

CS 455: Image Processing

Fall Semester 2012

T Th 8:30-9:50 PM, SE 102.

Professor:

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Office Hours:

Tuesday: 10:00-12:00, 3:10-5:10
Wednesday: 10:00-12:00
Thursday: 10:00-12:00
And by appointment

Course Description:

Objectives: This course introduces various techniques for the enhancement and analysis of digital imagery. Topics to be covered include the interpretation of image statistics, image enhancement based on histogram transformations, spatial filtering, and geometric image transforms. Issues concerning data acquisition and storage will also be discussed.

Prerequisite: CS221N (Data Structures). Knowledge of Java, object-oriented programming and data structures.

Textbook: Steven L. Tanimoto, *An Interdisciplinary Introduction to Image Processing*.

Evaluation: Your course grade will consist of the following percentages:

Homework and projects: 45%

Research Paper: 10%

Tests: 45% (15% each)

Homework: Your homework will consist of assignments, a combination of written homeworks, computer-based problems, and programming assignments, throughout the semester. This will account for 45% of your grade.

Graded assignments will be due at the beginning of class. Late assignments will be assessed a penalty of 10% per day. Once an assignment has been graded and returned to the class, that particular assignment will no longer be accepted.

Written homeworks: Written assignments should represent the quality expected of upper level college students. Each answer to an assigned problem should be preceded by a copy of the question it is answering. Show all work. The process is as important, if not more so, than the answer. Work may be handwritten, but should be neat, legible, and stapled if necessary. Ragged edges from pages torn out of a spiral notebook are unacceptable. *(There are scissors, stapler and other supplies available in the NAS lobby if needed.)*

Programming assignments: All programs should compile and run. Develop your solution step by step so that your program does something, even if the output that it produces is not completely correct. Programming assignments should be documented. At a minimum, a program should contain a comment section at the top with your name, the date, the purpose of the program, and a description of any inputs and outputs. Each logical section of code should be preceded by at least a brief one line sentence fragment describing what the section of code does.

Tests: There will be two tests during the semester as well as a comprehensive final exam. These tests along with the homework and projects will provide materials for the evaluation of your

understanding and progress. If you have an A in the course going into the final, then the final exam will be optional. If you take the exam, it will contribute to your final grade in the course. If you do not have an A in the course and do not take the final exam, you will have a grade of zero for this portion of your grade.

Disability Accommodations: . If you have a documented learning disorder and need additional time or other accommodations, please have the counseling center send me the documentation. Then, meet with me to discuss a test format and schedule a time when you will take the exam. All information will be kept confidential. No accommodations can be made without the proper documentation in advance of scheduled exams.

Academic Dishonesty

For all assignments, please remember to pledge your work. The **Honor Pledge at Eckerd means you agree to this statement** “On my honor, as an Eckerd College student, I pledge not to lie, cheat, or steal, nor to tolerate these behaviors in others.” Suspected violations of the Honor Code will be referred to the Eckerd College Honor Council.

Homework is based on the book, notes from class lectures, and work you will do on the computer. You may drop your lowest homework. Unless specifically stated in the assignment, you need to do your work BY yourself. A small amount of help from a lab assistant or friend is allowed to identify SYNTAX errors in programs or to discuss general concepts covered in class. However, the work you submit for grading must be your own. Do not discuss specific homework problems. Do not work side-by-side in lock step with another student in the class. **Do not give any homework material to another student or receive any homework material from another student, in either written or electronic form.** Failure to follow this requirement will be considered a violation of the Eckerd College Honor Code and will be referred to the Honor Council.

Of course, I am always available during office hours to answer your questions, clarify specific aspects of the assignment which may be unclear to you, or help you to understand concepts with which you may be struggling. Learning the materials we will cover in this class will hopefully be an enjoyable experience for you as a computer science major!

Semester Schedule Disclaimer

The attached schedule for lectures, tests and assignments in the course is subject to change in response to, among other things, threatening weather conditions, or cancellation of classes/campus evacuations in anticipation of such events. In the event of a campus evacuation you are expected to take your textbook, syllabus, and course notes with you and to check your email daily. All changes to the schedule will be announced in class and/or via your campus email address. You are responsible for ensuring an awareness of the announcement of any such changes. **You must read your campus email.**

Schedule – Fall 2012

Date		Subject	Assignment (what is due)
9/4	T	Course Intro, Images, Human Vision, Image Representation (Ch 1, 2.1)	¹
9/6	Th	Image Representation, Pixel Math (Ch 2.1-2.5, 2.7)	
9/11	T	Brightness, contrast, intensity transformations (Ch 3.1-3.3)	² Homework 1: Ch 2, p38 – 2,3,5,9
9/13	Th	C++ and images	Homework 2: Ch 3, p53 – 2,5,12, extra part question 12
9/18	T	Brightness, contrast, histograms (Ch 3.1-3.3)	³
9/20	Th	Histogram based enhancement (Ch 3.3.2)	Program 1- threshold, sqrt
9/25	T	Visible light, color representation, color histograms (Ch 4)	⁴ Paper Topic due
9/27	Th	Color models and conversions, color image enhancement, indexed color (Ch 4)	Program 2 – contrast, histogram
10/2	T	Geometric transformations: Scaling, Rotation groups (Ch 5)	⁵ Homework 3: Ch 4, p81- 1, 9, 12
10/4	Th	Geometric transformations : Arbitrary rotation (notes)	Homework 4: Ch 5, p109 – 1, 2, 4, 8 Annotated bibliography due
10/9	T	Geometric transformations : Arbitrary rotation (notes)	⁶ Homework scaling/rotation
10/11	Th	Review	Program 3 - geometric trans
10/16	T	Test 1 – Chapters 1-6	⁷
10/18	Th	Affine transformations (Ch 20)	Research Paper due
10/23	T	Affine transformations (Ch 20)	⁸ Homework 5 – arbitrary rotation about the origin
10/25	Th	Filtering and convolution: noise removal (Ch 10.1-10.3)	
10/30	T	FALL BREAK	⁹
11/1	Th	Filtering and convolution: high-pass filtering and sharpening (Ch 10.4-10.5)	Homework 6– spatial filtering
11/6	T	Introduction to the frequency domain: periodic functions	¹⁰ In-class assignment: periodicity
11/8	Th	Introduction to the frequency domain (Ch 10.12-10.13)	Program 4 - filtering
11/13	T	Frequency Domain and the DFT	¹¹

11/15	Th	Frequency domain noise removal (Ch 10.14)	FFT lab assignment
11/20	T	Test 2	¹²
11/22	Th	<i>THANKSGIVING BREAK</i>	
11/27	T	Image analysis: thresholding, binary images, region representation (Ch 17.1- 17.5)	¹³
11/29	Th	Connectivity, morphology (Ch 17.5, 17.6)	
12/4	T	Review. Morphology: erosion and dilation	¹⁴ Program 5 – Chain code due
12/6	Th	Image Compression: basics	Homework: Morphology
12/11	T	Comprehensive Final Exam 3:00 pm	