PHYS8900 MRI Basics and Applications

Friday, 3rd period 10:10-11:00am, Physics 221, Spring 2007

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Office hours: Wed., 4:00-5:00pm or by appointment

Course Objective: To provide students with basic knowledge to understand and apply modern methods of MR imaging to solve research problems.

Course Goals: Lectures will provide a detailed treatment of current magnetic resonance imaging methods for living systems with a focus on human neuro-imaging. Also current parallel imaging methods for improving imaging speed and reducing artifact will be treated. In addition, a lab will be taught so students will have practical experiences in understanding of the whole MR system, operation of the imaging instrumentation, preliminary data acquisition and data analysis.

Textbook:
Magnetic resonance imaging: Physical Principles and Sequence Design, by E.M. Haacke, R.W. Brown, M.R. Thompson, and R. Venkatesan, John Wiley & Sons, Inc. 1999

Reference book:
Functional Magnetic Resonance Imaging, by S.A. Huettel, A.W.Song and G. McCarthy, Sinauer Associates, Inc. 2003

Topic of Lectures

1. Introduction to MRI: Concepts of magnetic resonance
2. MRI system and Instrumentation
3. Relaxation and Contrast
4. Signal Generation & Detection
5. One-dimensional imaging: RF pulses and echoes
6. Imaging in multiple dimensions
7. Image field-of-view, resolution, and SNR

8. Rapid imaging
9. Parallel Imaging & applications
10. functional MRI
11. fMRI application
12. Diffusion Imaging

Laboratory
(3-hour labs; once a week for 5 weeks, starting from 9th week)

1. MR lab safety, instrumentation & system
2. Data acquisition I: T1/T2/proton weighted images, key pulse sequences
3. Data analysis: k-space, Fourier transform
4. Data acquisition II: parallel imaging, fMRI
5. fMRI data processing

Student Presentation
Students will be assigned readings (published papers on MRI) and give presentations (in a group) during the course.

Class attendance:
Class attendance is not required, but without regular attendance, the student will miss a great deal of important discussion and interaction.

Grading: Class grades will be based on results from graded homework /presentation (30%), laboratory (30%), and a final exam/term paper (40%).

A if **AS >= 87**
A- **if 87>AS>=85**
B+ if **85 > AS >= 83**
B if **83 > AS >= 77**
B- if **77 > AS >= 75**
C+ if **75 > AS >=73**
C if **73 > AS >=67**
C- if **67 > AS >= 65**
D if **65 > AS >= 50**
F if **50 > AS**