PSYC 555
Introduction to Functional Magnetic Resonance Imaging
Fall, 2015

Class Number: 52711D
Instructors: Bosco Tjan (SGM 1017, 213-821-2954, btjan@usc.edu), Professor of Psychology, Co-Director of the USC Dornsife Cognitive Neuroscience Imaging (DNI) Center
Class Time: 10:00 – 11:50 am, Mondays and Wednesdays (certain lectures and labs, marked with an '*', may run overtime to 12:15 pm)
Office Hours: 12:30 – 1:30 pm, Tuesdays
Location: DNI Conference Room
TAs: We do not have any officially assigned TAs. There are two volunteers, whom you may consult: Mr. Jared Gilbert (on lab exercises and scanner operations; Jared is the MR Technical Assistant of DNI), and Dr. Nihong Chen (on experimental design and data analysis; Nihong is a postdoc in Bosco's lab)

Required Textbook: *Functional Magnetic Resonance Imaging,* (3nd Ed.) by S. A. Huettel, A. W. Song, G. McCarthy, Sinauer Associates, Inc. Sunderland, MA, USA (2014). [Yes, you need this book and this version!]

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 three mid-terms (no final, but you must be present during the scheduled final exam time for project presentation). Class grades will be assigned according to the following weights: Homework & Lab: 30%; Midterms I, II, III 15% each; Group Project with written report, 25%.

Grade Distribution: A: 90-100%; B: 80-89%; C: 70-79%; D: 60-69%; F: <60%

Tentative Schedule (*Lectures/labs that are likely to run overtime)

8/24 (M) Lectures 1,2: Class logistics. fMRI, an introduction. Safety (Ch. 1,2)
(W) Lab 1: Typical control-room workflow; first acquisition.
8/31 (M) Lecture 3: Basic principles of MR signal generation and contrast (Ch. 3)
(W) Lecture 4: Hemodynamic activity, the BOLD signal and its relationship to neural activities (Chs. 6 &7)
9/7 (M) *Labor Day*
(W) Lecture 4 (cont.)
(*9/11 Last date to add / drop without 'W' / change grade option*)
9/14 (M) Lecture 5: Spatial and temporal properties of the BOLD signal (Ch. 7)
(W) Lecture 6: Experiment design (Ch. 9)

(F) Midterm I (take home, 24 hr turn around, work independently, Lectures 1-6)

9/21 (M) Lecture 7: fMRI data analysis (I): General Linear Model (Ch. 10)
(W)* Lab 2: BOLD Imaging (block and rapid-event-related designs) [lab may run overtime]
(F)* Lab 2: (cont.)

9/28 (M) Lecture 8: Signal & noise of fMRI; functional data preprocessing (Ch. 8)
(W) DA 1: Introduction to fMRI data analysis packages (mostly FSL), general workflow, file management, anatomical image processing, segmentation, cortical and subcortical templates

10/5 (M)* DA 2: Single-session GLM analysis. First result; DA 3: Defining ROIs from results
(W)* Lecture 9: fMRI data Analysis (II): Deconvolution and statistical efficiency of a design (Ch. 10)
(F) Project proposal presentation

10/12 (M) DA 4,5 I: ROI analysis, deconvolution, multi-session fixed-effect GLM
(W) DA 4,5 II: ROI analysis, deconvolution, multi-session fixed-effect GLM

10/19 SfN (no class, work on your project if you are not at SfN)
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10/26 (M) (M) Lecture 10 / DA 6: Group-level mixed effect analysis
(W) (W) Lecture 11: Reviews of basics of fMRI and data analysis
(F) Midterm II (take home, 24 hr turn around, work independently, Lectures 7-11)

11/2 (M) Lecture 12: Basic principles of MR image acquisition/reconstruction (Ch. 4)
(W)* Lecture 13: Basic principles of MR image acquisition/reconstruction (Ch. 4)

11/9 (M) Lecture 14: Contrast mechanisms pulse sequences (I) (Ch. 5)
(W) Lecture 15: Contrast mechanisms pulse sequences (II) (Ch. 5)

(*11/13 Last date to drop a class 'W'*)

11/16 (M) Lecture 16: Useful tips on distortion, ghosting, susceptibility, BOLD sensitivity, and spatiotemporal resolution. (Ch. 8)
(W) Lab 3: Reducing spatial distortion, ghosting, susceptibility artifacts in EPI

11/23 (M) Lecture 17: Review of MR physics
(W) *Thanksgiving*

11/30 (M)* Lecture 18 / DA 6: Advanced topics (I): Functional "connectivity" (Ch. 11)
(W) Lecture 19: Advanced topics (II): Multi-voxel pattern analysis (Ch. 11)
(F) Midterm III (take home, 24 hr turn around, work independently, Lectures 12-17)

Final project presentation: Dec 14, 8:00 am - 10:00 am. (This is the scheduled time for final exam. You must be present to receive credit for the final project.)