EE5372 IMAGE PROCESSING, CRN 26300, and EE4395-001 Special Topics (Fundamentals of Digital Image Processing, CRN 22830)

Joint Offering in Spring 2019

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OFFICE HRS.: (tentative)
Tuesday & Thursday 11:30 AM – 12:25 PM
Monday & Wednesday 1:30 – 2:00 PM (after EEDIP class)
Friday (unless other meetings conflict) 11-12 noon (send e-mail or call before)

CLASS TIME/PLACE: **Tuesday and Thursday 12:00 – 1:20 P. M.**
Liberal Arts Building 207

TEXTBOOKS:

(1) Main Textbook (DIP): DIGITAL IMAGE PROCESSING, by R. C. Gonzalez and R. E. Woods, 3rd Edition 2008 (or 4th Edition) from Pearson Prentice-Hall (differences are not very dramatic)
3rd Edition URL: http://www.imageprocessingplace.com/DIP-3E/dip3e_main_page.htm
4th Edition URL: http://www.imageprocessingplace.com/DIP-4E/dip4e_main_page.htm

(2) **Additional Textbook (IPE)**: Image Processing for Engineers, by Andrew E. Yagle and Fawwaz T. Ulaby from University of Michigan Publishing, available for free download.
Textbook URL: http://ip.eecs.umich.edu/

(3) **Classic Reference (Lim):** Two-Dimensional Signal and Image Processing, by Jae S. Lim, Prentice-Hall, 1990.

PREREQUISITE: The following courses or their equivalents: (1) EE3353 (Discrete-Time Signals and Systems) and (2) EE 3384 (Probabilistic Methods). Optional additional background that would be useful:
(3) Digital Signal Processing (DSP)
(4) Biomedical Imaging or Biomedical Signal and Image Processing
(5) Computer Vision
For non-EE majors the pre-requisite can be "Mathematical Maturity" and permission from the instructor.

COMPUTER USAGE: Homeworks and computer assignments will require the use of MATLAB with the ***Image Processing Toolbox (IPT)***. Having access or experience with other image processing or computer vision software packages such as *CVIPTools, CVIPLab, ImageJ, LabView*, *OpenCV*, etc. is beneficial and such packages could be used instead of Matlab in some cases for your own practice.

COURSE APPROACH: The course will follow closely the theme presented by the Main textbook and will be complemented using the other two textbooks (see class Lecture Notes). You must have a PAPER copy of the Main textbook for in-class open-book Exams. Graduate students will be required to do a project with a presentation and final report. Undergraduates taking this course will be allowed to skip the Project and finish the course early by approximately 2 weeks.

GRADING:	Exams 1 and 2 in-class semester exams:	60 %
	Homeworks and computer assignments	20 %
	Final Project **(graduate students only)**	**20 %**
	TOTAL	100 % **(80% for undergraduates)**

PROPOSED TOPICS FROM THE MAIN TEXTBOOK (topics from additional textbook to be incorporated gradually)

I- DIGITAL IMAGE FUNDAMENTALS (parts of Chapter 2): visual perception, image acquisition, image sampling and quantization, pixel relationships, Intro. to mathematical tools used in DIP, etc.

II- INTENSITY TRANSFORMATION AND SPATIAL FILTERING (parts of Chapter 3): gamma correction, histogram equalization and matching, spatial convolution, filter masks, image sharpening, Intro. to bilateral filtering (supplement) etc.

III- FILTERING IN THE FREQUENCY DOMAIN (parts of Chapter 4): Fourier transform of 2-D signals and sampling, the DFT in 1-D and 2-D and properties, image smoothing and sharpening in the frequency domain, etc.

IV- IMAGE RESTORATION AND RECONSTRUCTION (parts of Chapter 5): mean and order statistics filters, image degradation estimation, Wiener filtering, Intro. to regularization-based restoration (supplement)

V- COLOR IMAGE PROCESSING (parts of Chapter 6): Color models, color transformations, color corrections, processing of color images, etc.

VI- MORPHOLOGICAL IMAGE PROCESSING (parts of Chapter 9): Basic operations on binary images such as: *dilation, erosion, opening and closing*, various applications of morphological filters, etc.

VII- IMAGE SEGMENTATION (parts of Chapter 10): Edge detection and linking, thresholding, region-based segmentation, use of motion in image sequences, etc.

IX- ADDITIONAL, SPECIAL TOPICS (basics of Fourier Imaging (e. g. MRI), 2-D DSP based on additional textbook or classic textbook)