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):

• Supplementary references:
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 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
  – Cell phone cameras: 8 mega pixel; \(\approx \$115\) (iPhone 6)
  – Point and shoot cameras: 16 mega pixel; \(\approx \$115\) (Canon A2500)
  – Single lens reflex (SLR) and portrait cameras: 36.3 mega pixel; \(\approx \$3,000 + \) lenses (Nikon D810)

• 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