CSCI 574 Computer Vision

Fall 2013

Instructor

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Office Hours : T,Th 14:00 – 15:30
Office Location : PHE 204

Teaching Assistant: TBD

Course Enrollment

This course is currently closed to M.S. students. We will make an effort to increase capacity but we will not have an accurate picture of availability until after the start of classes. The course will be repeated in Spring 2014 so students will have another opportunity. We apologize for any inconvenience.

Schedule Irregularity

Due to an unavoidable circumstance, the instructor has to miss the first week of classes. This, of course, is highly undesirable as students like to find out about the course content, required work, difficulty of the course, personality of the instructor etc during the first week to finalize their course selection. Fortunately, as this is a DEN class, we can use the webcast technology to partially offset the negative effects.

Professor will conduct a "make-up" class on Auguest 21 from 10:30 to 11:50 AM (location is TBD but it will be one of the DEN classrooms in OHE). It is understandable that not all students will find this time convenient or even be on campus by then. However, we do hope that at least some will be able to attend. Those who cannot will be able to watch a stored video of the class. Thus, August 21 class will stand as a make-up for the scheduled Aug 27 class; we will make-up the Aug 29 class at a later time, depending on the availability of a suitable classroom. Our regular class meeting will resume starting on September 3.

Textbooks

Required: “Computer Vision: A Modern Approach”, D. Forsyth and J. Ponce,Prentice-Hall, Second Edition, 2011

Recommended: “Computer Vision: Algorithms and Applications”, R. Szeliski, 2010; personal use, electronic copy available at http://szeliski.org/Book.

Prerequisites:

1. CSCI 455 or equivalent - Data Structures, good programming skills, and ability to convert informal descriptions of methods into computer algorithms. Students must be able to program in C or C++.

2. Basic Mathematics - Knowledge of and ability to use calculus, analytical geometry, linear algebra (matrix theory) and basic probability theory is essential. If you have not used these skills for several years, you must be prepared to learn them rapidly.

3. CSCI 561 and 573 are helpful but NOT required.

Course Objective

The objective of this course is to understand the basic issues in computer vision and major approaches that address them. Even though Computer Vision is being used for many practical applications today, it is still not a *solved* problem. Hence, definitive solutions are available only rarely; mostly, we will discuss alternatives and their limitations.

After completing the course, the students may expect to have the knowledge needed to read and understand the more advanced topics and current research literature, and the ability to *start* working in industry or in academic research. However, this course is *NOT* designed to be a "cookbook" course that gives just a survey of the methods needed in "practice", nor will it cover "commercial" systems in any detail.

Course Requirements

There will be two exams:

1. Exam1: *Likely* to be scheduled around October 17

2. Exam2: likely on the last day of the class, December 5, to be confirmed only after start of classes; do not make travel plans yet!

Both exams will be conducted during class hours. The grade will be based on the Exam 1 and 2, the homework and the project. The Exam 1 and 2 will count for 30% each, the homework assignments, both written and programming taken together, will count for 30%; 10% weight will be given for class attendance and participation (does not apply to DEN students).

Note that all assignments are considered an integral part of the course and MUST be completed. Not completing even a single assignment may result in "F" grade.

Programming Facility

A software library of basic image processing algorithms, called OpenCV, will be used in programming assignments; this library is available for free download for educational purpose. This library is available for MS Windows and Linux; however, we will only provide TA support for the windows version. Students may choose to complete assignments using USC computer facilities or their own PCs.

Syllabus

Following is a list of topics expected to be covered, in anticipated order, and with expected time to be spent on them. This list is intended to be only indicative, the actual topics, the order and the time may vary somewhat depending on various factors including student interests and preparation.

1. **Introduction (1 week)**
   Background, requirements and issues, human vision.
2. **Image formation: geometry and photometry (2 weeks)**
   Geometry, brightness, quantization, camera calibration, photometry (brightness and color)
3. **Image segmentation (2 weeks)**
   Region segmentation, Edge and line finding
4. **Multi-view Geometry (3 weeks)**
   Shape from stereo and motion, feature matching, surface fitting, Active ranging
5. **Image classification(2 weeks)**
   Pixel classification, region classification, face detection and identification
6. **Object Recognition(2 weeks)**
   Alignment methods, Shape descriptions
7. **Motion analysis (1 weeks)**
   Motion detection and tracking, Inference of human activity from image sequences
8. **Applications survey, Review (1 week)**
   Industrial, navigation, mapping, multimedia