ECE 51800 -- Digital Image Processing

Type of Course
Graduate course, can be technical Elective for EE/CmpE

Catalog Description
This course introduces the fundamentals of digital image processing from both theory and application perspectives. It covers digital image fundamentals, image transformation, image enhancement in spatial and frequency domains, image restoration and reconstruction, image segmentation, and advanced topics in digital image processing including deep learning for image classification, object recognition, and semantic/instance segmentation. Permission from department required. Permission from instructor required.

Credits
3

Contact Hours
3

Prerequisite Courses
ECE 22900, ECE 30100

Corequisite Courses

Prerequisites by Topics
Matlab or C++ Programming, Basic signal processing knowledge

Textbook
R. C. Gonzalez and R. E. Woods, "Digital Image Processing," 4th edition

Course Objectives
A student who successfully fulfills the course requirements will have demonstrated:

1. an understanding of fundamental techniques and algorithms used for acquiring and processing digital images
2. knowledge of image sampling and quantization
3. an ability to apply and evaluate image transforms in spatial and frequency domains
4. modeling and assessing image enhancement and restoration
5. comprehension and application of image analysis and pattern recognition
6. design and implementation of deep convolutional neural networks for image classification and localization
7. an ability to analyze real world applications using advanced image processing methods and latest AI techniques

Lecture Topics
1. Review: Matlab orientation and refreshment
2. Review: Linear algebra and linear systems
3. Vision, Image sampling, resolution, and quantization
4. Spatial domain image transforms: Intensity transformation, histogram processing, spatial filtering
5. Frequency domain image transforms: Fourier transforms and frequency filtering
6. image enhancement and restoration: noise modeling, degradation estimation, restoration filtering
7. image analysis and pattern recognition: morphological image processing and reconstruction, traditional edge detection and segmentation
8. Deep learning in image processing
9. Deep learning based image classification, localization and segmentation
10. Real world applications using advanced image processing methods and latest AI techniques

Computer Usage

High

Laboratory Experience

None

Design Experience

Median

Coordinator

Bin Chen, Ph.D.

Date

11/14/2022