1)

Image Sampling and Quantization.

- The output of most sensors is a continuous voltage waveform whose amplitude and spatial behavior are related to the physical phenomenon being sensed. To create a digital image, we need to convert the continuous sensed data into digital form. This involves two processes: sampling and quantization
- For computer processing, the image function $f(x, y)$ must be digitized both spatially and in amplitude.
- Digitization of spatial coordinates is called image sampling and amplitude digitization is called grey level quantization.
- Sampling: Consider a digital image of size 1024 * 1024, 256 with a display area used for the image being the same, the pixels in the lower resolution images where duplicated inorder to fullfill the entire display. the pixel replication produced a checker board effects which is visible in the image of lower resolution. It is not possible to differentiate a 512 * 512 images from a 1024 * 1024

under this effect, but a slight increase in graineres and a small decrease in sharpness is noted. A 256 * 256 image shows a fine checker board pattern in the edges and more pronounced graineres there out the image. these effect is much more visible in 128 * 128 images and it becomes quite pronounced in 64 * 64 and 32 * 32 images.

- Quantization:
it is discuss the effects produced when the number of bits used to represent the level in an image is decreased. this is illustrated by reducing the grey level required to represent a 1024 * 1024, 512 image. the 256, 128, and 64 level image are visually identical for all practical purpose the 32 level image has developed a set of rigid like structure in areas of smooth grey If lines. this effect caused by the user insufficient number of

grey levels in smooth areas of digital image is called a false contouring. this is visible in images displayed using 16 or lesser gray level values.

2.

5 Representing Digital Images:

- we will use two principle ways to represent digital images. Assume that an image $f(x, y)$ is sampled so that the resulting digital image has M rows and N colums. the values of the coordinates (x, y) now become discreate quantities. For notational clarity the convenience we shall use integer values for these discrete coordinates.
- thus the values of the coordinates at the origin are $(x, y) = (0, 0)$. the next coordinate values along the first row of the image are represented as $(x, y) = (0, 1)$.
- It is important to keep in mind that the notation $(0, 1)$ is used to signify the second sample along the first row. It does not mean that these are the actual values of physical coordinates when the image was sampled. Figure 1 shows the coordinate convention used.

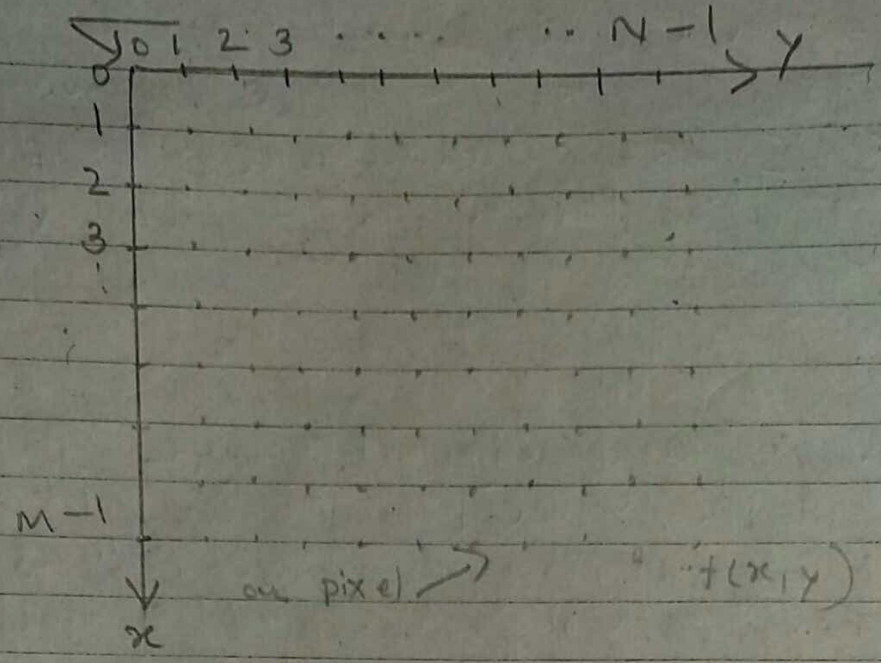

Fig 1 coordinate convention used to represent digital images.

The notation introduced in the preceding paragraph allows us to write the complete $M \times N$ digital image in the following compact matrix form:

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

The right side of this equation is by definition a digital image. Each element of this matrix array is called an image element, picture element, pixel, or pel

3) Agriculture: image processing for need detection and removal, and other video exhibit,
   - image processing based system is developed to classify the fruits based on the texture properties.
   - For harvesting, cleaning, quality inspection, disease identification, and so on.

- Banking: Typical tasks include: document verification; person authentication; Bankers cheque analysis.
- Biometrics - authentication of a person.
  - Banking, Airport, Electronic voting, ~~Banking~~ other sectors, secured transactions
  - using suitable pre-processing techniques, it is possible to extract the hidden information in an image which is commonly used in forensic application
- Quality Assurance.

  Remote sensing is the process of capturing the information about an scene without any physical contact. This is very useful in many applications such as visual surveillance, flood detection and hence to work for survival of the mankind, agricultural field and many more

- Traffic Management :

Road traffic control involves directing vechicular and pedestrain traffic around a construction zone accident or other road disruption, thus ensuring the safety of emergency response teams, construction workers and the general public. Traffic control also includes the use of CCTV and other means of monitoring traffic by local or state roadway authorities to manage traffic flows and providing advice concerning traffic congestion.

4. Biometrics.

- Image is used to extract the hidden information in an obliterated image. using suitable pre-processing technique it is possible to extract the hidden information in an image which is commonly used in forensic application
- Authentication of a person.
  - Banking
  - Airport
  - Electronic voting
  - Defence Sectors
  - secured transactions

- Forensic Application.
  image enhancement is used to detect and localize the fingerprint on the knife so that it is possible to identify the victim.

2. Digital image processing deals with the manipulation of digital images. It is a type of signal processing in which input is an image and output may be image or characteristics associated with that image.
- As a subcategory or field of digital signal processing, digital image processing has many advantages over analog image processing. It allows a much wider range of algorithms to be applied to the input data and can avoid problems such as the build-up of noise and distortion during processing.
- the image analysis preprocessing methods are: Smooth: Spatial smoothing for images Background Subtraction: Rolling ball background subtraction for images.

close (Dilate + Erode): perform dilation followed by erosion on a binary image
Dilate: perform dilation on a binary image