NeuroImaging: Fall 2008

Psychology 607: Functional Magnetic Resonance Imaging

Instructor: Scott H. Frey, Director Lewis Center for Neuroimaging & Associate Professor of Psychology

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Office Hours: Wednesdays, 8:00 – 10:00AM.

Time and Location: Fridays, 9 – 11:50am in Straub 143

Objectives. This is an introductory course about functional brain imaging as undertaken with magnetic resonance imaging (fMRI). No prior knowledge of these techniques is assumed, however, it is expected that you have a basic understanding of statistics, and ideally some previous neuroscience background. At the end of the course you should have an understanding of the history of these methods, how and why they work, their strengths and limitations. You will be introduced to techniques for effective design, issues in data preprocessing, analysis and interpretation. Along the way you will learn some basic human neuroanatomy and physiology and nuclear magnetic resonance (nmr) physics. Because this is a very young and rapidly evolving approach, I will also endeavor to share with you some heuristics and practical insights gleaned through my own experiences with these techniques.

What you will not get here is hands-on experience using data analysis programs. With only 10 weekly meetings, there is simply not enough time to do it all, and gaining a critical understanding what you are doing and why is vastly more important (and more challenging). Should you choose to undertake research using these techniques, you will find the time here was well spent. For those seeking a hands-on accompaniment to this course, I have added pointers to information on accessing software tutorials (FSL and SPM) and sample data sets on your own.

Pre-requisites: Knowledge equivalent to that provided by the graduate-level statistics series offered in Psychology.

Readings. Two books are available at the UO Bookstore.

*Required***.** Weekly textbook readings will come from: *Functional Magnetic Resonance Imaging*, by Huettel, Song, and McCarthy (2004). Sunderland, MA: Sinnauer.

For those desiring a more technical treatment the following book is recommended: *Functional MRI: An Introduction to Methods*, Edited by P. Jezzard, P.M. Matthews and S.M. Smith, (2001). Oxford University Press.

Organization. During the first half of class, I will lecture on critical topics in functional MRI. Along with your reading assignments from HS&M, these lectures are designed to provide you with fundamental concepts and background. The second half of class will be devoted to additional mechanisms are intended to get you actively applying what you are learning.

Journal Club. In addition to text readings, on some meetings, we will read and discuss articles during the second part of class. These papers will focus on current issues and debates in fMRI research. Everyone will read all assigned papers before class and come prepared for a discussion. The class will be divided into groups. Each group will work together to prepare a short critique of their paper. A member of each group will then present the critique to the full class, followed by open discussion.

Flash Presentations. Each student will make one 5 min. formal presentation based on a maximum of two slides. The first slide will describe and critique a published research paper that used functional neuroimaging to test a hypothesis about human brain function. You are free to choose any paper you wish provided that it was published in a peer-reviewed journal. The second slide will describe a follow-up study of your own design. This must be original, and cannot be something that you are already doing. Pdf versions of the paper must be provided to me at least 1 week before class. These will then be posted for all to read. Each presentation will be followed by 5 mins. for questions from the class. Additional details on the organization of these presentations will be provided.

Grant Proposal. You will write a research proposal that uses fMRI to address a question that interests you. This proposal must be in the form of an NIH grant, but cannot exceed 8 single spaced pages, NIH type and margin restrictions apply. The grant will focus on clearly articulating an fMRI project. You must include all of the elements: specific aims, background & significance, preliminary data (if any), and research description. The research description section must include complete descriptions of the question, hypothesis (and alternatives) what pattern of results it predicts, detailed methods, potential difficulties & solutions, and future directions. Figures should be embedded in the text, and references do not count against your page limit. You are welcome and strongly encouraged to work through drafts of one another's grants. I am also happy to provide guidance during office hours. The final version is due on **Monday Dec. 8th by 5pm**, and should represent something that you think is of high enough quality to submit for NIH funding as, for instance, an NRSA pre-doc or post-doc.

Grades. Final grades will be based on class participation (20%), Flash presentations (20%), and the final grant proposal (60%).

Tentative Schedule

1. Introduction, History & Concepts	**Oct. 3**
2. Physiology and BOLD Imaging	**Oct. 10**
3. Real-time fMRI demo & Neuroanatomy	**Oct. 17**
4. Physics & Safety	**Oct. 24**
5. Experimental Designs I	**Oct. 31**
6. Experimental Designs II	**Nov. 7**
7. Image Pre-processing	**Nov. 14**
8. Data Analysis & Interpretation	**Nov. 21**
9. Thanksgiving Break	**Nov. 28**
10. Pulling it all together	**Reschedule for Dec. 1 -3**
Final Grant proposal due	**Mon. Dec. 8th @ 5PM.**