

PSYCH 741: Advanced Topics in PNB

Functional MRI

In this course, we will read and discuss Huettel et al.'s textbook *Functional Magnetic Resonance Imaging* 2nd Edition (2009) in order to learn the basics of this methodology. The course will cover one chapter per week.

The course will be hands-off: there will be no data processing. The class will focus on theoretical aspects of MRI methodology and experimental design.

- (1) Jan 11 Chapter 1: An introduction to fMRI
- (2) Jan 18 Chapter 2: MRI scanners
- (3) Jan 25 Chapter 3: Signal generation
- (4) Feb 1 Chapter 4: Image formation
- (5) Feb 8 Chapter 5: Contrast mechanisms and pulse sequences
- (6) Feb 15 Chapter 6: Hemodynamic activity

READING WEEK: NO CLASS FEB 22

- (7) Feb 29 Chapter 7: BOLD fMRI

NO CLASS MARCH 7

- (8) March 14 Chapter 8: Preprocessing
- (9) March 21 Chapter 9: Experimental design
- (10) March 28 Chapter 10: Statistical analysis

NO CLASS APRIL 4

- (11) April 11 Student presentations
- (12) April 18 Student presentations

Textbook

Huetell, S. A., Song, A. W. and McCarthy, G. (2009). *Functional Magnetic Resonance Imaging*, 2nd Edition. Sunderland, MA: Sinauer.

Term paper

Students will be asked to write a 10-15 page (double-spaced) term paper on an advanced fMRI method (see a listing of potential topics on the next page). This will be due one week after the last day of class (April 25). The reference section should be as comprehensive as possible.

Presentation

During weeks 11 and 12, students will give a 30-minute Powerpoint presentation on the topic of their term paper.

Answers to Study Questions

Textbook website: www.sinauer.com/fmri2e/html/index.html

The textbook website contains a list of 15-20 questions for each chapter. Each student will be responsible for leading a discussion of these questions for one chapter. In addition, they will provide a printed copy of the answers that will be distributed by email to the class.

Assessment

Participation/preparedness in class	50%
Term paper + reading list	20%
Presentation	20%
Answer to Study Questions	10%

Potential topics for term paper on advanced imaging methods

Several of the advanced methods are discussed in Chapters 11, 12 and 13

Data-driven analyses: ICA, PCA, etc.

Diffusion tensor imaging

Functional connectivity analysis: Grainger causality modeling; dynamic causal modeling; structural equation modeling; psychophysiological interaction; etc.

Voxel based morphometry

Multivoxel pattern analysis

Imaging genomics

Fast event-related fMRI

Image-guided TMS

Sparse sampling and other techniques to reduce noise during scanning

Hyperscanning

Intersubject correlations (ISC)

Correlations of behaviour to brain activity

Region-of-interest analysis

Real-time fMRI

MEG + fMRI

EEG + fMRI

Many other possibilities