"Neuroimaging Methods and Theory: from image to inference"
16:26:830: 512; Sem in Cog Sci IV
Instructors; S. Hanson and C. Hanson
Time: W 2:30-5pm
Place: Fishbowl, SMITH HALL Newark-Campus

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 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.   (These dates may change below; shown for topic only).

Date Week	Topic	Reading
09/04/13	Introduction to MRI: Theory and Practice	No Readings
09/11/13	MRI: basics and biophysics: we are all just water!	Poldrack Chapter 1, . McRobbie 9 (online)
09/18/13	Collecting Data/MR Parameters/Pulse sequences (Level I training/ Safety)	McRobbie: Chapter 3, Chapter 10 (online)
09/25/13	Work Flow/Image processing/Preprocessing	Poldrack Chapter 2, Chapter 3
10/02/13	Brain structures/Spatial Normalization/Atlases	Poldrack Chapter 4
10/09/13	Statistical analysis/BOLD Signal and Noise/FSL Lab outside Speaker; functional focus	Poldrack Chapter 5, Chapter 6
10/16/13	Statistical Inferences on Images/FSL Lab outside Speaker; functional focus	Poldrack Chapter 7
10/23/13	MIDTERM First pass on Project ideas and modeling	Draft proposals
10/30/13	Modeling Brain Connectivity/IMAGES	Poldrack Chapter 8
11/06/13	MVPA/Predictive Decoding	Poldrack Chapter 9
11/13/13	Visualization and Localization of fMRI data	Poldrack Chapter 10
11/20/13	Project Scanning	RUBIC—scheduled times per group
11/30/13	Project Scanning	RUBIC—schedule times per group.
12/04/13	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.