COSC 4393/6397
Introduction to Digital Image Processing
Department of Computer Science
University of Houston
http://cbl.uh.edu/courses/DIPFall07


Instructors: Prof. Ioannis Kakadiaris (COSC 6397)
Prof. Shishir Shah (COSC 4393)

Prerequisites: You are expected to know basics of linear algebra, linear systems, calculus, and probability/statistics. Homework assignments and course projects will require knowledge of C/C++/Java.

Outline: The objective of this course is to introduce the essential concepts of digital image processing from an operational perspective with some exposure to theory. Aspects of image acquisition, processing, practical applications, and elementary image analysis algorithms will be covered. This course will make digital image processing accessible to computer scientists and engineers that are currently unfamiliar with the topic. We will be programming in C/C++/Java and/or MATLAB for numerous visual examples in the form of actual digital image processing results and homework assignments.

Tentative Topics: Digital Image Acquisition, Binary Image Processing, Histogram and Point Operations, Discrete Fourier Transform, Sampling Theorem, Linear Filtering, Enhancement, and Restoration, Nonlinear Image Filtering, Digital Image Coding and Compression

Tentative Grading: Homework 30%, Midterm Exam 30%, Term Project 30%, Final Report 10%

Recommended Text: Digital Image Processing, 2nd Edition, R. C. Gonzales and R. E. Woods, Prentice Hall, 2002.

Supplement: Digital Image Processing, K. R. Castleman, Prentice Hall, 1996.

HOW TO ADD THIS CLASS [for COSC6397]

To add the class, click "View All Selection" from COSC6397 – Topics Computer Science. Currently the schedule only displays five classes. Doing so, you will be able to see the class "Digital Image Processing" (Section: 04-LEC(14931)) and add.

COURSE OBJECTIVE

1] Introduce essential concepts of **Digital Image Processing**
-Acquisition
-Display
-Processing
-Practical Applications and Implementation
-Elementary Image Analysis

2] Make digital image processing accessible to engineers and computer scientists

3] Present numerous examples to illustrate the use of image processing and the material taught in class

4] Create an interactive teaching environment
-Ask questions
-Comment on level of instruction and material
-Comment on speed of delivery

WHAT WILL YOU KNOW AT THE END OF THIS COURSE?

1] Understanding of theoretical as well as practical issues of basic digital image acquisition and processing

2] The ability to apply digital image processing principles for emerging applications in inspection, remote sensing, microscopy, surveillance, robotic assembly, etc.

3] The ability to perform various operations on images, such as, filtering, enhancement, restoration, edge detection, segmentation, template matching, etc.

4] Understanding of current research initiatives within the image processing and analysis community

5] Ability to complete an independent practical project and carryon further research

6] Preparation for deeper understanding in image processing and related topics in image analysis, computer vision, pattern recognition, etc.

TENTATIVE SCHEDULE

TIMELINE	MATERIAL COVERED
WEEK 1	Class Preliminaries Introduction – Types of images, imaging devices, acquisition, representation Image Geometry – Transformations, pixels, sampling Readings: TBA
WEEK 2	Human Visual System – Visual perception, image formation, photoreceptors Binary Image Processing – Image generation, logical operations, blob coloring Readings: TBA
WEEK 3	Point Operation – Histogram, linear operators, nonlinear operators, histogram shaping Algebraic Image Operations Geometric Image Operations Readings: TBA
WEEK 4	Discrete Fourier Transform – Image frequencies, sampling theorem Readings: TBA
WEEK 5	Linear Filtering – Wraparound and linear convolution, linear filters, linear enhancement, deconvolution, Wiener filter Readings: TBA
WEEK 6	Nonlinear Filtering – Median filters, morphology, noise models, order statistic filters Review/Questions Readings: TBA
WEEK 7	Mid-term Exam Color – Fundamentals, models Readings: TBA
WEEK 8	Segmentation – Points, lines, edge, thresholding, regions Readings: TBA
WEEK 9	Object Measurements – Size, shape, texture, curve, surface Template Matching Edge Detectors Readings: TBA
WEEK 10	Hough Transform B-Splines Readings: TBA
WEEK 11	Stereo – Range finding, 3D geometry 3D image processing Readings: TBA
WEEK 12	Compression – Lossless, lossy, JPEG, Wavelets Readings: TBA
WEEK 13	Image Processing in Multimedia – Image retrieval, representations Project Presentations Readings: TBA
WEEK 14	Project Presentations
WEEK 15	Review/Questions

NOTES

Attendance and participation in class in encouraged. The exams will cover topics discussed in class and will test your understanding of the basic principles. The exams will be different for students enrolled in COSC 4393 and COSC 6397,. All students are expected to complete a project and provide a written report on the day of the final exam. Project presentations will be held in class in the last week before exams. All students should prepare an abstract of their proposed projects by the eighth week of the Semester and submit them for approval. Students enrolled in COSC 6397 will propose a project commensurate to their expected knowledge.

All assignments submitted after the due date will accrue a penalty of 33% per day.