University of Al-Qadisiya

College of Computer Science and information Technology

Computer science Dept

Lecture No: 2 the Human Visual System

The Human Visual System (HVS) has two primary components:

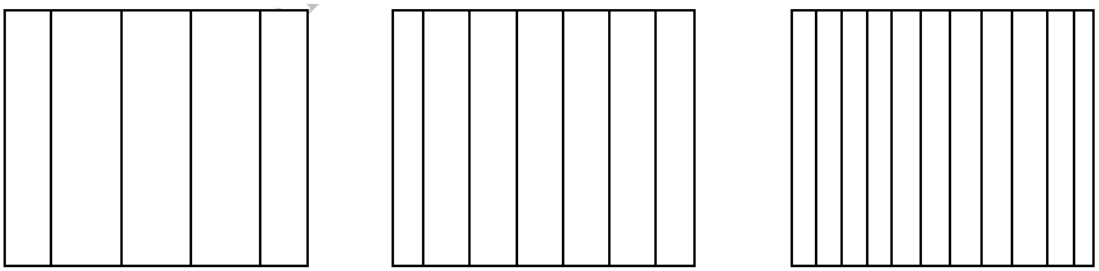
- Eye.
- Brian.

The structure that we know the most about is the image receiving sensors

(The human eye). The brain can be thought as being an information processing unit analogous to the computer in our computer imaging system. These two are connected by the optic nerve, which is really bundle of nerves that contains the path ways for visual information to travel from the receiving sensor (the eye) to the processor (the brain).

Image Resolution

The resolution has to do with ability to separate two adjacent pixels as being separate, and then we can say that we can resolve the two. The concept of resolution is closely tied to the concepts of spatial frequency. Spatial frequency concept, frequency refers to how rapidly the signal is changing in space, and the signal has two values for brightness-0 and maximum. If we use this signal for one line (row) of an image and then repeat the line down the entire image, we get an image of vertical stripes. If we increase this frequency the strips get closer and closer together, until they finally blend together.



a. Low Freq. =2 **b. Low Freq. =3** **c. Low Freq. =5**

Resolution and spatial frequency Image representation

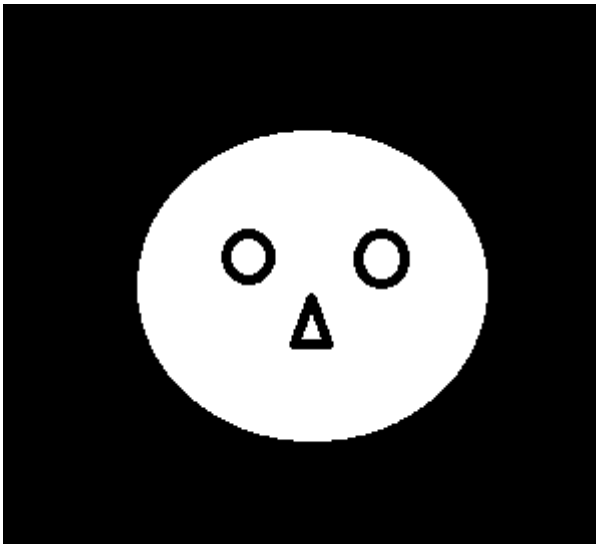
We have seen that the human visual system (HVS) receives an input image as a collection of spatially distributed light energy; this is form is called an optical image. Optical images are the type

we deal with every day –cameras captures them, monitors display them, and we see them [we know that these optical images are represented as video information in the form of analog electrical signals and have seen how these are sampled to generate the digital image I(r , c). The digital image I (r, c) is represented as a two- dimensional array of data, where each pixel value corresponds to the brightness of the image at the point (r, c). in linear algebra terms , a two-dimensional array like our image model I(r, c) is referred to as a matrix , and one row (or column) is called a vector.

The image types we will consider are:

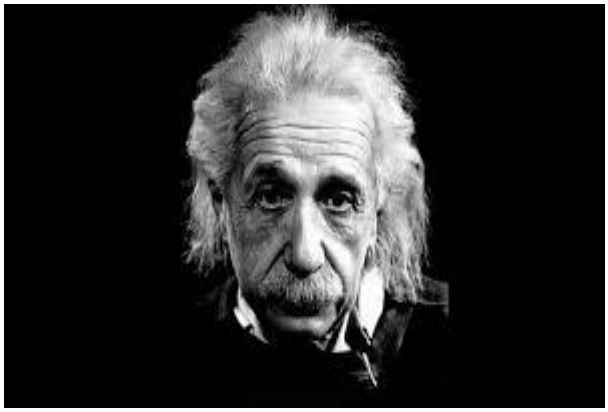
- Binary image

  Binary images are the simplest type of images and can take on two values, typically black and white, or '0' and '1'. A binary image is these types of images are most frequently in computer vision application where the only information required for the task is general shapes, or outlines information.



- Gray Scale image

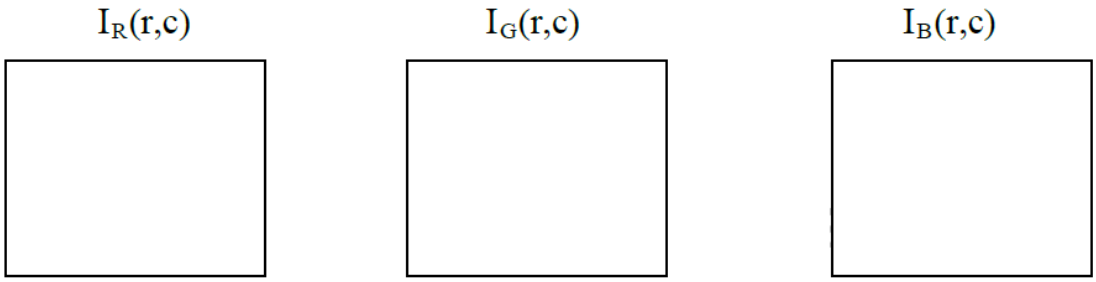
Gray _scale images are referred to as monochrome, or one-color image. They contain brightness information only brightness information only, no color information. The number of different brightness level available.The typical image contains 8 bit/ pixel (data, which allows us to have (0-255) different brightness (gray) levels. The 8 bit representation is typically due to the fact that the byte, which corresponds to 8-bit of data, is the standard small unit in the world of digital computer.



- Color image

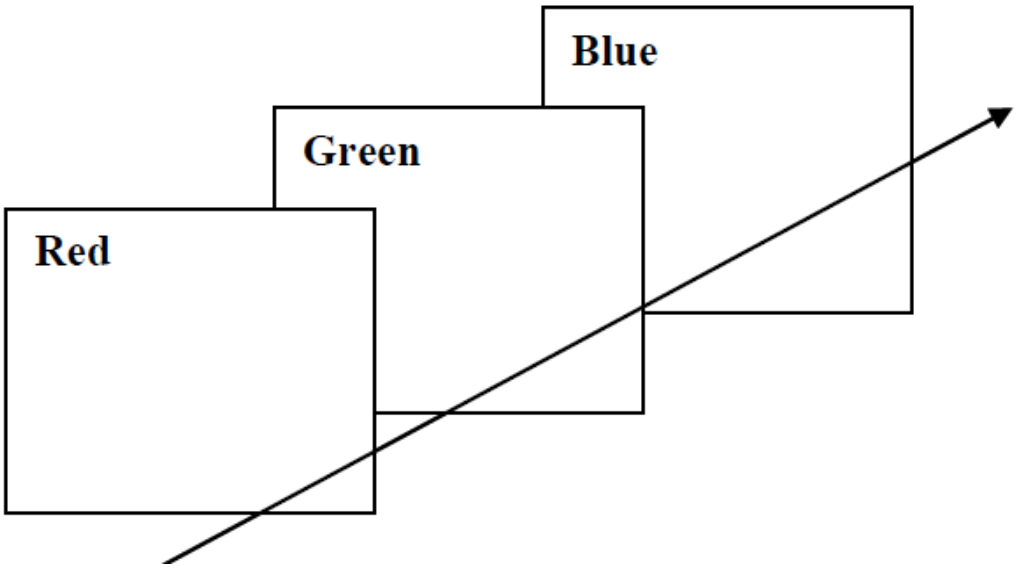
Color image can be modeled as three band monochrome image data, where each band of the data corresponds to a different color. The actual information stored in the digital image data is brightness information in each spectral band. When the image is displayed, the corresponding brightness information is displayed on the screen by picture elements that emit light energy corresponding to that particular color. Typical color images are represented as red, green ,and blue or RGB images .using the 8-bit monochrome standard as a model , the corresponding color image would have 24 bit/pixel – 8 bit for each color bands (red, green and blue). The following figure we see a representation of a typical RGB color image.

Color image



Typical RGB color image can be thought as three separate image

The following figure illustrate that in addition to referring to arrow or column as a vector, we can refer to a single pixel red ,green, and blue values as a color pixel vector –(R,G,B).



Color pixel vector consists of the red , green and blue pixel value