BME Advanced Imaging [399-650B]

Rationale: Approximately 30–50 graduate students work within the medical imaging community at McGill. The current Physics of Medical Imaging course (563–607 B) provides the basis for the understanding of modern medical imaging technologies but does not cover advanced techniques that are used in most state-of-the-art medical imaging modalities, particularly for research. This course is designed to provide graduate students in the medical imaging discipline with a comprehensive treatment of most major imaging technologies at an advanced level.

Course Summary: Review of advanced techniques in medical imaging including: image processing techniques (classification, segmentation, rendering), fast magnetic resonance imaging (MRI), functional MRI, MR angiography and quantitative flow measurement, spiral and dynamic x-ray computed tomography, 2D/3D positron emission tomography (PET), basic PET physiology, surgical planning and guidance, functional and anatomical brain mapping, ultrasound imaging, and medical image processing.

The format of the course is the style of a *journal-club*. During each class, one student will be responsible for presenting a journal article. Class will consist of the student presentation and directed discussion of the journal topic, guided by Dr. Collins and invited experts from the field.

Credits: 3

Lectures: 3 hours per week, Mon-Wed 14:35-15:55

References:

- Handouts. Journal review papers: IEEE Transactions on Medical Imaging, Magnetic Resonance in Medicine, Journal of Magnetic Resonance Imaging, Journal of Computed Assisted Tomography, Medical Physics, Journal of Cerebral Blood Flow and Metabolism, etc.
- Texts:
    - The Physics of Medical Imaging, S. Webb, Institute of Physics Publishing
    - The Physics of Magnetic Resonance Imaging, Michael J. Bronskill and Perry Sprawls, American Association of Physicists in Medicine Medical Physics Monograph.

Grading: is in four parts, but subject to change depending on the number of students registered.

- Journal article summaries
  (40%): All students must prepare a one-page summary for each journal article presented.
- Journal article presentations
  (2 x 20%): Each student will present two journal articles during the semester.
- Class participation
  (20%). It is important to participate in class.

McGill University values academic integrity. All students must understand the meaning and consequences of cheating, plagiarism and other academic offences under the Code of Student Conduct and Disciplinary Procedures (see http://www.mcgill.ca/integrity/ for more information).

BME Advanced Imaging [399-650B] Journal Summaries

Goal: Each class, a journal paper is presented. At the beginning of class, a short 1 page (max) written summary of the journal is required using 12-point font. The summary should contain the following elements:

- BME Advanced Imaging [399-650B]: Journal Summary
- Student Name, ID number
- Article Title, Author list, Journal name
- Maximum one page summary of article (not just a paraphrase of the abstract). The summary should contain something about the research question, problem statement, proposed methods and experiments, the results, and a short critique.

The last page of this document contains template with more details for the 1-page summaries.

When reading the paper, prepare 3-5 questions that will be used in class discussion.

Grading: The grade for the summary will be based on comprehension of the material, organization, clarity, and quality of the writing.

Deadline: The summaries must be received at the beginning of class before the journal club presentation. No summary will be accepted late.

BME Advanced Imaging [399-650B] Journal Presentation

Goal: Each week, a journal paper is presented. The student presenting the paper will talk about the paper, covering the following items:

- Article Title, Author list, Journal name.
- Summary. Start with a short summary of the article.
- Motivation. Why are these authors working on the particular problem?
- Problem Statement. What exactly are the authors working on? What is the scope of the project?
- Previous work. You'll have to look into the work done by other authors in the field to determine what is the state of the art, and how the current article relates to the state of the art.
- Describe the methods in detail. What is used and why? What were the other choices possible? Are there items that can be critiqued in the methods? Are there caveats to look out for?
- Describe the experiments. What is the goal of the experiments? What is the experimental design? Is it good/bad?
- Results and Discussion. Are the results good/bad? How are they interpreted? Do you agree?
- (you can also use the summary page guidelines to organize your presentation).

The goal is to discuss the paper amongst ourselves, so it is important to invite discussion throughout the presentation.

There may be an expert associated with many of the topics covered in the course. Each expert can act as a resource for preparation of the presentation (to suggest related material) and may be present during the class discussion.

Grading: The presentation will be based on clarity, organization and ability to solicit participation from the other members of the group.

BMDE 399-650B summary (date) **LASTNAME**, First Name ID#

Replace this with paper title
enter author list here
Journal name, vol(num):pages

The research question(s) (2-4 lines):

- What is the general field of study? (not the paper-specific question, but the general topic)
- What is the motivation? Why is this question important in the field?
- What is the state of prior research in this field?
- What research gaps does the author address?

The problem statement (1-2 lines):

- What is the Hypothesis? the specific question asked?
- What are the major theoretical/methodological propositions?
- How does the author operationalize the concepts that underlie these propositions?

The Methods/Experiments (3-10 lines):

- Are the methods appropriate? (well cited?)
- Is data acquisition appropriate? quality control completed?
- Good mathematical model chosen?
- Statistical analysis well explained?
- Sample sizes sufficient (power analysis done?)

The results (3-10 lines):

- What are the major findings?
- Significant vs non-significant?
- Graphs – error bars/ confidence regions?
- What are the implications of these specific results? Why are they important for the field?
- Are the results over/under interpreted in the discussion?

The critique (3-5 lines):

Based on your read of the paper, offer an accurate, clear and concise critique of the article (this is not necessarily negative).

- Does the author's argument make sense? Is it logical? Internally consistent?
- Do the experimental results/evidence support the hypotheses? Is this well presented in the discussion?
- What do other papers on the same topic say?
    - skim abstract/intro/conclusions of related papers
    - are the findings of this paper consistent? contradictory? evolutive?
- Do others cite this article (google scholar, pubmed, research gate, web of science)? What about social media or blogs?
- How does this paper fit in the broader context of the field?