CARLETON UNIVERSITY | Department of Systems and Computer Engineering

SYSC 4205
Image Processing for Medical Applications

Calendar description

Two-dimensional signals, filters, and Fourier transforms. Image acquisition, sampling, quantization and representation. Image perception. Digital and film cameras. Medical imaging technologies. Image processing operations: histogram, convolution, morphological, segmentation, registration. Image compression and formats.

Includes: Experiential Learning Activity.

Lectures three hours a week, laboratory/problem analysis three hours alternate weeks.

http://calendar.carleton.ca/undergrad/courses/SYSC/

Prerequisites

MATH 1005 and fourth-year status in Engineering.

Prior knowledge

Students should have knowledge of:

- First-order differential equations.
- Second-order linear equations with constant coefficients, undetermined coefficients, variation of parameters.
- Sequences and series, convergence tests, estimation of sums.
- Power series, Taylor series, remainders.
- Fourier series.

Course objectives

Course objectives are the same topics described in the calendar description. Two-dimensional signals, filters, and Fourier transforms. Image acquisition, sampling, quantization and representation. Image perception. Digital and film cameras. Medical imaging technologies. Image processing operations: histogram, convolution, morphological, segmentation, registration. Image compression and formats.

List of topics

- Fundamentals of digital image processing
- Imaging system
- Medical imaging: X-ray, CT, Nuclear medicine
- Image enhancement in the spatial domain

- Image enhancement in the frequency domain
- Image restoration
- Morphological image processing
- Image segmentation
- Feature recognition and classification
- Medical imaging: Ultrasound, MRI
- Medical applications of imaging Review

Learning outcomes

By the end of this course, students should be able to:

- Understand digitization processes (sampling and quantization) of a 2-D image.
- Understand a histogram of a digital image.
- Understand the mechanism of image contrast in medical images.
- Explain image artifacts (image errors) in medical images.
- Implement digital image processing to enhance the image quality in spatial and frequency domains using a computer program.
- Implement digital image processing to perform image segmentation, restoration, and feature extraction and recognition using a computer program.

Graduate Attributes (GAs)

The Canadian Engineering Accreditation Board requires graduates of engineering programs to possess 12 attributes at the time of graduation. Activities related to the learning outcomes listed above are measured throughout the course and are part of the department's continual improvement process. Graduate attribute measurements will not be taken into consideration in determining a student's grade in the course. For more information, please visit: https://engineerscanada.ca/.

Graduate Attribute	Learning outcome(s)
1.10.S - Knowledge base: Discipline-specific concept SCE-7: Biomedical Instrumentation	

Instructor and TA contact

Specific to course offering (tbd)

Textbook (or other resources)

Specific to course offering (tbd)

Evaluation and grading scheme

Specific to course offering (tbd)

Breakdown of course requirements

Specific to course offering (tbd)

Tentative week-by-week breakdown

Specific to course offering (tbd)

General regulations

Specific to course offering (tbd)