EE5470	Computer Vision	Handout 1
Fall 2009		August 23, 2009

ECE5470 Course Syllabus

Location

Lectures:	Phillips 407	TR	10:10am – 11:25am
Lab Sec 1:	Phillips 314	TBA	TBA
Lab Sec 2:	Phillips 314	TBA	TBA

Instructor

A. P. Reeves, 392 Rhodes Hall, (255-2342) reeves@ece.cornell.edu

Teaching Assistant

Prerequisite

The prerequisite for ECE5470 is ECE2200, or permission of the instructor.

Textbook

Sonka, Hlavac and Boyle, Image Processing, Analysis and Machine Vision, Third Edition, Thomson , 2008.

Exam Schedule

There will be 2 in class exams and no Final exam

Prelim 1	Thursday October 8	10:10am – 11:25am
Prelim 2	Tuesday December 1	10:10am – 11:25am

Poster Presentation

Computer Poster	Tuesday December 8	10:10am – 11:25am

Information and Help

The primary information source for ECE5470 is the on-line web at the following URL:

http://www.via.cornell.edu/ece5470

This will provide current information on handouts, reference materials, lecture contents, labs and homework assignments. Furthermore, any corrections or changes will be posted on the web pages. Questions about the course may be sent to the instructor or the TA by e-mail.

For help with the course material see the instructor in his posted office hours. Also the lab instructors may be able to provide assistance on homework assignments or labs during their lab sections if they are not too busy with their scheduled lab students.

If you wish to have a homework or exam regraded then see the instructor, preferably during his Tuesday 2:00pm office hour. If you need to see the course instructor and are unable to

come during scheduled office hours then request an appointment preferably by phone (255-2342) or by e-mail.

Course Requirements

The final grade for the course will be computed from the following weighted components. There are no absolute thresholds for grades; the grades for the course will be determined from the distribution of grades for the whole class. All work for this course is expected to be original.

Exam 1	20%
Exam 2	20%
Labs & Homeworks	30%
Project	30%

Exams:

There are two in class exams for this course. Exams cover the material given in both lectures and labs. The second exam will focus on material that is not covered in the first exam.

Homeworks:

Homeworks will be occasionally given based on the lecture material to reinforce the understanding of various course topics.

Labs:

Lab sections meet at the same time each week for the first part of the course. Students are expected to attend their scheduled lab section and to meet with their lab instructor each week. If a lab section is missed then the student should attend a different lab section to make up the work and discuss the situation with their regular lab instructor. The lab grade will be determined mainly from written lab reports; the evaluation provided by your lab instructor will also be considered.

Labs will begin with a pre-lab discussion given by the lab instructor so it is important that you are present at the start of the lab section. Lab work can be completed at times outside your scheduled lab section, possibly by remote access. However, please note the above requirement that you are expected to attend your scheduled lab section (especially the pre-lab) and meet with your assigned lab instructor each week when labs are scheduled unless otherwise stated.

Project:

A major component of the course will be a project that is done mainly during the last part of the semester. Projects are on selected computer vision topics and usually involve groups of two students. Each project group will meet several times with the course instructor during the project.

The project grade is based on both a project report and a poster presentation.

Course Description

This course is concerned with the computer acquisition and analysis of image data. Computer vision is the construction of explicit meaningful descriptions of a physical objects or other observable phenomena from images.

This course focuses on descriptions of objects at two main levels of abstraction: Segmented images-images organized into subimages that are likely to correspond to interesting objects, and Geometric structures-quantitative models of image and world structures. Basic techniques for image processing and feature extraction are covered in lectures; topics include: image formation, edge detection, region growing, and shape description. The higher-level more experimental image analysis techniques, such as video image sequence analysis, are covered by selected presentations and projects.

During the first part of the semester a sequence of computer labs will provide experience in the software tools that are appropriate for computer vision applications. In the last part of the semester, students will do an in-depth project, which builds on their lab experience, on a topic which they select. Typically, a project will involve exploring a state-of-the-art technique which will include research literature review.

Essentially, ECE5470 is a first course on learning about how computers can see; that is, interpret the multidimensional signals provided by imaging sensors. Computer vision has a very wide range of applications from medical diagnosis to seeing robots, from particle physics to geological surveying. Wherever images play an important role in understanding a problem, there is a potential application for computer vision. The objective of this course is to provide students with an understanding of the fundamental methods and an appreciation for the state of the art and the potential of computer vision.

Course Objectives

Students will gain an understanding of the fundamental issues and techniques for extracting information from digital imagery. They will have a good knowledge of well established methods for decomposing an image into basic elements: edges, regions, and other features. They will also be introduced to the more experimental higher-level image understanding methods.

Introductory labs provide the student with experience in using computer systems and the associated specialized software tools for processing and extracting information from digital images. The student will gain in-depth understanding of a specific computer vision application through the course project.

Caveat

The schedule and procedures in this course are subject to change as always.

Academic Integrity

Each student in this course is expected to abide by the Cornell University Code of Academic Integrity. Any work submitted by a student in this course for academic credit will be the student's own work. For this course, collaboration is allowed in the following instances: course projects.

Provisional Course Outline

		Topic	*Pages in IPAMV*
1.		**Introduction**	
	1.	Introduction	1-10
	2.	Image Sensors and Data Structures	11-15, 591-595
	3.	Image Display and Digital Images	14-24, 41-44
2.		**Binary Image Processing**	
	Lab 1.	Introduction to VisionX (linux), and Images	
	4.	Binary Image Processing and the VisionX system	351-357, 332-335
	5.	Medial Axis Transform and Morphological Filtering	365-368, 657-666, 351-357, 106-109
	Lab 2.	Binary Image Processing	
3.		**Regions**	
	6.	Thresholding and Region Growing	24-25, 175-183, 225-233
4.		**Image Filtering**	
	7.	The Fourier Transform	49-66, 164-166
	Lab 3.	Segmentation: Automatic Image Thresholding	
	8.	Project Proposal	29-31
	9.	Contrast Enhancement	113-118
	Lab 4.	Image Filtering	
	10.	Image Filtering	123-130, 148-152
5.		**Edge Detection**	
	11.	Edge Detection	132-142
	Lab 5.	Image Sequence Processing	
	12.	Image Matching	237-240
6.		**Contours**	
	13.	Curves, Splines and Polylines	328-332, 335, 341-347
	14.	The Hough Transform	212-221
7.		**Object Recognition**	
	15.	Fourier Descriptors	339-341
	16.	Statistical Pattern Recognition and Neural Networks	380-402, 404-407
	17.	Moments	357-359
8.	22.	**Radiometry**	
	18.	Radiometry	88-94
	19.	Color	31-41
9.		**Three-dimensional Image Analysis**	
	20.	Reconstruction from Projections	620-622
	21.	Poster Presentations	