Syllabus for CLP 7934 / PSY 4930: Neuroimaging Applications and Analyses with Lab

Spring Semester 2021
Mondays 10:40 to 1:40 PM
Online / HPNP Building Room G-114

Instructor

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Office Hours: Thursdays 1-3 or schedule via email (preferred)

GENERAL OVERVIEW AND PURPOSE

This 3-credit-hour course will be an applied and practical introduction to common tools for structural and functional analyses of human brain MRI. The course consists of limited topical and practical lectures and in-class lab time to help students become more comfortable with command line interfaces, HiPerGator, and comfortable with commonly used MRI tools, including FreeSurfer, FSL, and SPM/CONN (for fMRI analyses).

COURSE OBJECTIVES

Successful completion of the course should allow students to 1) develop fundamental command line skills including basic scripting, 2) become acquainted with multiple software packages for structural and resting state MRI analysis, and 3) develop understanding of robust statistical analyses of MRI data.

COURSE WEBSITE: http://elearning.ufl.edu*;* https://github.com/neured/MRI_Guide/wiki

COURSE COMMUNICATIONS: All general questions should be posted to the discussion board on eLearning. Private questions should be sent via email or Canvas message.

COURSE REQUIREMENTS

HARDWARE

A laptop is required and must be brought to class. If you have a Mac, you are ready to attend class. If you have a Windows-based computer, please install MobaXterm (https://mobaxterm.mobatek.net/) or a similar command line environment (one option is using the Windows Subsystem for Linux: https://docs.microsoft.com/en-us/windows/wsl/install-win10).

We will utilize HiPerGator for all analyses. However, if you want to run processing locally, macOS (MacBook Pro, MacBook Air, or MacBook [in that order of preference]) or Linux are strongly recommended. It is preferable if you have at least 30 GB of free storage for installation of imaging applications. A laptop running Windows 10 will also work with an installation of the Windows subsystem for Linux (https://docs.microsoft.com/en-us/windows/wsl/install-win10) and/or an installation of VirtualBox and appropriate Linux virtual machine (e.g., http://neuro.debian.net). Help with installation is available online or possibly via PHHP IT. You can also contact

me for installation help but set-up for non-Apple machines should be done before the class starts. HiPerGator access will be provided for the semester.

COURSE OR TRAINING PREREQUISITES

Having rudimentary knowledge of the command line and Bash is helpful but not required. There are many great tutorials and videos online to get started. For example: https://ryanstutorials.net/linuxtutorial/*;* Beginner's Guide to the Bash Terminal

FOR GRADUATE STUDENTS, *CLP 7934 (Clinical and Cognitive Neuroscience Methods and Theory) is recommended but not required.*

Enrollment is limited to 20 students with preference given to graduate students. Undergraduate student enrollment will be capped at 10.

ADDITIONAL RESOURCES: FreeSurfer tutorials: http://surfer.nmr.mgh.harvard.edu/fswiki/FsTutorial/Sept2015CourseSchedule

FSL tutorials: http://fsl.fmrib.ox.ac.uk/fslcourse/

CONN documentation and tutorials: https://sites.google.com/view/conn/

SPM documentation and tutorials: http://www.fil.ion.ucl.ac.uk/spm/doc/; http://www.fil.ion.ucl.ac.uk/spm/course/video/

INSTRUCTIONAL METHODS: The course consists of limited lecture with hands-on synchronous and asynchronous lab time. Students are encouraged to collaborate and use all reasonable resources (the internet, software listservs, etc.) to complete their work.

COURSE MATERIALS

The syllabus and assigned readings are available on the course website. Readings will consist of articles or image processing guides selected by the course instructor. Make sure you have a working email address. If your email address changes or you miss the first day of class, it will be your responsibility to contact Dr. Tanner with your desired email address to receive notification about changes in course readings or topics. The content of the course includes assigned readings, lectures, and practicals. If available, lecture slides will be provided in advance.

COURSE POLICIES

Policy Related to Required Class Attendance: You are expected to attend lecture and lab. Attendance will not be taken or graded but you will be at a significant disadvantage if you do not attend lecture and lab. This class follows the UF policy for excused absences. For information regarding the UF Attendance Policy see the Registrar website for additional details: https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx

QUIZ AND EXAM POLICIES: *There will be no exams or quizzes for this course. All grades come from assignments.*

MAKE-UP POLICY: Assigned work might be made up under extenuating circumstances after discussion with the professor. *If you have difficulty meeting a deadline please consult with your instructor*. Technology failures

will not result in penalized work if the professor was contacted in a timely manner about such failures. Any requests for make-ups due to technical issues MUST be accompanied by the ticket number received from the Help Desk or other service when the problem was reported to them.

ASSIGNMENT POLICY: Assigned homework will be due as indicated in the course schedule below. While it might be possible to obtain a passing grade with one missing assignment, ***missing more than three assignments will automatically result in a failing grade for the class***. Additionally, completing all assignments does not guarantee a passing grade. Please talk with Dr. Tanner in advance of the end of the semester if you have any concerns about your assignments or grade. Readings are recommended but not required.

COURSE TECHNOLOGY: *Technical issues or questions can be addressed with me. Helpdesk or IT might also be able to help.*

- http://helpdesk.ufl.edu
- (352) 392-HELP - select option 2

GRADING POLICIES

METHODS BY WHICH STUDENTS WILL BE EVALUATED AND THEIR GRADE DETERMINED

The final grade will be determined according to the students' scores on the weekly assignments (70%) and a final project (30%). **Note, graduate students have an additional required mid-term assignment**. Graduate students' grades are based on weekly assignments (50%), the mid-term (20%), and a final project (30%).

Assignments are practical applications and repetitions of work completed in class. They are assigned during the first class period of a new topic and are due before the start of class the following week. For example, if class is held Monday, assignments will be given on Monday with the due date the following Monday. In some cases, the assignment will cover more than one week and thus be due more than one week after assignment.

GRADUATE STUDENTS ONLY

MID-TERM ASSIGNMENT

The additional assignment should be one of the following

- Create a comprehensive step-by-step tutorial with screenshots for one MRI software tool where you cover installation, processing, troubleshooting, and quality control. This should not be just a copy of what's available online, although online tutorials might serve as a guide and foundation. If it is a tool where there are clear and substantial online guides, your instructions need to be substantively different. Make the guide clear enough that someone with little or no processing experience could follow it.
- 3-page review paper on one of the following: 1) imaging modality (i.e., type of scan) with utility for research or clinical applications (this could also be targeted towards a clinical population), or 2) applications and utility of one neuroimaging tool (e.g., FreeSurfer) with a discussion of some of the major results found using the tool. If there are not many results yet (i.e., it is a new tool), you could offer a discussion of potential applications of the tool. A discussion of its validity should also be included.
- Write a working (and bug-free) bash, Python, or other language script using multiple neuroimaging tools (we do not cover Python or other scripting languages but if you know a language and can demonstrate the script that will count). This ideally should be a script you could or would use with data. If you have data or an idea to process publicly available data this will be most useful. The script should include comments

and white space as needed. The goal behind the length of the script is to automate or semi-automate the bulk or processing you might do for a project.

FINAL PROJECT

The final project ***must receive approval before starting***.

Perform a new analysis of existing MRI data (from your lab, a public dataset, or data Dr. Tanner has) written up in manuscript format (about 5 pages) including a brief introduction (1 page maximum – this could just be aims and hypotheses), methods, results, and a very brief discussion. You must include a script (or all the code) you used to perform your analyses (this allows for reproducibility and serves as part of your lab notebook).

UNDERGRADUATE STUDENTS ONLY

FINAL PROJECT

The final project **must receive approval before starting**.

CHOOSE ONE OF THE FOLLOWING

- Use publicly available, data provided by the instructor, or a mentor's data to perform an analysis using one of the tools covered in class. This assignment should be written up as a methods and results section of an original research article.
- 5-page review paper on one of the following: 1) imaging modality (i.e., type of scan) with utility for research or clinical applications (this could also be targeted towards a clinical population), or 2) applications and utility of one neuroimaging tool (e.g., FreeSurfer) with a discussion of some of the major results found using the tool. If there are not many results yet (i.e., it is a new tool), you could offer a discussion of potential applications of the tool. A discussion of its validity should also be included.
- A comprehensive step-by-step tutorial with screenshots for one MRI software tool where you cover installation, processing, troubleshooting, and quality control. This should not be just a copy of what's available online, although online tutorials might serve as a guide and foundation. If it is a tool where there are clear and substantial online guides, your instructions need to be substantively different. Make the guide clear enough that someone with zero processing experience could follow it.
- Write a working (and bug-free) bash, python, or other language script (including comments) using multiple neuroimaging tools. This ideally should be a script you could or would use with data. If you have data or an idea to process publicly available data this will be most useful. The script must be a minimum of 250 lines, including comments and white space as needed. The goal behind the length of the script is to automate or semi-automate the bulk or processing you might do for a project.

Point system used

Points earned	**93-100**	**90-92**	**87-89**	**83-86**	**80-82**	**77-79**	**73-76**	**70-72**	**67-69**	**63-66**	**60-62**	**Below 60**
Letter Grade	A	A-	B+	B	B-	C+	C	C-	D+	D	D-	E

Letter Grade	**A**	**A-**	**B+**	**B**	**B-**	**C+**	**C**	**C-**	**D+**	**D**	**D-**	**E**	**WF**	**I**	**NG**	**S-U**

Grade Points	4.0	3.67	3.33	3.0	2.67	2.33	2.0	1.67	1.33	1.0	0.67	0.0	0.0	0.0	0.0	0.0

More information on UF grading policy may be found at:
https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx

Late and Make-up Work: Late work will be penalized 5% per late day unless 1) arrangements are made with me **prior** to the due date, or 2) there is a **documented** emergency. Be prepared to provide documentation of any emergencies that may arise (e.g., a doctor's note if you are out sick, a police report if you have a car accident). This policy will be strictly enforced.

COURSE SCHEDULE

CRITICAL DATES: The midterm (graduate students) and final project topic (all students) are due ***March 1.*** The final paper/project is due ***April 27 at 10:00 PM***.

WEEKLY SCHEDULE OF TOPICS AND ASSIGNMENTS:

Week	Date	Topic	Assignment
1	Jan 11, 2020	MRI intro and common clinical and research sequences with a dash of neuroanatomy Intro to the command line	Write a 1-page summary (can be technical or for a lay audience) of a single type of neuroimaging modality. It does not have to be one covered in class.
2	Jan 25, 2020	Intro to the command line, basic scripting, and HiPerGator	Write working Bash/HiPerGator submission script including the use of a for loop. It should perform multiple steps using multiple command line tools.
3	Feb 1, 2020	FreeSurfer processing, and survey of FreeSurfer tools	Process a set of 3 brains using FreeSurfer
4	Feb 8, 2020	FreeSurfer quality control	Process, assess, and reprocess one problematic brain
5	Feb 15, 2020	FreeSurfer analyses – exporting and QDEC	QDEC and stats assignment
6	Feb 22, 2020	Survey of FSL structural tools (bet, flirt, fsleyes, fast, first, and more)	BET, FLIRT, FNIRT, FAST, and FIRST (fsl_anat) **Project topic and outline due!**
7	Mar 1, 2020	FSL tools continued	**Graduate students only: Mid-term assignment due!**
8	Mar 8, 2020	FSL continued and statistical analyses in FSL	FSL GLM and VBM assignment
9	Mar 15, 2020	Resting state functional connectivity in SPM/CONN	
10	Mar 22, 2020	rsfMRI continued	CONN assignment
11	Mar 29, 2020	rsfMRI continued	

12	Apr 5, 2020	Diffusion processing (DTIFIT, TBSS, Tracula)	Diffusion preprocessing assignment
13	Apr 12, 2020	Diffusion processing continued	Diffusion analysis assignment
14	Apr 19, 2020	Diffusion processing continued and course wrap-up	**Project due by April 28 at 10:00 PM.**

STUDENT EXPECTATIONS, ROLES, AND OPPORTUNITIES FOR INPUT

Expectations Regarding Course Behavior and Communication

All members of the class are expected to follow rules of common courtesy in all email messages, threaded discussions and chats. You are expected to interact respectfully and courteously with other students and the instructor. Course communication should be civilized and respectful to everyone. The means of communication provided to you through eLearning (e-mail, discussion posts, course questions, and chats) are at your full disposal to use in a respectful manner.

Abuse of this system and its tools through disruptive conduct, harassment, or overall disruption of course activity will not be tolerated. Conduct that is deemed to be in violation with University rules and regulations or the Code of Student Conduct will result in a report to the dean of students.

Refer to the Netiquette Guide for Online Courses for more information.

Our class sessions may be audio visually recorded for students in the class to refer back and for enrolled students who are unable to attend live. Students who participate with their camera engaged or utilize a profile image are agreeing to have their video or image recorded. If you are unwilling to consent to have your profile or video image recorded, be sure to keep your camera off and do not use a profile image. Likewise, students who un-mute during class and participate orally are agreeing to have their voices recorded. If you are not willing to consent to have your voice recorded during class, you will need to keep your mute button activated and communicate exclusively using the "chat" feature, which allows students to type questions and comments live. The chat will not be recorded or shared. As in all courses, unauthorized recording and unauthorized sharing of recorded materials is prohibited.

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. Link to full policy: http://facstaff.phhp.ufl.edu/services/resourceguide/getstarted.htm

SUPPORT SERVICES

Accommodations for Students with Disabilities

If you require classroom accommodation because of a disability, it is strongly recommended you register with the Dean of Students Office http://www.dso.ufl.edu within the first week of class or as soon as you believe you might be eligible for accommodations. The Dean of Students Office will provide documentation of accommodations to you, which you must then give to me as the instructor of the course to receive accommodations. Please do this as soon as possible after you receive the letter. Students with disabilities should follow this procedure as early as possible in the semester. The College is committed to providing reasonable accommodations to assist students in their coursework.

Students in UF Health Sciences programs should be mindful that unique course accommodations may not be applicable in a clinical, fieldwork or practicum setting. Thus, planning a semester in advance with the DRC Health Sciences Learning Specialist, Lisa Diekow ldiekow@ufsa.ufl.edu , is highly encouraged.

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. Online 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 Shands is a satellite clinic of the main Student Health Care Center located on Fletcher Drive on campus. Student Health at Shands 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/

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.

Inclusive Learning Environment

Public health and health professions are based on the belief in human dignity and on respect for the individual. As we share our personal beliefs inside or outside of the classroom, it is always with the understanding that we value and respect diversity of background, experience, and opinion, where every individual feels valued. We believe in, and promote, openness and tolerance of differences in ethnicity and culture, and we respect differing personal, spiritual, religious, and political values. We further believe that celebrating such diversity enriches the quality of the educational experiences we provide our students and enhances our own personal and professional relationships. We embrace The University of Florida's Non-Discrimination Policy, which reads, "The University shall actively promote equal opportunity policies and practices conforming to laws against discrimination. The University is committed to non-discrimination with respect to race, creed, color, religion, age, disability, sex, sexual orientation, gender identity and expression, marital status, national origin, political opinions or affiliations, genetic information and veteran status as protected under the Vietnam Era Veterans' Readjustment Assistance Act." If you have questions or concerns about your rights and responsibilities for inclusive learning environment, please see your instructor or refer to the Office of Multicultural & Diversity Affairs website: www.multicultural.ufl.edu

COVID-19

We will have remote and face-to-face instructional sessions to accomplish the student learning objectives of this course. In response to COVID-19, the following policies and requirements are in place to maintain your learning environment and to enhance the safety of our in-classroom interactions.

1. You are required to always wear approved face coverings during class and within buildings. Following and enforcing these policies and requirements are all our responsibility. Failure to do so will lead to a report to the Office of Student Conduct and Conflict Resolution.
2. This course has been assigned a physical classroom with enough capacity to maintain physical distancing (6 feet between individuals) requirements. Please utilize designated seats and maintain appropriate spacing between students. Please do not move desks or stations.
3. Sanitizing supplies are available in the classroom if you wish to wipe down your desks prior to sitting down and at the end of the class.
4. Follow your instructor's guidance on how to enter and exit the classroom. Practice physical distancing to the extent possible when entering and exiting the classroom.
5. If you are experiencing COVID-19 symptoms (Click here for guidance from the CDC on symptoms of coronavirus), please use the UF Health screening system and follow the instructions on whether you are able to attend class. Click here for UF Health guidance on what to do if you have been exposed to or are experiencing Covid-19 symptoms.
    - Course materials will be provided to you with an excused absence, and you will be given a reasonable amount of time to make up work. Find more information in the university attendance policies.

Disclaimer

This syllabus represents current plans and objectives. As we go through the semester, those plans may need to change to enhance the class learning opportunity. Such changes, communicated clearly, are not unusual and should be expected.

Last update: 01/06/2021