Lab Materials

Download data for pro-subject #1.

Download data for pro-subject #2.

Protocol files for the event-related runs (run1, run2 and run3). For the first pro-subject, please ignore the first event run in your analysis.

Here are the BrainVoyager instructions that we have been using in the lab.

Here is a lab handout.

Here is a getting started guide from BrainVoyager.

Please refer to these three published papers (Kanwisher et al., 1997; Epstein & Kanwisher, 1998; and Kourtzi & Kanwisher, 2000) on how to properly describe the fMRI methods and report the results.

Lecture Slides

Lecture 1: Introduction, overview of fMRI experiments, MRI physics (**slides**)

Lecture 2: MRI contrast, pulse sequence and BOLD response (**slides**)

Lecture 3: fMRI data preprocessing (**slides**)

Lecture 4: Experimental design and data analysis (**slides**)

Lecture 5: Data analysis and further development (**slides**)

Lecture 6: In-class experiment (**slides**)

Course Details

PowerPoint lecture slides will be posted online after the lecture.

Instructor: Professor Yaoda Xu, yaodaxu@fas.harvard.edu

Teaching fellow: Ruosi Wang, ruosiwang@fas.harvard.edu

Lecture (January to March): Monday 10:00 am-12:00 pm, William James Hall 765

Lecture office Hour: Monday 12:00 â€“ 1:00 pm, or by appointments, William James Hall 780

Lab (April only):

Section 1: Monday 10:00 am â€“ 12:00 pm, William James Hall 1303

Section 2: Monday 2:00 pm â€“ 4:00 pm, William James Hall 1303

Lab office hour: Monday 4:00 â€“ 6:00 pm, William James Hall 1303

Course Description

Functional magnetic resonance imaging (fMRI) has become one of the most widely used methods in cognitive neuroscience research. In this course, students will learn the basics of fMRI research and gain hands-on experience in conducting fMRI experiments. In the first half of the course, students will have an overview of the fMRI methods, including how fMRI works, basic designs of fMRI experiments, fMRI data collection, analysis and interpretation, and current applications of fMRI in cognitive neuroscience research. In the second half of the course, students will conduct fMRI experiments and analyze fMRI data using BrainVoyager fMRI analysis software.

Please note that this is not a course that covers current research using fMRI. Students interested in that topic are encouraged to take Psych 14: Cognitive Neuroscience (by Profs. Schacter and Alvarez). Also note that this is an upper level survey course and requires students to master some of the materials on their own. The course moves at a fast pace, covers a lot of materials, and requires some basic background knowledge of physics, math and statistics.

Supplementary Textbook: Huettel, Scott A., Song, Allen W., and McCarthy, Gregory (2014). Functional

Magnetic Resonance Imaging, 3rd ed., Sinauer Associates, Sunderland, MA.

One copy of the textbook are on reserve at Cabot Science Library.

Other materials: Research papers and BrainVoyager Guides (posted on the course web site).

You need to have a college, an fas, or an fas graduate school computer account in order to use the computers in the computer lab. Please double check that your account can log you into any on campus public computers. If you can't, please apply for an account at the help center located at the basement level of Science Center computer room.

Course Requirements

Your grade will be calculated as the sum of all points earned = 100

(A = 100-94, A- = 93-90, B+ = 89-87, B = 86-84, B- = 83-80, C+ = 79-77, C = 76-74, C- = 73-70, D+ = 69-67, D = 66-65, F = 64-0)

Class Participation (5%): Attendance and active participation in class.

Mid-term Exam (50%): There will be an in-class mid-term exam. You will be tested on the materials covered in the lectures and in your reading assignments.

- If you have a legitimate reason for missing the exam (e.g., illness) please contact the instructor to make alternative arrangements as soon as you know it. If you miss the exam without a legitimate excuse, a grade of zero will be given for the exam.

Final Paper (45%): You will be asked to write a final paper either reporting the in-class fMRI experiment or an fMRI research project that you are actively involved in at an fMRI research lab. Details of this requirement will be given later.

Optional Extra Credit Activity (extra 10%): You can give a short PowerPoint slide presentation on an fMRI-related topic that is not covered in the course. Details of this requirement will be given later.

Enrollment

Lecture and Lab: Limited to 18, for graduate and advanced undergraduate students who have no prior experience with fMRI research.

Lecture Only: Unlimited, for graduate and advanced undergraduate students who have some experience with fMRI research and who DO NOT need to take the lab part of the course. The final paper requirement will be a research report of an fMRI project that the student is actively involved in at an fMRI research lab.

Auditing the course: Unlimited, restricted to the lecture part of the course only; if there is space in the lab, auditors can take the lab as well.

Academic Honor

You are expected to submit your own, original work for the exam and the final paper. Any misconduct will be reported, as is required by the college. Please follow the appropriate guidelines posted by the college.

Accessibility

Any student needing academic adjustments or accommodations is required to present their letter from the Accessible Education Office (AEO) and speak with the professor by the end of the second week of the term. Failure to do so may result in the professorâ€™s inability to respond in a timely manner. All discussions will remain confidential, although AEO may be consulted to discuss appropriate implementation.

Course Outline

Week	Day	Topic	Reading
1	**Jan**	Introduction, overview of fMRI experiments, MRI	Chap. 1 to 4

	23	physics (WJH 765)	
2	**Jan 30**	MRI contrast, pulse sequence, and BOLD response (WJH 765)	Chap. 5 to 7
3	**Feb 6**	fMRI data preprocessing and experimental design (WJH 765)	Chap. 8 to 9
4	**Feb 13**	MRI safety class (will meet in WJH 1st floor lobby and head over to the imaging center â€“ please donâ€™t be late!)	
5	**Feb 20**	***No class â€“ Presidentâ€™s Day***	
6	**Feb 27**	fMRI data analysis (WJH 765)	Chap. 10
7	**Mar 6**	fMRI adaptation, decoding and other topics (WJH 765)	
8	**Mar 13**	***No class â€“ Spring break***	
9	**Mar 20**	Midterm exam (WJH 765)	
10	**Mar 27**	In-class experiment description, preparation and fMRI data collection (will meet in WJH 1st floor lobby and head over to the imaging center â€“ please donâ€™t be late!)	Optional: Chap. 11-14 Kanwisher et al. (1997)
11	**Apr 3**	Data analysis: Talairach transformation (NW B129)	BrainVoyager Guides
12	**Apr 10**	Data analysis: Preprocessing (NW B129)	BrainVoyager Guides
13	**Apr 17**	Data analysis: GLM and ROI-based analysis (NW B129)	BrainVoyager Guides

14 Apr 24 Student presentations (WJH 765)

Final requirement: Final lab report, due on Wednesday, May 3.