



MEDICAL IMAGING PROCESSING

FOURTH STAGE

2025-2026

Introduction and Basics

BY

MS.c Mortada Sabri

MS.c Najwan Thaeer Ali

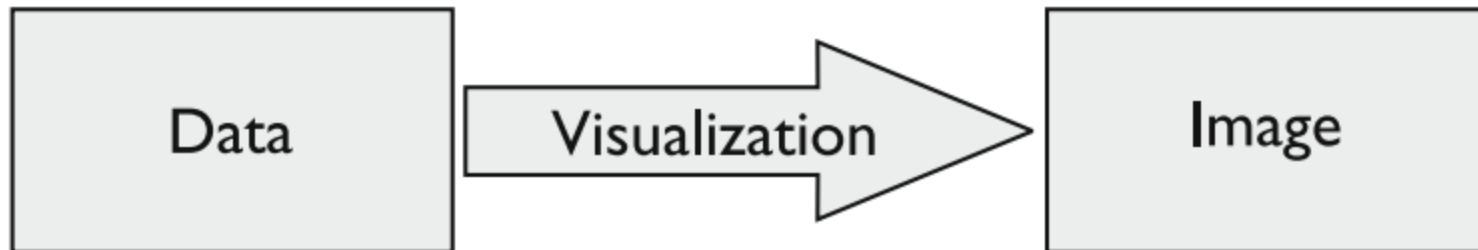
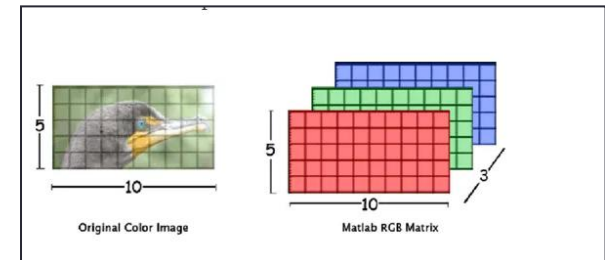
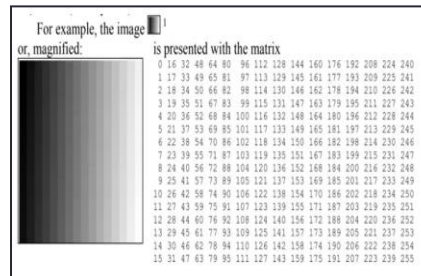
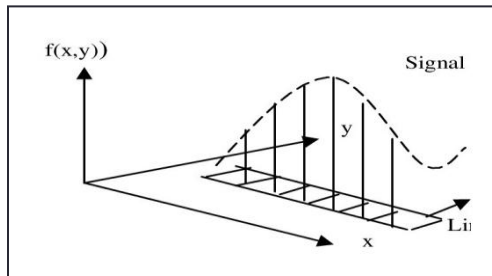
Lec 1

Learning Objectives

- - Define image processing.
- - Differentiate between image, graphics, and visualization.
- - Understand the goals and applications of image processing.
- - Distinguish between low, mid, and high-level processing tasks.

What is an Image?

- A 2D function of light intensity.
- Represented as a matrix of pixels.
- Gray scale image $\rightarrow$ 1 value per pixel.
- Color image $\rightarrow$ 3 values per pixel (R, G, B).



What is Image Processing?

- - A set of methods and techniques to analyze, enhance, and transform images using a computer.
- - Intersects with computer graphics, computer vision, and signal processing.

Main Goals

- 1. Image Enhancement → Improve visual quality (e.g., sharpening).
- 2. Image Restoration → Remove distortions (e.g., noise, blur).
- 3. Image Compression → Reduce storage size.
- 4. Image Analysis → Extract information (e.g., edge detection).

Applications

- - Medical Imaging (X-ray, MRI).
- - Remote Sensing (satellites).
- - Robotics & AI (computer vision).
- - Industrial Inspection.
- - Security & Biometrics.

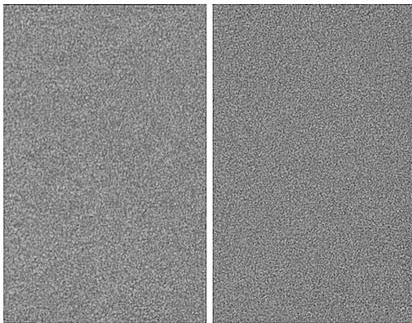
Levels of Processing

- - Low-level: noise removal, brightness adjustment.
- - Mid-level: segmentation, feature extraction.
- - High-level: recognition, interpretation.

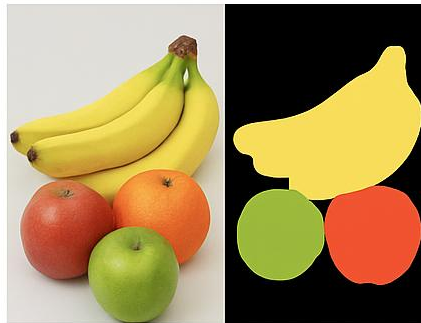
Levels of Processing

Levels of Processing

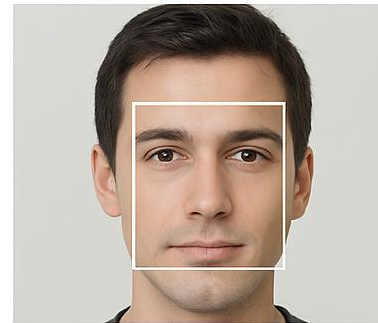
**Low-level
Processing**



**Mid-level
Processing**



**High-level
Processing**



Summary

- - Image = 2D representation of visual data.
- - Image processing = manipulation of images by computer.
- - Two major purposes:
 - - Visualization (for humans).
 - - Analysis (for machines).
- - Widely applied in science, medicine, industry, and security.

Assignment??

- **1. Define image processing in your own words.**
- **2. List 3 real-life applications of image processing.**
- **3. Differentiate between image enhancement and restoration with examples.**

□ Homework ?

- **Definition:** Write in your own words what image processing means.
- **Applications:** List **3 real-life applications** of image processing that you encounter in daily life.
- **Enhancement vs. Restoration:** Explain the difference between:
 - *Image Enhancement* (give an example, e.g., increasing brightness).
 - *Image Restoration* (give an example, e.g., removing blur).
- **Levels of Processing:** For each level (Low, Mid, High), provide **one example** of an image processing task.
- **Critical Thinking:** **Why do you think image processing is important in modern technologies like self-driving cars or medical imaging?**

Practical side

- Image Representation
 - - Digital image = matrix of pixels.
 - - Grayscale: pixel values [0–255].
 - - Color (RGB): 3 channels (Red, Green, Blue).
 - - Example: 256×256 grayscale image = 65,536 pixels.

MATLAB Basics

- % Read and show image
- `img = imread('peppers.png');`
- `imshow(img);`

- % Convert to grayscale
- `gray_img = rgb2gray(img);`
- `imshow(gray_img);`

Resize & Rotate

- % Resize

- `resized_img = imresize(img, 0.5);`
- `imshow(resized_img);`

- % Rotate

- `rotated_img = imrotate(img, 45);`
- `imshow(rotated_img);`

Save Image

- `imwrite(gray_img, 'gray_peppers.png');`

Practical Example

- % Read
- `img = imread('peppers.png');`
- `figure, imshow(img), title('Original Image');`
- % Grayscale
- `gray_img = rgb2gray(img);`
- `figure, imshow(gray_img), title('Grayscale Image');`

GOOD LUCK
EVERYONE