

SOMI-277A: Functional Magnetic Resonance Imaging: Methods and Analysis

(Schedule change – This year the course is in Winter quarter 2017 - Not Fall 2016)

Time and dates: Tuesday and Thursday 2:00-3:20pm, January 10 thru March 16, 2017
Location: Conference room, Center for functional MRI (building #822 on campus maps)
Course website: learnfmri.ucsd.edu
Organizer: David Dubowitz (dubowitz@ucsd.edu)
Other Faculty: Rick Buxton, Frank Haist, Tom Liu, Don Hagler

Overview: This course aims to provide an introduction to functional neuroimaging. Students will gain a grounding in the fundamental physical principles of magnetic resonance imaging, the underlying neurochemistry and energetics that make functional neuroimaging possible, and will learn how functional MRI can provide insights into neural physiology and cognitive function. The course will include hands-on tutorials with an introduction to using MRI scanners, so that students will understand how MRI and fMRI data are generated and can be assessed for quality. The latter half of the course introduces fMRI experimental design and analysis. This will include design and analysis assignments and several open discussion forums to provide practical experience in addition to the lecture format.

Organization: The course comprises teaching videos, reading and problem sets that students are expected to complete before each class. Classes are held twice per week, and consist of didactic lecture, discussion sessions and group problem solving. The class sessions provide a forum to explore many of the underlying concepts in more detail that build on the pre-class assignments. In addition, the course also includes two hands-on labs for acquisition and analysis of MRI & fMRI data, with an introduction to using MRI scanners. Pass/Fail grade is based on homework, attendance at lectures and labs, and participation in discussions.

Attending the course: There are no prerequisites for this course. We encourage students to register for the course, but in addition we welcome UCSD researchers and faculty who would like to attend as well.

Syllabus (subject to change):

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| 1 | Tu 1/10/17 | Dubowitz | Introduction & historical overview: Functional MRI & other imaging techniques |
| 2 | Th 1/12/17 | Dubowitz | Introduction to the MRI scanner and MRI Safety |
| 3 | Tu 1/17/17 | Buxton | Basic Physics of Nuclear Magnetic Resonance |
| 4 | Th 1/19/17 | Buxton | Basics of Magnetic Resonance Imaging |
| 5 | Tu 1/24/17 | Dubowitz | Image Contrast |
| 6 | Th 1/26/17 | Liu | Image acquisition: methods, artifacts and noise |
| 7 | Tu 1/31/17 | Dubowitz | Diffusion Imaging |
| 8 | Th 2/2/17 | Buxton / Dubowitz | Review of Magnetic Resonance Imaging |
| | 1/30–2/2 | Dubowitz | MRI Lab (I): MRI Data Acquisition. Introduction to prescanning, image contrast, diffusion, SNR, artifacts |
| 9 | Tu 2/7/17 | Buxton | Brain Energy Metabolism and Blood Flow |
| 10 | Th 2/9/17 | Buxton | Nature of the BOLD signal |
| 11 | Tu 2/14/17 | Haist | Essentials of fMRI Experimental Design & Data Collection |
| 12 | Th 2/16/17 | Haist | Analysis of Individual Data |
| | 2/13–2/16 | Dubowitz | MRI Lab (II): fMRI Data Acquisition. Set up and run EPI BOLD acquisition with physiological data & B0 field map |
| 13 | Tu 2/21/17 | Haist | Analysis of Group Data |
| 14 | Th 2/23/17 | Hagler | Advanced Analysis and Presentation of fMRI Results |
| 15 | Tu 2/28/17 | Haist | Functional Connectivity I |
| 16 | Th 3/2/17 | Haist | Functional Connectivity II |
| 17 | Tu 3/7/17 | Haist / Hagler | Review of fMRI Design and Analysis |
| 18 | Th 3/9/17 | Hagler | Advanced Analysis of Diffusion Data |
| 19 | Tu 3/14/17 | Buxton | Interpretation of the BOLD Signal |
| 20 | Th 3/16/17 | Haist | fMRI Applications Papers |