FALL 2020: "NEUROIMAGING METHODS AND THEORY: FROM IMAGE TO INFERENCE"
26:830:515 (NK-GRAD); 16:185:603 (NB-GRAD)

Instructors; S. Hanson and C. Hanson
Time: M 1-3:30
Place: FISHBOWL; SMITH HALL, Newark Campus and Remote.

COVID-19 SPECIAL ACCOMMODATIONS: We will be teaching this course as a hybrid. It will be completely synchronous for all meetings/lectures. As we get closer to November, we will try and meet in person but also with remote access available to lectures for those who still feel uncomfortable coming to in class meetings.

We are now at an unprecedented point in the field of neuroscience: We can watch the human brain in action as it sees, thinks, decides, reads, and remembers. Functional magnetic resonance imaging (fMRI) is the only method that enables us to monitor local neural activity in the normal human brain in a noninvasive fashion and over cognitively relevant time spans with excellent spatial resolution. The goals of this course are to help students become savvy and critical users of the current neuroimaging methods, to understand the strengths and weaknesses of the technique, and to design their own cutting-edge, theoretically motivated studies. Lectures and discussions will cover fMRI methods and experimental design. The course is primarily intended for students who will use neuroimaging (fMRI) techniques in their own thesis projects, and need to have a solid understanding of the physical and computational and mathematical principles behind these tools in order to acquire good data and analyze them appropriately. The basic statistical considerations for neuroimaging and new methods that use multivariate analysis (MPVA/PD) and Network/Connectivity analysis will be discussed. Students will be expected to do a project using the RUBIC facilities and develop a testable hypothesis using methods discussed in the course.

Date Week	**Topic**	**Reading**
1	Introduction to MRI: Theory and Practice	No Readings
2	MRI: basics and biophysics: we are all just water!	Poldrack Chapter 1, . McRobbie 9 (online)
3	Collecting Data/MR Parameters/Pulse sequences (Level I training/ Safety)	McRobbie: Chapter 3, Chapter 10 (online)
4	Work Flow/Image processing/Preprocessing	Poldrack Chapter 2, Chapter 3
5	Brain structures/Spatial Normalization/Atlases	Poldrack Chapter 4
6	Statistical analysis/BOLD Signal and Noise/FSL Lab outside Speaker; Specific TOPIC FOCUS	Poldrack Chapter 5, Chapter 6
7	Statistical Inferences on Images/FSL Lab Outside Speaker; Specific Topical Focus	Poldrack Chapter 7
8	MIDTERM First pass on Project ideas and modeling	Draft proposals
9	Modeling Brain Connectivity/IMAGES	Poldrack Chapter 8
10	MVPA/Predictive Decoding	Poldrack Chapter 9
11	Visualization and Localization of fMRI data Special Guest (Poldrak Skypes into class!)	Poldrack Chapter 10
12	Project Scanning	RUBIC—scheduled times per group
13	Project Scanning	RUBIC—schedule times per group.
14	Final Project presentations	Presentations

Handbook of Functional MRI Data Analysis, Russell A. Poldrack, Jeanette Mumford, Thomas Nichols, Cambridge, 2011.
MRI from Picture to Proton Edition 1 by Donald W. McRobbie, Elizabeth A. Moore, Martin J. Graves, Martin R. Prince, Cambridge, 2003.