MRI Class Projects (20%)

The class project is your opportunity to take your understanding of MRI to the next level. You should learn, implement, and simulate and/or test an imaging or reconstruction method. I must approve your topic and goals in advance. In ambitious circumstances you may work in a group.

Due Dates:

Approved topics: April 2nd ☞ title and scope of work

Progress report: April 13th ☞ one page summary including preliminary results

Presentations: April 27th and/or April 30th ☞ 12 minute oral (class + guests)

Suggested Approach:

Read about hot topics in MRI (http://www.ismrm.org/12/12program.htm). Check out the published literature. Discuss ideas with your classmates and people actively using MRI or doing MRI-related research. Ask me for references if you need them. I will likely give you a combination of review papers and research articles.

Consider implementing or simulating a published method, and evaluate its performance. Brainstorm (with your fellow classmates or with me) possible improvements and implement them. See if they work. The point of this project is to have new ideas, evaluate their strengths and weaknesses, and provide a demonstration.

Topics:

The best topic comes from you! Sample projects from previous semesters can be found at: http://ee-classes.usc.edu/ee591/projects/. Here are some questions to get you thinking:

- "Gradient Linearity" -- Gradients are not perfectly linear. Can you develop a general toolbox for correcting image distortion caused by gradient non-linearities (assuming they are known). How would you measure the gradient non-linearities?
- "Motion, Data Consistency" -- The body often moves during an MRI scan, even if the subjects is cooperative. What is the most accurate way to reconstruct continuously acquired data from smoothly moving objects?
- "MRI Scanner Market" -- What types of MRI scanners are commercially available? What are the key hardware differences? Explain differences in market penetration, and utilization. Simulate differences in image quality based on published specifications.
- "Compressed Sensing and Parallel Imaging" -- How can imaging be accelerated using receiver coil arrays and/or using assumptions about compressibility of resulting images? Compare these techniques and evaluate image quality.
- "Motion Compensated Averaging" -- Sometimes we would like to collect multiple averages to improve SNR, but there may be motion between repetitions. Can this motion be compensated? What is the impact on SNR?
- "Robust Excitation" -- Is it possible to excite tissue in the presence of system imperfections such as B0 and B1 inhomogeneity? Design such pulses and illustrates their strengths and weaknesses.