RAD 229: MRI Signals and Sequences

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web.stanford.edu/class/rad229
Course Goals

• Develop **Intuition**
• Understand MRI signals
• Exposure to numerous MRI sequences and naming:
  – “gradient-echo”
  – “spiral”
  – “T₂* BOLD”
  – many, many confusing acronyms
• Expand EE369B, Complement EE369C, EE469B
General Course Logistics

• Website: web.stanford.edu/class/rad229
• GitHub: https://github.com/mribri999/MRSignalsSeqs
  – Lectures, homeworks, and other code/data
• 3 Units, Letter or Cr/No Cr (EE300 Equivalent, ideally)
• Flipped Classroom + Zoom (2020)
• Monday & Wednesday 12:30pm-2:20pm (See Calendar)
• Quizzes for each lecture, weekly homework, midterm, project
• Texts (NOT required, but useful)
  – M. A. Bernstein
  – D. G. Nishimura
  – Z.P. Liang
Prerequisites / Grading

• Prerequisite: EE369B /equivalent
  – (complements EE369C / EE469B)
• Paper / Matlab assignments / no MRI scanner needed!
• Grading:
  – 10% Quizzes & Participation
  – 20% Midterm
  – 50% Homework
  – 20% Project
• Auditing:
  – Please participate, but allow for-credit students to do so first
Class Sessions

• **Flipped Classroom: Please come to learn!!**
  – Watch Pre-recorded Lectures, do Quizzes
    • Try to focus on interactive questions in lectures!
  – Class Q&A sessions on Lectures
  – Examples and Exercises

• Homework overview/problems

• Please minimize email, texting, etc. in class

• Zoom: Please keep video on!

• We try to stay on time - please help by joining early

• Join early, we will try to entertain with questions etc!
Recorded Lectures

- ~75 min lectures, in segments --
  - Recordings via YouTube (see class website)
- Notes on website (PDF) - please minimize printing!
- Try to keep numbered: Example - Lecture 3A-2
- Watch ~2 lectures per week (in segments)
- Quiz for each lecture
  - Out of 10, nominally due before class
  - “Open Notes” - encouraged to review material to learn!
  - Drop worst quiz
  - Make-up if you miss class
Homework & Project Options

• **Any Homework:** *Replace* a HW Question:
  – Spend <10min explaining how you’d do a question
  – Replace it with a problem and solution that you choose, related to recent lectures

• **Project:** *(details to follow)*
  – Approximately 1-2 Homeworks
  – Simulate and present a sequence / signals / recon
    • A sequence we didn’t cover or simulate
    • A novel sequence that you devise
Homework Submissions

• Due Wednesday 11:59pm, (minus 10% per day late)
• Ask if you need additional time
• No Paper Submission!
  – Take good photographs, scan or write online
  – Email w/ subject “RAD229: HW#” or similar, <10MB please!
• Purpose is to learn the material. Note honor code.
• Please do not share course problems or solutions without permission
Instructors

• Instructors: Daniel Ennis & Brian Hargreaves
• Office Hours - By appointment. Fridays are good
  – May offer Q&A Zoom session if demand?
• Grader: Alex Toews (may do some sessions)
Working Together - Rules

• Absolutely please work together!
• Follow Honor Code
  – Work on homeworks,
    • Discuss freely, work jointly, but write your own Matlab code
  – Use resources, but not solutions.
  – Considered HC violations:
    • No discussion of exams with others.
    • No use of prior solutions on assigned homeworks.

• In general your responsibility is to learn!
  – You should be able to explain anything you submit.
Participation!

• Attending Class sessions
  – Video on
  – Ask questions and make comments
  – Give feedback on class
• Anything else to make the course better!
Introductions (Course Students)

• Your name?
• Who do you work with?
• Your Research?
• Comments - What you came to learn?
Course Overview / Topics

• Review of Basic MRI (EE369B equivalent)
• Signal Calculation Tools, System Imperfections
• Pulse Sequences
• Advanced Acquisition Methods

• The RAD229 class will continue to evolve!
  – Things might change, and your input will shape the course!
  – You may know more than us about some topics - great!
Course Website and Calendar

- Website:
  - Logistics
  - Notes
  - All links!

- Calendar (google subscribable)
  - Class times, locations, topics
  - Homework due dates
  - Subscribe on your device!
The Typical Week…

Recorded Lectures → Quizzes → Class Sessions

- Lecture Segment QA
- Examples / Exercises
- Lecture Segment QA
- Examples / Exercises
- …
- Longer Exercise or HW Discussion

Mon | Wed | Fri | Mon | Wed | Fri | Mon | Wed | Fri

HW Out → HW Due → HW Graded
Rad229 GitHub

- All code, data
- Lecture examples (.m and Matlab live)
- New additions…

- Clone (best)
- Download ZIP (no ID needed)
- Push/Pull
Zoom

• Zoom link sent to class email list:
  • Save it and please do not post!
• Video on wherever possible please!
• Name label (defaults to something reasonable)
• Use chat, but beware lecturer may not see right away
• Mute audio as appropriate
• Be interactive! Energize!
• Learn the options in zoom - many useful, especially 2 screens
Summary - Logistics

• **Website:** [web.stanford.edu/class/rad229](web.stanford.edu/class/rad229)
  – Lecture Notes, Course Information, Instructors
  – Links: Calendar, Lectures, Box (Homework), Canvas (Quizzes),
  – GitHub:
    • Matlab functions, lecture examples, data

• **Flipped Classroom + Zoom (2020)**

• **Grading:** 50% HW, 20% project, 20% midterm, 10% participation

• Zoom - let’s make it work!!