ECE4783 Course Syllabus

ECE4783

Introduction to Medical Image Processing (3-0-0-3)

CMPE Degree

This course is Elective for the CMPE degree.

EE Degree

This course is Elective for the EE degree.

Lab Hours

0 supervised lab hours and 0 unsupervised lab hours

Prerequisites

(ECE 2025/2026 [min C]) and (CEE/ISYE/MATH 3770* or ISYE 2027* or ECE 3077 or BMED 2400) * Prerequisites indicated with an asterisk may be taken concurrently with ECE4783

Corequisites

None

Catalog Description

A study of mathematical methods used in medical acquisition and processing. Concepts, algorithms, and methods associated with acquisition, processing, and display of two- and three-dimensional medical images are studied. Crosslisted with BMED 4783.

Textbook(s)

Gonzalez RC, and Woods, *Digital Image Processing* (3rd edition), Prentice Hall, 2002. ISBN 9780131687288(optional) (comment: This book is strongly recommended. Course cross-listed with and taught by Biomedical Engineering. See BMED 4783.)

Rangayyan, *Biomendcal Image Analysis* (2004 edition), CRC Press.(optional) (comment: Additional Resource)

Rittscher, Machiraju, & Wong, *Microscopic Image Analysis for Life Science Applications (Bioinformatics & Biomedical Imaging)*, Artech House, 2008.(optional) (comment: Additional Resource)

Modersitzki & Peters, *Numerical Methods for Image Registration (Numerical Mathematics and Scientific Computation)*, 2004.(optional)

Related research papers for some of the topics..(optional)

Course Outcomes

Upon successful completion of this course, students should be able to:

1. Master the concepts and methods in medical imaging processing.
2. Learn and practice bimedical image analysis skills.

Student Outcomes

In the parentheses for each Student Outcome:
"P" for primary indicates the outcome is a major focus of the entire course.
“M” for moderate indicates the outcome is the focus of at least one component of the course, but not majority of course material.
“LN” for “little to none” indicates that the course does not contribute significantly to this outcome.

1. (P) An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. (LN) An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. (LN) An ability to communicate effectively with a range of audiences
4. (LN) An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. (P) An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. (LN) An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. (M) An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Topical Outline

1. Organ-level imaging modality
2. Microscopic-level imaging modality
3. Fundamentals of digital image processing (Gonzalez/Woods, ch 1,
4. Intensity Transformations and Spatial Filtering (Gonzalez/Woods,
5. Image enhancement and filtering in frequency domain, image resto
6. Color image processing (Gonzalez/Woods, ch.6)
7. Image segmentation (Gonzalez/Woods, ch.10)
8. Image representation and description, (Gonzalez/Woods, ch.11)
9. Morphological image processing (Gonzalez/Woods, ch.9)