440mcd2018

Master Course Description for EE 440 (ABET Sheet)

Title: Introduction to Digital Imaging Systems

Credits: 4

UW Course Catalog Description

Coordinator: Rania Hussein, Associate Teaching Professor, Electrical and Computer Engineering

Goals: To provide students with an introduction of the basic theory of image processing and key aspects in image computing and digital video systems, including various standards.

Learning Objectives: At the end of this course, students will be able to:

1. *Explain* various image representations, human visual perception, color space, and standards.
2. *Write* computer programs to perform image filtering, enhancement, restoration, and transform.
3. *Perform* various image and video compression using various techniques.
4. *Implement* algorithms to solve real-world image and video processing problems.

Textbook: Rafael C. Gonzalez and Richard E. Woods, *Digital Image Processing, 3th Ed.*, 2002, Prentice Hall.

Prerequisites by Topic:

1. Discrete time signal analysis
2. Discrete time Linear Time-Invariant Systems
3. Impulse response and Convolution
4. Correlation
5. Z-transform
6. Discrete Fourier Transform
7. Digital filters

Topics:

1. Image Representations (1 week)
2. Visual Perception and Color Spaces (0.5 week)
3. Image Enhancement (1.5 week)
4. Image Filtering (1 week)
5. Image Enhancement in the Frequency Domain (1 week)
6. Image Restoration (0.5 week)

7. Edge Detection, Segmentation, and Mathematical Morphology (1 week)
8. Image Transform (1 week)
9. Image Compression (1 weeks)
10. Video Compression (1 week)

Course Structure: The class meets for two lectures a week and also has weekly lab assignments. The students use the computer resources to perform lab assignments with the help from the TA and the instructor.

Computer Resources: This course uses MATLAB or Python and image processing and video compression software to perform various kinds of image/video processing/manipulation.

ABET Student Outcome Coverage: This course addresses the following outcomes:

H = high relevance, M = medium relevance, L = low relevance to course.

(1) *An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.* **(M)** Through midterm and final exams, the students demonstrate they have the ability to identify, formulate, and solve complex engineering problems by applying the image processing theory and knowledge they learned in this course.

(2) *An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.* **(M)** The homework require students to apply engineering design techniques to produce solutions that meet specified needs with consideration of economic factors.

(3) *An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.* **(M)** The homework require the students to demonstrate their ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgement to draw conclusions.

(4) *An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.* **(H)** The final project requires students to search new knowledge as needed from the web to implement an image processing demonstration.

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