Project Discussion

M229 Advanced Topics in MRI

Kyung Sung, Ph.D.

Holden H. Wu, Ph.D.

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UCLA

Department of Radiological Sciences
David Geffen School of Medicine at UCLA

Homework #1 and #2

- HW #1 due this Fri 4/22 by 5 pm

- HW #2 due on Fri 5/6 by 5 pm

- Office Hours
  - Instructors: Fri 10-11 am

- Submit your answers (PDF) and Matlab code by email

Class Survey

- Pace
  A. too fast
  B. a bit fast
  C. just right
  D. a bit slow
  E. too slow

Class Survey

- Office hours
  A. helpful
  B. not helpful
  C. haven't gone yet

Class Survey

- Final project
  A. have a topic
  B. thinking about some topics
  C. need some more inspiration
  D. no clue

Course Topics

- Pulse Sequences

- RF Pulse Design

- Fast Imaging Trajectories

- Motion in MRI

- Parallel Imaging

- k-t Reconstruction

- Compressed Sensing

- Artificial Intelligence

- Invited Speakers

  - Imaging informatics

  - PET/MRI

Final Project

- ~6 weeks; start thinking now!
  - come to office hours

- Can be your own research
  - overlap with course topics

- Can be from list of ideas
  - can combine many ideas

- Components
  - Proposal (1 page), due 5/9 Mon
  - Abstract (1 page), due 6/3 Fri
  - Presentation, 6/7 Tue or 6/9 Thu
  - Q&A

Project Ideas

- Pulse sequences
  - bSSFP catalyzation
  - bSSFP banding artifact reduction
  - design of variable flip-angle TSE
  - simulation of diffusion-weighted SSFP
  - RF + seq simulator (Bloch, EPG)
  - MR fingerprinting
  - motion and flow encoding

Project Ideas

- RF pulse design
  - low SAR / wide bandwidth adiabatic pulse
  - velocity selective RF pulse
  - 2D excitation RF pulse
  - spectral-2D spatial pulse design (fat suppression + 2D excitation)
  - low SAR multi-band RF pulse

Project Ideas

- Fast imaging
  - trajectory design (EPI, PROP, spiral, etc.)
  - gradient waveform optimization
  - fast 3D re/gridding (or nuFFT) recon
  - gradient measurement / calibration
  - off-resonance correction

- Motion compensation
  - self navigation
  - model-based reconstruction

Project Ideas

- Image reconstruction
  - adaptive coil combine (preserve phase, etc.)
  - partial Fourier
  - GRAPPA vs SENSE

- Image analysis
  - image analysis for geometric distortion in DWI
  - B1+ mapping with improved spatial interpolation
  - Multi-modality image registration (MRI and H&E stained histological imaging)

Project Ideas

- Deep learning / machine learning
  - Texture analysis for prostate multi-parametric MRI
  - Prediction model for placenta insufficiency
  - Super-resolution MRI in TSE-T2 using deep learning
  - Deep learning based image segmentation
  - Prostate multi-parametric MRI synthesis
  - Anomaly detection via adversarial training using baseline MRI

Project Ideas

- Quantitative imaging
  - relaxometry (T_1, T_2, T_2^*)
  - diffusion
  - perfusion
  - fat/water
  - temperature
  - acquisition and signal modeling/fitting

Final Project

- Proposal due 5/9 Mon by email
  - Template on course webpage
- Ask about sample datasets
- Come to office hours!

Thanks!

Kyung Sung, Ph.D.

KSung@mednet.ucla.edu

http://mrrl.ucla.edu/sunglab

Holden H. Wu, Ph.D.

HoldenWu@mednet.ucla.edu

http://mrrl.ucla.edu/wulab