Computational Photography (CS 498) – Fall 2012

Instructor: **Derek Hoiem**

Room: **1214 Siebel Center**

Times: **11:00 - 12:15 Tuesday and Thursday**

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Webpage: http://courses.engr.illinois.edu/cs498dh3/

Overview

Computational photography is an emerging field created by the convergence of computer graphics, computer vision, and photography. Its role is to overcome the limitations of the traditional camera by using computational techniques to capture, enhance, and combine imagery for a more vivid and lifelike visual experience.

Course Objectives

By the end of this course, students will have written programs to create optical illusions, add or remove objects from a photograph, smoothly morph between faces, automatically stitch together photos into panoramas, and more. Through lectures and hands-on projects, the students will learn core principles of computer vision and graphics that will be of great use in robotics, psychology, media design, art, photography, information retrieval, entertainment technology, and a host of other growing areas. Beyond the practical benefits, the course also aims to provide students with a greater appreciation of their own amazing visual ability and to have fun in writing programs that can be used with their own photo collections.

Prerequisites

You should enter the course with basic programming skills and a working knowledge of **linear algebra** and calculus. Previous experience with Matlab, image processing, computer vision, or computer graphics will be very helpful but is not required. Students are recommended to own or purchase a digital **camera**, ideally with manual controls.

General Information

The course is open to both graduate students and undergraduate students. Graduate students should register for section DH4 and will be able to choose additional project components (also open to undergrads as extra credit).

Textbook: Lectures are not based on any particular textbook. The most closely related textbook is Computer Vision: Algorithms and Applications by Rick Szeliski, which is available for free online and for purchase at Amazon. You may also want to purchase either Computer

Vision by Linda Shapiro and George Stockman or Computer Vision: A Modern Approach (2nd edition) by David Forsyth and Jean Ponce. I have them both in my office, so you can look them through.

Other useful books:

Linear Algebra and its Applications, Gilbert Strang *(excellent book on linear algebra)*
Multiple View Geometry in Computer Vision, Hartley & Zisserman *(bible on recovering 3D geom.)*
Photography (8th edition), London and Upton, *(a great general guide to taking pictures)*
Vision Science: Photons to Phenomenology, Stephen Palmer *(great book on human perception)*
Digital Image Processing, 2nd edition, Gonzalez and Woods *(a good general image processing text)*
The Art and Science of Digital Compositing, Ron Brinkmann *(everything about compositing)*
3D Computer Graphics (3rd Edition), Watt *(a good general graphics text)*
Fundamentals of Computer Graphics, Peter Shirley *(another good general graphics text)*

Attendance is expected and is necessary to get the most from the course. Lecture slides will be posted afterwards, but they will 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

Grading is based on projects, midterm, and the final project. The final letter grade should reflect practical and theoretical grasp of concepts introduced in class, as demonstrated through regular and final projects and the exam. Although class participation and other intangibles are not formally evaluated, I may consider them to raise (but not lower) the letter grade. I will guarantee an "A" with a 95% average and guarantee a "B" with an 85% average.

Projects (60%): Undergraduate students are graded out of 525 points. Graduate students are graded out of 600 points. Each project is worth up to 100 points, so you can earn 500 points through the standard projects. Note that a perfect score requires more than 500 points. Additional points can be earned through suggested extensions to projects ("bells and whistles"), and possibly through additional projects and problems that are offered throughout the semester. Students are encourage to complete additional offered projects or components that are of interest and can receive up to 30 points extra credit (roughly 5% of the final grade).

Midterm (20%): The exam will be held in early-November and will cover a variety of concept and paper-and-pencil problems. I will provide sample problems throughout the semester.

Final project (20%): Do a final project of your choice (optionally in pairs). This could be an implementation of a paper that you find interesting, something discussed in class, a big extension of one of the existing projects, or something entirely of your own design. Start thinking about this early and talk to me about it once you have ideas.

Late policy: Aim to get all projects in on time so that your classmates can see what you have done while their own efforts are still fresh. You will have a total of five free late days. Use them wisely. Additional late days come at a penalty of ten points per day late.

Academic Integrity

You are welcome to discuss projects with your classmates, but do not share any code. Also, you may not use any code from the Internet or any other outside sources, unless it is specifically approved by the instructor. Be sure to acknowledge any help that you do get from other students or outside works, even if it's just a small suggestion. *Violations will go on record at the university, and the minimum penalty will be a zero for the assignment.*