CSE 803: Computer Vision Fall 2010

Department of Computer Science and Engineering
Michigan State University
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Office Hours: By appointment until further notice. Students are welcome to resolve questions after or before class. Also, if the office door is open at any time, come in.

Course: Class is T R 12:40 - 2:00 in EB 1300

Prerequisites: programming, algorithms and data structures, some probability and statistics, linear algebra, 3D calc.

Description: visual information processing problems; human and machine vision systems; image formation; image transforms, encoding, enhancement; edge detection; segmentation; 2D and 3D object description and recognition; scene analysis; applications

Objectives: to study problems associated with image acquisition, processing, and interpretation; to learn tools for solving vision problems in industry and various scientific disciplines; to explore the marvelous visual capability of man and how some of it might become known and bequeathed to machines.

Text: Computer Vision by Linda Shapiro and George Stockman, Prentice-Hall 2001.

References: Computer Vision, D Ballard and C Brown, Prentice-Hall 1982;
Machine Vision, R. Jain, R. Kasturi, and B. Schunk, McGraw-Hill (1995);
Computer Vision: a modern approach, Forsyth and Ponce, Prentice-Hall 2002;

Recent Papers: available on class website (more coming).

(S1) Computer Vision, Aloimonos and Rosenfeld, Science, V23 (Sep 91)
(S2) Veggie Vision: Chapter 16 of S&S and paper.
(S3) How Iris Recognition Works, Daugeman, Proc. ICIP Rochester, NY (Sep. 2002)
(S4)
(S7) Snakes: Active Contour Models, M. Kass, A. Witkin and D. Terzopoulos,
Proc. 1st ICCV (London, England),(1987)259-267: also in
Int. Journal of CV, vol 1, no 4 (1987)321-331.
(S8)
(S9)

Graded Homework

Homework is to be done independently unless otherwise discussed. Use of web or text resources is encouraged, but they must be cited.

Seven homework assignments are planned, as shown on the course calendar. Written homework problems provide exercise on concepts and methods. Some programming may be needed to complete homework. Programming is intended to reinforce algorithms and concepts and to get correct results; it is NOT intended to be an exercise in software development (so minimum documentation and useability but careful testing). Students will often use multiple tools or programs. A report of program/algorithm behavior and results is required. Programming work will be submitted via paper or handin, or email in emergencies: **more details will follow with the assignments.** Unless otherwise stated, **ANY** programming language or computer can be used; however, the instructor can only be of limited help in debugging anything other than C++ and MATLAB. Students will be responsible if conversion of data or program modules is needed. Students should seriously consider using MATLAB due to its rapid development capability. Also, students should become familiar with one or more popular image processing tool. It should be clear when basic algorithms should be implemented by the student and not obtained from an existing library or function.

Late work will be accepted without penalty only with an acceptable excuse: without such, late penalty is 20% for the first day and another 20% for the next two days. No late work will be accepted three or more days after it's due. Some problems solved is far better than none. (Don't hang yourself with this rope.)

Homework Report

The homework report should be a single .pdf or .doc ˙le. Handwork or hand annotated images or code is acceptable and can be scanned into electronic form. Program modules, if requested, should be in tar or zip form. An entirely paper report is allowed, but must be submitted by the end of business on Friday.

Report format is not rigid, but should include the following elements.

- The problem[s] or homework objectives.
- The approach taken / major algorithm[s], possibly mentioning what alternatives were not taken.
- Results are most important.
- Provide a few cases where things look good.
- Often there will be required cases.
- Document the parameters, process, etc.
- Provide a few cases where things don't look good.
- Document the parameters, process, etc.
- Maybe some concluding comments, how things went overall, what would be good to try if the work continued.

Academic Integrity

The critical language from the MSU code is as follows. "...all academic work will be done by the student to whom it is assigned, without unauthorized aid of any kind. ... If any instance of academic dishonesty is discovered by an instructor, it is his or her responsibility to take appropriate action." Possible actions include assigning a failing grade for the assignment or course.

Unless discussed beforehand, CSE 803 assignments are NOT to be done in groups. Discussion of course material relating to an assignment with fellow students is a valuable learning technique and is encouraged. Discussion of computer tools and clari¨cation of assigned problems is also encouraged. However, group writing of programs or group solutions of assigned problems is NOT ACCEPTABLE. Reviewing another student's work AFTER all work is submitted is encouraged as a learning experience for both students. It should be clear from the assignment what the student may or may not obtain from the WWW: any text or code used from the WWW must be cited by URL and author.

Final Grade Computation

Grading is NOT competitive; individual performance will be used. Items will be weighted as follows: midterm exam (15%), final exam [or project] (25%); 7 homeworks (60%). (Attendance may be used to replace 10% points of the final exam.) A course avg. of 90% insures a grade of 4.0; 75% will insure a grade of 3.0.

Course Materials

Other course materials are available under www.cse.msu.edu/˜stockman/CV including most images in the textbook, some C++ programs, and slides for most lectures. Slides are under constant improvement, but are never a substitute for class.

Course Calendar

The following topics and readings are planned by week: reading assignments may be refined as we approach them. Keep track of revisions of this calendar on the web. New readings will be added.

S i denotes a special assigned reading from the list above (in progress)
Ch j denotes a chapter in the Shapiro/Stockman text

Week		Reading	Topics
1	2 Sept	Ch1,2	general intro to CV and IP; applications;
		S1	images and imaging devices;
		Ch12.5	perspective projection
2	9 Sept	Ch3	binary image processing
			HW#1 due Fri at 11:59PM (electronic)
3	16 Sept	Ch4	pattern recognition concepts
		Ch3.6, S2	morphology ; Veggie Vision concepts
4	23 Sept	Ch5,S3	filtering and edge detection;
		Ch16	iris ID; HW#2 due Fri 11:59PM electronic
5	30 Sept	Ch6	color and shading, including 3D effects
6	7 Oct	Ch7,16	texture
			MidTerm Exam: Tue Oct 12
7	14 Oct	Ch8	texture cont., Image databases
			HW#3 due FRI 11:59PM
8	21 Oct	Ch9,S8	motion; motion vectors, optical flow
			(last day to drop is 20 Oct)
9	28 Oct	Ch10,S7	segmentation; regions and boundaries
			HW#4 due Fri:
10	4 Nov	Ch11,S4	2D matching
11	11 Nov	Ch12	3D perception; stereo and structured light;
			shape from shading; HW#5 due Fri:
12	18 Nov	Ch13	3D sensing; 3D transformations; camera calibration;
13	25 Nov	Ch13	3D reconstruction; HW#6 due Th: camera calibration
14	2 Dec	Ch14	3D object models and matching
15	9 Dec	Ch15	augmented reality; review on Thursday
			HW#7 due Saturday: stereo computation of surface
16	13 Dec	all	Final Exam, Mon 12:45-2:45 PM regular classroom