CMPT 412 - D100 Computational Vision

Instructor(s): Brian Funt

Calendar Objective/Description:
Computational approaches to image understanding will be discussed in relation to theories about the operation of the human visual system and with respect to practical applications in robotics. Topics will include edge detection, shape from shading, stereopsis, optical flow, Fourier methods, gradient space, three-dimensional object representation and constraint satisfaction.

Instructor’s Objectives:
Computational vision addresses the problem of programming computers to "see", recognize objects, navigate through space and so on. It is easy to capture digital images and videos, but how can the image data be used? The course provides an introduction to computer vision, but note that it's only a one-semester introduction—students will not suddenly become experts in this rapidly evolving field. Computer vision has many connections to machine learning, computer graphics, and multimedia, so some of the techniques covered in this course are relevant to those fields as well. The course also introduces related mathematical techniques, which are useful in many other fields besides computer vision. Although the only math prerequisite for the course is Math 152, computer vision is quite a mathematical field, so it will help if you generally feel comfortable with mathematical approaches to problems.

Note that, unfortunately, there is no textbook that directly matches the material covered in this course. This means that it's very important to attend almost all lectures (even if you find them boring). If you have a job or some other reason that will prevent you from attending the vast majority of classes you'll find it very hard to do well in the course.

For additional information please see  http://www.cs.sfu.ca/~funt/

Prerequisites:
MATH 152, and nine units in Computing upper division courses or permission of the instructor.

Topics:
- Surface reflectance and illumination models.
- Colour perception.
- Motion and optical flow.
- Fundamentals of 2D Fourier transforms.
- Image enhancement.
- Object recognition.
- Binocular vision.
- Machine learning applied to computer vision

Grading:
Assignments (30%), a midterm (20%), and a final (50%)

Students must attain an overall passing grade on the weighted average of exams in the course in order to obtain a clear pass (C- or better).

Reference Books:
Robot Vision, B.K.P. Horn, MIT Press, 1988, 9780262081597
Computer Vision Models, Learning and Inference, Simon J. D. Prince, Cambridge University Press, 2012, 9781107011793

Academic Honesty Statement:

Academic honesty plays a key role in our efforts to maintain a high standard of academic excellence and integrity. Students are advised that ALL acts of intellectual dishonesty will be handled in accordance with the SFU Academic Honesty and Student Conduct Policies ( http://www.sfu.ca/policies/gazette/student.html ).