Introduction to
EE637 Digital Image Processing I

- Prerequisites:

  – EE301 - Undergraduate signals and systems
  – EE302 - Undergraduate probability

- Course Objectives:

  – Learn analytical methods of image and 2-D signal processing.
  – Learn techniques commonly used in image processing.
  – Develop experience in using computers to process images.

- Course Text (optional):

  – Al Bovik editor, *Handbook of Image & Video Processing,* Academic Press, San Diego.

- Supplementary references:

  – A. K. Jain, Fundamentals of Digital Image Processing, Prentice-Hall, 1989.
  – A. Rosenfeld and A. Kak, "Digital Picture Processing," volume 1, Academic Press, 1982.

Course Structure

1. Course web page

   - http://www.ece.purdue.edu/~bouman/ee637
   - Contains class notes, laboratories, homeworks, and exams

2. Lectures emphasize topical coverage

   - Print out course notes **before** lecture
   - Lectures cover details of analytical methods

3. Laboratories and homeworks emphasize practical application

   - Should be performed **independently** by students.
   - Require Netscape, Acrobat, Matlab, and ANSI C compiler.

4. Old exams can be used to prepare for prepare for exams

   - Will not be collected
   - Solutions are posted, but you should work the problems first.

Overview of Laboratories Assignments

1. Image Filtering

2. 2-D Random Processes

3. Neighborhoods and Connected Components

4. Pointwise Operations and Gamma

5. Introduction to Colorimetry

6. Image Restoration

7. Image Halftoning

8. JPEG Image Coding

What is Image Processing?

- It is more than 2-D signal processing

- It is focused on the applications requiring the processing of "images"

- It requires a complete understanding of:

    - Physics of imaging system
    - Mathematics of imaging algorithms
    - Psychophysics of visual perception

Image Processing Applications

- Digital photography

  - Point and shoot cameras: 5 mega pixel; $\approx$\$400
  - Single lens reflex (SLR) and portrate cameras: 14 mega pixel; $\approx$\$5,000

- Digital scanners

  - Flat bed home scanner: 24bit, 600dpi; $\approx$\$100
  - High resolution PMT drum scanner: 4000 dpi 36-bit color; $\approx$\$10,000

- The internet

  - Real-time video
  - Image and video database
  - H.261,H.263
  - MPEG1, MPEG2, MPEG4

- Broadcast television

  - Direct satellite system (DSS) using MPEG1 and MPEG2
  - High definition television (HDTV)/digital television (DTV)

- Medical Imaging

  - Transmission tomography: Computed tomography (CT)

– Emission tomography: Positron emission tomography (PET), and single photon emission tomography (SPECT)

– Magnetic resonance imaging (MRI), and functional MRI (fMRI)

– Ultrasound

– Optical and spectroscopic Imaging

- Remote sensing

– Multispectral ($<<$ 100 bands) and hyperspectral imaging ($>>$ 100 bands)

– Synthetic aperture radar (SAR)

- Automation

– Optical character recognition (OCR)

– Manufacturing and industrial inspection