CST362-3 Digital Image Processing

Chapter1-Introduction

2016

Course Details

- Lectures:
  - Monday 11:00 – 1:00
- Labs:
  - Tuursday 11:00 – 1:00
  - D Lab
- Evaluation
  - Quiz-01 Structured Essay (Theory)
  - 5 Assignments (Practical)
  - Practical Exam (Practical)
  - Presentation (Research Papers)
  - Individual Mini Project (Practical Viva)

Theory Topics

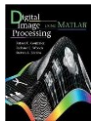
- Introduction and Digital Image Fundamental s
- Pixel Relationship
- Intensity Transformation and Spatial Filtering
- Filtering in the Frequency Domain
- Edge Detection
- Image Restoration
- Arithmetical Operators in Image Processing
- Morphological Operators
- Image Segmentation
- Color Image Processing
- Machine Learning in Image Processing
- Emerging Research applications of Image Processing

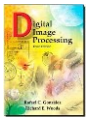
Practical Topics

- Introduction to Matlab
- Image Representation (Color, Grayscale and Black and White Images)
- Basic Operations
- Objects and Connectivity
- Histogram Equalization
- Filters and Mask
- Arithmetical Operations
- Morphological Operation
- Image Segmentation

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**", 2nd Edition, Prentice Hall





"One picture is worth more than ten thousand words"

Anonymous

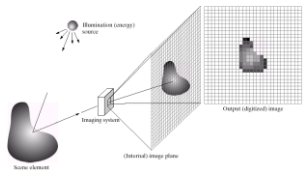
Introduction

Outline

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

Digital Image

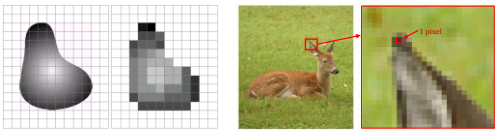
- A digital image is a representation of a two-dimensional image as a finite set of digital values, called picture elements or pixels



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

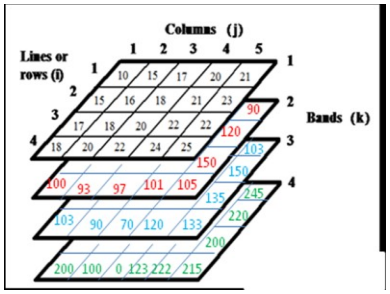
Digital Image

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



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

Digital Image



Digital Image

- Common image formats include:
  - 1 sample per point (B&W or Grayscale)
  - 3 samples per point (Red, Green, and Blue)
  - 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

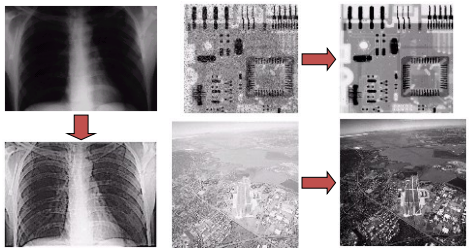
- The continuum from image processing to computer vision can be broken up into low-, mid- and high-level processes

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)

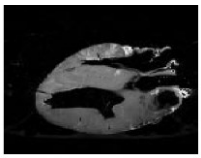
Hubble Images

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

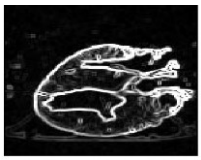
Artistic images

www.google.com

Medical Image Processing



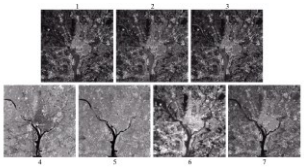
Original MRI Image of a Dog Heart

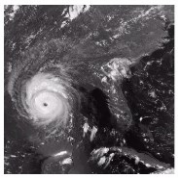


Edge Detection Image

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

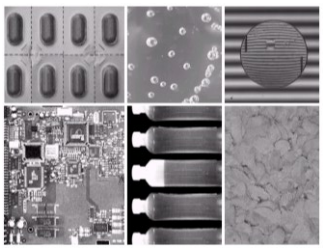
GIS & Remote Sensing





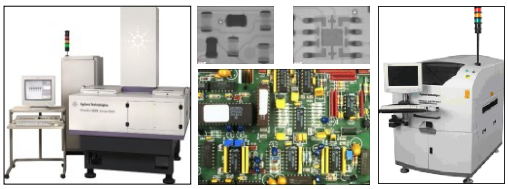
Images taken from Gonzalez & Woods, Digital Image Processing (2002)

Industry



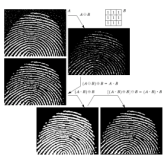
Images taken from Gonzalez & Woods, Digital Image Processing (2002)

Printed Circuit Board



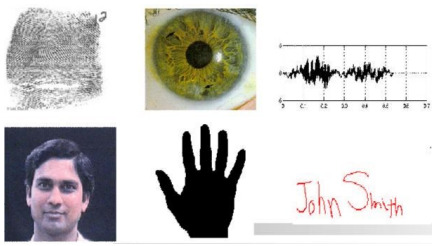
Images taken from Gonzalez & Woods, Digital Image Processing (2002)

Law and Crime

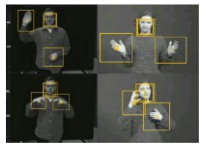


Images taken from Gonzalez & Woods, Digital Image Processing (2002)

Biometrics



Human Computer Interaction



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Key Stages

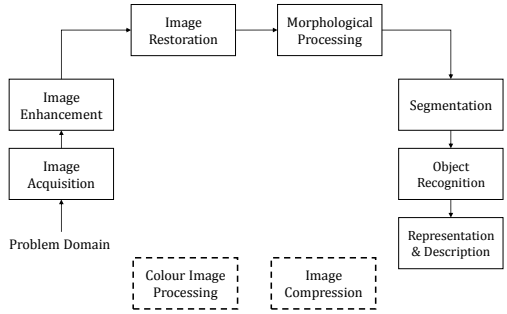
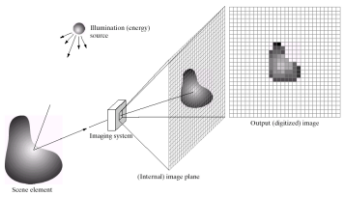
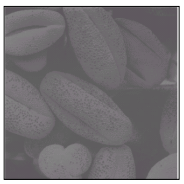


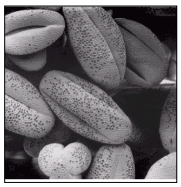
Image Acquisition



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

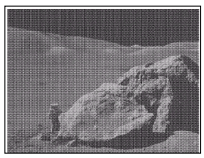
Image Enhancement





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

Image Restoration

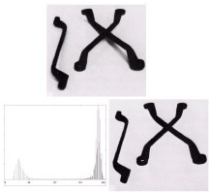


Images taken from Gonzalez & Woods, Digital Image Processing (2002)

Morphological Processing

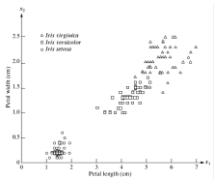
Images taken from Gonzalez & Woods, Digital Image Processing (2002)

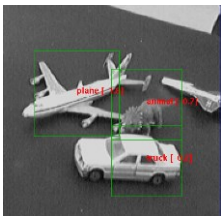
Segmentation



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

Object Recognition





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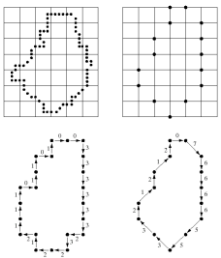
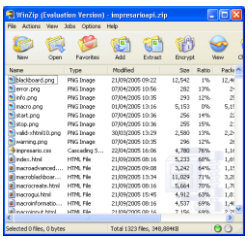
Representation & Description



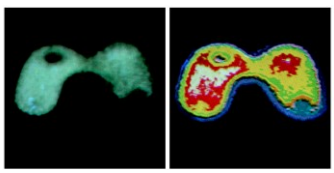
Images taken from Gonzalez & Woods, Digital Image Processing (2002)

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