A Review Paper on Digital Image Processing

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ABSTRACT: One of the most significant advantages of digital radiography is image processing, often known as digital image modification (DR). Pre-processing corrects for system abnormalities such as differential light detection efficiency, dead pixels, and dark noise, depending on the modality. Processing is the act of manipulating raw data shortly after it has been acquired. It includes operations like unsharp mask filtering within two or more spatial frequency bands, histogram sliding and stretching, and grey scale rendition or lookup table application, which are usually proprietary and particular to the DR manufacturer. These processing stages have a significant impact on the radiograph's final appearance, but they can also result in artefacts that are unique to digital systems. The term "post processing" refers to the end-manipulation users of the radiograph's final appearance rather than any changes to the raw data. Scanning the sky for other sentient species out in space will be the future of image processing.

KEYWORDS: Enhancement, Image, MATLAB, Processing, Sensor.

1. INTRODUCTION

The volume of F at any set of coordinates (x, y) is termed the intensity of that picture at that location. An image is defined as a two-dimensional function, F(x, y), where x and y are spatial coordinates. A digital picture is one in which the x, y, and amplitude values of F are all finite. Figure 1 shows the representation of Digital Image[1].

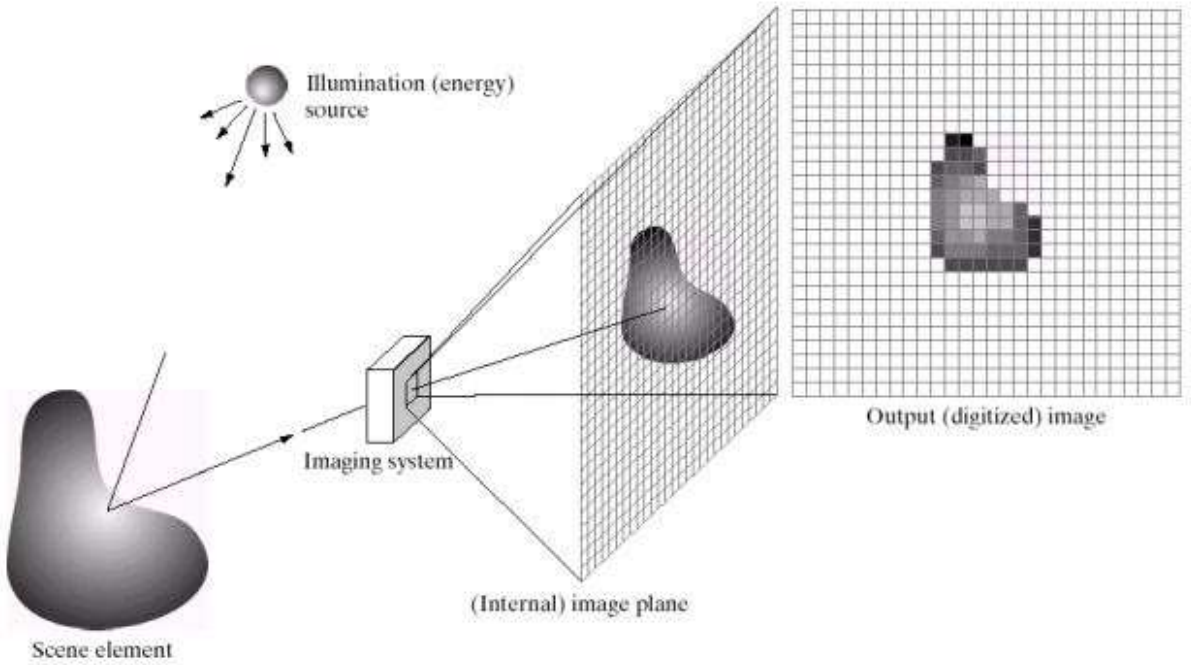

Figure 1: The above figure shows the representation of digital image [bharathuniv].

The use of a digital computer to process digital photographs using an algorithm is known as digital image processing. Digital image processing, as a subset or area of digital signal processing, provides a number of benefits over analogue image processing. It enables a considerably broader choice of algorithms to be applied to the input data, as well as avoiding issues like noise and distortion during processing[2]. Digital image processing may be represented as multidimensional systems since pictures are specified in two dimensions (or more).

On the acquisition gadget, the research is finished. This word is sometimes misunderstood, although it refers to the basic data collected by the digital imaging technology in order to generate a picture that resembles a screen–film radiograph. While the appearance of a traditional screen–film radiograph is primarily determined by the features of the screen–film system and can be adjusted, digitally recorded radiographs may be edited

and controlled by changing the grey scale or lookup table (LUT) application. Figure 2 shows the representation of Digital Image[3].

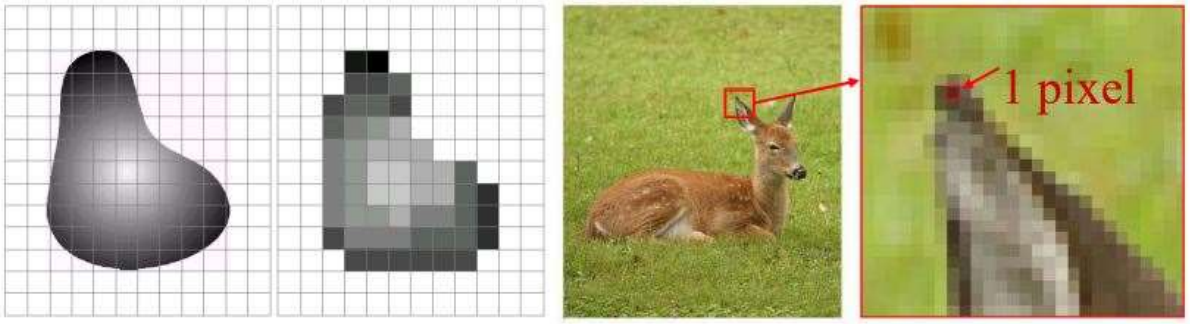

Figure 2: The above figure represents the pixel of the digital image [bharathuniv].

Physicists divide image processing into three areas:

- Preparation
- Processing
- Post processing

Three aspects have influenced the generation and growth of digital image processing:

- First, the advancement of computers.
- Second, the advancement of mathematics (particularly the creation and improvement of discrete mathematics theory).
- Third, the rising demand for a broad range of applications in the environment, agriculture, military, industry, and medical science.

Figure 3 shows an example of enhancing the margins of a picture to make it look sharper. It is worth noting how the second picture seems "cleaner", it is more appealing picture. Sharpening edges is an important part of printing: to make an image seem “at its best” on the printed page, some sharpening is generally done[4].

(a) The original image (b) Result after “sharperning”

Figure 3: The above figure shows the Image Sharpening of a picture[5]**.**

1.1 Types of Image:

1.1.1 Binary Image:

The binary picture, as the name implies, has only two pixel elements: 0 and 1, where 0 denotes black and 1 denotes white. Monochrome is another name for this picture.

1.1.2 Black and White Image:

BLACK AND WHITE Picture is an image made entirely of black and white pixels.

1.1.3 8 Bit Color Format:

It is by far the most well known picture format. Grayscale Image is a type of image that contains 256 different shades of colour. In this format, 0 represents black, 255 represents white and 127 represents grey[6].

1.1.4 16 Bit Color Format:

It is a type of colour picture. It contains 65,536 distinct colours. High Color Format is another name for it. The colour distribution in this format differs from that of a grayscale picture.

1.2 Fundamental Steps of Digital Image Processing:

Figure 4 shows the fundamental steps of Digital Image Processing.

1.2.1 Image Acquisition:

The picture is taken by a sensor (e.g., a camera) and digitised using an analogue-to-digital converter if the output of the camera or sensor is not already in digital form.

1.2.2 Image Enhancement:

The practise of altering a picture to make it more appropriate for a certain use than the original.

The goal of enhancement techniques is to bring out details that are otherwise buried in an image, or to simply emphasise particular characteristics of interest[7].

1.2.3 Image Restoration:

Improving the look of a picture. Improving the look of a picture. On the other hand, enhancement is dependent on human subjective preferences for what makes a "good" enhancement outcome.

1.2.4 Colour Image Processing:

To extract characteristics of interest in a picture, use the colour of the image.

1.2.5 Wavelets & Multiresolution Processing:

Are the building blocks for expressing pictures in different resolutions? It is designed to compress picture data.

1.2.6 Image Compression:

Techniques for decreasing the amount of storage or bandwidth necessary to save or transport an image.

1.2.7 Morphological Processing:

Tools for extracting picture components that may be used to represent and describe shapes.

There would be a change from processes that produce pictures to processes that output image characteristics at this stage.

1.2.8 Segmentation:

Segmentation is a technique for dividing a picture into its component sections or objects.

Note: The more precise the segmentation, the more probable it is that recognition will be successful.

1.2.9 Representation & Description:

Choose whether the data should be shown as a boundary or as a whole region. It nearly invariably follows the segmentation stage's output.

- Boundary Representation: Pay attention to exterior form features like corners and inflections.
- Representation of Regions: Emphasize internal characteristics such as texture and skeletal form.
- Choosing a representation is simply one element of the process of converting raw data into a format that can be processed by a computer (mainly recognition)

Feature selection, also known as attribute extraction, is the process of selecting features that result in useful information.

1.2.10 Object recognition:

The method of assigning a label to an item based on its description's contents.

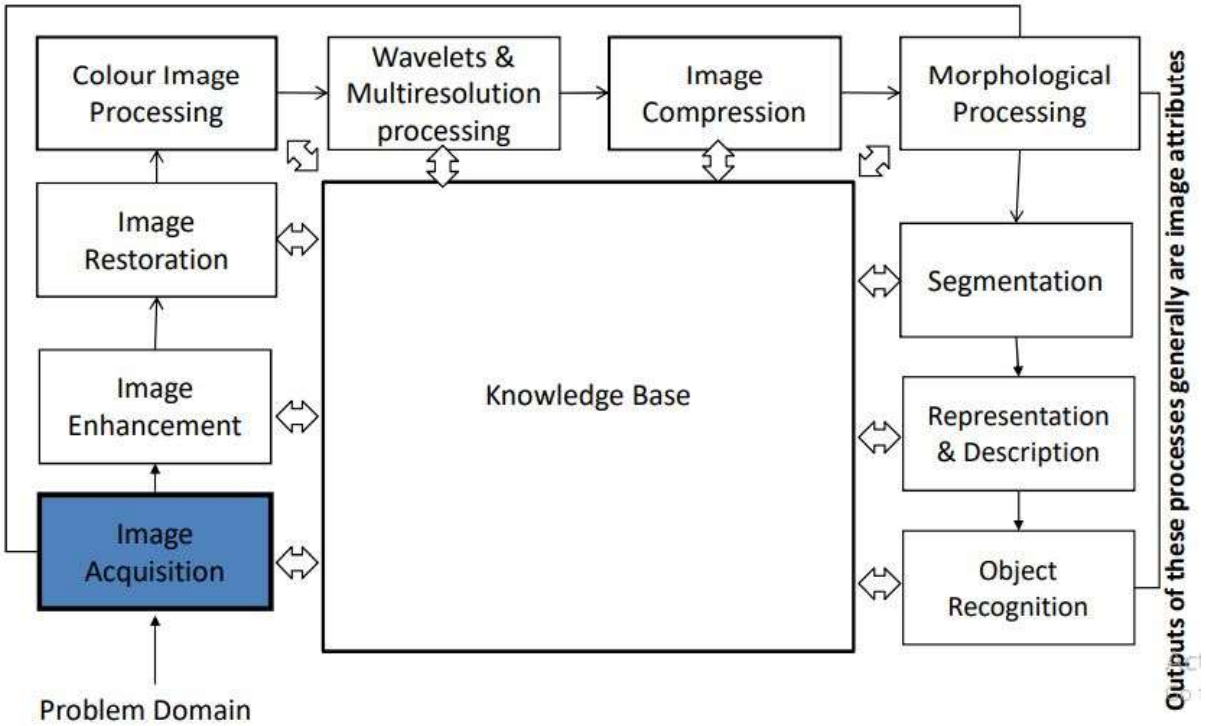

Figure 4: The above figure shows the Fundamental steps of Digital Image Processing [bharathuniv].

1.3 Components of an Image Processing System:

Figure 5 shows the components of an image processing system.

1.3.1 Image Sensor:

To acquire digital pictures, you will need two things. The first is a physical gadget that detects the energy emitted by the thing we want to photograph (Sensor). The second, known as a digitizer, is a machine that converts the real sensing device's output into digital form[8].

1.3.2 Specialized Image Processing Hardware:

Usually includes the digitizer, as well as hardware for performing other elementary tasks, such as an arithmetic logic unit (ALU), which conducts arithmetic and logical operations on whole pictures in simultaneously. The main distinctive feature of this sort of technology, also referred to as a frontend subsystem, is its speed. In other words, this unit performs activities that need high data throughputs that are beyond the capabilities of a conventional main computer.

1.3.3 Computer:

A general-purpose computer, which can vary from a PC to a supercomputer, is used in an image processing system. Specially built computers are occasionally employed in specific applications to attain a certain degree of performance.

1.3.4 Image Processing Software:

Image processing software is made up of specialised modules that execute particular tasks[9]. A well-designed package also allows the user to develop code that, at the very least, makes use of the specialised components.

1.3.5 Mass Storage Capacity:

In image processing applications, mass storage is required. If the image is not compressed, a 1024 * 1024 pixel image takes one megabyte of disk space. There are three types of digital storage for image processing applications:

- Processing-related short-term storage.
- on-line data storage for quick retrieval
- Archival storage, which is distinguished by its rare access.

Computer memory is one technique of delivering short-term storage. Another method is to use frame buffers, which are specialised boards that store one or more pictures and can be retrieved quickly.

The on-line storing approach enables for almost immediate picture zooming, as well as scrolling (vertical shifts) and panning (horizontal shifts). Magnetic discs and optical-media storage are the most common types of online storage. The frequent access to the stored data is a crucial feature of on-line storage[10].

1.3.6 Image Display:

Today's displays are mostly colour (ideally flat screen) television monitors. The outputs of the image and graphics display cards, which are an important element of a computer system, drive monitors.

1.3.7 Hardcopy Device:

Laser printers, film cameras, heat-sensitive devices, inkjet units, and digital units, such as optical and CD-ROM discs, are all used to record pictures.

1.3.8 Networking:

Is nearly a standard feature in today's computer systems. Because image processing programmes generate a great quantity of data, bandwidth is a critical factor in picture transmission.

This is usually not an issue on dedicated networks, but communication with faraway sites over the internet is not always as efficient.

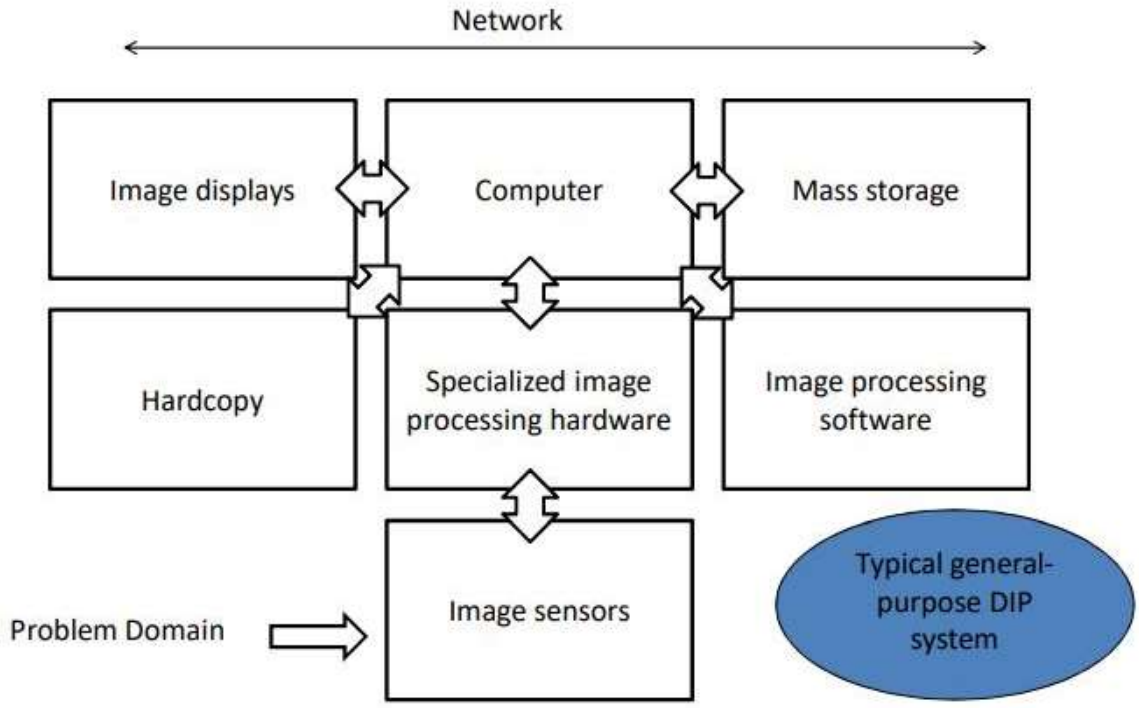

Figure 5: The above figure shows the components of digital image processing [bharathuniv].

2. DISCUSSION

The author has discussed about the digital image processing, as a subset or area of digital signal processing, provides a number of benefits over analogue image processing. It enables a considerably broader choice of algorithms to be applied to the input data, as well as avoiding issues like noise and distortion during processing. On the acquisition gadget, the research is finished. This word is sometimes misunderstood, although it refers to the basic data collected by the digital imaging technology in order to generate a picture that resembles a screen–film radiograph. The author has also discussed about the fundamentals of digital image processing. There are total 12 features in the fundamental of the digital image. The author has also discussed about the components of digital image processing.

3. CONCLUSION

The author has concluded about the digital image processing, an image is defined as a two-dimensional function, F(x, y), where x and y are spatial coordinates. Processing is the act of manipulating raw data shortly after it has been acquired. A digital picture is one in which the x, y, and amplitude values of F are all finite. One of the most significant advantages of digital radiography is image processing, often known as digital image modification (DR). Pre-processing corrects for system abnormalities such as differential light detection efficiency, dead pixels, and dark noise, depending on the modality. These processing stages have a significant impact on the radiograph's final appearance, but they can also result in artefacts that are unique to digital systems. It includes operations like unsharp mask filtering within two or more spatial frequency bands, histogram sliding and stretching, and grey scale rendition or lookup table application, which are usually proprietary and particular to the DR manufacturer.

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