

PSYC 555
Introduction to Functional Magnetic Resonance Imaging
Fall, 2012

Class Number: 52711D

Instructors: Professor Bosco Tjan (SGM 1017, 213-821-2954, btjan@usc.edu)

Class Time: 10:00 – 11:50 pm, Mondays and Wednesdays (*lectures / labs may run overtime)

Office Hours: noon – 1:30 pm, Tuesdays

Location: DNI Conference Room

Required Textbook: *Functional Magnetic Resonance Imaging*, (2nd Ed.) by S. A. Huettel, A. W. Song, G. McCarthy, Sinauer Associates, Inc. Sunderland, MA, USA (2008). [Yes, you need this book!]

Course Description: A general introduction to the physical bases of Magnetic Resonance Imaging (MRI), the physiological bases and principles of functional MRI, MRI related safety issues, design and analysis of fMRI experiments, and the operation of the Siemens 3T Trio system with hands-on experience.

Course Requirements: The course consists of lecture and lab components. Students are required to pass safety training and participate in several group projects. There will be two mid-terms (no final). Class grades will be assigned according to the following weights: Homework & Lab: 30%; Midterms I and II, 20% each; Group Project with written report, 30%.

Tentative Schedule

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| 8/27 | (M) Lecture 1: Class logistics. Brain imaging, an introduction (Ch. 1,2) |
| | (W) Lecture 2: MRI safety, control room tour, typical workflow |
| 9/3 | (M) <i>Labor Day</i> |
| | (W) Lecture 3: Basic principles of MR signal generation (Ch. 3) |
| 9/10 | (M) Lecture 4: Hemodynamic activity, the BOLD signal and its relationship to neural activities (Chs. 6 & 7) |
| | (W) Lecture 5: Spatial and temporal properties of the BOLD signal (Ch. 7) |
| 9/17 | (M) Lecture 6: Experiment design (Ch. 9) |
| | (W)* Lab 1: BOLD Imaging (block and rapid-event-related designs) [lab may run overtime] |
| | (F)* Lab 1: (cont.) |
| 9/24 | (M)* DA 1: Introduction to fMRI data analysis packages (mostly FSL), general workflow, file management, anatomical image processing, segmentation, cortical and subcortical templates (Dr. Jonas Kaplan) |
| | (W) Lecture 7: fMRI data analysis (I): General Linear Model (Ch. 10) |
| 10/1 | (M) Lecture 8: Signal & noise of fMRI; functional data preprocessing (Ch. 8) |
| | (W)* DA 2: Single-session GLM analysis. First result. Coregistration. Defining ROIs from results (Dr. Jonas Kaplan) |

- 10/8 (M)* Lecture 9: fMRI data Analysis (II): Deconvolution and statistical efficiency of a design (Ch. 10)
(W) DA 3: ROI analysis, deconvolution, multi-session fixed-effect GLM
- 10/15 (M) No class
(W) **Midterm I (open book, 24 hr turnaround, work independently)**
- 10/22 (M) **Project proposal presentation**
(W) Lecture 10 / DA 4: Group-level random effect analysis
- 10/29 (M) Lecture 11 / DA 5: Surface-based data analysis
(W)* Lecture 12: Basic principles of MR image reconstruction (Ch. 4)
- 11/5 (M) Lecture 13: Contrast mechanisms pulse sequences (I) (Ch. 5)
(W) Lab 2: Measuring T1 and T2
- 11/12 (M) Lecture 14: Contrast mechanisms pulse sequences (II) (Ch. 5)
(W) Lecture 15: Useful tips on distortion, ghosting, susceptibility, BOLD sensitivity, and spatiotemporal resolution.
- 11/19 (M) Lab 3: Reducing spatial distortion, ghosting, susceptibility artifacts in EPI
(W) Thanksgiving, no class
- 11/26 (M) Lecture 16: Review of MR physics
(W) **Midterm II (in class, close book)**
- 12/3 (M)* Lecture 17 / DA 6: Advanced topics (I): Functional “connectivity” (Ch. 11)
(W) Lecture 18: Advanced topics (II): Multi-voxel pattern analysis (Ch. 11) (Dr. Jonas Kaplan)

Final project presentation: Dec 17, 8:00-10 am