PSY 5065 – Functional imaging: Hands-on Training
Spring Semester, 2019

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Course Description

Course goals. By the end of the semester, students will:

- be comfortable with the hardware and software in the MR environment; be able to ensure safe operation and selection of the right equipment for a given experiment.
- be acquainted with the fundamental physical principles behind magnetic resonance imaging
- understand the possible types of image contrast and their uses in neuroscience
- be adept at modifying pulse sequence parameters to balance the inevitable trade-offs between signal-to-noise ratio, resolution and acquisition time.
- know how to modify an experimental protocol to minimize the impact of distortion and signal loss due to magnetic field inhomogeneities.

Logistics. The class will meet Fridays from 1:25-4:25 pm. 9 out of 15 meetings will be in 530B Bruininks Hall. Format for this portion is lecture, group discussion, and computer work (computational simulations). 6 out of 15 meetings will happen at the CMRR on Fridays, during the regularly scheduled class times. During this time, students will work in groups to collect data assigned by the instructor (first half of the semester) or conduct experiments that they design (second half of the semester). Exactly when each student arrives at the CMRR to acquire data with their group will be determined during the class time in Bruininks Hall.

Assignments and supplementary materials will be posted on the course website. Current website is TBD (voted on during first class meeting period), but the past course website is at: http://vision.psych.umn.edu/~caolman/courses/PSY5065.

Grading and Attendance policies

The course is offered for three credits, graded on an A-F basis (A: 93 – 100, A-: 90 – 92, B+: 88 – 89 …, C-: 70 – 72; students taking the course pass/fail will receive an S (satisfactory) for grades higher than D+.)

- Attendance and participation (including submission of weekly assigned exercises) will constitute 70% of the grade.
    - 30% of the course grade will be based on weekly assignments, which will be given full credit if completed and turned in on time. Arrangements for submitting late assignments must be made before the due date to receive partial credit.

- 40% of the course grade will be based on assignments that are completed during course meeting time. For excused (pre-arranged or sick) absences, students will be given the chance to make up these assignments outside of classtime.

- A mid-term (take-home) exam will constitute 15% of the grade. Students are allowed to work in groups but must submit proof that they did their own work.
- A final (take-home) exam will constitute 15% of the grade. Students are allowed to work in groups but must submit proof that they did their own work.

Background readings

Background readings will be selected from either current journal articles or the following texts, and made available a week before the relevant lecture. Readings will be drawn primarily from the following texts:

- Introduction to Functional Magnetic Resonance Imaging: Principles and Techniques by Richard B. Buxton (Cambridge University Press, Cambridge, UK, 2002)
- Functional Magnetic Resonance Imaging, by Scott A. Huettel, Allen W. Song, Gregory McCarthy (Sinauer Associates, Inc., Sunderland MA, 2004).

A good primary reference for understanding the physics of imaging is:

- Magnetic Resonance Imaging: Physical Principles and Sequence Design, by E. Mark Haacke, Robert W. Brown, Michael R. Thompson, and Ramesh Venkatesan (John Wiley & Sons, Inc., New York, NY 1999).

Weekly assignments

Short problem sets will be handed out each Friday during class and due the following Wednesday at 5 a.m. (i.e., so the instructor can grade them on Wednesday). They are designed to provide concrete instantiations of the material covered in the lecture and lab and will vary in format: short-answer, multiple choice, matching, calculation and/or data simulation/analysis.

Mid-term and Final exams

Both the mid-term and the final exam will be open book, short answer and require only pen and paper to complete. Format will vary, but will include matching images to pulse sequence diagrams, describing the origins of depicted artifacts, and providing brief definitions of technical terms.