

**Cognitive Brain Imaging Lab**  
**85:429/729**  
**Spring 2016**

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Lab time and location: Wednesday, 9:00-9:50pm (see schedule below)  
Baker Hall 332P (computer lab)  
Code to access computer lab wing: **5406\***  
(NOTE: You cannot stay in the computer lab past midnight)

## **I. Introduction**

In this lab, you will work with brain activation data in ways that you only read or hear about. You will gain hands-on experience with cutting-edge methods of analyzing and visualizing brain data—the technical details of which you read about in textbooks—to perform such feats as predicting what a person is thinking about or feeling—headlines about which you see in the press, which trumpet sometimes triumph, sometimes peril, for society. In humbler words, the lab portion of the class serves as a hands-on complement to the seminar. The lab focuses on an influential and widely used imaging method in cognitive neuroscience, namely functional magnetic resonance imaging (fMRI). You will work with this exciting technology to see how it has, and continues to, shed light on important neuroscientific questions such as where and how knowledge is represented in the human brain.

## **II. Learning objectives**

Apart from the goals of the lab listed in the seminar syllabus, the following is a more specific list of what you should learn how to do by the end of the semester:

- Process raw fMRI data in preparation for statistical data analysis;
- Visualize brain activation to discover which brain regions are active, or inactive, in a given cognitive or behavioral task;
- Conduct “mind-reading” to infer what a person is thinking about based on distributed brain activation patterns;
- Predict the brain activation pattern associated with thinking about a specific concept (the inverse of “mind-reading”); and
- State and elaborate on how the above data analysis methods complement each other

Along the way, you will learn how to use professional research-grade fMRI data processing and analysis software. (NOTE: You do *\*not\** need to have prior experience with this or similar software.) You will also complete brief assignments, for which you will report the results of guided data analyses and your own explorations of the vastness of brain activation data.

### III. Graded assessment of your learning

Lab activities and material are worth 15% of your final class grade. There are three in-session quizzes, each of which will be administered at the start of a lab session. They take less than ten minutes to complete and are straightforward. Second, there are six out-of-session assignments, each of which requires you to submit a relatively brief and informal lab write-up. The following is the breakdown of your grade for the lab:

- Quizzes (3, equally weighted) (20%)
- Assignments (i.e. lab write-ups) (6, \*not\* equally weighted) (80%)

There are no other forms of lab-specific graded assessment. However, much of what you will learn during the lab sessions and doing the assignments is eligible for appearing on the mid-term and final exams of the seminar part of the class, and may be relevant to your seminar grades in class participation and submission of weekly discussion questions/comments.

### IV. Assignments (lab write-ups)

For the assignments, you will apply what you learned during lab sessions in greater depth. You will be able to access the computer lab for most the day and evening to complete the assignments (Note that you cannot stay in the computer lab past midnight). Each assignment involves some work at a computer and culminates in a relatively brief and informal lab write-up. Each lab write-up will have its own unique instructions and grading criteria, which I will provide to you when one is assigned.

The slides contain detailed instructions on how to use the software, so that you can refer to them when doing the assignments; they also reference other helpful resources. For other assistance with the assignment exercises or lab write-ups, or any other aspect of the lab, please feel free to contact me or stop by my office.

Lastly, lab activities and assignments are for the most part self-contained, meaning that you will \*not\* be continually building on past work. Every student will start each lab session with the same data. Also, I will have “emergency” data available if you need to recover original files at any point.

### V. Other assessment information

Typically, a lab write-up will be assigned at the end of a lab session. Each lab write-up needs to be turned in by the beginning of the lab session of the day that it is due, either in paper form or as an e-mail attachment to me (bauera@cmu.edu). **Late submission policy:** For a late submission, you will be eligible only for that submission’s original value minus 5% multiplied by the number of days late. For every day late after ten days, you will be eligible only for 50% of the original value (i.e. the decrements stop at 50%).

**Participation:** Participation in lab sessions will not be directly counted toward your grade. However, your grade could be affected by missing a lab session in the following ways: You are consequently unable or inadequately prepared to do the assignment of that lab session; you are consequently unprepared for a future quiz that covers material during the lab session that you missed; or you miss the quiz administered that day.

Missing a lab session is highly discouraged, as it can be difficult to make up, especially if you will need my help (we may have to schedule a meeting, and in a timely fashion, maneuvering around both your busy schedule and mine). If you must miss a lab session, please inform me (e-mail is fine) beforehand and access Blackboard to review the slides and look up the new assigned lab write-up, if there is one.

**Cooperation with other students:** You may help each other in using the software to do the assignments, but you must turn in lab write-ups that you yourself have written. Also, many of the assignments require you to choose among alternative ways of answering some questions, so variation across students in the answers to those questions is expected. See the seminar syllabus for other expectations about cheating, plagiarism, and personal accommodations (e.g. disability), or please ask me or Dr. Just.

## VI. Blackboard class website

All slides and any other materials for a given lab session will be posted on Blackboard at least one day before the day of that session.

## VII. Expectations

Finally, the following extra guidelines will allow for a comfortable and productive learning environment:

You can expect me:

- To start and end lab sessions on time
- To reply to e-mails within 24 hours during the week (weekends are trickier), and be available for office hours by appointment
- To fairly assess what you learned according to the learning objectives, while adhering to expectations about the amount of work consistent with how much the lab is worth in your final class grade
- To give back graded work in a timely manner

I can expect you:

- To come to lab sessions on time and be attentive and engaged
- To spend an adequate amount of time and effort on the assignments
- To keep up-to-date on the material, keep track of assignments, and make up any missed work
- (Unfortunately, no food or drinks are allowed in the computer lab)

## VIII. Schedule

The schedule might change during the semester (but your workload would never increase). If so, I will inform you and post an updated schedule on Blackboard in a timely fashion.

Session no.	Date (all Wednesday)	Topic/activity	Topic of quiz that day	Topic of lab write-up due that day
1	13-Jan	Lab overview		
2	20-Jan	Brain anatomy		
3	27-Jan	Data preprocessing	Brain anatomy (no. 1)	
4	3-Feb	Set up GLM model	Functional brain anatomy (no. 2)	
5	10-Feb	Single-subject SPM contrasts	Data preprocessing and GLM model (no. 3)	Brain anatomy (no. 1)
6	17-Feb	Within-subject MVPA		Single-subject SPM contrasts (no. 2)
7	24-Feb	SIBR tour and review for mid-term exam		Within-subject MVPA (no. 3)
No lab	2-Mar	No lab (mid-term exam)		
No lab	9-Mar	No lab (spring break)		
8	16-Mar	Group-level SPM contrasts		
9	23-Mar	Between-subjects MVPA		Group-level SPM contrasts (no. 4)
10	30-Mar	Voxel-wise modeling		Between-subjects MVPA (no. 5)
11	6-Apr	Functional connectivity analysis (no assignment)		
12	13-Apr	Review for final exam		Voxel-wise modeling (no. 6)
No lab	20-Apr	No lab		
No lab	27-Apr	No lab (final exam)		