

DIGITAL IMAGE PROCESSING

Course Name: digital image processing

Course No: 408

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1. Computer Imaging

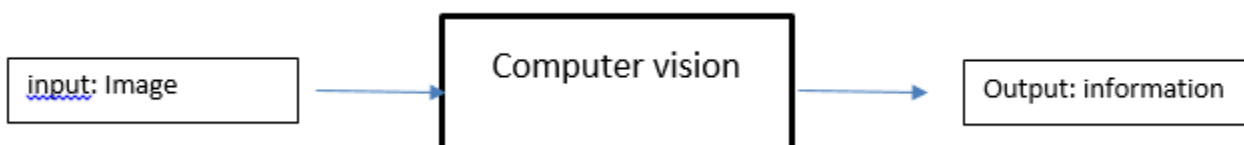
Can be defined an acquisition and processing of visual information by computer. Computer representation of an image requires the equivalent of many thousands of words of data, so the massive amount of data required for image is a primary reason for the development of many sub areas with field of computer imaging, such as image compression and segmentation .Another important aspect of computer imaging involves the ultimate “receiver” of visual information in some case the human visual system and in some cases the human visual system and in others the computer itself. Computer imaging can be separate into two primary categories:

1. Computer Vision.
2. Image Processing.

(In computer vision application the processed images output for use by a computer, whereas in image processing applications the output images are for human consumption).

1.1 Computer Vision

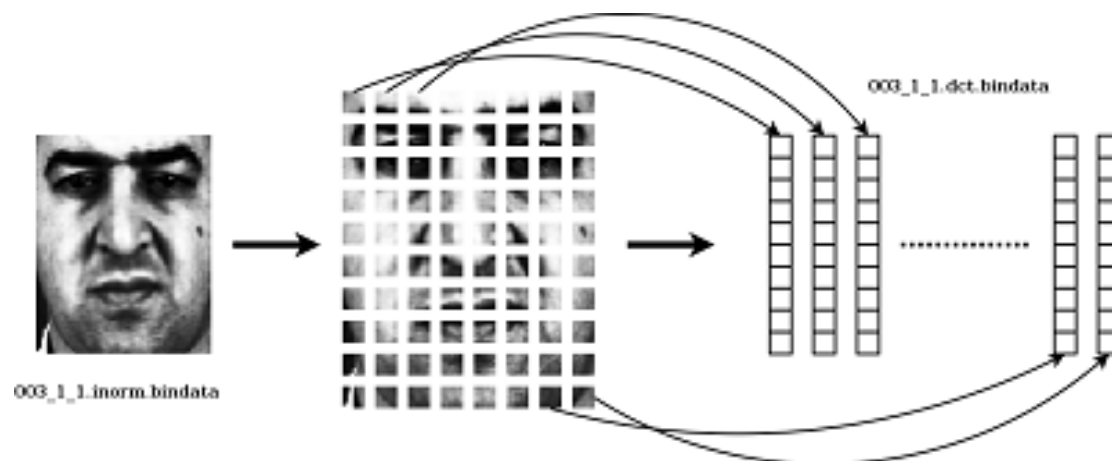
Computer vision computer imaging where the application doses not involve a human being in visual loop. One of the major topics within this field of computer vision is image analysis.



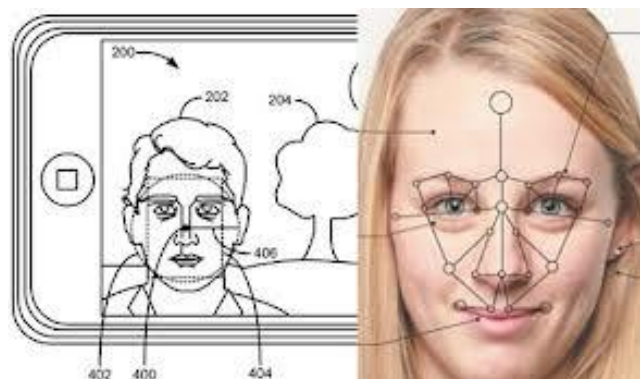
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1. Image Analysis: involves the examination of the image data to facilitate solving vision problem. The image analysis process involves two other topics:

- Feature Extraction: is the process of acquiring higher level image information, such as shape or color information.



- Pattern Classification: is the act of taking this higher –level information and identifying objects within the image.



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Computer vision systems are used in many and various types of environments, such as:

1. Manufacturing Systems
2. Medical Community
3. Law Enforcement
4. Infrared Imaging
5. Satellites Orbiting.

1.2 Image Processing

Image processing is computer imaging where application involves a human being in the visual loop. In other words the image are to be examined and an acted upon by people.

The major topics within the field of image processing include:

1. Image restoration.
2. Image enhancement.
3. Image compression.

Image Restoration

Is the process of taking an image with some known, or estimated degradation, and restoring it to its original appearance. Image restoration is often used in the field of photography or publishing where an image was somehow degraded but needs to be improved before it can be printed.

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a. Image with distortion



b. Restored image

Image

Enhancement

Involves taking an image and improving it visually, typically by taking advantages of human Visual Systems responses. One of the simplest enhancement techniques is to simply stretch the contrast of an image. Enhancement methods tend to be problem specific. For example, a method that is used to enhance satellite images may not suitable for enhancing medical images.

Although enhancement and restoration are similar in aim, to make an image look better. They differ in how they approach the problem. Restoration method attempt to model the distortion to the image and reverse the degradation, where enhancement methods use knowledge of the human visual systems responses to improve an image visually¹.

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a. image with poor contrast



b. Image enhancement by contrast stretching

Image Compression

Involves reducing the typically massive amount of data needed to represent an image. This done by eliminating data that are visually unnecessary and by taking advantage of the redundancy that is inherent in most images. Image processing systems are used in many and various types of environments, such as:

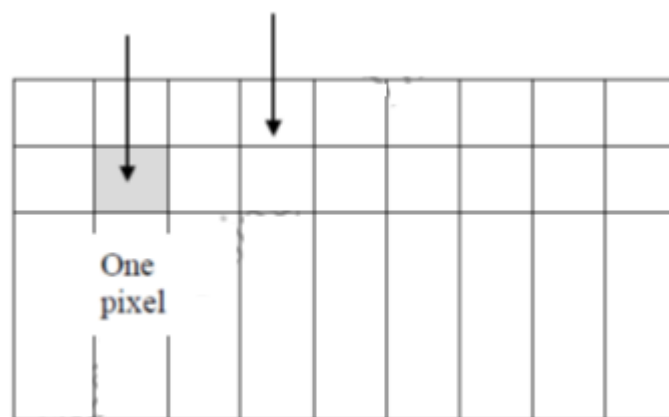
1. Medical community
2. Computer – Aided Design
3. Virtual Reality
4. Image Processing.

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Computer Imaging Systems

Computer imaging systems are comprised of two primary components types, hardware and software. The hardware components can be divided into image acquiring sub system (computer, scanner, and camera) and display devices (monitor, printer). The software allows us to manipulate the image and perform any desired processing on the image data.



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The image can now be accessed as a two-dimension array of data ,where each data point is referred to a pixel (picture element).for digital images we will use the following notation :

$I(r,c)$ = The brightness of image at the point (r,c)

Where r= row and c= column.

When we have the data in digital form, we can use the software to process the data”.

The digital image is 2D- array as:

$$\left(\begin{array}{lll} I(0,0) & I(0,1) & \dots\dots\dots I(0,N-1) \\ I(1,0) & I(1,1) & \dots\dots\dots I(1,N-1) \\ \dots\dots\dots & & \\ \dots\dots\dots & & \\ I(N-1,0) & I(N-1,1) & \dots\dots\dots I(N-1,N-1) \end{array} \right)$$

In above image matrix the image size is $N \times N$

Gray image

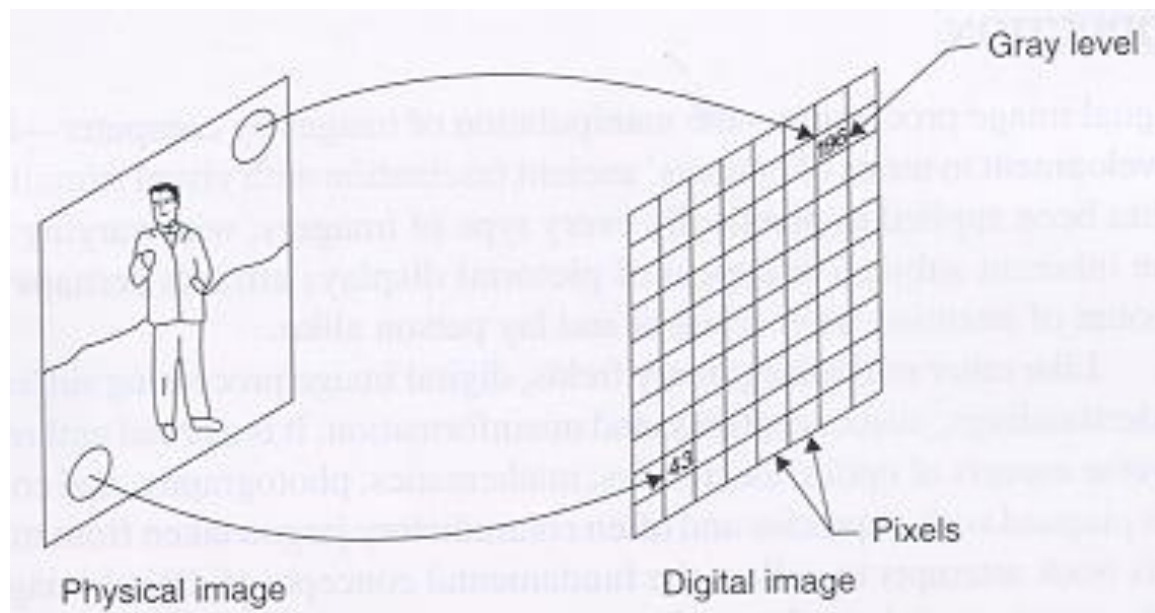
each pixel in gray image consist of 8 bit value means

0000 0000 in binary = 0 in decimal

1111 1111 in binary = 256 in decimal

So the value in the pixel in the range of [0-255]

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Example : If we have (6 bit) in 128×128 image. Find the no. of gray levels to represent it, then find the no. of bit in this image?

Solution

$$N_g = 2^6 = 64 \text{ Gray Level}$$

$$\text{Bit} = 128 * 128 * 6 = 98304 \text{ bits}$$