M229: Advanced Topics in Magnetic Resonance Imaging
Spring 2020: 4 Units
Room: 300 Medical Plaza, B500
Lectures: Tue/Thu 10:00 AM – 11:50 AM
https://mrrl.ucla.edu/pages/m229

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.	Mar 31, Tue	**Introduction** – Advanced MRI Techniques and Applications
#2.	April 2, Thu	**Pulse Sequences** – Rapid GRE
#3.	April 7, Tue	**Pulse Sequences** – RARE / Bloch Simulation MATLAB demo
#4.	April 9, Thu	**Pulse Sequences** – Extended Phase Graphs (EPG) / MATLAB demo
#5.	April 14, Tue	**RF Pulse Design** – Adiabatic Pulses
#6.	April 16, Thu	**RF Pulse Design** – Multi-dimensional Excitation k-space / MATLAB Demo
	[ISMRM 4/18 – 4/23]	
#7.	April 21, Tue	**TBD**
#8.	April 23, Thu	**TBD**
#9.	April 28, Tue	**Project Discussion**
#10.	April 30, Thu	**Fast Imaging** – EPI, PROPELLER
#11.	May 5, Tue	**Fast Imaging** – Non-Cartesian Sampling I
#12.	May 7, Thu	**Fast Imaging** – Non-Cartesian Sampling II
#13.	May 12, Tue	**Managing Motion in MRI**
#14.	May 14, Thu	**MR Temperature Mapping - Dr. Le Zhang**
#15.	May 19, Thu	**Image Reconstruction –** Partial k-space
#16.	May 21, Tue	**Image Reconstruction –** Parallel Imaging I
#17.	May 26, Tue	**Image Reconstruction –** Parallel Imaging II / Coil Compression
#18.	May 28, Thu	**Compressed Sensing / Artificial Intelligence**
#19.	June 2, Tue	**Advanced Application Topic - TBD**
#20.	June 4, Thu	**Advanced Application Topic - TBD**
	[Final Project Presentation]	

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:

- Handbook of MRI Pulse Sequences. M. A. Bernstein, K. F. King, and X. J. Zhou. Elsevier Academic Press, 2004. ISBN-13: **978-0120928613**.
- Research papers as assigned