Boston University
Department of Electrical and Computer Engineering
EC522 Computational Optical Imaging

Information Sheet

Spring 2024

Description:

Recent years have seen the growth of computational optical imaging – optical imaging system that tightly integrates optical hardware and computational algorithms. The result is imaging systems with capabilities that are well beyond with traditional methods. Computational optical imaging systems have a wide range of applications in consumer photography, scientific and biomedical imaging, microscopy, defense, security and remote sensing. This course looks at this new design approach as it is applied to modern optical imaging, with the focus on the tools and techniques at the convergence of physical optics, and signal processing.

Instructor: Lei Tian, leitian@bu.edu, PHO 830, 353-1344

Lectures: Mon/Wed, 2:30-4:15pm, STH 113

Office hours: Piazza
Friday 1-2pm PHO 830 (with occasional cancellations due to departmental service)
By Appointment

Prerequisites: linear algebra, e.g. EK102 or MA142
linear systems and Fourier analysis, e.g. EC401
Multivariate Calculus, e.g., MA225
MATLAB/Python Programming skills, e.g. EK127
Background in optics is helpful but not required, e.g. EC591 or EC562

Reading: There is no single textbook that sufficiently covers all the materials in this course. Below is a list of books that can prove useful for various parts of this course. You are also expected to rely on lecture notes and supplementary material that will be uploaded regularly to the course website.

Main Text (required)

M. Bertero, P. Boccacci, **Introduction to Inverse Problems in Imaging (2nd Edition)**, (Routledge Taylor&Francis Group), ISBN 9780367467869
Free online version of the 1st Edition.

Other Reading References:

J. Goodman, **Introduction to Fourier Optics**, 4th Edition. ISBN: 978-1-319-11916-4
A. Kak, M. Slaney, **Principles of Computerized Tomographic Imaging**. ISBN: 978-0-87942-198-4.
A. Bhandari, A. Kadambi, R. Raskar, Computational Imaging, MIT Press.

Grading: 60% **Homework**
20% **Group lecture**
20% **Final project Presentation**

Academic conduct:

Collaboration is permitted in homework and project. If there is collaboration in a homework, it must be explicitly acknowledged, and each collaborator must turn in his/her individual analysis/code and description of results. The student handbook defines academic misconduct as follows: "Academic misconduct occurs when a student intentionally misrepresents his or her academic accomplishments or impedes other students' chances of being judged fairly for their academic work. Knowingly allowing others to represent your work as theirs is as serious an offense as submitting another's work as your own." Please see the student handbook for procedures to be followed should academic misconduct be discovered.

Group lecture:

- A team of 2-3 persons to teach a specific topic about computational imaging modality
- The lecture should be ~ 1 hour in length
- Basic materials will be given by Prof. Tian as the starting point. Preparing additional materials are highly encouraged

Final project:

- In groups of 2-3 persons
- Should investigate a computational imaging modality based on studies of a few seminal papers
- Reproduce key results both analytically and numerically in Matlab/Python
- Final Presentation 30-45min