

# **ECE 547: Topics in Image Processing**

Fall 2009

<http://courses.ece.uiuc.edu/ece547/>

## **Instructor:**

Prof. Minh N. Do (minhdo@illinois.edu, 115 Coordinated Science Lab)  
Lectures: Tuesdays and Thursdays, 11am -12:20 pm; 163 Everitt Lab.  
Office hours: Thursdays 2-3 pm (115 CSL) + appointments by email.

## **Teaching Assistants:**

John Yang (jyang29@illinois.edu) and Vuong Le (vuongle2@ifp.uiuc.edu)  
Office: 2323 Beckman Institute (phone: 244-2960)  
Office hours: Tuesdays 2-3 pm (East Bridge, 2nd floor, Beckman Institute) + appointments by email.

## **Course Description**

Examines fundamental concepts, techniques, and directions of research in image processing; topics include two-dimensional Fourier transform and filtering, image digitization, coding, restoration, reconstruction, analysis, and recognition.

**Prerequisite:** ECE 410 (Digital Signal Processing), and ECE 313 (Probability with Engineering Applications); or equivalent.

## **Text:**

- A. Bovik, "The Essential Guide to Image Processing", 2nd ed., Academic Press, 2009.

## **Recommended Text:**

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

Both of these books are on reserve at the Grainger Engineering Library.

**Course Objectives:** Upon completion of this course, you should be able to:

1. Explain the mathematical theory and principles underlying a variety of image processing tasks.
2. Use appropriate computational techniques in image processing applications.
3. Think critically, ask questions, and apply problem-solving techniques.
4. Research, present, and report a chosen project within a specified time.

**Grading:**

Homework and machine problems	30%
Midterm exam 1	25%
Midterm exam 2	25%
Mini-project	20%

**Homework and Machine Problems:** There will be weekly assignments, alternating between homework and machine problems. These will always be due in the Thursday class of the following week. Solutions will be posted on the course web page. Late homework will not be accepted.

**Exams:** There will be two mid-term exams. These exams will be open book.

**Mini-Project:** There will be a mini-project consisting of a presentation and written report on a topic of your choosing related to this course. A list of suggested project topics will be provided. A ten-minute oral presentation and a four-page report in the format and style of an IEEE conference paper are expected.

**Course Plan:**

Week	Topic	Reading	Assignment
1	Introduction and basic image processing	Ch. 1, 3	HW 1
2	Color image representation and processing	Ch. 8	MP 1
3	Image Fourier analysis	Ch. 5	HW 2
4	Linear filtering and edge detection	Ch. 10, 19	MP 2
5	Wavelets and filter banks	Ch. 6	HW 3
6	Statistical image and noise models	Ch. 7, 9	Exam 1
7	Image denoising and enhancement	Ch. 11, 12	MP 3
8	Morphological image processing	Ch. 4, 13	HW 4
9	PDE-based image processing	Ch. 20	MP 4
10	Image restoration	Ch. 14, 15	HW 5
11	Image coding and JPEG	Ch. 16, 17	MP 5
12	Wavelet image coding and JPEG2000	Ch. 18	Exam 2
13	Visual perception and image quality assessment	Ch. 21	Mini-project
14	Applications: fingerprint and face recognition	Ch. 23, 24	
15	Project presentations		

Reading chapters are from the textbook A. Bovik, "The Essential Guide to Image Processing", 2nd ed., Academic Press, 2009. Occasionally, supplement notes and papers will be provided.