

Lecture 1, Introduction to Images

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August 2020

1 Introduction

- **Image** : A matrix of numbers representing color intensities.

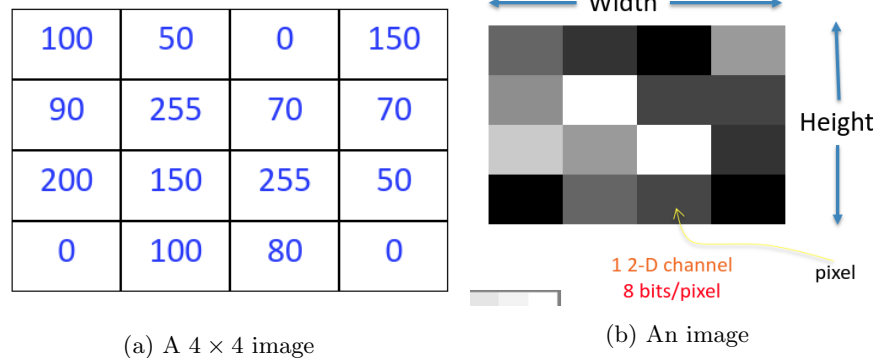


Figure 1: Representation of a Digital Image

- As 1 pixel is of 8 bits, and each bit can hold 2 values : 0,1 so the range of values a pixel can have is 0 to $2^8 - 1 = 255$.) representing the darkest intensity and 255 represents the brightest pixel.

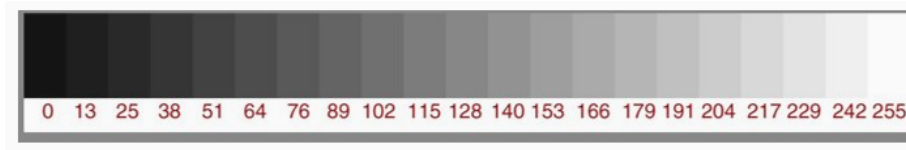


Figure 2: Range of color intensities in a 8 bit image

- A **Gray Scale image** is a single 2D matrix. It is said to have 1 channel.
- A **RGB image** is a 3D matrix having 3 2D matrices, i.e it has 3 channels namely Red, Green Blue. Each pixel is of 24 bit($3 \times 8 = 24$ bits/pixel)

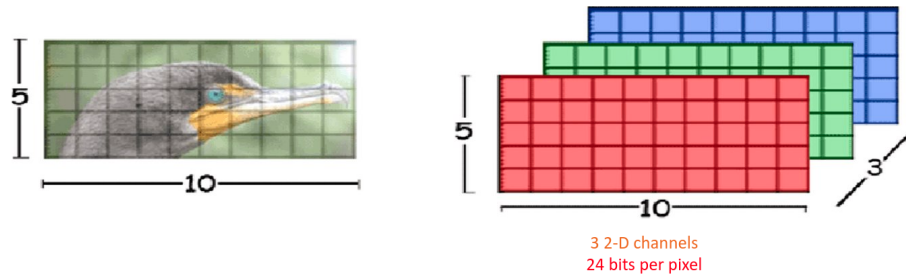


Figure 3: Representation of an RGB image

- An **fMRI image** has 56 2D matrices stacked together. It is said to have 56 channel.

2 Classification of Images

2.1 Based on source of Generation :

- **Radiation from EM Spectrum** : This is the most common form of image generation. Rays from different regions of the EM have different properties and are used for various application depending on their properties.

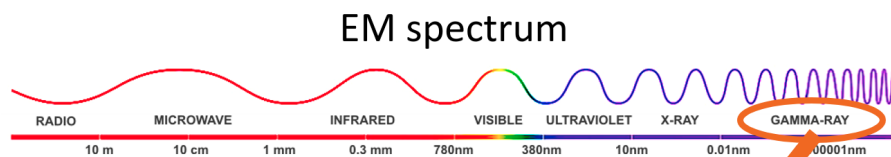


Figure 4: Em Spectrum

- **Acoustic/Ultrasonic/Spectrogram** : Sound waves are sent and the time taken for waves to reflect is noted and distance is calculated, this gives an image in terms of distance.
- **Electronic** : Electronic beams of various sizes are sent through the surface and the change in the electric beam is used to generate very sharp images.
- **Computer Generated** : Generated using various Image processing tools or Generative Networks.
- The scale of these images ranges from microns to light years for astronomical objects.

2.2 Based on Optical Phenomenon

- **Reflection** : Generated from EM waves reflected from a surface, so we can study about surfaces using such images.
- **Emission** : Generated when some source emits radiation and those radiation are captured and image is generated, as rays are emitted from inside, we can study internal structures using this type of image.
- **Absorption** : Generated from the rays that are left out and help to picture the internal structure and not what is deep inside the structure. (Eg - to see shape of bone fracture or structures of bones).

2.3 Based on Arrangement

- **Grayscale** : Single channel, one 2D array.
- **RGB** : 3 channel
- **Multispectral** : Multiple spectrum captured and put together.

3 Digital Image PROCESSING

Designing Algorithms that operate on existing images either to create new images or retrieve some attributes.

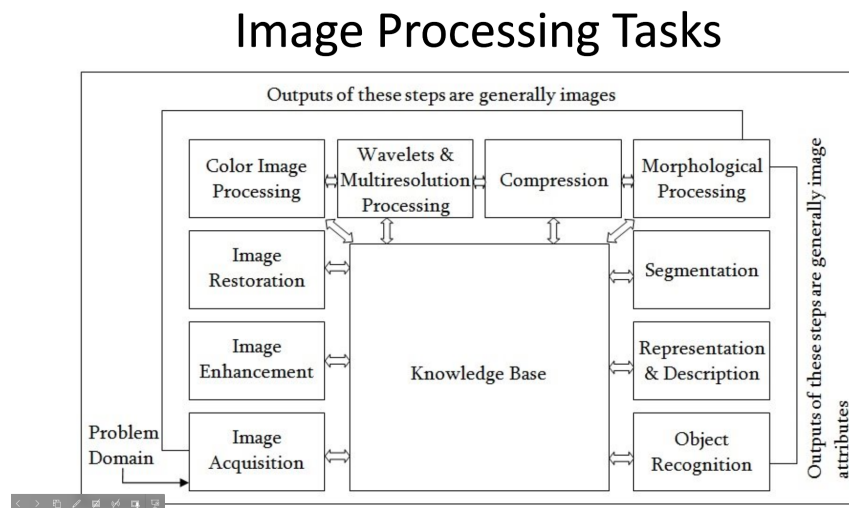


Figure 5: Tasks in Image Processing