DALHOUSIE UNIVERSITY
FACULTY OF COMPUTER SCIENCE

THERE WILL BE NO CONVERTING OF FINAL GRADES TO PASS/ILL THIS SEMESTER.
ALL LETTER GRADES WILL BE FINAL!

CSCI4261 – Introduction to Computer Vision

Course Syllabus

Instructor Information:

Instructor: Dr. Carlos Hernandez Castillo
Course Homepage: https://dal.brightspace.com
Office hours: Wednesday 10 - 11 am

Course Description

This course introduces students to the fundamental concepts of computer vision providing an overview of the current methodologies and techniques. Students will explore the theory behind fundamental processing tasks, including segmentation, feature extraction, image classification, and object detection, using a mathematical framework to analyze images as two-dimensional signals. By the end of this course, students will be able to apply the basic principles and tools used in computer vision to solve practical problems in scientific and commercial settings.

Learning Outcomes

- Identify the effects of light and shading in the process of image formation.
- Describe human color perception and its representation.
- Implement linear filters and convolution.
- Implement edge detection algorithms.
- Describe the binocular camera geometry and reconstruction.
- Compare different applications of motion detection.
- Apply a variety of techniques for image segmentation.
- Select and Implement common registration approaches.
- Identify challenges in applying transformations for object recognition.
- Contrast the advantages and disadvantages of different classification techniques.
- Develop code for image enhancement using a combination of the previously learned approaches.

Class format and course communication

Content will be delivered each Tuesday in Goldberg building and will consist of lectures for each topic on the syllabus. The lecture will be also available online as a short video. With each lecture, a quiz covering the material on the video lecture will be released. Students will have until Wednesday at midnight pm (ADT) to submit their answers using Brightspace. A tutorial on each Thursday will be held to further talk about the weekly topics and answers questions. Assignments and Practicums will be scheduled each week on interleaved order during the course. Final examination will be scheduled based on the official period set by the University.

Course announcements will be posted in the main page of the course (Brightspace) and via the mailing list. Avoid sending emails to TAs and the professor regarding the course content, assignments, and practicums. All questions must be posted in the corresponding chat in Brightspace, in this way other can benefit from the answers.

Assessment Criteria

Quizzes 20% - Quizzes will review the lecture material. There will be one quiz per week, starting in week 1, making a total of 10. Quizzes can be written by the student any time after the quiz is released and before Wednesday at 23:50 hours ADT.

Assignments 20% - Assignments will consist of either theoretical questions or practical exercises related to the lecture content with the objective of reinforce the topic. In total, there will be 4 assignments in the course, Assignments will be released on Tuesdays and the results should be submitted on Friday before 23:50 ADT.

Practicums 30% - Students will implement software solutions to some problems discussed on the previous lectures. The focus of the practicums is both the result and the original code used to solve the problem. There will be 4 practicums released on Tuesdays and the results should be submitted on Friday before 23:50 hours ADT. Auto-grading will be use by comparing the result submitted by the student against the expected result. The code used to process the image will be reviewed and it must follow the best practices for style and clarity. Any case of plagiarism will be reported.

Final project 30% - There will be a final project scheduled for the last week of classes. During that week, there will be no lectures, quizzes, or assignments. The students will submit their code and results during the exam period at the end of the semester.

Requirements and resources

- CSCI2110, MATH1000, and MATH1030 are requirement to take this course.
- Basic knowledge of algorithms, artificial Intelligence/machine learning is expected but not mandatory, examples are CSCI2203, CSCI3151, and CSCI3154.
- There is no specific book for this course. Any textbook in digital image processing can be used for further reading. However, I recommend the book Robot Vision from Horn (MIT Press) and Digital Image Processing by Gonzalez and Woods (Pearson).
- All the material on this course will be delivered via video lectures prepared by the instructor and all material will be available in Brightspace.
- All students will need a computer with reliable internet connection, webcam microphone and headset, so they can connect for the videocalls.
- Is up to the discretion of the instructor to use remote proctoring in online testing. Hence students may be required to download proctoring software onto their computers. Students who cannot meet system requirements for remote proctoring should contact the instructor for an alternate assessment.

Important Dates

May 01 - Classes begin.
May 29 - Last day to drop without a "W"
May 22 - Victoria Day - University closed.
June 26 - Last day to drop with a "W"
June 12 to 16 - Summer Break - No class.
July 01 - Canada Day - University closed.
Aug 07 - Natal Day – University Closed.

Tentative Course schedule

Week 01 - (May 02) – Welcome session, introduction to the course.
Week 02 - (May 09) – Human vision and color perception.
Week 03 - (May 16) – Linear filters.
Week 04 - (May 23) – Local image features.
Week 05 - (May 30) – Binocular geometry.
Week 06 - (June 06) – Motion perception.
Week 07 - (June 20) – Image segmentation.
Week 08 - (June 27) – Object recognition.
Week 09 - (July 04) – Image registration.
Week 10 - (July 11) – Image classification.

Assignments and Practicums

May 09 – Assignment 1: Image formation and color perception, due May 12
May 16 – Assignment 2: Linear filters, due May 19
May 23 – Practicum 1: Morphological analysis, due to May 26
May 30 – Assignment 3: Stereopsis, due June 2
June 06 – Assignment 4: Motion perception, due June 9
June 20 – Practicum 2: Segmentation, due June 23
June 27 – Practicum 3: Object boundaries, due June30
July 04 – Practicum 4: Registration, due July 7
July 11 – Final project: TBD, due July 28

Important links

- Dalhousie Academic Integrity: http://www.dal.ca/dept/university_secretariat/academic-integrity.html
- Student code of conduct: https://www.dal.ca/campus_life/safety-respect/student-rights-and-responsibilities/student-life-policies/code-of-student-conduct.html
- Diversity, Inclusion and Respect: http://www.dal.ca/cultureofrespect.html
- Check the Dalhousie Responsible Computing Policy here: https://www.cs.dal.ca/downloads/fcs_policy_local.pdf
- Dalhousie University acknowledges that the University is located on Traditional Mi'kmaq Territory. The Elders in Residence program provides students with access to First Nations elders for guidance, counsel and support. Visit the office in the McCain Building (room 3037) or contact the programs at elders@dal.ca or 902-494-6803.