UNIVERSITY OF ARKANSAS

J. William Fulbright College of Arts & Sciences
Department of Psychological Science

PSYC 6413: Neuroimaging Data Analysis
Fall 2020
Wednesdays 3:30-6:00pm
Old Main 0208

Instructor: Josiah Leong
Office: Memorial Hall 202F
Email: josiah@uark.edu
Phone: 650-515-5259

Advances in neuroimaging data acquisition and analysis allow researchers to see and measure living human brains. This course surveys the methods that researchers use to characterize the structure and function of the brain. The course includes a laboratory in neuroimaging data analysis with a final project. The course closes with discussion about the promise and the limitations of new technologies that can manipulate brain activity. Prior experience with computer programming is not required.

Laboratory: The course involves working with real magnetic resonance imaging (MRI) data. The instructor will provide the software to perform MRI data analyses (e.g., command line, git, MATLAB / Unix Shell / R). Students will learn the following concepts and skills: measurement reliability / validity / generalizability, data processing / analysis / visualization, computer programming, statistics.

Final project: The course includes a final project that will flow naturally from in-class work. Students will choose an MRI modality (gray-matter volumetrics / white-matter structural connectivity / functional activity) and analyze a real dataset. The project will include all of the computer code the student used to process the data, the raw data and data derivatives, and a brief report. The report should be written like a journal article. Introduce the scientific motivation for the project, describe the methods and results, and discuss the findings. Students will present their project in class.

Miscellaneous
Accommodations: https://cea.uark.edu/
Code: https://github.com/fullstackneuro/nrimg20
Communications: https://fullstackneuro.slack.com/
Data: https://fullstackneuro.io/pedagogy/nrimg20/ / google drive
Safety: https://report.uark.edu/

Grades do not matter and least in graduate school. The purpose of the course is to help you figure out how neuroimaging analyses might be useful for your research. If you attend class and submit a final project, then you will receive an A. Please reach out to me if you have any questions about the course.

As a core part of its mission, the University of Arkansas provides students with the opportunity to further their educational goals through programs of study and research in an environment that promotes freedom of inquiry and academic responsibility. Accomplishing this mission is only possible when intellectual honesty and individual integrity prevail.

Each University of Arkansas student is required to be familiar with and abide by the University's 'Academic Integrity Policy' at honesty.uark.edu/policy. Students with questions about how these policies apply to a particular course or assignment should immediately contact their instructor.

Schedule

Date	Topic	Reading
8/26	Introduction and setup	
9/2	Brain anatomy and chemistry	Huettel ch. 1-2
9/9	**Structure**: MR physics and data acquisition	Huettel ch. 3-5
9/16	Volumetric analysis (VBM / FreeSurfer)	Fischl, Ashburner
9/23	Diffusion MRI acquisition	Basser, Smith
9/30	Diffusion MRI analysis (TBSS / tractography)	Jones, Behrens
10/7	**Function**: electrical recordings	Huettel ch. 6, Hubel and Wiesel
10/14	Functional MRI acquisition (MR physics / BOLD)	Huettel ch. 7, Ogawa, Logothetis
10/21	Neuroimaging experimental design	Huettel ch. 8-9
10/28	Functional MRI analysis (AFNI / SPM / FSL)	Huettel ch. 10-11, Bandettini
11/4	Functional connectivity (resting-state / DCM)	Huettel ch. 12, Friston, Seeley
11/11	Work on project (Brainlife)	Poldrack, Nichols
11/18	Other methods (PET / SPECT / ASL / MRS)	Huettel ch. 13-14, Jagust
12/2	**Control**: Optogenetics / DREADDs / TMS / DBS	Deisseroth, Tyler
12/9	Student presentations	

Reading

The instructor will provide a PDF of the Functional Magnetic Resonance Imaging 2nd edition textbook by Scott Huettel. The Huettel readings are not required, but you should read them at your leisure to support your learning throughout the course. The instructor will additionally provide 1-3 papers every week. These papers are required reading and will be discussed in class. The purpose of the papers is to practice distilling information from technical writing, and then to critique whether the researchers' data and methods support their conclusions.