assignment will be presented in class by each student.*

*Pick a script that has been created by someone else in your lab, or by yourself in the past, and apply the concepts of the class to improve the readability of the code, minimize loops, lines of code and/or improve the annotations and documentation of the code.*

**Final project** (Datasets options below)

*Write a well annotated and documented script that can do the following:*

1. *Run a linear or logistic regression on your dataset*
2. *identify the most and the least correlated variables*
3. *Perform a clustering method on your dataset*
4. *Write a paragraph on how correlation affects regressions and clustering and general observations of your data.*

*Include pseudocode for the script*

*Dataset requirements: large sample size, numerical and multivariate (at least 3 variables). options:*

1. *Your own data*
2. <http://archive.ics.uci.edu/ml/datasets.php>
3. [GitHub - mwaskom/seaborn-data: Data repository for seaborn examples](#)

### Canvas usage:

Canvas will be used to submit programming exercise homework and code submission.

### Course Materials and Technology:

Neural Data Science: A Primer with MATLAB and Python, Erik Lee Nylen, Pascal Wallisch (2017)

A computer

For technical support for this class, please contact the UF Help Desk at:

- [Learning-support@ufl.edu](mailto:Learning-support@ufl.edu)
- (352) 392-HELP - select option 2
- [UF eLearning](#)

### Academic Requirements and Grading:

#### Assignments:

Each student is expected to present on their data analysis project during the semester and actively participate in discussions every week. Student presenters order will be selected by the instructors. Several coding assignments will be submitted via canvas.

#### Grading:

Requirement	Percent Final Grade
Attendance and participation	40%
Assignments	40%
Final project	20%

**Point system used (i.e., how do course points translate into letter grades).**

Percentage Earned	Letter Grade
93-100	A
90-92	A-

87-89	B+
83-86	B
80-82	B-
77-79	C+
73-76	C
70-72	C-
67-69	D+
63-66	D
60-62	D-
Below 60	E

More information on UF grading policy may be found at:

<http://gradcatalog.ufl.edu/content.php?catoid=10&navoid=2020#grades>

**Exam Policy:** No exams

**Policy Related to Required Class Attendance:**

Requirements for class attendance and assignments, and other work in this course are consistent with university policies that can be found at:

<https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>

Excused absences must be consistent with university policies in the Graduate Catalog (<http://gradcatalog.ufl.edu/content.php?catoid=10&navoid=2020#attendance>). Additional information can be found here:

<https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>

**Academic Integrity:**

Students are expected to act in accordance with the University of Florida policy on academic integrity. As a student at the University of Florida, you have committed yourself to uphold the Honor Code, which includes the following pledge:

**“We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity.”**

You are expected to exhibit behavior consistent with this commitment to the UF academic community, and on all work submitted for credit at the University of Florida, the following pledge is either required or implied:

**“On my honor, I have neither given nor received unauthorized aid in doing this assignment.”**

It is your individual responsibility to know and comply with all university policies and procedures regarding academic integrity and the Student Honor Code. Violations of the Honor Code at the University of Florida will not be tolerated. Violations will be reported to the Dean of Students Office for consideration of disciplinary action. For additional information regarding Academic Integrity, please see Student Conduct and Honor Code or the Graduate Student Website for additional details:

<https://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/>

<http://gradschool.ufl.edu/students/introduction.html>

**Please remember cheating, lying, misrepresentation, or plagiarism in any form is unacceptable and inexcusable behavior.**

### **Online Faculty Course Evaluation Process:**

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at <https://gatorevals.aa.ufl.edu/students/>. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via <https://ufl.bluera.com/ufl/>. Summaries of course evaluation results are available to students at <https://gatorevals.aa.ufl.edu/public-results/>.

### **Policy Related to Guests Attending Class:**

Only registered students are permitted to attend class. However, we recognize that students who are caretakers may face occasional unexpected challenges creating attendance barriers. Therefore, by exception, a department chair or his or her designee (e.g., instructors) may grant a student permission to bring a guest(s) for a total of two class sessions per semester. This is two sessions total across all courses. No further extensions will be granted. Please note that guests are **not** permitted to attend either cadaver or wet labs. Students are responsible for course material regardless of attendance. For additional information, please review the [Classroom Guests of Students policy](#) in its entirety.



## **Support Services:**

### **Accommodations for Students with Disabilities:**

Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the Disability Resource Center by visiting <https://disability.ufl.edu/students/get-started/>. It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester. The College is committed to providing reasonable accommodations to assist students in their coursework.

### **Counseling and Student Health:**

Students sometimes experience stress from academic expectations and/or personal and interpersonal issues that may interfere with their academic performance. If you find yourself facing issues that have the potential to or are already negatively affecting your coursework, you are encouraged to talk with an instructor and/or seek help through University resources available to you.

- The Counseling and Wellness Center 352-392-1575 offers a variety of support services such as psychological assessment and intervention and assistance for math and test anxiety. Visit their web site for more information: <http://www.counseling.ufl.edu>. On line and in person assistance is available.

- You Matter We Care website: <http://www.umatter.ufl.edu/>. If you are feeling overwhelmed or stressed, you can reach out for help through the You Matter We Care website, which is staffed by Dean of Students and Counseling Center personnel.
- The Student Health Care Center at UF Health is a satellite clinic of the main Student Health Care Center located on Fletcher Drive on campus. Student Health at UF Health offers a variety of clinical services. The clinic is located on the second floor of the Dental Tower in the Health Science Center. For more information, contact the clinic at 392-0627 or check out the web site at: <https://shcc.ufl.edu/>
- UF Health Emergency Room / Trauma Center: For immediate medical care call 352-733-0111 or go to the emergency room at 1515 SW Archer Road, Gainesville, FL 32698, [ufhealth.org/emergency-room-trauma-center](http://ufhealth.org/emergency-room-trauma-center).
- University Police Department: Visit [police.ufl.edu/](http://police.ufl.edu/) or call 352-392-1111 (or 9-1-1 for emergencies).
- Crisis intervention is always available 24/7 from:

Alachua County Crisis Center:

(352) 264-6789

<http://www.alachuacounty.us/DEPTS/CSS/CRISISCENTER/Pages/CrisisCenter.aspx>

Do not wait until you reach a crisis to come in and talk with us. We have helped many students through stressful situations impacting their academic performance. You are not alone so do not be afraid to ask for assistance.

## Academic Resources

**E-learning technical support:** Contact the UF Computing Help Desk at 352-392-4357 or via e-mail at [helpdesk@ufl.edu](mailto:helpdesk@ufl.edu).

**Career Connections Center:** Reitz Union Suite 1300, 352-392-1601. Career assistance and counseling services [career.ufl.edu/](http://career.ufl.edu/).

**Library Support:** [cms.uflib.ufl.edu/](http://cms.uflib.ufl.edu/) ask various ways to receive assistance with respect to using the libraries or finding resources.

**Teaching Center:** Broward Hall 352-392-2010 or to make an appointment 352 392-6420. General study skills and tutoring. [teachingcenter.ufl.edu/](http://teachingcenter.ufl.edu/)

**Writing Studio:** 2215 Turlington Hall, 352-846-1138. Help brainstorming, formatting, and writing papers. [writing.ufl.edu/writing-studio/](http://writing.ufl.edu/writing-studio/)

**Student Complaints On-Campus:** [sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/](https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/)

**On-Line Students Complaints:** [distance.ufl.edu/student-complaint-process](https://distance.ufl.edu/student-complaint-process)

**Note regarding respect for diverse ideas:** At times your instructors may make provocative statements related to course content to spark discussion. This is not an endorsement of a position. We welcome and have respect for dissenting opinions. Moreover, we feel that hearing and sharing diverse ideas is an essential component of the active learning process. Please discuss with course faculty if you ever feel that your ideas are not being heard or respected.

