CAS 750 & CSE 750 Model-Based Image Reconstruction - Summer 2019

News

The choice of material for both lectures and student presentations will depend on the student project areas. Students without other interests will be assigned a problem area based on the availability of data, which probably means Electron Microscopy.

Outline

Calendar Description

An overview of two themes in advanced image processing: functional analysis (e.g., Fourier, Wavelet and SVD methods), optimization of statistical models (e.g. Total Variation regularization). And, a detailed look at specific methods and techniques for applying these methods in new areas. Including all phases of application development from mathematical modelling, through complexity analysis.

Course Objective

In this course you will learn (1) what an inverse problem is (2) what the instructor classifies as an inverse imagining problem (3) methods of mathematical modelling which lead to inverse problems, using examples from Magnetic Resonance Imaging and Electron Microscopy (4) methods of solving such inverse probems (5) factors which affect the performance of the solver and (6) factors which affect the stability of the solver. Students who

Recommended Texts

- Deblurring Images: Matrices, Spectra, and Filtering; Per Christian Hansen, James G. Nagy, and Dianne P. OLeary, 2006 / xiv+130 pages / Softcover, ISBN-13: 978-0-898716-18-4 / ISBN-10: 0-89871-618-7 (cheaper if ordered from SIAM using free student membership)

- Computational Methods for Inverse Problems; Curtis R. Vogel, ISBN-13: 978-0-898715-50-7. (cheaper if ordered from SIAM using free student membership)

- Magnetic Resonance Imaging Physical Principles and Sequence Design; Haacke, E. Mark / Brown, Robert W. / Thompson, Michael R. / Venkatesan, Ramesh; 1999, Wiley, 914 Pages, Hardcover ISBN-10: 0-471-35128-8 ISBN-13: 978-0-471-35128-3

- Geometric Level Set Methods In Imaging, Vision, And Graphics, Osher, Stanley; Paragios, Nikos

- Scanning Electron Microscopy and X-Ray Microanalysis: Fourth Edition, Goldstein et al., 2007. ISBN-13: 978-0306472923

Instructor

Christopher Anand, ETB 112, x21397. anandc (circled a) (name of university) (country). Make an appointment by slack.

Schedule

To be decided. If you are planning to take the course as a part-time student, contact the instructor as

soon as possible. Estimated first class May 23rd. Last class July 18.
We will not meet every week. Class time will include both lectures on course topics, and presentations by students. Rough order: (1) Overview of objectives, what is expected in a project, methodolgy, and discussion of possible areas for student projects. (2) Guest Lecture on Electron Microscopy. (3) Introduction to MRI. (4) Introduction to Model Based Image Reconstruction. (5) Example of a previous student project. (6) Student presentations of assigned problem areas. (7-8) Advanced topics in modeling Electron Microscopy or MRI. (9) Student presentations of chosen problem. (10-11) Advanced topics in inverse problems. (12-13) Student presentations of final results.

Evaluation

20 percent for class participation. 20 percent for presentation of assigned problem; 20 percent for presentation of selected problem; 20 percent for presentation of results in class; 20 percent for written documentation, including code, and demonstrations.

The number and weighting of presentations may change depending on the number of students registered.

Each student will choose a problem, and one or more methods of solution, as approved by the instructor, and carry out all steps in the above procedure. Each student will be evaluated primarily based on a final written report including log (see below) (9/12) and a presentation of the results (3/12). Final reports must be submitted by April 15th, via email. Collaboration on implementation of the solver is encouraged, but all collaboration must be documented in a log in a way which makes the nature of the collaboration clear. For this purpose, it is recommended that all students use a version-control system such as subversion, and use it to record all of their work on source code, documentation and their report.

ACADEMIC INTEGRITY

You are expected to exhibit honesty and use ethical behaviour in all aspects of the learning process. Academic credentials you earn are rooted in principles of honesty and academic integrity. Academic dishonesty is to knowingly act or fail to act in a way that results or could result in unearned academic credit or advantage. This behaviour can result in serious consequences, e.g. the grade of zero on an assignment, loss of credit with a notation on the transcript (notation reads: "Grade of F assigned for academic dishonesty"), and/or suspension or expulsion from the university.
It is your responsibility to understand what constitutes academic dishonesty. For information on the various types of academic dishonesty please refer to the Academic Integrity Policy, located at http://www.mcmaster.ca/academicintegrity
The following illustrates only three forms of academic dishonesty: 1. Plagiarism, e.g. the submission of work that is not one's own or for which other credit has been obtained. 2. Improper collaboration in group work. 3. Copying or using unauthorized aids in tests and examinations.

If in doubt, ask the instructor how this applies to your work.

TURNITIN.COM

In this course we reserve the right to use a web-based service (Turnitin.com) to reveal plagiarism. Students will be expected to submit their work electronically to Turnitin.com and in hard copy so that it can be checked for academic dishonesty. Students who do not wish to submit their work to Turnitin.com must still submit a copy to the instructor. No penalty will be assigned to a student who does not submit

work to Turnitin.com. All submitted work is subject to normal verification that standards of academic integrity have been upheld (e.g., on-line search, etc.). To see the Turnitin.com Policy, please go to www.mcmaster.ca/academicintegrity

Personal Information

In this course we will be using subversion, email and other on-line discussion fora. Students should be aware that, when they access the electronic components of this course, private information such as first and last names, user names for the McMaster e-mail accounts, and program affiliation may become apparent to all other students in the same course. The available information is dependent on the technology used. Continuation in this course will be deemed consent to this disclosure. If you have any questions or concerns about such disclosure please discuss this with the course instructor.

Possible Changes

The instructor and university reserve the right to modify elements of the course during the term. The university may change the dates and deadlines for any or all courses in extreme circumstances. If either type of modification becomes necessary, reasonable notice and communication with the students will be given with explanation and the opportunity to comment on changes. It is the responsibility of the student to check their McMaster email and course websites weekly during the term and to note any changes.xsxs