



**INSTITUTE OF ENGINEERING,**  
**JIWAJI UNIVERSITY**

**Alpana Sharma**

**Subject:- Digital image Processing (CS-8302)**

**Topic:- Different types of digital Images**

**Semester:- B.E. Eight Semester**

# Classification of Digital Images

- ▶ Digital Images can be broadly classified in to two types:

1) Raster Image

2) Vector Image

- ▶ A raster image file is defined as a rectangular array of regularly sampled values known as pixels.

or

- ▶ Graphics made up of tiny squares are called raster images.  
(squares refer to “pixels”)
- ▶ Scanned graphics and web graphics are the most common forms of raster images.
- ▶ Raster images are mapped to grids which are easily scalable.



# 1. Raster Image or Bitmap Image (Cont.)

- ▶ A raster image is resolution dependent because it contains a fixed number of pixels that are used to create the image.
- ▶ Since there are fixed and limited number of pixels, a raster image will lose the quality if it is enlarged beyond that number of pixels as the computer will have to 'make up' for the missing information.
- ▶ The spatial resolution of a raster image is determined by the resolution of the acquisition device and the quality of the original data source.
- ▶ Common raster image formats include:
  - BMP (Windows Bitmap)
  - PCX (Paintbrush)
  - TIFF (Tag Interleave Format)
  - JPEG (Joint Photographics Experts Group)
  - GIF (Graphics Interchange Format)
  - PNG (Portable Network Graphics)
  - PSD (Adobe Photoshop) and
  - CPT (Corel PhotoPaint)



## 2. Vector Image

- ▶ A vector image is defined by objects which are made of lines and curves that are mathematically defined in the computer.
- ▶ A vector can have various attributes such as line thickness, length and color.
- ▶ Vector Images are mathematically defined and hence they are easily scalable.
- ▶ This implies that vectors can be printed at any size on any output device, at any resolution, without losing the detail and without altering the resolution of the image.
- ▶ As compared to raster images, vector images can be scaled by several factors without altering the resolution of the image.
- ▶ Vector images are thus suitable for typography, line art and illustrations.



# Image Types

- ▶ Images can be broadly of four types:
  - 1) Black and White or Binary Images
  - 2) Grayscale Images
  - 3) Color Images
  - 4) Multispectral Images

## 1. Binary Images

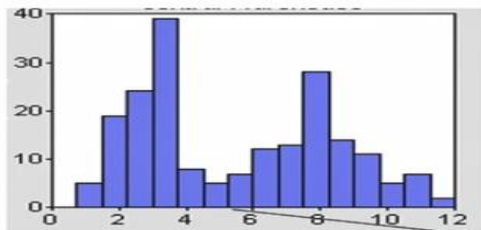
- ▶ Images with only two values (0 or 1)
- ▶ Simple to process and analyze
- ▶ Very useful for industrial applications
- ▶ Obtained from gray-level (or color) image  $g(x, y)$  by Thresholding





▶ Characteristic Function

$$b(x, y) = \begin{cases} 1 & ; \quad \text{if } g(x, y) < T \\ 0 & ; \quad \text{if } g(x, y) \geq T \end{cases}$$



Bimodal Histogram

Threshold



## 2. Grayscale Images

- ▶ Grayscale images are referred to as monochrome (one color) images.
- ▶ They contain gray-level information, no color information.
- ▶ The number of bits used for each pixel determines the number of different gray levels available.
- ▶ The typical grayscale image for example may contains 8bits/pixel data, which allows us to have 256 different gray levels.
- ▶ In applications like medical imaging and astronomy, 12 or 16 bits/pixel images are used.
- ▶ These extra gray levels become useful when a small section of the image is made much larger to discern details.





Grayscale images

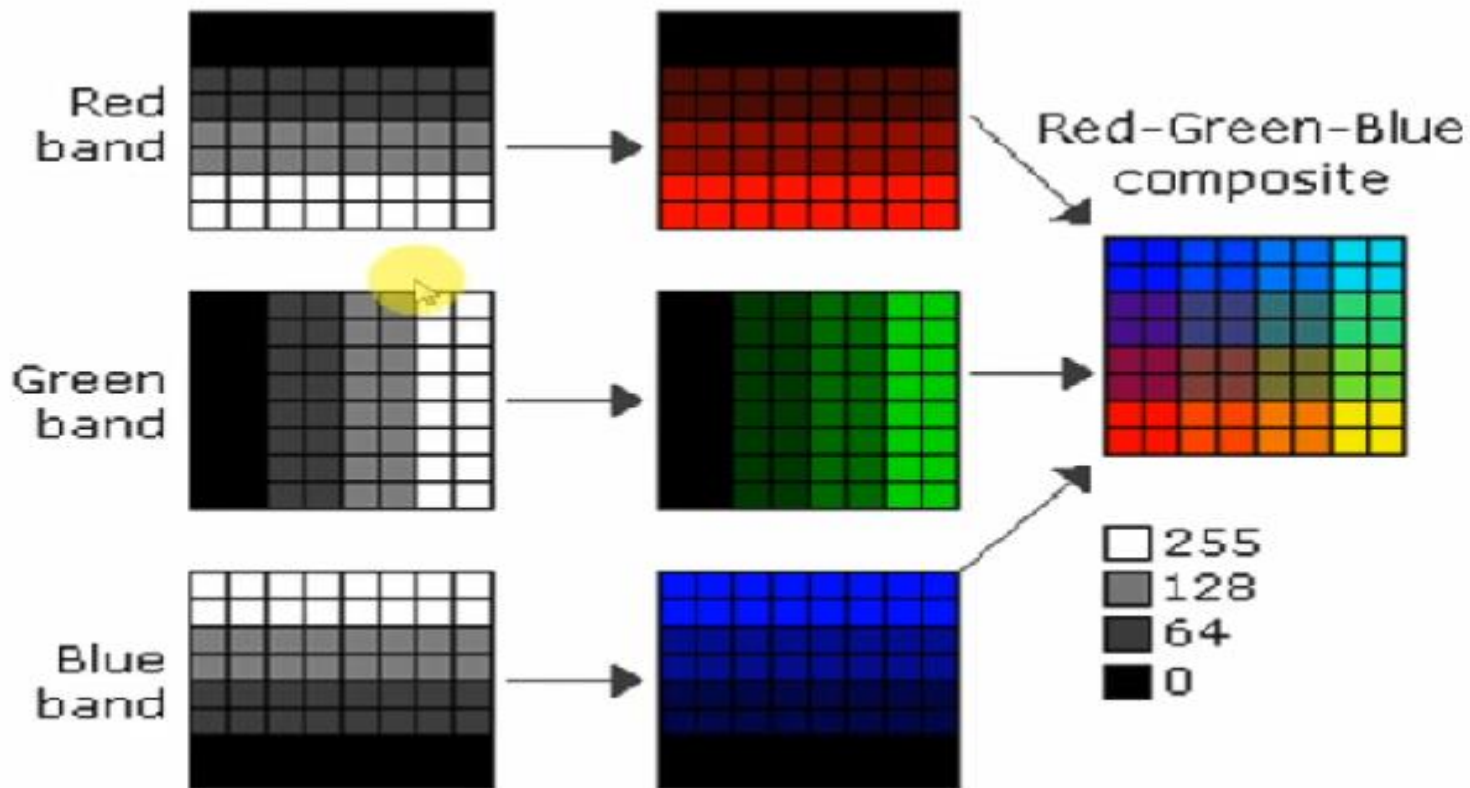
## 3. Color Images

- ▶ Color images can be modeled as three-band monochrome image data, where each band of data corresponds to a different color.
- ▶ The actual information stored in the digital image data is the gray-level information in each spectral band.





- ▶ Typical color images are represented as red, green, and blue (RGB images).
- ▶ Using the 8-bit monochrome standard as a model, the corresponding color image would have 24-bits/pixel (8-bits for each of the three color bands red, green, and blue).



Binary



Grayscale



Color



## 4. Volume Image

- ▶ A three-dimensional image is an example of volume image.
- ▶ The volume image can be obtained from some medical imaging equipment in which individual data points are called 'voxels'.
- ▶ Voxels stand for volume pixels.



## 5. Range Image

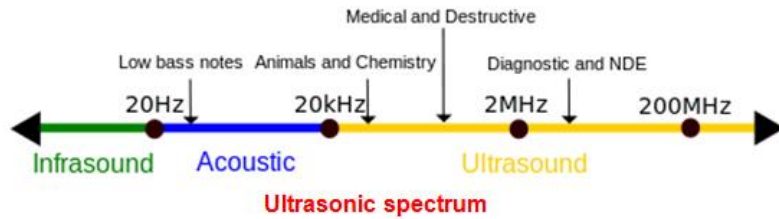
- ▶ These are special class of digital images.
- ▶ Each pixel of a range image expresses the distance between a known reference frame and a visible point in the screen.
- ▶ The range image reproduces the 3D structure of a scene.
- ▶ Range images are also referred to as depth images.

## 6. Multispectral Image

- ▶ Multispectral images typically contain information outside the normal human perceptual range.
- ▶ This may include infrared, ultraviolet, X-ray, acoustic, or radar data.
- ▶ These are not images in the usual sense because the information represented is not directly visible by the human system.
- ▶ However, the information is often represented in visual form by mapping the different spectral bands to RGB components.



# Ultrasound Imaging

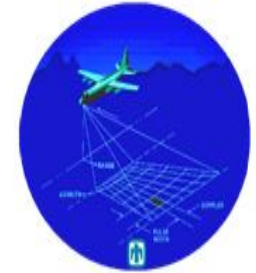
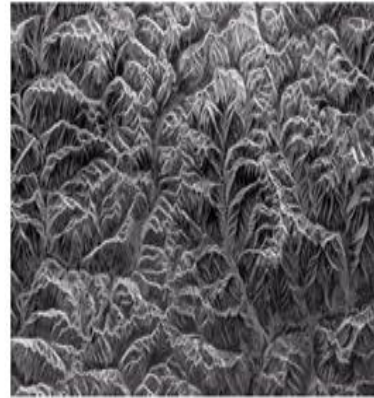


Ultrasound Baby image during pregnancy



Ultrasound image acquisition device

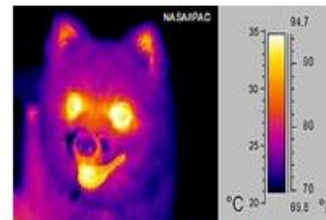
FIGURE 1.16 Spaceborne radar image of mountains in southeast Tibet. (Courtesy of NASA.)



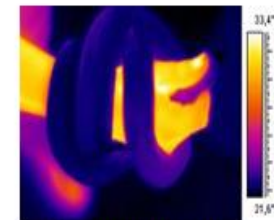
Synthetic Aperture Radar System

# Microwaves

# Infrared

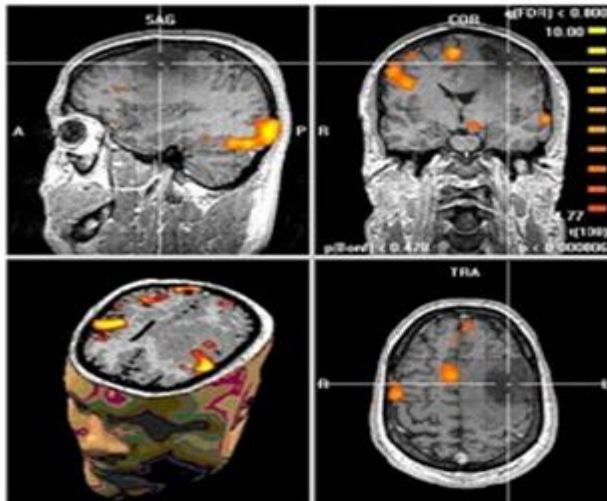


infrared ("thermal") image

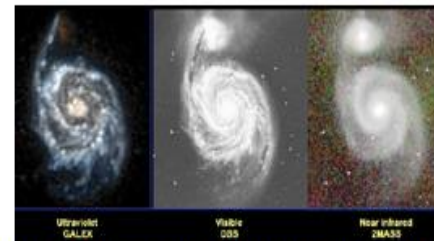


Snake around the arm

# Radio Waves



MRI image slices from the brain



Messier 51 in ultraviolet (GALEX), visible (DSS), and near infrared (2MASS). Courtesy of James Fanson.



## REFERENCES

- Anil K. Jain , “Fundamentals of digital Image processing”, Prentice Hall, 1997.
- Rafael C. Gonzales , Richard E. Woods,”Second Edition,Pearson Education,2004.
- Chi-Wah Kok, Wing –Shan Tam,” Digital Image Interpolation in Matlab“, John Wiley & Sons, 14-Dec-2018.



THANKS

