USCDornsife

Psychology 555: Introduction to Functional Magnetic Resonance Imaging

Units: 4
Term—Day—Time: Tues, Thurs 12-1:50

Location: BCI Conference Room

Instructor: Jonas Kaplan, Ph.D.
Office: 251 DNI
Office Hours: Weds 10-12 or by appointment
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Course Description

A general introduction to the physical bases of Magnetic Resonance Imaging (MRI), the physiological bases and principles of functional MRI, MRI related safety issues, design and analysis of fMRI experiments, and the operation of the Siemens 3T Prisma system with hands-on experience. The emphasis will be on practical issues related to using fMRI to answer psychological questions.

Learning Objectives

By the end of this course you should be able to:

- understand the basic physical and physiological principles that govern the generation of the fMRI signal
- understand how fMRI experimental design efficiency relates to the construction of optimal paradigms for investigating psychological functions
- understand why and how to apply basic preprocessing to neuroimaging data
- know how to apply the General Linear Model to analyze activation-based fMRI data using FSL and related tools
-have some familiarity with other techniques including functional connectivity analysis, independent components analysis, and multivoxel pattern analysis

Prerequisite(s): None
Co-Requisite (s): None
Concurrent Enrollment: None
Recommended Preparation: General familiarity with the command line

Course Notes

Lectures will focus on conceptual understanding and practical applications. The class will be include a hands-on component in which the class will collect and analyze data from a simple neuroimaging experiment.

Textbook

The textbook is “Functional Magnetic Resonance Imaging, Third Edition” by Scott Huettel, Allen W. Song, and Gregory McCarthy, published by Sinauer & Associates.

Description and Assessment of Assignments

The course consists of lecture and lab components. Students are required to pass safety training and participate in several group projects. There will be three mid- terms (no written final, but you must be present during the scheduled final exam time for project presentation). Class grades will be assigned according to the following weights: Homework & Lab: 30%; Midterms I, II, III 15% each; Group Project with written report, 25%.

Grading Breakdown

Your grade will be based upon the weekly assignments and the final project.

Assignment	Points	% of Grade
Homework & Lab	30	30
Midterm 1	15	15
Midterm 2	15	15
Midterm 3	15	15
Final Project	25	25
TOTAL	100	100
TOTAL		

Assignment Submission Policy

Assignments are due exactly when indicated by the syllabus and/or the instructor. Preferred method of submission is by email.

Course Schedule: A Weekly Breakdown

	Topics/Daily Activities	Readings and Homework	Deliverable/ Due Dates
Week 1 8/27 8/29	(T) Lectures 1,2; Introduction to the class and to fMRI (Th) MRI Safety, DNI policies, introduction to the control room	(T) Chapters 1 & 2	
Week 2 9/3 9/5	(T) Lecture 3; Basic principles of MRI signal and contrast (Th) Lecture 4; Hemodynamics, BOLD signal and its relation to neural activity	(T) Chapter 3, 4 (conceptual path) (Th) Chapters 6 & 7	
Week 3 9/10 9/12	(T) Lecture 5; **Lab 1: First acquisition** (Th) Lecture 6; Spatial and temporal properties of BOLD signal		
Week 4 9/17 9/19	(T) Lecture 7; preprocessing (Th) Lecture 8; Experimental design **(F) Midterm 1 (take home)**	(T) Chapter 7 (Th) Chapter 9	**Miderm 1 due Friday 9/20**
Week 5 9/24 9/26	(T) Lecture 7; fMRI data analysis 1, General linear model (Th) **Lab 2: BOLD Imaging (block and rapid event-related designs)**	(T) Chapter 10	
Week 6 10/1 10/3	(T) Lecture 8; Signal and noise of fMRI; functional data preprocessing (Th) Introduction to FSL, general workflow, file management, anatomical processing, segmentation	(T) Chapter 8	
Week 7 10/8 10/10	(T) Single-session GLM analysis; defining ROIs from results (Th) Single-session GLM analysis continued, ROI analysis	(Th) Chapter 10	
Week 8 10/15 10/17	(T) ROI analysis continued, multi-session fixed-effects GLM		

	(Th) Data analysis Lab, practice ROI analysis and multilevel fixed effects		
Week 9 10/22 10/24	(T) Data analysis cont'd, permutation testing and functional connectivity, PPI (Th) **Project proposal presentation**		
Week 10 Dates 10/29 10/31	(T) **GUEST LECTURE (TBA)** (Th) Lecture 10; Introduction to resting state analysis **(F) Midterm 2: Take home**		**Midterm 2 due Friday, 11/1**
Week 11 11/5 11/7	(T) Midterm review; Resting state fMRI Data analysis lab, seed based connectivity, task data (Th) Seed connectivity lab cont'd		
Week 12 11/12 11/14	(T) Resting state connectivity, ICA lab (Th) Reading and writing about fMRI - COBIDAS, how to make figures		
Week 13 11/19 11/21	(T) Finish reading fMRI papers, Nonparametric Stats, Intro to MVPA (Th) MVPA 2		
Week 14 11/26	(T) Surface mapping (Th) no class		
Week 15 12/3 12/5	(T) ?? Graph theory, networks, dynamical FC (Th) Advanced topics: Looking to the future		
FINAL 12/10	**Midterm 3, take-home;** **Final project presentation**		Date: For the date and time of the final for this class, consult the USC *Schedule of Classes* at www.usc.edu/soc.

Statement on Academic Conduct and Support Systems

Academic Conduct

Plagiarism – presenting someone else's ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in *SCampus* in Section 11, *Behavior Violating University Standards*https://scampus.usc.edu/1100-behavior-violating-university-standards-and-appropriate-sanctions/. Other forms of academic dishonesty are equally unacceptable. See additional information in *SCampus* and university policies on scientific misconduct, http://policy.usc.edu/scientific-misconduct/.

Discrimination, sexual assault, and harassment are not tolerated by the university. You are encouraged to report any incidents to the *Office of Equity and Diversity* http://equity.usc.edu/ or to the *Department of Public Safety* http://capsnet.usc.edu/department/department-public-safety/online-forms/contact-us. This is important for the safety whole USC community. Another member of the university community – such as a friend, classmate, advisor, or faculty member – can help initiate the report, or can initiate the report on behalf of another person. *The Center for Women and Men* http://www.usc.edu/student-affairs/cwm/ provides 24/7 confidential support, and the sexual assault resource center webpage sarc@usc.edu describes reporting options and other resources.

Support Systems

A number of USC's schools provide support for students who need help with scholarly writing. Check with your advisor or program staff to find out more. Students whose primary language is not English should check with the *American Language Institute* http://dornsife.usc.edu/ali, which sponsors courses and workshops specifically for international graduate students. *The Office of Disability Services and Programs* http://sait.usc.edu/academicsupport/centerprograms/dsp/home_index.htmlprovides certification for students with disabilities and helps arrange the relevant accommodations. If an officially declared emergency makes travel to campus infeasible, *USC Emergency Information http://emergency.usc.edu/*will provide safety and other updates, including ways in which instruction will be continued by means of blackboard, teleconferencing, and other technology.