CS 543 / ECE 549 – Computer Vision – Spring 2010

Instructors

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Room: **Everitt ECE Lab 260**

Class Time: **Tuesday and Thursday 12:30pm – 1:45pm**

Office Hours: TBA

Computer vision algorithms attempt to make sense of photographs, video, and other imagery. Applications include analysis of medical images, automated quality inspection, entertainment, vehicle safety, security, and media search, among many others.

In this course, we will cover many of the basic concepts and algorithms of computer vision: single-view and multi-view geometry, lighting, linear filters, texture, interest points, tracking, RANSAC, K-means clustering, segmentation, EM algorithm, recognition, and so on. In homeworks, you will put many of these concepts into practice. As this is a survey course, we will not go into great depth on any topic, but at the end of the course, you should be prepared for any further vision-related investigation and application.

General Information

The recommended **textbook** is Computer Vision: A Modern Approach by David Forsyth and Jean Ponce. Other useful books include the draft Computer Vision: Algorithms and Applications by Rick Szeliski and Multiple View Geometry in Computer Vision by Hartley and Zisserman.

Prerequisites include basic knowledge of linear algebra, calculus, and probability. Some homeworks will involve programming in Matlab.

Attendance is expected. Lecture slides will be posted, but they may be difficult to interpret without attending lectures.

To obtain **disability-related academic adjustments** and/or auxiliary aids, students with disabilities must contact the course instructor and the Disability Resources and Educational Services (DRES) as soon as possible. To contact DRES you may visit 1207 S. Oak St., Champaign, call 333-4603 (V/TDD), or e-mail a message to disability@uiuc.edu.

Assignments and Grading

Grades are based on four homeworks and a final project. Each homework is worth up to 20 points, and the final project is worth up to 25 points. At least 80 points are needed for a guaranteed A, but completion of a final project is required to pass. Homeworks can be completed in groups. Each person should submit his or her own complete solutions and indicate any collaborators.

Late assignments will be worth half credit, if returned within one week of the due date, and zero credit afterwards. Exceptions are unlikely.

Tentative **due dates** are Feb 16, March 9, April 6, April 27, and the final period for the four homeworks and the final project, respectively.

Final Project

The project is a chance to further explore a topic of interest. Groups of up to four are highly encouraged. More is expected of larger groups. Projects will include a short written component and a class presentation. Various types of projects are possible, including those below.

Research Project. Perform a project in a topic of your choice. Formulate a goal, devise an approach, and evaluate. When proposing, indicate what dataset you will use for evaluation.

Review and Implement a Paper. Choose a paper or set of papers and write a scholarly review. Then, implement and evaluate the paper. Reviews should be written independently for each person, but the group can collaborate on implementation and evaluation.

Topic Survey. Survey the research in a particular topic related to computer vision. Examples include the use of context for recognition, machine learning techniques for categorization, visual recognition by humans, etc.

Planned Schedule

Weeks 1-3: Image Formation and Basic Processing

- Camera models, geometry, and single-view metrology
- Shading and color
- Image filters, Gaussian pyramid, texture

Weeks 4-6: Grouping and Fitting

- Edge detection, line fitting, and registration
- Clustering, EM, and mixture models
- Image segmentation and MRFs

Weeks 7-10: Recognition

- Interest points, SIFT, and object instance recognition
- Face recognition
- Image features and categorization
- Object category recognition
- Region-based classification

Weeks 11-13: Multiple Views and Motion

- Epipolar geometry
- Image stitching
- Structure from motion
- Dense stereo and optical flow
- Tracking with Kalman filters

Weeks 14-15: Special Topics

- Vision with people
- 3D scene interpretation