

AN OVERVIEW OF DIGITAL IMAGE PROCESSING

R.Vasugi¹, V.Vijayalakshmi²

¹ Assistant Professor, Bharathiyar Arts And Science College For Women, India

² HOD Cum Assistant Professor, Bharathiyar Arts and Science College for Women, India

²vijisylvia@gmail.com, ¹vasubhuvan11@gmail.com,

Abstract : The field of Digital Image Processing refers to digital images by the Digital Computer. The main thematic of Image Processing to improve the Pictorial Information for that Human Interpretation, which is stored as Matrix of Binary Numbers and moreover displayed on high resolution Monitor. In this paper is to demonstrate the *basics of Digital Image Processing and their techniques*.

INTRODUCTION

An Image is equal to more than 10,000 words. Image – Like Picture | Object. Digital Image – An array of real or complex Numbers represented by the finite amount of Picture Elements. Digital Image Processing - An image $f(x,y)$ is a two dimensional function. where X and Y are Spatial co ordinates and Amplitude of f at any pair of values are intensity on gray levels of an image.

WHY WE NEED FOR DIP

An image given in the form of Transparency , Slide, Photograph and others. we capture the image after that to produce more accurately defined as a means of translation between the Human Vision system and Digital imaging devices. Because of the human system does not perceive the accurate images. So far must be a DIP.

HOW IT'S POSSIBLE

Basically an image convert to digital form and it's perform the some operations

- ❖ Image Acquisition.
- ❖ Image Preprocessing.
- ❖ Image segmentation.
- ❖ Image Enhancement.
- ❖ Image Restoration.
- ❖ Image Compression.
- ❖ Image Representation and Description.
- ❖ Image Recognition and Interpretation.

CATEGORIES OF DIP

There are three categories of Image Processing ,

- ❖ Image Processing = Image In -> Image Out.
- ❖ Image Analysis =Image In-> Measurement Out.
- ❖ Image Understanding = Image In -> Image Description.

PURPOSE OF DIP

Because of Better Visualization ,Image sharpening and Restoration , Image Retrieval ,Pattern Recognition , Image Recognition.

METHODS OF DIP

We have two types Digital Image Processing ,
Analog and Digital

Analog – It can be used for hard copies such as printouts and photographs.



Digital – A raw data from imaging sensors from satellite platform related to computer graphics and computer vision.
ELEMENTS OF DIP

A general purpose systems capable of performing the image processing operations are ,

- Image Acquisition.
- Image Processing.
- Image Storage.
- Image Communication.
- Image Display.

Image Acquisition :

We have two elements are required to an acquire the digital images.

Physical Devices- A device that is sensitive to electromagnetic spectrum.

Digitizer – A device for convert the electrical output of the physical devices.

Image Processing :

The aim of Preprocessing is an improvement of the image data that suppress un desired distortions or some Image Enhancement. To correct the some degradation in the image. if its done by the methods are ,

- ❖ Brightness Transformation.
- ❖ Geometric Transformations.
- ❖ Preprocessing Methods.
- ❖ Image Restoration.

Ex :Noise Smoothing and Contrast Manipulation.

Image Storage :

There are three ways of Image Processing stages are

Short term storage , On Line storage , Archival storage.

It was measured in Bytes , Kilo bytes , Mega Bytes , Giga Bytes and Tera Bytes.

Ex:Let be an 8 – Bit Image, size is 1024 *1024, So far we have one million MBytes .

Communication : It has involve the local and remote process. If local then to between the image processing systems and remote then doing image processing from one into another.

Display : Monochrome and Color TV monitors are prefer the modern image processing systems.

IMAGE ACQUISITION

An acquire the digital image. It require the imaging sensor and its digitize the signal. Doing image digitization process that is $f(x,y)$ is a continuous function of two co ordinate in the plane. A continuous image is digitized at sampling points that is corresponding to picture elements.

One and Two Dimensional – An Image Element or PIXELS.

Three Dimensional – VOXAL-Volume Element.

Quantization - A value of sampled images expressed as digital value in Image Processing.

IMAGE PREPROCESSING

The key function of Preprocessing is to correct the some degradation in the image with nature of Priors information. There are two types of image preprocessing,

Magnification – To improve the scale of display for visual interpretation match an image.

Reduction – The incident of high frequency and cause several pixels to collapse into one.

IMAGE SEGMENTATION

The process of partitions an 1lp image in to its constituent parts or object. The aim of segmentation is to simplify and modify the representation of an image. Typically segmentation used to locate the object & boundaries. If it's done assign the label to every pel in an image such that pels with same label then to share the visual characters. Finally an output of image segmentation is a set of segmentation that are cover the entire image or set of contours extracted from the image.

There are 3 ways of segmentation methods to be used. They are ,

1. Global knowledge – Segmentation about an image /parts of an image.
2. Edge based – A large group of methods based on information about the edged in the image.
3. Region based – To find borders between the region or divide an image into zone based on gray level, color, texture, shape & model.



Segmentation Techniques:

- Edge Based segmentation.
Color Based Segmentation.
Texture Based segmentation.
Disparity Based Segmentation.
Motion Based Segmentation.

Threshold : A way of reformation process. It's based on clip level on threshold value to turn a gray scale image into binary image. A complete segmentation of an image R is finite set of regions.

Ex: R1.....Rs

R = union_{i=1}^s Ri

Ri intersection Rj = 0 where i not equal to j.

Thresholding is the transformation of input image f and its output of an image g as follows ,

G(i ,j) = 1 for f(i ,j) >= T , G(i ,j) = 0 for f(i ,j) < T

Where T is Threshold. If g(i ,j) = 1 for image elements of an object otherwise image element is background.

Algorithms:

- 1 . Let be an Image f (i , j) is search all the Pels.
2 . Doing segmentation Process.
3 . An Output image as g (i , j) is to apply the condition as
If f(i,j) > T then segmented image is an Object.
If not Segmented image is an Background.
4 . Obtain the new Image.

IMAGE ENHANCEMENT

The purpose of the image enhancement process to implementation of digital image quality without knowledge about the source degradation. Based on either spatial domain methods or Frequency domain methods.

Spatial Domain Methods :

It refers to the aggregate of pixels are compose of an image. It may be expressed as by an image G(x , y) = T[f(x,y)]

Where f(x, y) is Input image and g(x,y) is processed image and T is an operator on f.

Frequency Domain Methods :

It refers the convolution theorem. G (u,v) = H(u ,v)F(u ,v)

It can be formed by an image f(x,y)and linear, position invariant operator h(x,y) , G(x,y) = h(x,y) *f(x,y)

To make an image may be lighter or darker or to be increase or decrease the Contrast manipulation ,Pseudo coloring , Noise Filtering , Edge crispening , Sharpening , Interpolation and Magnification. So far the main theme of Image Enhancement is to improve an image in some sense.

IMAGE RESTORATION

It is the process that attempts to reconstruct or recover an image that is degraded by using some priori knowledge of the degradation process. It depends on the extent and accuracy of the knowledge of degradation process and as well as on filter.

Ex:Input image f(x,y)to add the degradation process H an additive noise eta(x,y) and its produce the new image as g(x,y).

F(x,y) -> H D(x,y) -> ADD -> g(x,y)

Filter - It is the process to be filter the un necessary information from an image and moreover to remove the various types of noises.

There are two kinds of filters

- Spatial Filter
Smoothing Filter , Sharpening Filter.
Frequency Filter
Low Pass Filter , High Pass Filter , Band Pass Filter.

Ex:

- Low Pass Filter – Image Blurring.

- High Pass Filter – Attenuate or Eliminate the low frequency.
- Band Pass Filter – Between the low pass and high pass filter. Remove the selected region.
- Smoothing Filter – It is used for blurring and noise reduction.
- Sharpening Filter – Highlight of an image.

IMAGE COMPRESSION

It refers to the process of image compression is to reduce the number of pixels in an image without loss of data. The main goal of this process to achieve or leads to redundancy or eliminate the correlation of data in the way , which makes image reconstruction is possible.

There are two groups of compression ,

Lossy Compression – With Loss of information.

Loss less Compression – To preserve the information.

Image Representation

An image function $f(x,y) - 2D | 3D$ Projection.

Bit map image representation.

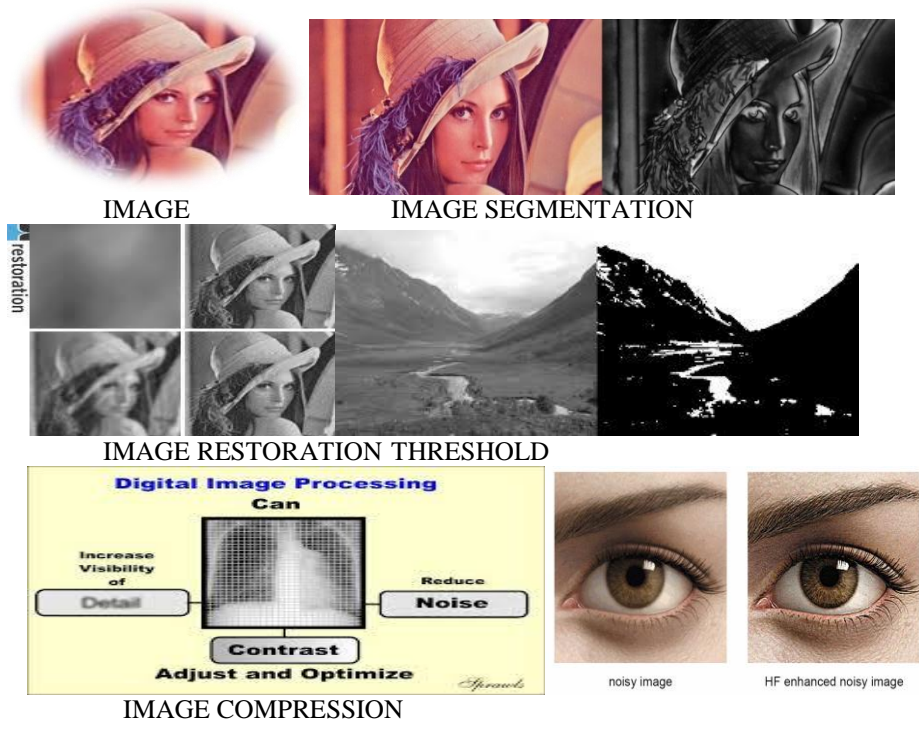
Monochrome.

Gray scale and Color.

Vector Graphics and Color resolution.

CONCLUSION

In this paper provides an Introduction to Basic concepts of Image Processing and ease of know about the Digital Image Processing. The topics covered the ranges from Fundamental steps of DIP such as Image Acquisition , Image Preprocessing , Image segmentation , Image Enhancement , Image Restoration and Image Compression.



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