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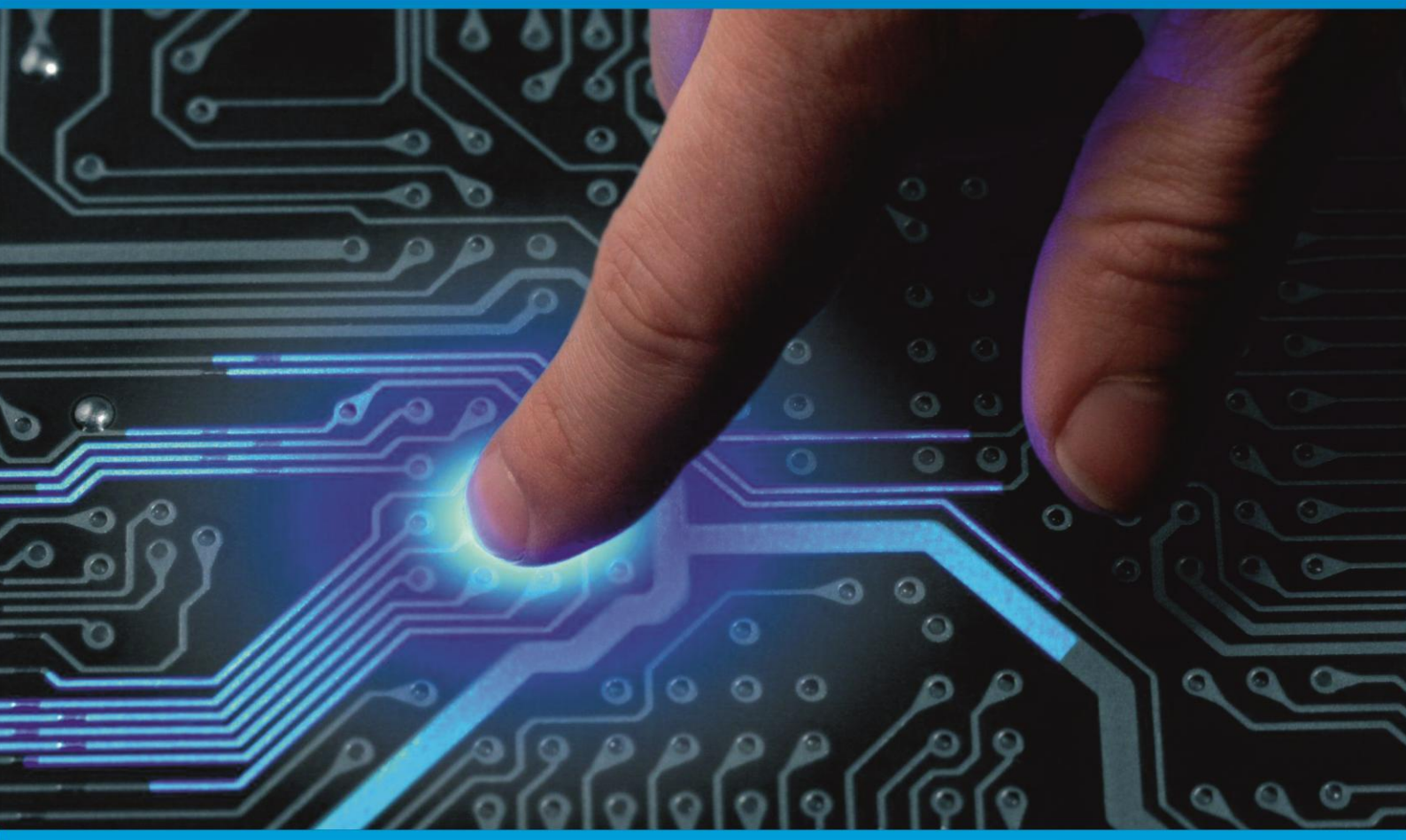

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Image Processing in Digital Enhancement using Digital Image Processing

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ABSTRACT: In this paper, the fundamentals of capturing a picture, image processing to change and enhance the image are discussed. There are many applications for Image Processing like surveillance, navigation, and robotics. Robotics may be a very interesting field and promises future development so it's chosen as an example to elucidate the varied aspects involved in Image Processing. Image processing has definitely has its impact on communication devices such as cell phone, web camera. This is describes the basic technological aspects of Digital Image Processing with special reference to satellite image processing. Basically, all satellite image-processing operations can be grouped into three categories: Image Rectification and Restoration, Enhancement and Information Extraction. The enhancement procedures are applied to image data in order to effectively display the data for subsequent visual interpretation.

KEYWORDS: Image Enhancement, Stages and Types of Images, Digital Image Processing.

I. INTRODUCTION

Digital Image Processing is concerned with acquiring and processing of an image. In simple words an image is a representation of a real scene, either in black and white or in colour, and either in print form or in a digital form i.e., technically an image is a two-dimensional light intensity function. In other words it is a data intensity values arranged in a two-dimensional form like an array, the required property of an image can be extracted from processing an image. Image is typically by stochastic models. It is represented by AR model. Degradation is represented by MA model.

Pictures are the most common and convenient means of conveying or transmitting information. A picture is worth a thousand words. Pictures concisely convey information about positions, sizes and inter-relationships between objects. They portray spatial information that we can recognize as objects. Human beings are good at deriving information from such images, because of our innate visual and mental abilities. About 75% of the information received by human is in pictorial form. In the present context, the analysis of pictures that employ an overhead perspective, including the radiation not visible to human eye are considered.

Other form is orthogonal series expansion. Image processing system is typically non-casual system. Image processing is two dimensional signal processing. Due to linearity Property, we can operate on rows and columns separately. Image processing is vastly being implemented by “Vision Systems” in robotics. Robots are designed, and meant to be controlled by a computer or similar devices. They relate the function of a robot to its environment as all other sensors do. “Vision Systems” may be used for a variety of applications, including manufacturing, navigation and surveillance. Some of the applications of Image Processing are:

1. Robotics.
2. Medical Field.
3. Graphics and Animations.
4. Satellite Imaging.

Image processing is a subclass of signal processing concerned specifically with Pictures. Improve image quality for human perception and/or computer interpretation. Image Enhancement To bring out detail is obscured, or simply to highlight certain features of interest in an image. Thus our discussion will be focusing on analysis of remotely sensed images. These images are represented in digital form.

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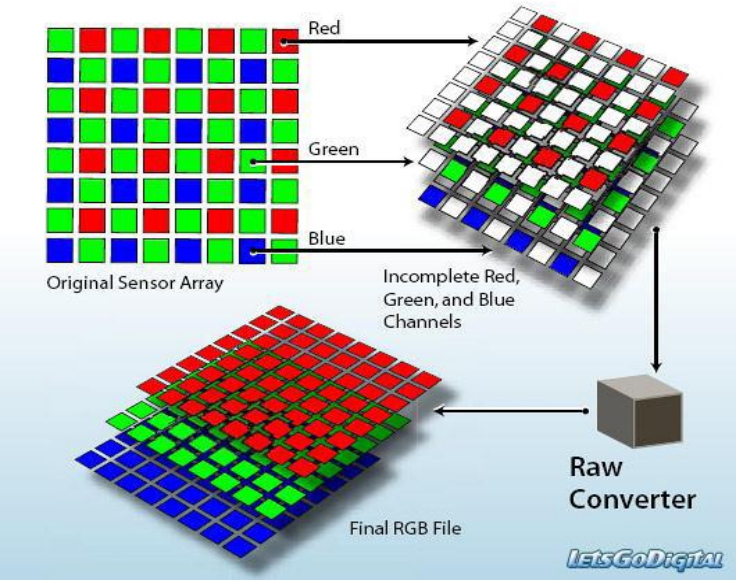

Fig.1. Spatial Information

When represented as numbers, brightness can be added, subtracted, multiplied, divided and, in general, subjected to statistical manipulations that are not possible if an image is presented only as a photograph. Although digital analysis of remotely sensed data dates from the early days of remote sensing, the launch of the first Land sat earth observation satellite in 1972 began an era of increasing interest in machine processing (Campbell, 1996 and Jensen, 1996). Previously, digital remote sensing data could be analysed only at specialized remote sensing laboratories. Specialized equipment and trained personnel necessary to conduct routine machine analysis of data were not widely available, in part because of limited availability of digital remote sensing data and a lack of appreciation of their qualities.

II. DIGITAL IMAGE

A digital image is a representation of a two-dimensional as a finite set of values, called picture elements or. Typically, the pixels are stored in computer memory or a two-dimensional array of small integers. These values are often transmitted or stored in a form. Digital images can be by a variety of input devices and techniques, such as, scanners, coordinate-measuring machines, seismographic profiling, airborne radar, and more.

It is an image that was acquired through scanners or captured from digital cameras. The most common kind of digital image processing is digital image editing Image processing is enhancing image or extracting information or features from an image. A digital remotely sensed image is typically composed of picture elements (pixels) located at the intersection of each row i and column j in each K bands of imagery. Associated with each pixel is a number known as Digital Number (DN) or Brightness Value (BV), which depicts the average radiance of a relatively small area within a scene (Fig. 1). A smaller number indicates low average radiance from the area and the high number is an indicator of high radiant properties of the area.

The size of this area effects the reproduction of details within the scene. As pixel size is reduced more scene detail is presented in digital representation While displaying the different bands of a multispectral data set, images obtained in different bands is displayed in image planes (other than their own) the colors composite is regarded as False Color Composite (FCC). High spectral resolution is important when producing cooler components. For a true collar composite an image data used in red, green and blue spectral region must be assigned bits of red, green and blue image processor frame buffer memory. A colors infrared composite „standard false colors composite" is displayed by placing the infrared, red, green in the red, green and blue frame buffer memory (Fig. 2). In this healthy vegetation shows up in

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shades of red because vegetation absorbs most of green and red energy but reflects approximately half of incident Infrared energy. Urban areas reflect equal portions.

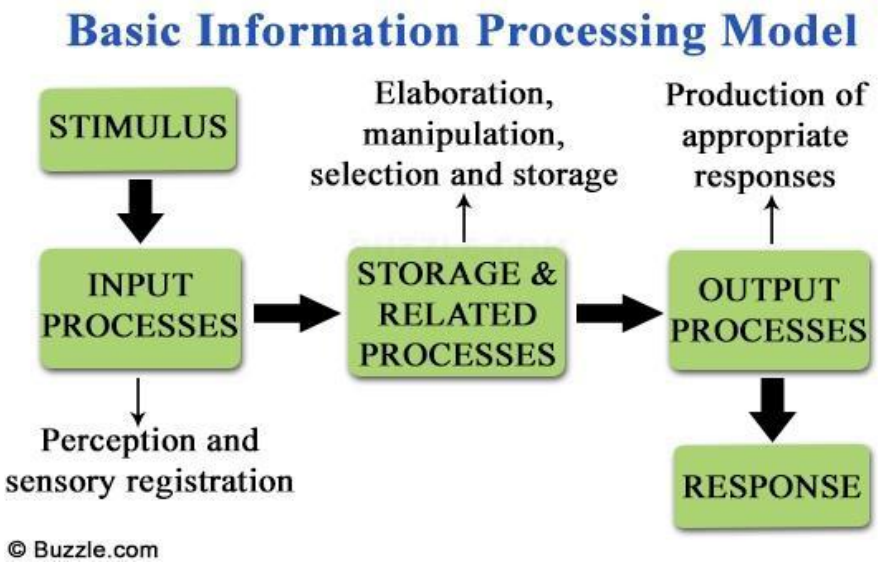

Fig.2. Information process model

III. STAGES IN IMAGE PROCESSING

Geometric distortions manifest themselves as errors in the position of a pixel relative to other pixels in the scene and with respect to their absolute position within some defined map projection. If left uncorrected, these geometric distortions render any data extracted from the image useless. This is particularly so if the information is to be compared to other data sets, be it from another image or a GIS data set. Distortions occur for many reasons. This is usually done to improve the scale of display for visual interpretation or sometimes to match the scale of one image to another. To magnify an image by a factor of 2, each pixel of the original image is replaced by a block of 2x2 pixels, all with the same brightness value as the original pixel. To reduce a digital image to the original data, every math row and math column of the Original imagery is selected and displayed. Another way of accomplishing the same is by taking the average in 'm x m' block and displaying this average after proper rounding of the resultant value.

Image enhancement techniques improve the quality of an image as perceived by a human. These techniques are most useful because many satellite images when examined on a color display give inadequate information for image interpretation. There is no conscious effort to improve the fidelity of the image with regard to some ideal form of the image. There exists a wide variety of techniques for improving image quality.

The contrast stretch, density slicing, edge enhancement, and spatial filtering are the more commonly used techniques. Image enhancement is attempted after the image is corrected for geometric and radiometric distortions. Image enhancement methods are applied separately to each band of a multispectral image. Digital technique have been found to be most satisfactory than the photographic technique for image enhancement, because of the precision and wide variety of digital processes. The satellites cover different portions of the electromagnetic spectrum and record the incoming radiations at different spatial, temporal, and spectral resolutions. Most of these sensors operate in two modes: multispectral mode and the panchromatic mode.

The various Image Processing techniques are as follows.

- Image representation.
- Image pre-processing.
- Image enhancement.
- Image restoration.
- Image analysis.

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• Image reconstruction.
• Image data compression.

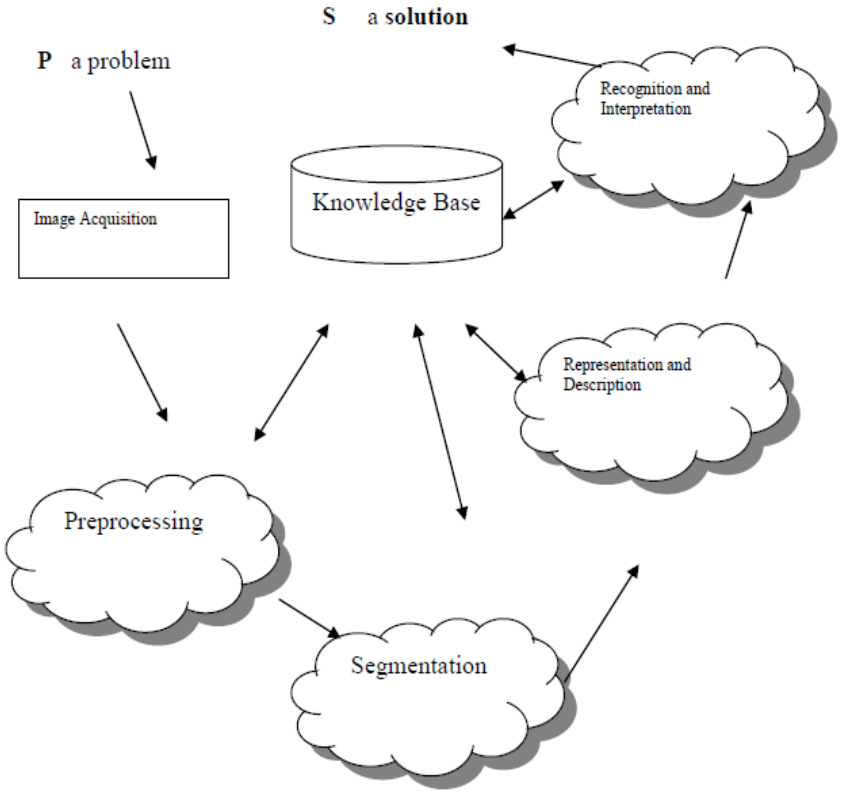

Fig.3. Image Processing Stages

1. IMAGE ACQUISITION:

An image is captured by a sensor (such as a monochrome or color TV camera) and digitized. If the output of the camera or sensor is not already in digital form, an analog-to digital converter digitizes it.

2. RECOGNITION AND INTERPRETATION:

Recognition is the process that assigns a label to an object based on the information provided by its descriptors. Interpretation is assigning meaning to an ensemble of recognized objects.

3. SEGMENTATION:

Segmentation is the generic name for a number of different techniques that divide the image into segments of its constituents. The purpose of segmentation is to separate the information contained in the image into smaller entities that can be used for other purposes.

4. REPRESENTATION AND DESCRIPTION:

Representation and Description transforms raw data into a form suitable for the Recognition processing.

5. KNOWLEDGE BASE:

A problem domain detailing the regions of an image where the information of interest is known to be located is known as knowledge base. It helps to limit the search.

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IV. IMAGE ENHANCEMENT TECHNIQUE

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The panchromatic mode corresponds to the observation over a broad spectral band (similar to a typical black and white photograph) and the multispectral (color) mode corresponds to the observation in a number of relatively narrower bands. For example in the IRS – 1D, LISS III operates in the multispectral mode. It records energy in the green (0.52 – 0.59 μm), red (0.62-0.68 μm), near infrared (0.77- 0.86 μm) and mid-infrared (1.55 – 1.70 μm). In the same satellite PAN operates in the panchromatic mode. SPOT is another satellite, which has a combination of sensor operating in the multispectral and panchromatic mode. Above information is also expressed by saying that the multispectral mode has a better spectral resolution than the panchromatic mode. Now coming to the spatial resolution, most of the satellites are such that the panchromatic mode has a better spatial resolution than the multispectral mode, for e.g. in IRS -1C, PAN has a spatial resolution of 5.8 m whereas in the case of LISS it is 23.5 m. Better is the spatial resolution, more detailed information about a land use is present in the imagery, hence usually PAN data is used for Observing and separating various features. Both these type of sensors have their particular utility as per the need of user. If the need of the user is to separate two different kind of land uses, LISS III is used, whereas for a detailed map preparation of any area, PAN imagery is extremely useful.

Image Fusion is the combination of two or more different images to form a new image (by using a certain algorithm).

The commonly applied Image Fusion Techniques are

1. IHS Transformation
2. PCA
3. Bravely Transform
4. Band Substitution

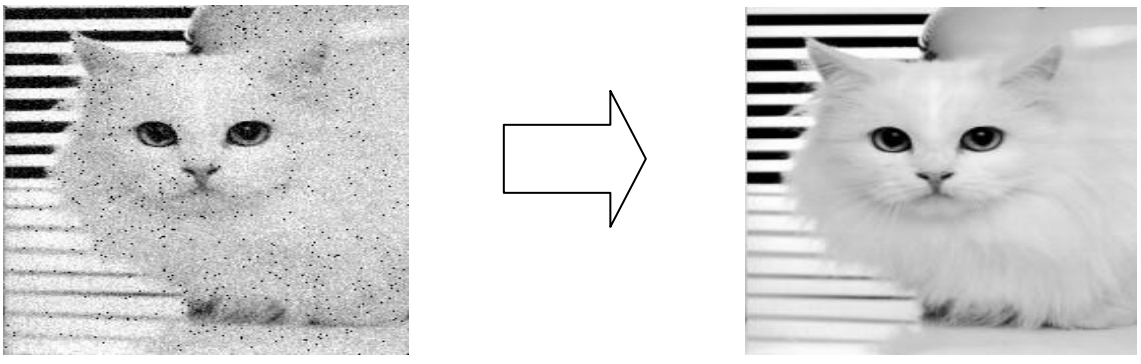

Fig.4. Image Enhancement

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V. IMAGE EDITOR FEATURES

Listed below are some of the most used capabilities of the better graphic manipulation programs. The list is by no means all inclusive. There are a myriad of choices associated with the application of most of these features.

- **Image Size Alteration:** Image editors can **resize an image**, making it larger, or smaller. High **image resolution** cameras can produce large images which are often reduced in size for Internet use. Image editor programs use a mathematical process called re-sampling to calculate new pixel values whose spacing is larger or smaller than the original pixel values.

- **Noise Removal:** Image editors may feature a number of algorithms which can add or remove noise in an image. JPEG artifacts can be removed; dust & scratches can be removed and an image can be despeckled. Noise tends to invade images when pictures are taken in low light settings.

- **Removal of Unwanted Elements:** Most image editors can be used to remove unwanted branches, etc, using a "clone" tool.

Original

Removal of branch at the top of image

- **Selective Color Change**: Image editors have the ability to selectively change the image.

- **Merging Of Images:** Many graphics applications are capable of merging one or more individual images into a single picture. The orientation and placement of each image can be controlled. The two images shown here were once individual studio portraits.

- **Change Color Depth:** It is possible, using software, to change the color depth of images. Common color depths are 2, 16, 256, and 16 million colors. The JPEG and PNG image formats are capable of storing 16.7 million colors (equal to 256 luminance values per color channel). In addition, grayscale images of 8 bits or less can be created, usually via conversion and down sampling from a full color image.

Operations of image processing

- Colour corrections such as brightness and contrast adjustments, quantization, or color translation to a different colour space.
- Image registration, the alignment of two or more images.
- Image segmentation.

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- Neighborhood and block operations.
- Linear filtering and filter design.
- Transforms.
- High dynamic range imaging by combining multiple images.
- Deblurring.

VI. TYPES OF IMAGES

Intensity image

This is the equivalent to a "gray scale image". It represents an image as a matrix where every element has a value corresponding to how bright/dark (each element represent intensities).

Binary image

This image format also stores an image as a matrix but can only colour a pixel black or white (and nothing in between). It assigns a 0 for black and a 1 for white.

Indexed image

This is a practical way of representing colour images. An indexed image stores an image as two matrices. The first matrix has the same size as the image and one number for each pixel. The second matrix is called the colour map and its size may be different from the image. The numbers in the first matrix is an instruction of what number to use in the colour map matrix.

RGB image

It represents an image with three matrices of sizes matching the image format. Each matrix corresponds to one of the colours red, green or blue and gives an instruction of how much of each of these colours a certain pixel should use. A pixel whose colour components are (255,255,255) is displayed as *White*. And whose colour components are (0,0,0) is displayed as *Black.*

VII. ADVANTAGES AND DISADVANTAGES

ADVANTAGES:

1. One of the biggest advantages of digital imaging is the ability of the operator to manipulate the pixel shades to correct image density and contrast, is called **Post-Processing**. And perform other processing functions that could result in improved diagnosis and fewer repeated examinations.
2. Digital imaging allows the electronic transmission of images to third-party providers, referring dentists, consultants, and insurance carriers via a modem.
3. Digital imaging is also environmentally friendly since it does not require chemical processing. It is well known that used film processing chemicals contaminate the water supply system with harmful metals such as the silver found in used fixer solution.
4. Radiation dose reduction is also a benefit derived from the use of digital systems. Some manufacturers have claimed a 90% decrease in radiation exposure, but the real savings depend on comparisons.

DISADVANTAGES:

There are also disadvantages associated with the use of digital systems.

1. The initial cost can be high depending on the system used, the number of detectors purchased, etc.
2. Competency using the software can take time to master depending on the level of computer literacy of team members. Finally, since digital imaging in dentistry is not standardized, professionals are unable to exchange information without going through an intermediary process.

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VIII. CONCLUSION

It's a critical study, which plays a vital role in modern world as it is involved with advanced use of science and technology. The advances in technology have created tremendous opportunities for Vision System and Image Processing. There is no doubt that the trend will continue into the future Over the next few years, the growth of digital image processing is going to be enormous with new products and technologies coming out frequently. In order to get the most out of this period, it is going to be important that image processing planners and developers have a clear idea of what they are looking for and then choose strategies and methods that will provide them with performance today and flexibility for tomorrow. . From the above discussion we can conclude that this field has relatively more advantages than disadvantages and hence is very useful in varied branches.

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