COSC 428 Computer Vision

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Overview

The goal of **computer vision**/machine vision/robot vision/drone vision **and deep learning** is to recognise objects and their motion by creating a model of the real world from images. Object recognition and tracking needs to allow for large variations in appearance caused by changes in viewing position, illumination, occlusion and object shape.

This course encompasses the theory and practical applications of computer vision including image processing (useful in early stages of computer vision, usually to enhance particular information and suppress noise) and visual cognition (computational models of human vision) – from medical imaging to intelligent autonomous UAV/robot vision.

The objective of this course is to present an insight into the world of computer vision that goes beyond image processing algorithms. Students will acquire knowledge and an understanding of artificial vision from a system's viewpoint. Various aspects will be examined and the main approaches currently available in the literature will be discussed, opening the door to the most important research themes.

Prerequisites

COSC428 is available to all computer science, computer engineering, mechatronics, electrical engineering and software engineering students enrolled in their fourth year. The mathematical nature of computer vision enables the course material to be pitched as algorithms to computer science students and mathematics to engineering students (images are 2D matrices after all) and students have the option of completing their projects using any programming language/script (such as Python, C, C++, MATLAB, C#, Java) on any operating system (such as Windows, Linux, macOS, iOS or Android).

Syllabus

The topics studied in this course will include:

- Image processing
- Deep learning
- Filtering, Image Representations, and Texture Models
- Image registration and mosaics
- Colour Vision
- Neurophysiology of vision
- Multi-view Geometry
- Projective Reconstruction
- Stereo vision
- Bayesian Vision; Statistical Classifiers
- Clustering & Segmentation; Voting Methods
- Invariant local features
- Object recognition
- Medical Imaging
- Image Databases
- Motion interpretation
- Tracking and Density Propagation
- Biometric authentication
- Human activity recognition
- Visual Surveillance and Activity Monitoring
- Real-time robot vision (for robots and drones)
- Innovative computer vision based human-computer interfaces

Assessment

COSC428 assessment items are:
50%: research project presented as a conference style paper, including a relevant literature review (due week 8)
10%: class participation/presentations (presentations in final weeks of semester)
40%: final exam (during the examinations period) is CLOSED BOOK

Research Project

You will decide on a research topic, in consultation with Richard Green, early in the course. This computer vision project is evaluated by the quality of a 6-page conference style paper (not more than 4000 words), that describes your work[1]. Depending on project choice, COSC428 students can access the computer vision lab in Erskine room 234.

Your research project consists of:
1. Final conference ready paper.
2. Commented documented source code (which you authored) and associated documentation
3. Demonstration of your project (where demos are expected to match your conference paper results).

Useful references

1. “Computer Vision, A Modern Approach”, by D.A. Forsyth & J. Ponce, Prentice Hall.
2. “Machine Vision”, by R. Jain, R. Kasturi, B. G. Schunck, McGraw Hill.
3. “Learning OpenCV: Computer Vision with the OpenCV Library”, by Gary Rost Bradski, Adrian Kaehler.

[1] **UC Dishonest Practice Policy:**

Plagiarism, collusion, copying and ghost writing are unacceptable and dishonest practices.
- Plagiarism is the presentation of any material (test, data, figures or drawings, on any medium including computer files) from any other source without clear and adequate acknowledgment of the source.
- Collusion is the presentation of work performed in conjunction with another person or persons, but submitted as if it has been completed only by the named author(s).
- Copying is the use of material (in any medium, including computer files) produced by another person(s) with or without their knowledge and approval.
- Ghost writing is the use of another person(s) (with or without payment) to prepare all or part of an item submitted for assessment.

Do not engage in dishonest practices. The Department reserves the right to refer dishonest practices to the University Proctor and where appropriate to not mark the work.