PMP596 Digital Image and Video Processing

Course Syllabus
Credits: 4

Goal: The goal of this course is to introduce to students the basic theory and recent important topics related to digital image and video processing.

Description: The first part of the course provides the background and basic techniques for digital image processing. The second part of the course cover various special topics including image restoration, high dynamic range imaging, image fusion, multi-resolution imaging with wavelet transform, image super resolution, and 3D-video. The course consists of weekly lectures and homework. The homework exercises are specifically designed towards providing hands-on experience on digital image processing.

Prerequisites: EE 341, Discrete Time Signal Analysis, familiarity with MATLAB, or permission of the Coordinator.

Textbook: Rafael C. Gonzalez and Richard E. Woods, Digital Image Processing, 3nd Ed. Prentice Hall.
http://www.imageprocessingbook.com/

Course Contents:
1. Image Representations (1 week)
  * Image acquisition, Sampling, Quantization
2. Visual Perception and Color Spaces (0.5 week)
  * Physiological characteristics of the eye and image formation
  * Human color vision
  * Color models: CIE, RGB, CMYK, HSI, HSV, L*a*b*
3. Image Enhancement and Manipulation (1.5 week)
  * Intensity transforms
  * Pseudocolor image processing
  * Affine transform
4. Spatial Domain Image Enhancement and Filtering (1 week)
  * Spatial domain 2-D LSI filtering
  * Median filtering
5. Frequency Domain Image Filtering and Enhancement (1.5 week)
  * 2-D Discrete Fourier Transform
  * Frequency domain LSI filtering
  * Enhancement in the frequency domain
Midterm (0.5 week)
6. Edge Detection and Mathematical Morphology (1 week)
7. Image Restoration (1 week)
  * Image degradation model
  * Inverse Filtering
  * Wiener filtering
8. Multi-resolution and wavelet transform (1.5 week)
9. Image segmentation (0.5 week)
10. 3D Video (0.5 week)

Grading:
Midterm: 30%
Homework: 20%
Final report: 20%
Final exam: 30%