

DIGITAL IMAGE PROCESSING

UNIT-1

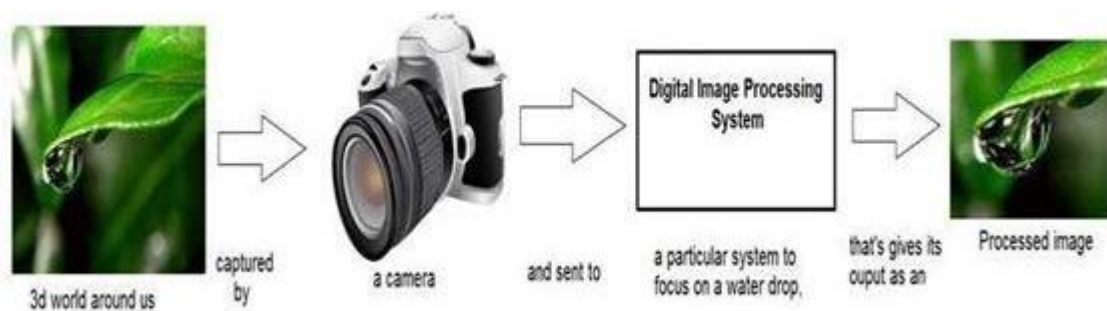
DIGITAL IMAGE FUNDAMENTALS

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The field of digital image processing refers to processing digital images by means of digital computer. Digital image is composed of a finite number of elements, each of which has a particular location and value. These elements are called picture elements, image elements, pels and pixels. Pixel is the term used most widely to denote the elements of digital image.

An image is a two-dimensional function that represents a measure of some characteristic such as brightness or color of a viewed scene. An image is a projection of a 3-D scene into a 2D projection plane.

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



The term **gray level** is used often to refer to the intensity of monochrome images. Color images are formed by a combination of individual 2-D images.

For example: The RGB color system, a color image consists of three (red, green and blue) individual component images. For this reason many of the techniques developed for monochrome images can be extended to color images by processing the three component images individually.

An image may be continuous with respect to the x - and y - coordinates and also in amplitude. Converting such an image to digital form requires that the coordinates, as well as the amplitude, be digitized.

APPLICATIONS OF DIGITAL IMAGE PROCESSING

Since digital image processing has very wide applications and almost all of the technical fields are impacted by DIP, we will just discuss some of the major applications of DIP.

Digital image processing has a broad spectrum of applications, such as

- ☐ Remote sensing via satellites and other spacecrafts
- ☐ Image transmission and storage for business applications
- ☐ Medical processing,
- ☐ RADAR (Radio Detection and Ranging)
- ☐ SONAR (Sound Navigation and Ranging) and
- ☐ Acoustic image processing (The study of underwater sound is known as underwater acoustics or hydro acoustics.)
- ☐ Robotics and automated inspection of industrial

parts. Images acquired by satellites are useful in tracking of

- ☐ Earth resources;
- ☐ Geographical mapping;
- ☐ Prediction of agricultural crops,
- ☐ Urban growth and weather monitoring
- ☐ Flood and fire control and many other environmental

applications. Space image applications include:

- ☐ Recognition and analysis of objects contained in images obtained from deep space-probe missions.
- ☐ Image transmission and storage applications occur in broadcast television
- ☐ Teleconferencing
- ☐ Transmission of facsimile images (Printed documents and graphics) for office automation

Communication over computer networks

- ☐ Closed-circuit television based security monitoring systems and
- ☐ In military

communications. Medical applications:

- ☐ Processing of chest X- rays
- ☐ Cineangiograms
- ☐ Projection images of transaxial tomography and
- ☐ Medical images that occur in radiology nuclear magnetic resonance (NMR)

IMAGE PROCESSING TOOLBOX (IPT) is a collection of functions that extend the capability of the MATLAB numeric computing environment. These functions, and the expressiveness of the MATLAB language, make many image-processing operations easy to

Specialize image processing hardware: It consists of the digitizer just mentioned, plus hardware that performs other primitive operations such as an arithmetic logic unit, which performs arithmetic such addition and subtraction and logical operations in parallel on images.

Computer: It is a general purpose computer and can range from a PC to a supercomputer

write in a compact, clear manner, thus providing a ideal software prototyping environment for the solution of image processing problem.

Components of Image processing System:

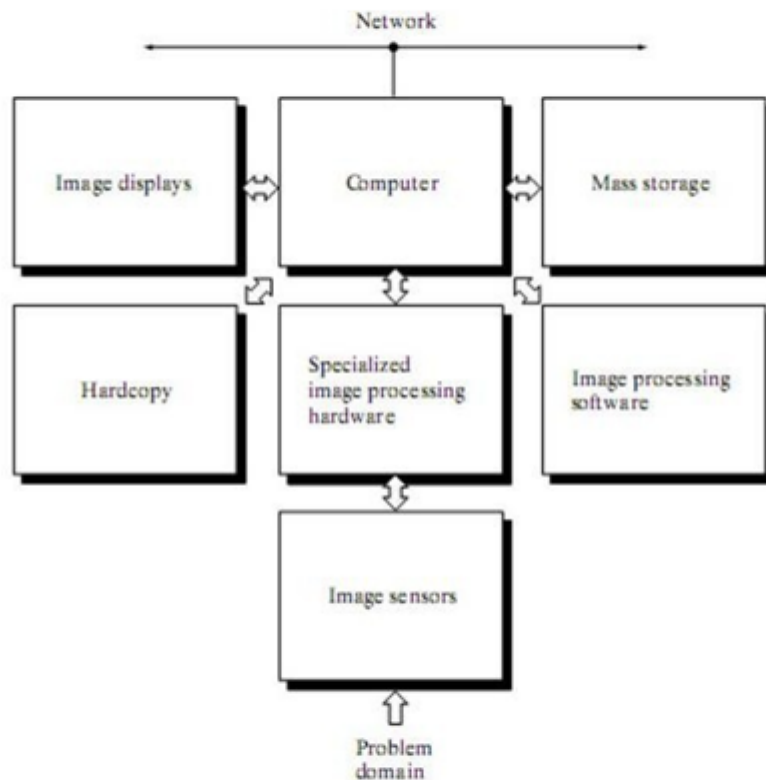


Figure: Components of Image processing System

Image Sensors: With reference to sensing, two elements are required to acquire digital image. The first is a physical device that is sensitive to the energy radiated by the object we depending on the application. In dedicated applications, sometimes specially designed computer are used to achieve a required level of performance

Software: It consists of specialized modules that perform specific tasks a well designed package also includes capability for the user to write code, as a minimum, utilizes the specialized module. More sophisticated software packages allow the integration of these modules.

Mass storage: This capability is a must in image processing applications. An image of size 1024 x1024 pixels, in which the intensity of each pixel is an 8- bit quantity requires one Megabytes of storage space if the image is not compressed .Image processing applications falls into three principal categories of storage

- i) Short term storage for use during processing
- ii) On line storage for relatively fast retrieval
- iii) Archival storage such as magnetic tapes and disks

Image display: Image displays in use today are mainly color TV monitors. These monitors are driven by the outputs of image and graphics displays cards that are an integral part of computer system.

Hardcopy devices: The devices for recording image includes laser printers, film cameras, heat sensitive devices inkjet units and digital units such as optical and CD ROM disk. Films provide the highest possible resolution, but paper is the obvious medium of choice for written applications.

Networking: It is almost a default function in any computer system in use today because of the large amount of data inherent in image processing applications. The key consideration in image transmission bandwidth.

Fundamental Steps in Digital Image Processing:

There are two categories of the steps involved in the image processing -

1. Methods whose outputs are input are images.
2. Methods whose outputs are attributes extracted from those images.

Fig: Fundamental Steps in Digital Image Processing