Spring 2011

ECE 513
Digital Image Processing

Prerequisites: ECE 312 and ECE303 or equivalents.

Course Credits: 03

Class Hours & Place: 12:30-1:45 p.m. TR, Engr. B3

Textbook: "Digital Image Processing", R.C. Gonzalez and R.E. Woods, 3rd Edition, Prentice-Hall, 2008.

Reference: 1. "Digital Image Processing using MATLAB, R.C. Gonzalez, R.E. Woods, and S. L. Eddins, Pearson Prentice-Hall, 2004.

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Office Hours: TR, 2:00-3:00 p.m.

Objectives:
The objective of this course is to introduce the students to the fundamental techniques and algorithms used for acquiring, processing and extracting useful information from digital images. Particular emphasis will be placed on covering methods used for image sampling and quantization, image transforms, image enhancement and restoration, image encoding, image analysis and pattern recognition. In addition, the students will learn how to apply the methods to solve real-world problems in several areas including medical, remote sensing and surveillance and develop the insight necessary to use the tools of digital image processing (DIP) to solve any new problem.

Course Outline:
1. Review and Introduction: Introduction to the DIP areas and applications.
2. Image Digitization: Sampling and quantization.
3. Image Transforms: 2-D DSFT and 2-D DFT, 2-D discrete cosine transform (DCT), 1-D and 2-D Karhonen Loeve (KL) or principal component analysis (PCA) and 1-D and 2-D discrete wavelet transforms and relation to filter banks.
4. Image Enhancement: Point and algebraic operations, edge detection and sharpening, filtering in the spatial and transformed domains.
5. Image Restoration: Degradation models, inverse and pseudo-inverse filtering, 2-D Wiener filtering and implementation.
6. Image Compression and Encoding: Entropy-based schemes, Transform-based encoding, Predictive encoding and DPCM, Vector quantization, Huffman coding.
7. Feature Extraction and Segmentation: Contour and shape dependent feature extraction, textural features, region-based and feature-based segmentation.
8. Pattern Classification: Standard linear and Bayesian classifiers, supervised vs unsupervised classification, classification performance index.
9. Applications in satellite, sonar, radar and medical areas.

Grading and Exams:

Homework	15%	
Mid-term	25%	(Tentative date: Thursday March 24, 2011)
Computer Assignments □	35%	
Final Project ♣	25%	

□There will be four computer assignments using MATLAB image processing toolbox dealing with simulation and application of a number of selected DIP algorithms.

♣The topic of the final project must be approved by the instructor. A final report (75%) and an oral presentation (25%) must be delivered by the last week of the semester.