Computer Vision and Image Processing (CSEL-393)

Lecture 2

Dr. Qurat ul Ain Akram
Assistant Professor
Computer Science Department (New Campus) KSK, UET, Lahore

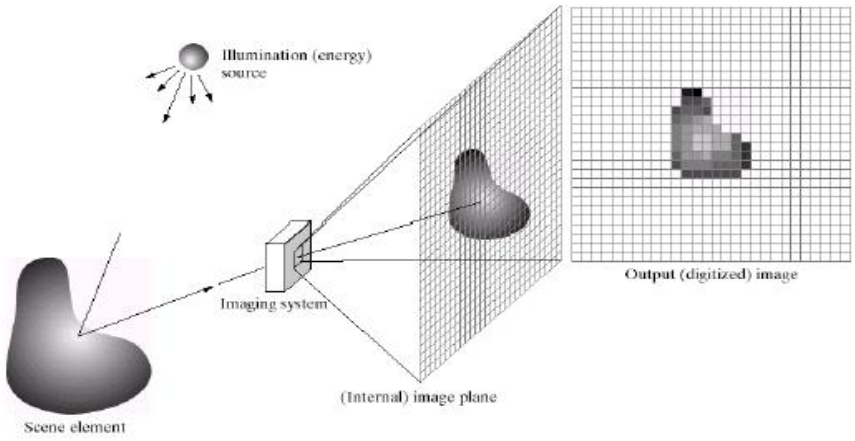
Image

- Image can be described by multiple means mostly focus on
  - What objects are available in the image
  - What are the properties of the objects
  - What are relationships between the objects

Image

- Image can be described by multiple means mostly focuses on
  - What **objects** are available in the image
  - What are the **properties** of the objects
  - What are **relationships** between the objects

Image Acquisition



What is an Image?

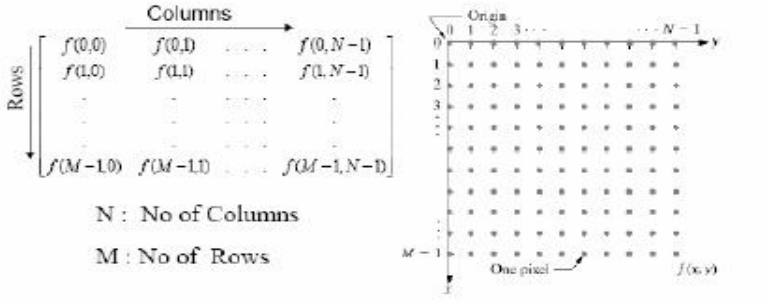
- An image may be defined as a **two dimensional function** f(x,y) where x and y are **spatial coordinates** and amplitude of *f* at any pair of coordinates (x,y) is called **intensity** of the image at that point.

Digital Image

- When x,y and the amplitude values of *f* are all finite, discrete quantities, we call the image a Digital Image.
- A digital Image is composed of a finite number of elements each of which has a particular location and value
- These elements are referred to as **Picture Elements**, **Image Elements**, or **Pixels**

Digital Image

Digital image is expressed as



Types of Images

- Categories of Images based on intensity values
  - Binary Images: intensity Value (0 or 1)
  - Gray scale Images : Intensity Value (0-255)
  - Color Images: Intensity Value (RGB)
    - R(0-255),G(0-255),B(0-255)

RGB (color) Images

Red + Blue + Green

Red Green Blue

Digital Image

Digital image is expressed as

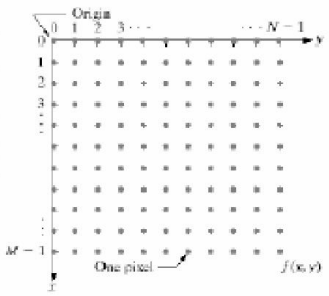
$$\begin{bmatrix} f(0,0) & f(0,1) & \cdots & f(0,N-1) \\ f(1,0) & f(1,1) & \cdots & f(1,N-1) \\ \vdots & \vdots & \cdots & \vdots \\ f(M-1,0) & f(M-1,1) & \cdots & f(M-1,N-1) \end{bmatrix}$$

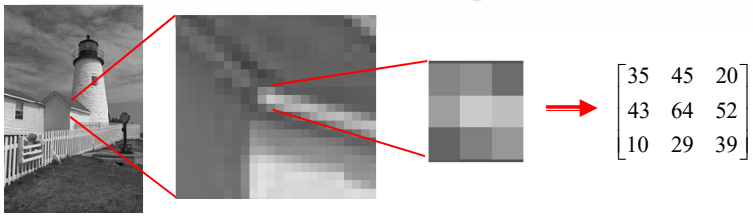
Columns

Rows

N : No of Columns

M : No of Rows





$$\begin{bmatrix} 35 & 45 & 20 \\ 43 & 64 & 52 \\ 10 & 29 & 39 \end{bmatrix}$$

Digital Image Processing

- The DIP field refers to processing of Digital Images by means of Digital Computer

Computer Vision

- Vision is about discovering what is present (visual objects) and where it is.

Computer Vision

- **Vision** is about discovering what is present (visual objects) and where it is.
- In **Computer vision** a camera is linked to a computer. The computer interprets images of a real scene to obtain information useful for tasks such as navigation, manipulation and recognition.

Computer Vision

Make computers understand images and video.

What kind of scene?

Where are the cars?

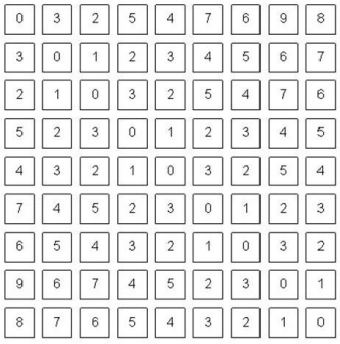
How far is the building?

…

Computer Vision and Nearby Fields

- Computer Graphics: Models to Images
- Image Processing: Images to Images
- Computer Vision: Images to Models

What we see



What a computer sees

Computer vision vs human vision

0	3	2	5	4	7	6	9	8
3	0	1	2	3	4	5	6	7
2	1	0	3	2	5	4	7	6
5	2	3	0	1	2	3	4	5
4	3	2	1	0	3	2	5	4
7	4	5	2	3	0	1	2	3
6	5	4	3	2	1	0	3	2
9	6	7	4	5	2	3	0	1
8	7	6	5	4	3	2	1	0

What we see

What a computer sees

Human Vision Vs Computer Vision

Humans are better: For images when number of objects and their properties are high

0	3	2	5	4	7	6	9	8
3	0	1	2	3	4	5	6	7
2	1	0	3	2	5	4	7	6
5	2	3	0	1	2	3	4	5
4	3	2	1	0	3	2	5	4
7	4	5	2	3	0	1	2	3
6	5	4	3	2	1	0	3	2
9	6	7	4	5	2	3	0	1
8	7	6	5	4	3	2	1	0

What we see

What a computer sees

Human Vision Vs Computer Vision

Humans are better: For images when number of objects and their properties are high
Computer vision is better: When recognition of objects and counting

Classification of Image processing and Computer Vision Processes

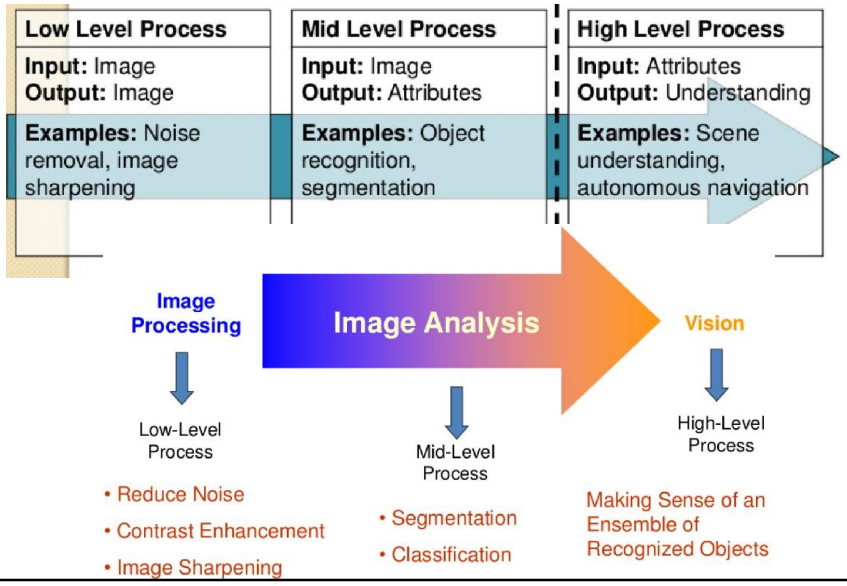


Image Processing and Computer Vision

- Image Processing (IP):
  - Subset of Computer Vision (CV)
  - Image Processing is the field of enhancing the images by tuning many parameter and features of the images. For example, transformations are applied to an input image and the resultant output image is returned. Some of these transformations are- sharpening, smoothing, stretching etc.
  - Input: Image
  - Output: Image

Image Processing and Computer Vision

- Computer Vision (CV):
  - In Computer Vision, computers or machines are made to gain high-level understanding from the input digital images or videos with the purpose of automating tasks that the human visual system can do.
  - Input: Image/ Videos
  - Output: Automation of cognitive functions associated with vision

Project Discussion