M229: Advanced Topics in Magnetic Resonance Imaging
Spring 2018: 4 Units
Room: 300 Medical Plaza, B500
Lectures: Tue/Thu 10:00 AM – 11:50 AM
https://sites.google.com/site/bmp229ucla/

Instructors: Holden Wu, PhD (holdenwu@mednet.ucla.edu)
Kyung Sung, PhD (ksung@mednet.ucla.edu)

Office: 300 UCLA Medical Plaza, B119

Course Description: This course will explore recent MRI developments that 1) have had high impact on the field, 2) involve novel pulse sequence design or image reconstruction, and/or 3) enable imaging of anatomy or function in a way that surpasses what is currently possible with any other modality. Simulations and programming exercises in Matlab will provide hands-on experience for students. Students will propose and carry out a final project along current directions of advanced MRI research.

Prerequisites: This course is a follow-up to M219 (Principles and Applications of MRI) and is meant for students interested in pursuing research related to the development or translation of new MRI techniques.

Course Schedule:

#1. April 3 Introduction – Advanced MRI Techniques and Applications
#2. April 5 RF Pulse Design – Adiabatic Pulses
#3. April 10 RF Pulse Design – Excitation k-space I
#4. April 12 RF Pulse Design – Excitation k-space II / Matlab Demo
[Homework 1]
#5. April 17 Pulse Sequences – SSFP / GRE / SPGR
#6. April 19 Pulse Sequences – RARE & Bloch Simulation (Matlab demo)
#7. April 24 Pulse Sequences – Extended Phase Graphs and Simulation
#8. April 26 Project Discussion
[Homework 2]
#9. May 1 Fast Imaging – EPI, PROPELLER
#10. May 3 Fast Imaging – Non-Cartesian Sampling I
#11. May 8 Fast Imaging – Non-Cartesian Sampling II
#12. May 10 Water-Fat Imaging
#13. May 15 MR Temperature Mapping
#14. May 17 Image Reconstruction – Partial k-space
#15. May 22 Image Reconstruction – Parallel Imaging I
#16. May 24 Image Reconstruction – Parallel Imaging II / k-t Reconstruction
#17. May 29 Image Reconstruction – Compressed Sensing
#18. May 31 Advanced Application Topic – Guest Lecturer: TBD
#19. June 5 Advanced Application Topic – Guest Lecturer: TBD
[Final Project Presentation, either 6/7 or 6/8]
Course Assignments:

- Reading book chapters and research papers
- Programming assignments x2 (Matlab)
- Final project presentation (1 page abstract and 10+10 min oral presentation)

Grading Structure:

- Participation (10%), Homework (30%), Final Project (60%), Extra Points.

Reading List:

- Research papers as assigned