CST382-3 Digital Image Processing

Lecture 1-Introduction

Objective

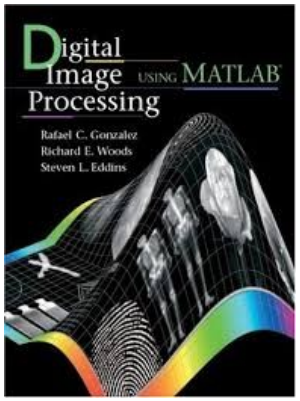
- To provide the knowledge on Images and its representation, types and manipulations.

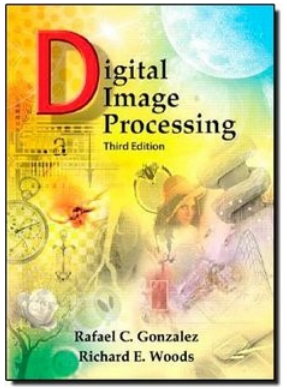
Learning Outcomes

- At the end of the course, the students will be able to
  - ✓describe Image representation
  - ✓perform Basic Operation on images
  - ✓perform Enhancement in images using filters
  - ✓perform Extraction and Processing the Region of Interest (ROI)

Reference Book

- Rafael C. Gonzalez & Richard E. Woods , 2009, "**Digital Image Processing using matlab**", 2nd Edition, Gatesmark Publishing,
- Rafael C. Gonzalez & Richard E. Woods , 2007 , "**Digital Image Processing**", 3rd Edition, Prentice Hall





Evaluation Criteria

- Continuous Assessment – 40%
  - 2 Practical Assignment -> 15%
  - 1 Mini Project (Group) -> 25%

- End Semester Examination – 60%

Outline

- Digital image?
- Digital image processing?
- History of digital image processing
- Examples of digital image processing
- Key stages

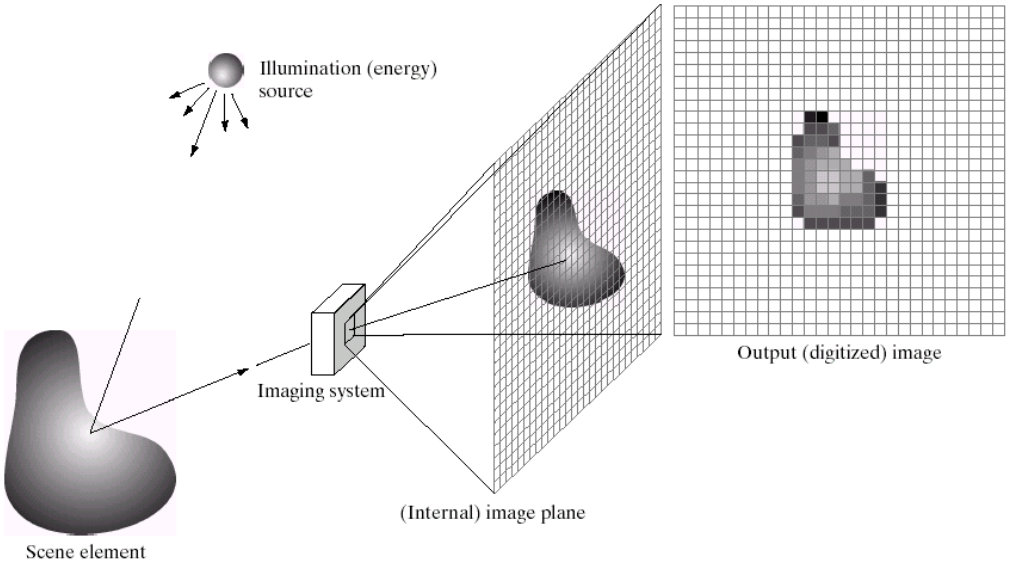
"One picture is worth more than ten thousand words"

Anonymous

www.google.com

Digital Image

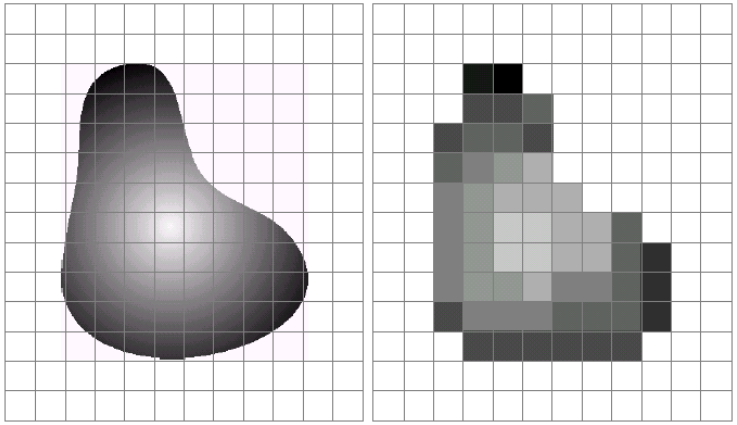
- A digital image is a representation of a two-dimensional image as a finite set of digital values, called picture elements or pixels

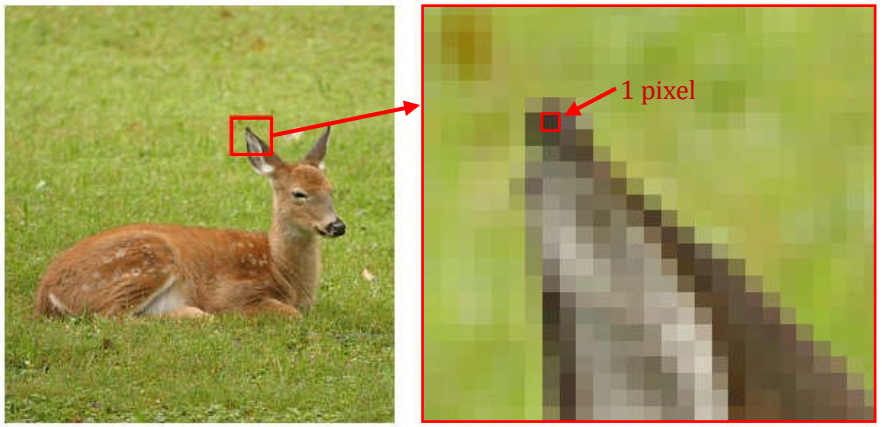


Images taken from Gonzalez & Woods, Digital Image Processing (2002)

Digital Image

- Pixel values typically represent gray levels, colours, opacities etc.
- Digitization implies that a digital image is an approximation of a real scene





Images taken from Gonzalez & Woods, Digital Image Processing (2002)

Transparent vs Opacity

opacity 0.2

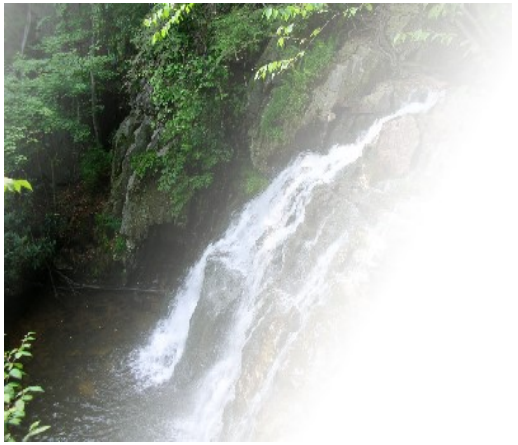
opacity 0.5

opacity 1
(default)

Digital Image

- Common image formats include:
  - 1 sample per point (B&W or Grayscale)
  - 3 samples per point (RGB)
  - 4 samples per point (Red, Green, Blue, and "Alpha", a.k.a. Opacity)





Images taken from Gonzalez & Woods, Digital Image Processing (2002)

What is Image Processing

- Processing of a Two dimensional picture in a digital computer
- Digital image processing focuses on two major tasks
  - Improvement of pictorial information for human interpretation
  - Processing of image data for storage, transmission and representation for autonomous machine perception

What is Digital Image Processing

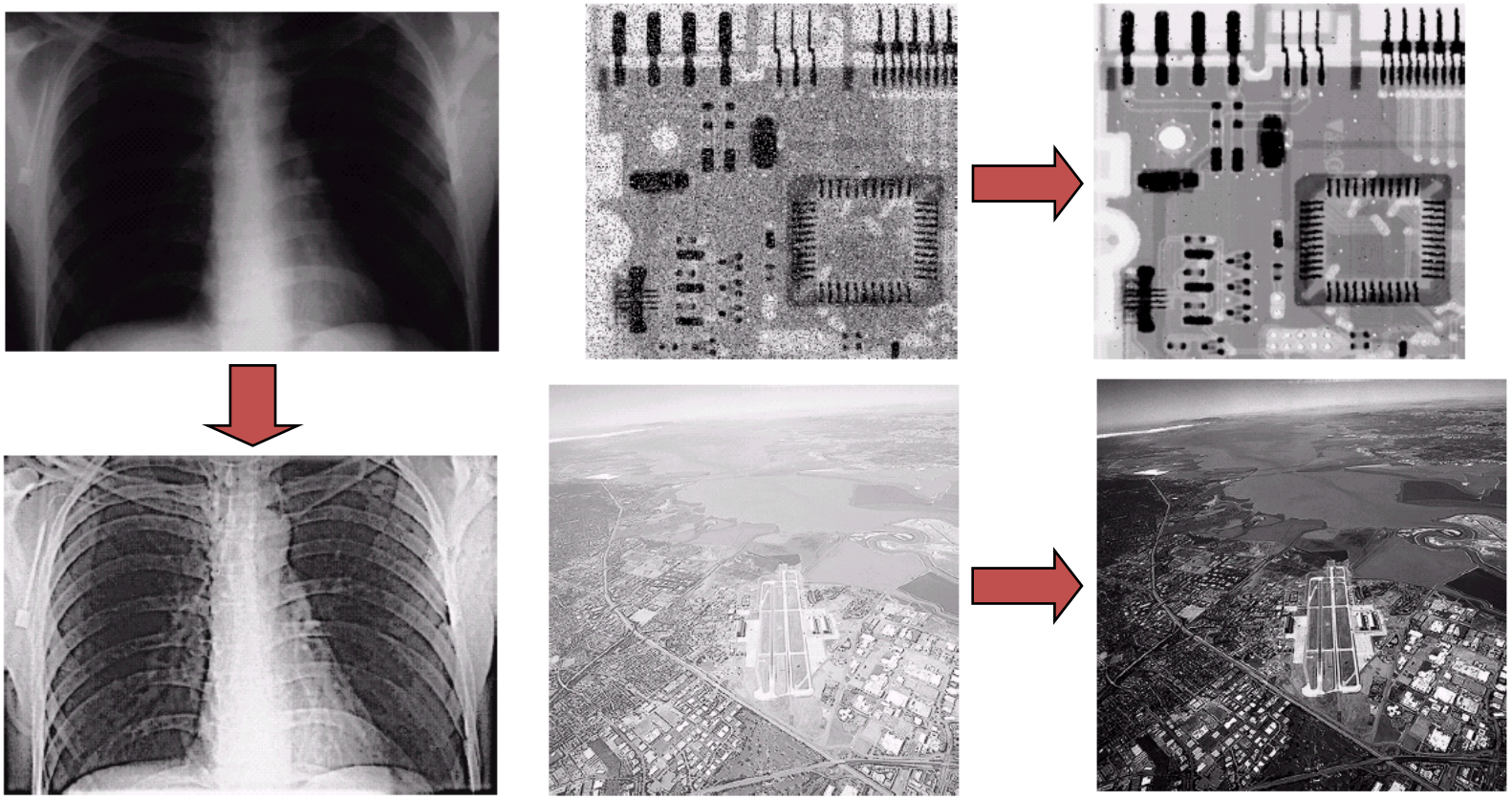
- The continuum from image processing to computer vision can be broken up into low-, mid- and high-level processes

Low Level Process	Mid Level Process	High Level Process
Input: Image **Output:** Image **Examples:** Noise removal, image sharpening	**Input:** Image **Output:** Attributes **Examples:** Object recognition, segmentation	**Input:** Attributes **Output:** Understanding **Examples:** Scene understanding, autonomous navigation

History of DIP

- Early 1920s
  - Transfer images between Submarines
- Mid to late 1920s
  - Improved Images
- 1964
  - Computers used to improve the quality of images of the moon taken by the Ranger 7 probe
- 1979:
  - Sir Godfrey N. Hounsfield & Prof. Allan M. Cormack share the Nobel Prize in medicine for the invention of tomography (CAT)

Image Enhancement



Images taken from Gonzalez & Woods, Digital Image Processing (2002)

Hubble Images

Wide Field Planetary Camera 1

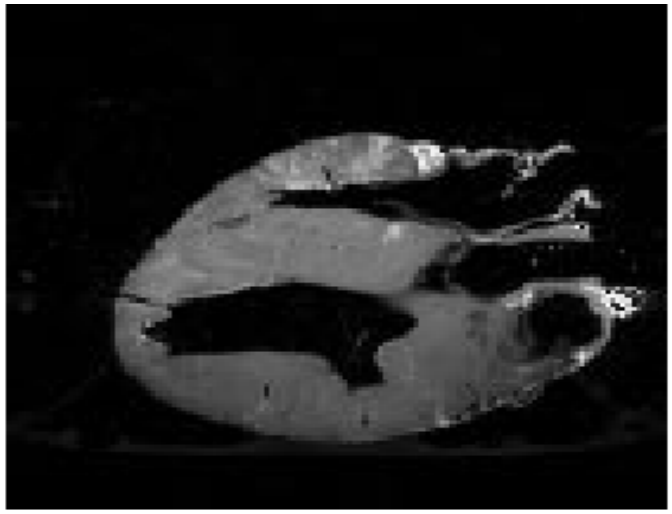
Wide Field Planetary Camera 2

Images taken from Gonzalez & Woods, Digital Image Processing (2002)

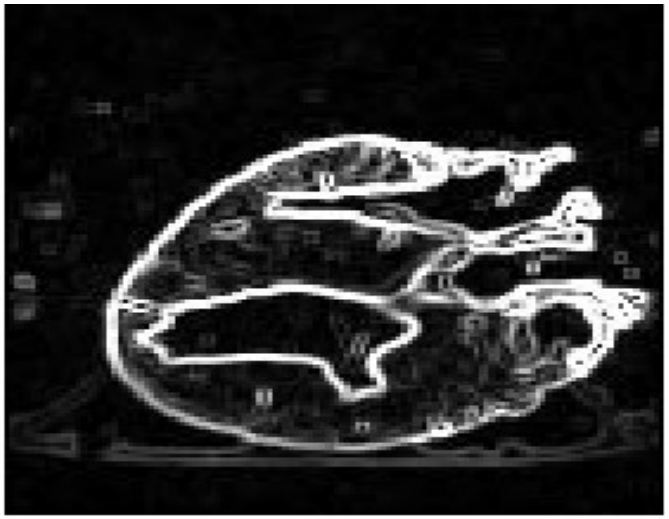
Artistic images

www.google.com

Medical Image Processing



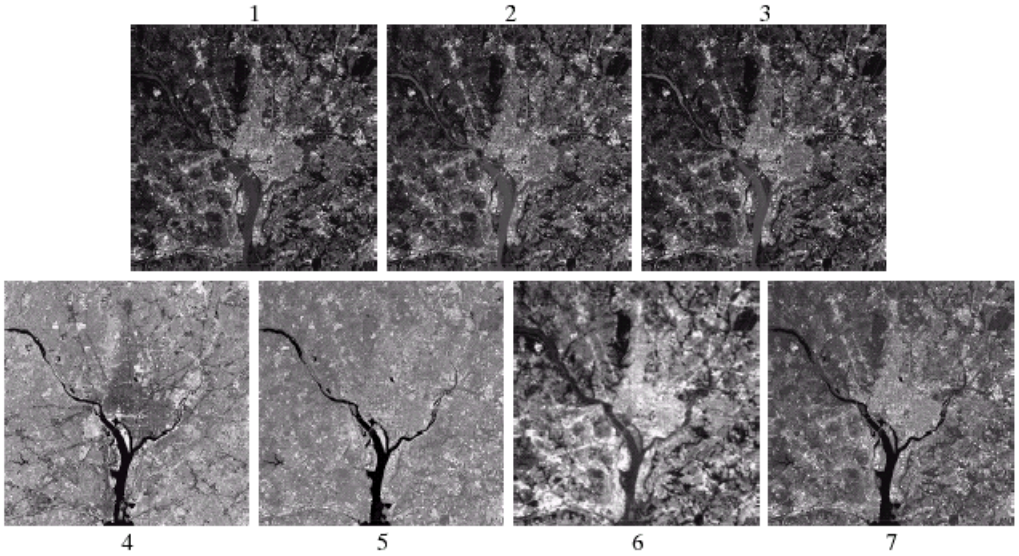
Original MRI Image of a Dog Heart



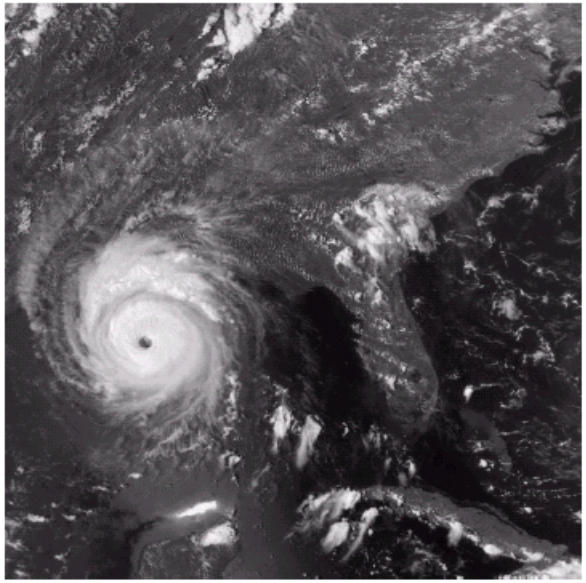
Edge Detection Image

Images taken from Gonzalez & Woods, Digital Image Processing (2002))

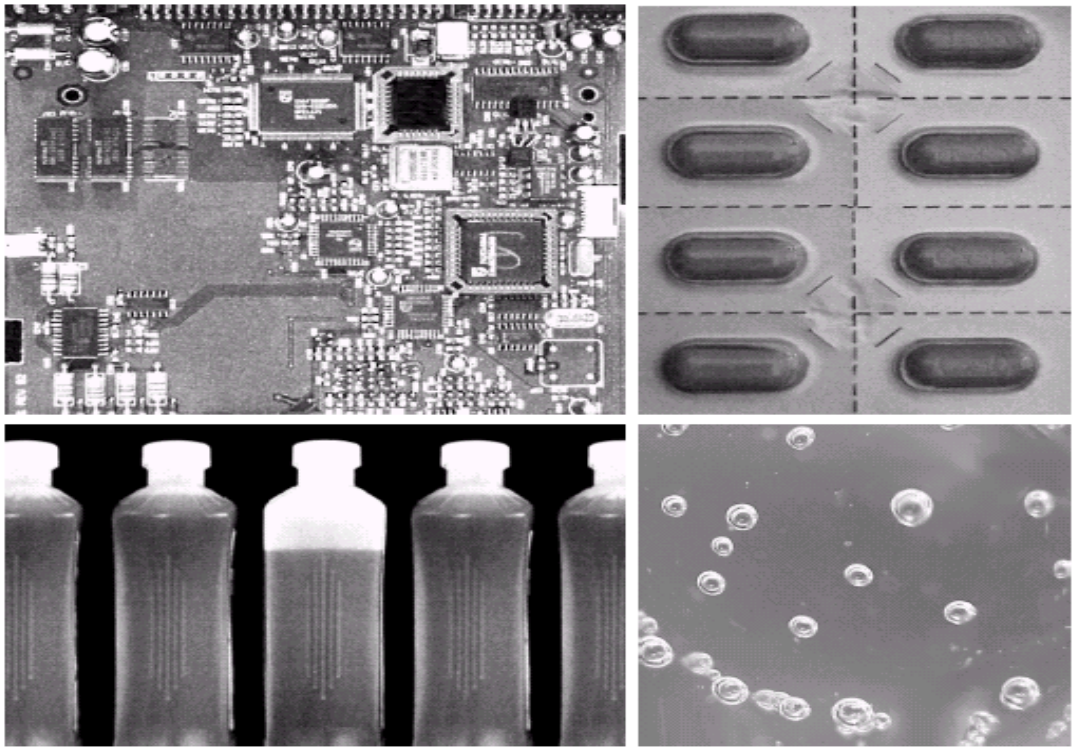
GIS & Remote Sensing



Images taken from Gonzalez & Woods, Digital Image Processing (2002)

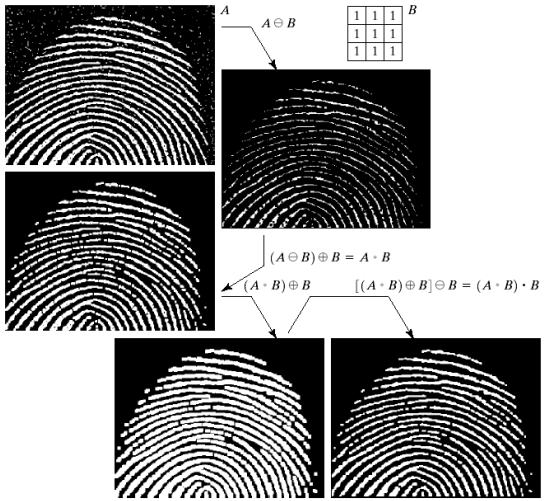


Industry



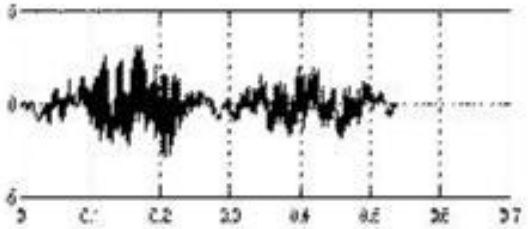
Images taken from Gonzalez & Woods, Digital Image Processing (2002)

Law and Crime

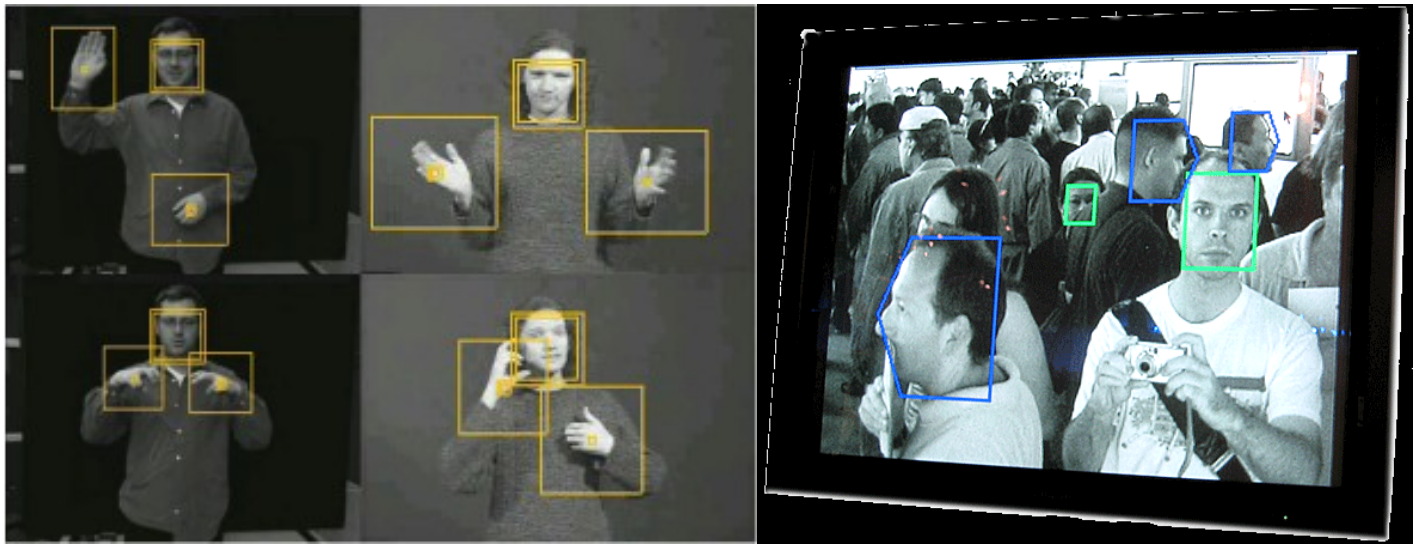


Images taken from Gonzalez & Woods, Digital Image Processing (2002)

Biometrics



Human Computer Interaction



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Key Stages

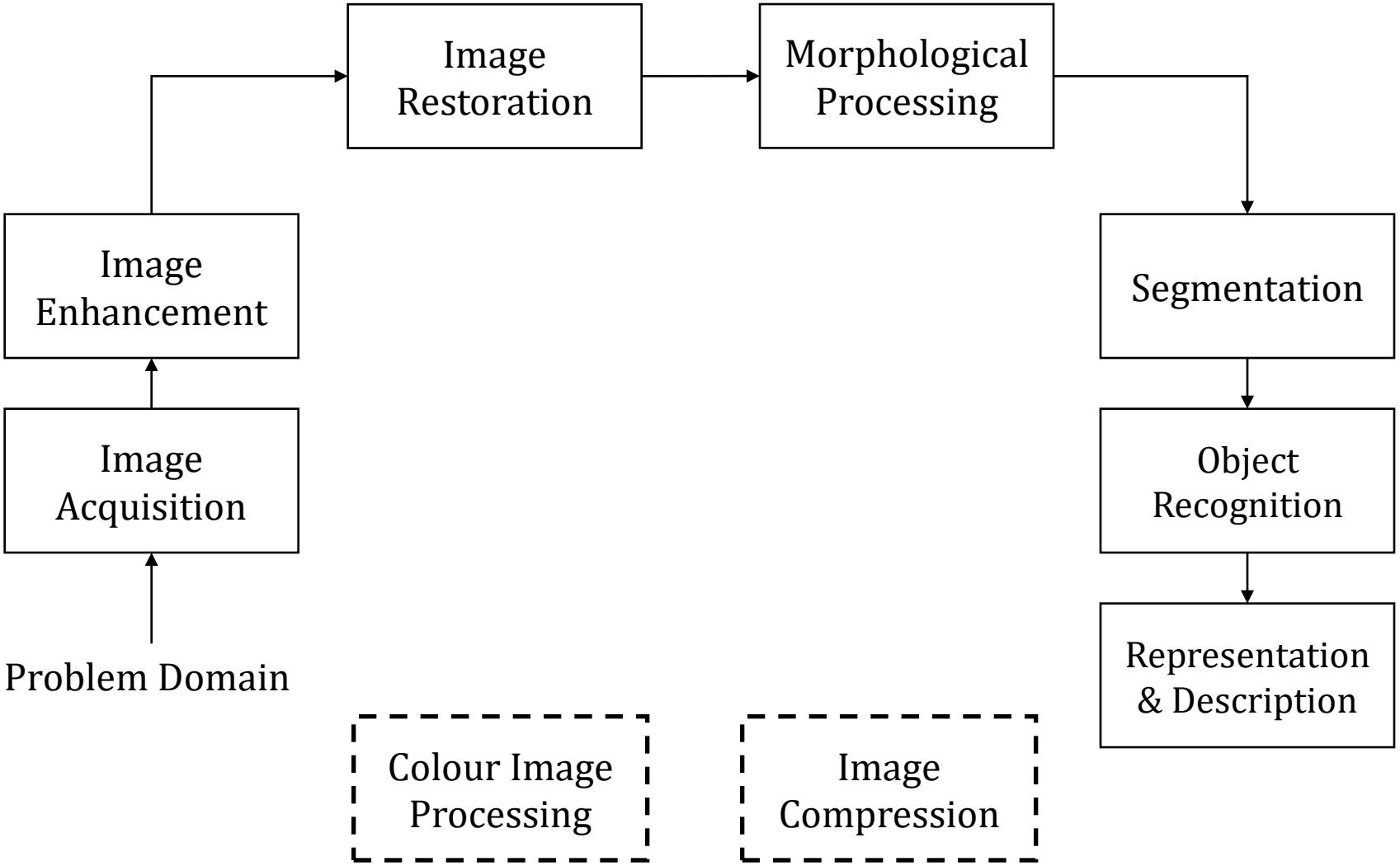
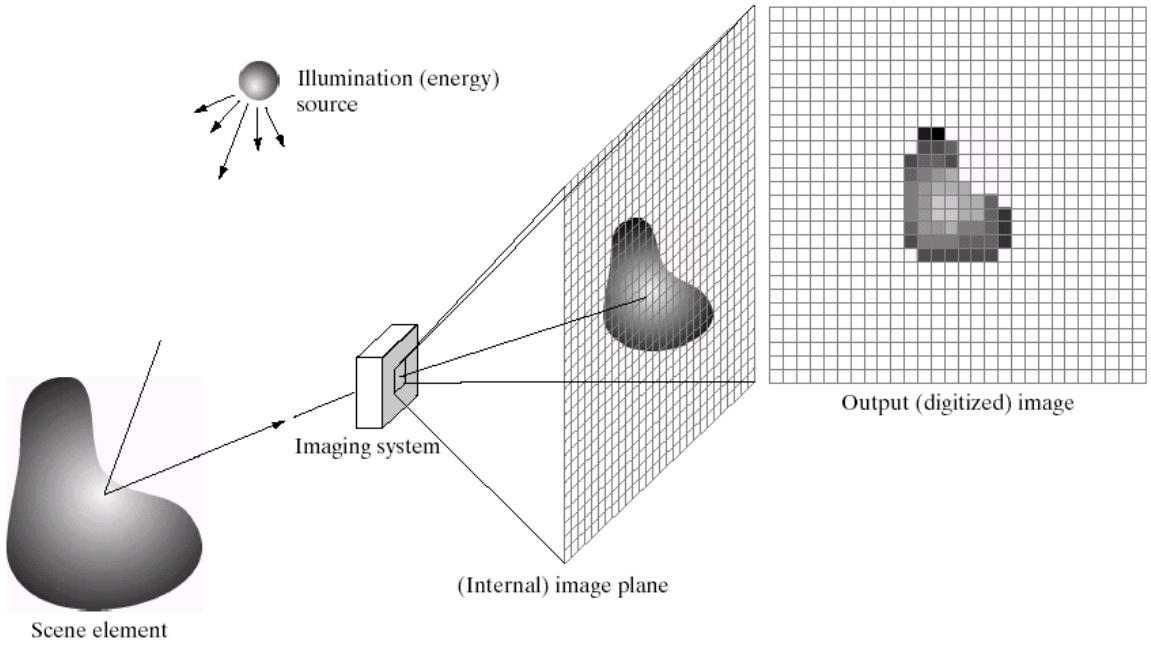


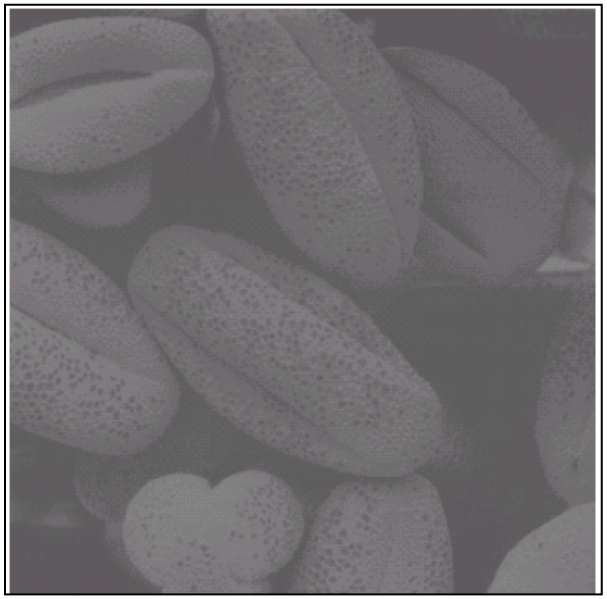
Image Restoration
Morphological Processing
Image Enhancement
Segmentation
Image Acquisition
Object Recognition
Representation & Description
Problem Domain
Colour Image Processing
Image Compression

Image Acquisition



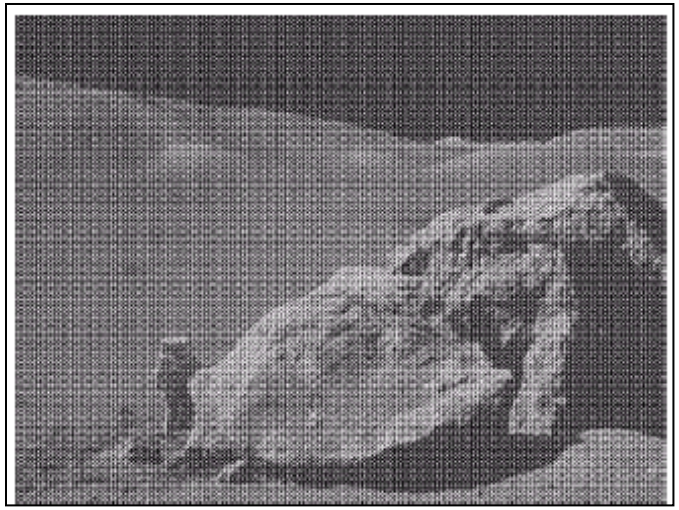
Images taken from Gonzalez & Woods, Digital Image Processing (2002)

Image Enhancement



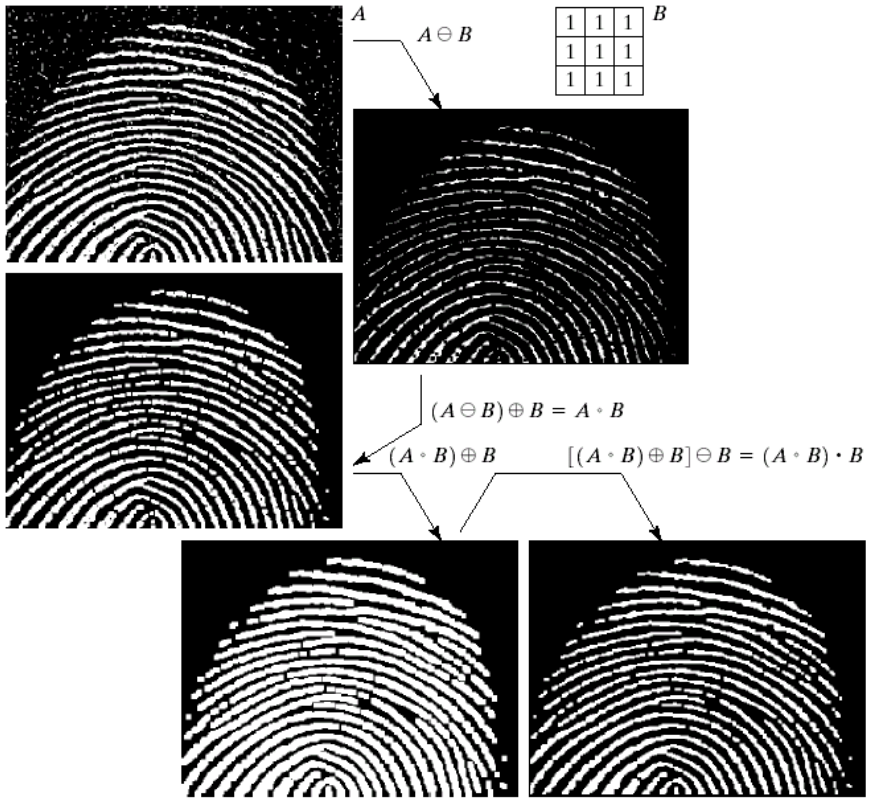
Images taken from Gonzalez & Woods, Digital Image Processing (2002)

Image Restoration



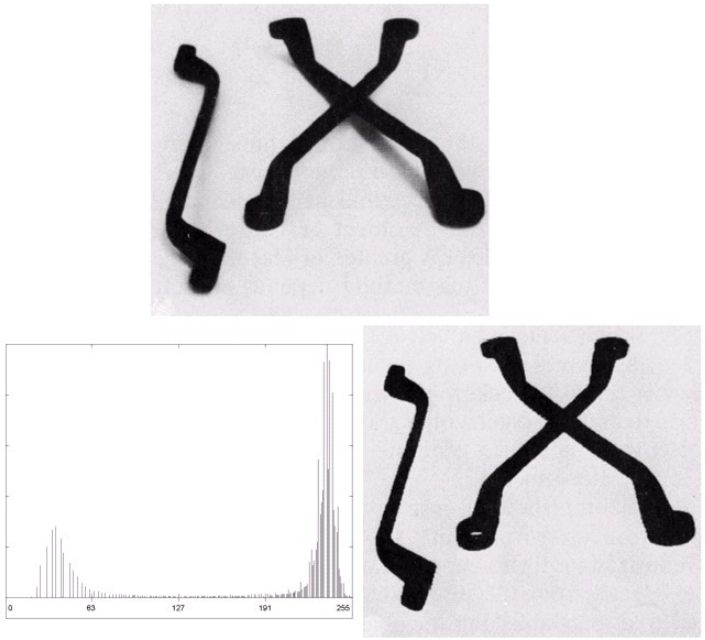
Images taken from Gonzalez & Woods, Digital Image Processing (2002)

Morphological Processing



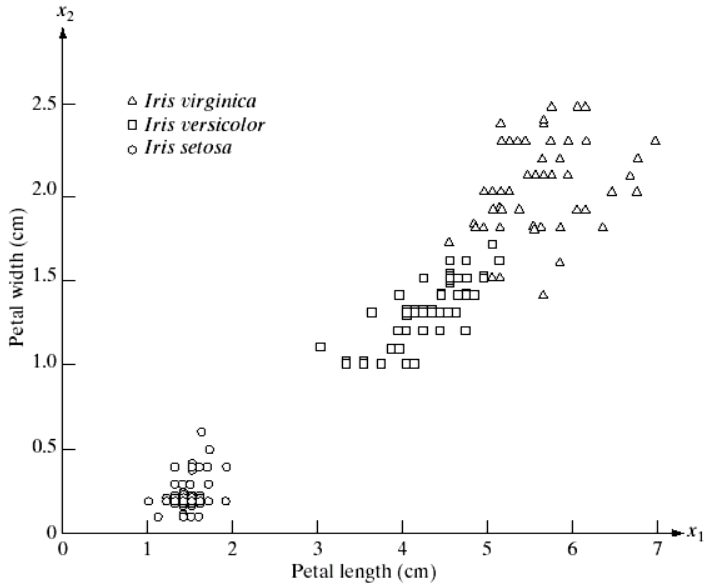
Images taken from Gonzalez & Woods, Digital Image Processing (2002)

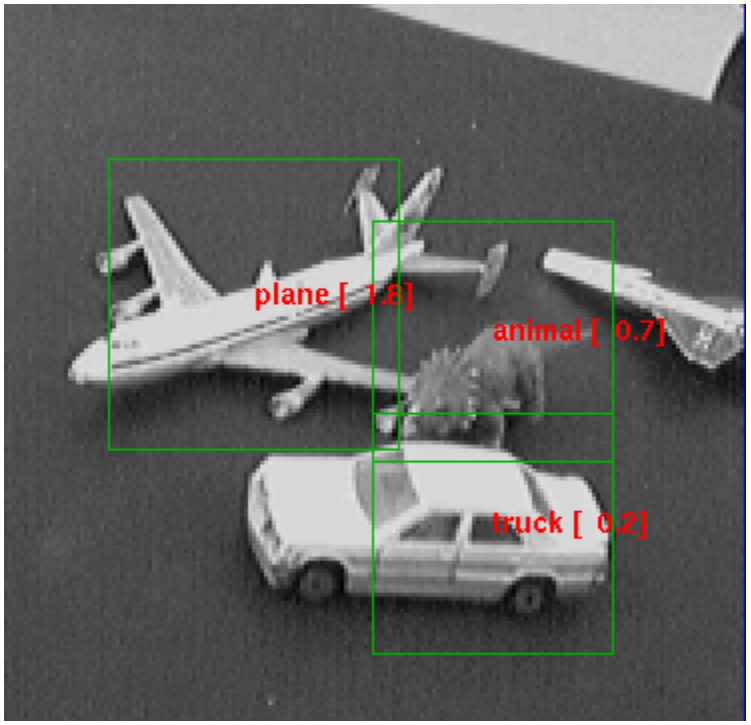
Segmentation



Images taken from Gonzalez & Woods, Digital Image Processing (2002)

Object Recognition





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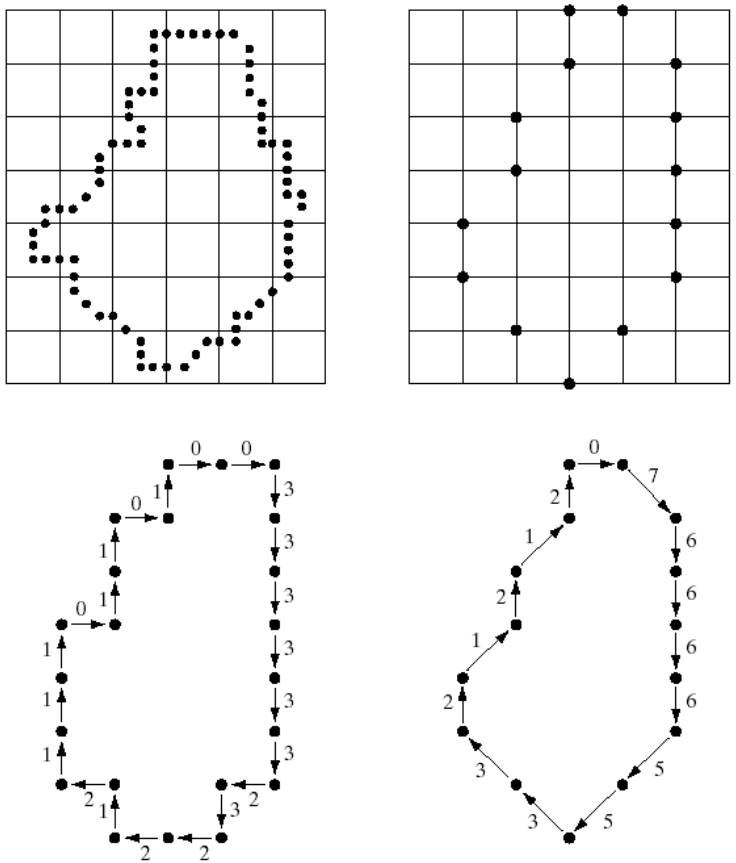
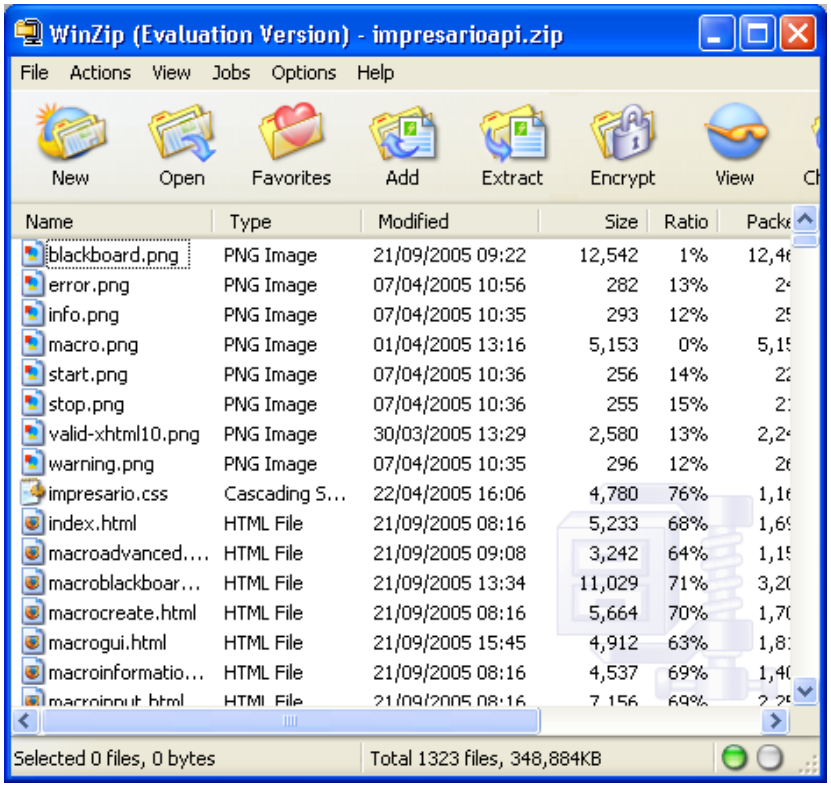
Representation & Description



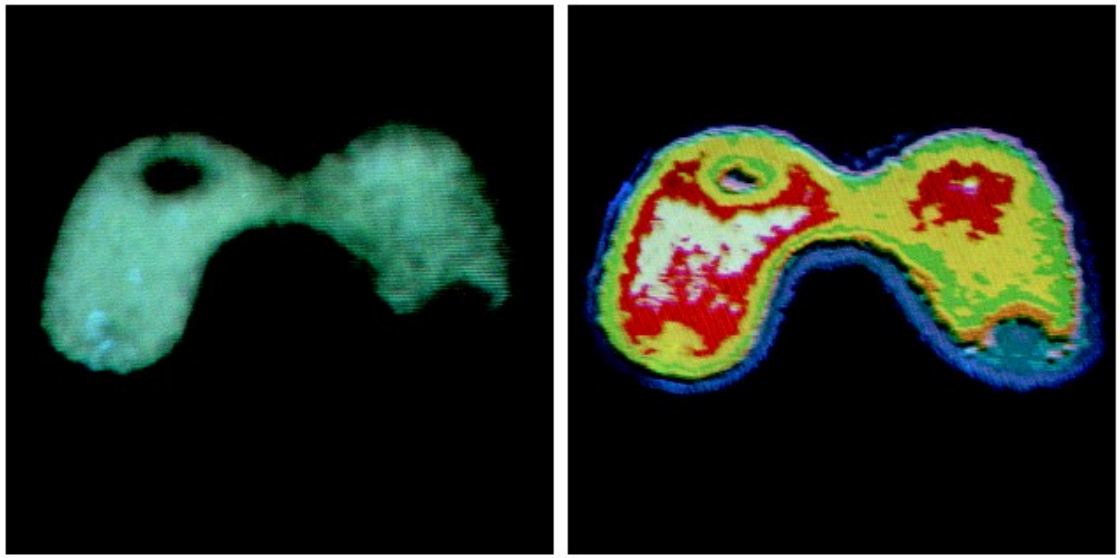
Images taken from Gonzalez & Woods, Digital Image Processing (2002)

Image Compression



www.google.com

Colour Image Processing



Images taken from Gonzalez & Woods, Digital Image Processing (2002)

Summary

- What is an Image
- What is DIP
- Application of DIP
- Key Stages
- Example for Each Stages