

Introduction to Digital Image Processing

Priya¹, Dr. Deepak Chahal²

¹Student, Department of IT, Jagan Institute of Management Studies, Sector -05, Rohini, New Delhi, India

²Professor, Department of IT, Jagan Institute of Management Studies, Sector -05, Rohini, New Delhi, India

Abstract- This paper describes about the digital image processing. Digital image processing is the process of improving pictures information for human interpretation. It is a field of signals and systems but mainly focuses on images. This process helps a computer system to process images using algorithms. This paper tells us brief overview of digital image processing techniques.

Index terms- Digital, Image, Processing, Analog

1. INTRODUCTION

Extracting data from digital image and process it additional for specific application we will say it is extent of digital image process it's a sort to indicate a paradigm of what specifically a digital image processing is. Image is a projection of 3D scene in 2D plane. Mathematical definition says "a two-dimensional function, $f(x, y)$, where x and y are coordinates and f at any pair of coordinates (x, y) is called gray level of the image at that point.

$$f(x, y) = f(0,0) \quad f(0,1) f(0,2) \dots f(0,N-1)$$

$$f(1,0) \quad f(1,1) f(1,2) \quad \dots f(1,N-1)$$

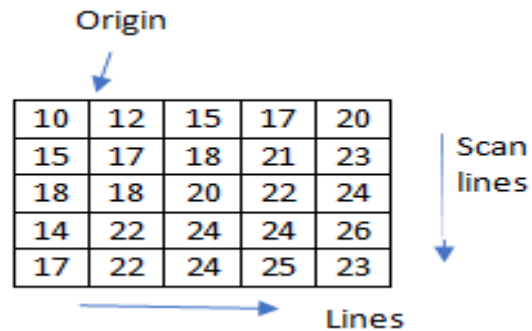
$$f(M-1,0) \quad f(M-1,1) \quad f(M-1,2) \quad \dots f(M-1, N-1)$$

Depending on values of x, y and f we have the classification divided into two types of image-

1. Analog image
2. Digital image

Analog image may be defined as when x, y and f representation have continuous range of values representing position and intensity. For example, image produced on the screen of a CRT monitor. High memory is required for storing the requirement of analog image.

Digital image may be defined as when x, y and f are all finite, discrete quantities at a particular location and value. For storage requirement we convert it into digital image with help of digital computers.



For this purpose, analog image we do sampling, the sampling will have discretization in terms of (x, y) after sampling it will have quantization which will have discretization on (x, y) . After sampling and quantization, we obtain a form of image to be the digital image. These elements are called picture elements, image elements or pixels. To have digital image we have different advantages as cost effective, fast processing, effective storage, etc.

2. DIGITAL IMAGE PROCESSING

The first application of digital imaging was in newspaper industry in 1920s later on there were many improvements as with increasing time. Now a day's digital image processing techniques have been mostly required and used in different areas as image enhancement, artistic effects, medical visualisation, industrial inspection, law enforcement and human computer interfaces. It improves quality, removes noise, etc.

The analysis and manipulation of a digitized image, particularly so as to enhance its quality. The image processing method provides different steps to process an image. First step, it will include the importing of image via using tool. Second step, it will analyse and manipulate the image regarding with required actions. And the final step, the result which contain the altered image.

Humans are limited to the visual band of the electromagnetic spectrum but as we talk about storage transmission with the help of machines exactly we can see our digital computers so the imaging machines cover almost the entire EM spectrum ranging from gamma to radio waves as further we operate on images generated by sources that humans are not capable to sense we can have in digital image processing that include ultrasound, electron microscopy and computer generated images. It is a distinction typically is created as a discipline during which each input and output of a method area unit images however it's a limiting and somewhat artificial boundary. For example, task of computing the average intensity of an image which is a single number would not be considered as an image processing operation but we know that it is task that is associated into digital image processing only so there is no general agreement and definition where we can say that scope of digital image processing. There are fields like computer vision which use computers to emulate human vision, including learning and being able to make inferences and take actions based on visual inputs. Different techniques are involved in Digital Image Processing (fig1).

Image Acquisition

First step involved in the fundamental techniques of digital image processing. In Image Acquisition the image should be in digital form. This stage involves colour conversion i.e. RGB to Gray and vice versa and resizing of a digital image. For example, in videos technique, the magnification of digital material is known as ratio between the apparent size of image and its true value it came to the dimensionless number. For image acquisition scaling is depend on various algorithms such as Nearest-neighbour interpolation, Bilinear and bicubic algorithms, Sinc and Lanczos resampling, Box sampling, Mipmap and etc.

Image Enhancement

To involve the hiddenness behind the image details about the appearance, brightness and contrast. To improve the appearance of an image enhancement technique is used. In this technique noise is removed, quality is improved. It provides some features of interest in an image.

Colour image processing

It deals with colour enhancements and pseudo codes are applicable to digital image processing.

Wavelets and Multi resolution Processing

Wavelets represent the scale as well as their position and it can also be applied to 1D signals of an image. They are useful for a number of applications including image compression, etc. It means to represent images in various degrees.

Compression

It encodes the digital image into few bits. It is used to reduce the excess of the image and to store and transmit data in an efficient data. It reduces the storage required to save image or bandwidth to transmit it.

Morphological Processing

It simply extracts the image components that are used to represent and describe shape of an image.

Image Restoration

It is basically based on mathematical or probabilistic model or image degradation.

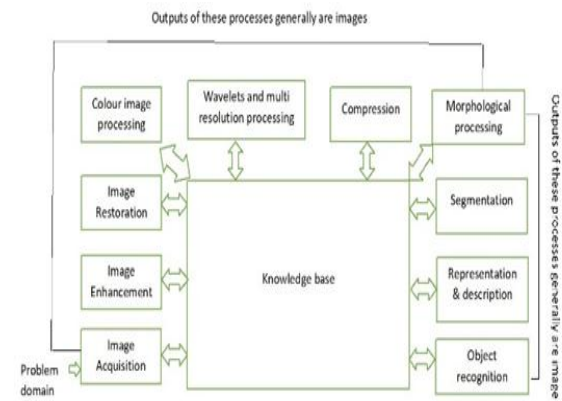


Fig 1. Processing Techniques

Segmentation

It divides an image into constituents' parts or objects. A watershed transformation algorithm was proposed for image segmentation using mathematical morphology. In order to avoid over segmentation, they proposed to adapt the topological gradient method. Integrity of data refers to protecting information from falsely being modified by an unauthorized party. Information is valuable only if it is correct, tampered information could prove costly to both the sender and the receiver party [1].

3. CONCLUSION

Digital image processing deals with digital images through a digital computer. In this article various techniques of digital image processing are discussed. These techniques provide us to maintain the storage maintenance on the internet and provides better appearance of an image. The process of building applications has been a journey and it varies depending on one's application requirements and purpose [2].

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