

University of Florida
College of Public Health & Health Professions Syllabus
PSY 4930 / CLP 7934: Neuroimaging Applications and Analyses with Lab (3 credits)
Spring Semester 2024
Delivery Format: On-Campus/Remote
Course Website: Canvas
Tuesdays 1:55 to 4:55 PM
Room: HPNP 1101

Instructor: Jared Tanner, Ph.D.

Position: Research Associate Professor

Department: Clinical and Health Psychology

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Office Hours: Thursdays 1-3 scheduled via

<https://outlook.office365.com/owa/calendar/TannerOfficeHours@uflorida.onmicrosoft.com/bookings/>

Prerequisites

Undergraduate students: Junior year or more advanced, or instructor approval. Enrollment is limited with preference given to graduate students.

Graduate students: CLP 7934 (Clinical and Cognitive Neuroscience Methods and Theory) is recommended but not required.

PURPOSE AND OUTCOME

Course Overview

This is 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 commonly used MRI tools, including FreeSurfer, FSL, and CONN (SPM; for fMRI analyses).

Relation to Program Outcomes

The course provides clinically and research relevant neuroimaging analysis experience.

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
3. Develop understanding of robust statistical analyses of MRI data.

Instructional Methods

The course consists of limited lecture with hands-on synchronous and asynchronous lab time. The lab portion is provided through a series of modules on Canvas. The course may be completed remotely and asynchronously if desired. In-class time will primarily be Blended Learning. Blended

Learning uses a mixture of technology and face-to-face instruction to help you maximize your learning. Foundational content that, as the instructor, I would traditionally present during a live class lecture is instead provided online before the live class takes place. This lets me focus my face-to-face teaching on course activities designed to help you strengthen higher order thinking skills such as critical thinking, problem solving, and collaboration.

In-person class time will be spent discussing research utilizing the neuroimaging methodology we cover and troubleshooting specific problems. Students may attend as needed to discuss issues. Students are *encouraged to collaborate* and *use all reasonable resources* (the internet, software listservs, etc.) to complete their work. Specifically, ChatGPT or similar tools can be highly helpful with scripting.

DESCRIPTION OF COURSE CONTENT

CRITICAL DATES: The midterm (graduate students) and final project topic (all students) are due **Feb 27**. The final paper/project is due **April 28 at 10:00 PM**.

Topical Outline/Course Schedule

Week	Date	Topic	Assignment
1	Jan 9	MRI intro and common clinical and research sequences with a dash of neuroanatomy	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 16	Intro to the command line, basic scripting, HiPerGator, and containers	Write working Bash/HiPerGator submission script including a for loop. It should perform multiple steps using multiple command line tools, including running a container with Apptainer.
3	Jan 23	BIDs, FreeSurfer processing, and survey of FreeSurfer tools	Organize two MRIs into BIDs format and process two T1 images using FreeSurfer
4	Jan 30	MRI and FreeSurfer quality control using FSQC and CAT12	Process and assess two brains for quality and create file for 3D printing
5	Feb 6	FreeSurfer analyses – Group Cortex GLM Assignment	GLM assignment
6	Feb 13	Survey of FSL structural tools (bet, flirt, fsleyes, fast, first, and more)	BET, FLIRT, FNIRT, FAST, and FIRST (fsl_anat)
7	Feb 20	FSL tools continued	All students: Project topic and outline due by Feb 27! Graduate students only: Mid-term assignment due by Feb 27!
8	Feb 27	Voxel based morphometry	CAT12 VBM assignment

9	Mar 5	Containers and iPython notebooks for Brain Age	Calculate the predicted age of an MRI using pymnet and USC
10	Mar 19	Resting state functional connectivity in SPM/CONN	CONN assignment
11	Mar 26	rsfMRI continued	
12	Apr 2	rsfMRI continued	Diffusion preprocessing assignment
13	Apr 9	Diffusion processing (MRTrix and FSL)	Diffusion analysis assignment using MRTrix
14	Apr 16	Diffusion processing continued (TBSS)	
15	Apr 23	Course wrap-up	Project due by April 28 at 10:00 PM

Course Materials and Technology

The syllabus and assigned readings are available on the course website (Canvas). Readings will consist of articles or image processing guides selected by the course instructor. Communication will be through Canvas. Please check Canvas regularly for updates.

The content of the course includes assigned readings, lectures, videos, and practicals. All material will be available in a series of Canvas Modules. Lecture videos will be posted in advance.

HARDWARE

A laptop is required and must be brought to class if you need any assistance with assignments. If you have a Mac, you are ready to attend class. We can do most of our work through a web browser but if you have a Windows-based computer, it might be helpful to 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. HiPerGator access will be provided for the semester.

SOFTWARE

All software is free and available on HiPerGator.

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](#)

ADDITIONAL RESOURCES:

Class-related GitHub: https://github.com/neured/MRI_Guide/wiki

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/>

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

- helpdesk@ufl.edu
- (352) 392-HELP - select option 2
- <https://helpdesk.ufl.edu/>

Additional Academic Resources

[Career Connections Center](#): Reitz Union Suite 1300, 352-392-1601. Career assistance and counseling services.

[Library Support](#): 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.

[Writing Studio](#): 2215 Turlington Hall, 352-846-1138. Help brainstorming, formatting, and writing papers.

Student Complaints On-Campus: [Visit the Student Honor Code and Student Conduct Code webpage for more information.](#)

On-Line Students Complaints: [View the Distance Learning Student Complaint Process.](#)

ACADEMIC REQUIREMENTS AND GRADING

Assignments and Grading

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 Tuesday, assignments will be given that day with the due date the following Tuesday. 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

Your final project **can be done independently or as a small group (no more than 3 students)**. If the opting for a group project, grading will be based on individual contributions to the project using confidential peer evaluations.

- 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 or a public or other dataset – your instructor cannot provide data) 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

Your final project **can be done independently or as a small group (no more than 4 students)**. **You can use all appropriate resources, but your instructor will not assist with this assignment.** If opting for a group project, grading will be based on individual contributions to the project using confidential peer evaluations.

- Use publicly available 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. If you choose this assignment, you must start early and provide your own data. Your instructor cannot provide any data.

- 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.

All students

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.

Please be aware that a C- is not an acceptable grade for graduate students. The GPA for graduate students must be 3.0 based on 5000 level courses and above to graduate. A grade of C counts toward a graduate degree only if based on credits in courses numbered 5000 or higher that have been earned with a B+ or higher. In addition, the Bachelor of Health Science and Bachelor of Public Health Programs do not use C- grades.

More information on UF grading policy may be found at:

<http://gradcatalog.ufl.edu/content.php?catoid=10&navoid=2020#grades>
<https://catalog.ufl.edu/UGRD/academic-regulations/attendance-policies/>

Policy Related to Required Class Attendance

Please note all faculty are bound by 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>

Excused absences must be consistent with university policies in the Graduate Catalog (<https://catalog.ufl.edu/graduate/regulations/#text>). Additional information can be found here:
<https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>

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.

Professionalism and COVID

As students pursuing a path in the health professions or public health, it is crucial to demonstrate professional behaviors that reflect integrity and commitment to the health of patients, fellow health professionals, and to populations we serve. To accomplish this, a strong responsibility for the well-being of others must be evident in our decisions, along with accountability for our actions. Professionalism in the health disciplines requires adherence to high standards of conduct that begin long before graduation. This is particularly true during times of health emergencies such as the COVID pandemic, given our professional habits can have a direct impact upon the health of persons entrusted to us.

If you are not vaccinated, get vaccinated. Vaccines are readily available at no cost and have been demonstrated to be safe and effective against the COVID-19 virus. Visit this link for details on where to get your shot, including options that do not require an appointment:

<https://coronavirus.ufhealth.org/vaccinations/vaccine-availability/>. Students who receive the first dose of the vaccine somewhere off-campus and/or outside of Gainesville can still receive their second dose on campus.

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. If you are withheld from campus by the Department of Health through Screen, Test & Protect you are not permitted to use any on campus facilities. Students attempting to attend campus activities when withheld from campus will be referred to the Dean of Students Office.

Continue to regularly visit coronavirus.UFHealth.org and coronavirus.ufl.edu for up-to-date information about COVID-19 and vaccination.

COVID-19 Symptoms

See <https://www.cdc.gov/coronavirus/2019-ncov/symptoms-testing/symptoms.html> for information about COVID-19 symptoms, which may include fever, cough, shortness of breath or difficulty breathing, fatigue, chills, muscle or body aches, headache, sore throat, congestion or runny nose, nausea or vomiting, diarrhea, and loss of taste or smell.

Recording Within the Course:

Students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are (1) for personal educational use, (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited. Specifically, students may not publish recorded lectures without the written consent of the instructor.

A “class lecture” is an educational presentation intended to inform or teach enrolled students about a particular subject, including any instructor-led discussions that form part of the presentation, and delivered by any instructor hired or appointed by the University, or by a guest instructor, as part of a University of Florida course. A class lecture does not include lab sessions, student presentations, clinical presentations such as patient history, academic exercises involving solely student participation, assessments (quizzes, tests, exams), field trips, private conversations between students in the class or between a student and the faculty or lecturer during a class session.

Publication without permission of the instructor is prohibited. To “publish” means to share, transmit, circulate, distribute, or provide access to a recording, regardless of format or medium, to another person (or persons), including but not limited to another student within the same class section. Additionally, a recording, or transcript of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third party note/tutoring services. A student who publishes a recording without written consent may be subject to a civil cause of action instituted by a person injured by the publication and/or discipline under UF Regulation 4.040 Student Honor Code and Student Conduct Code.

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.php.ufl.edu/services/resourceguide/getstarted.htm>

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.bluer.com/ufl/>. Summaries of course evaluation results are available to students at <https://gatorevals.aa.ufl.edu/public-results/>.

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.

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.
- **U 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>
- **University Police Department:** [Visit UF Police Department website](#) or call 352-392-1111 (or 9-1-1 for emergencies).
- **UF Health Shands 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 32608; [Visit the UF Health Emergency Room and Trauma Center website](#).

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

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: 1/5/2024