

An Overview of Image Processing and its Applications

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ABSTRACT

A technique to implement some operations on image is called Image Processing. Image Processing is to acquire an enhanced image or to extract some valuable information from it. Currently, image processing is a growing technology. Engineering and Computer science form two main research area in Image Processing. Image Processing can be divided into analog image processing and digital image processing. Here is an overview about image processing and its applications.

Keywords: Image, Signal Processing, Digital Image Processing, Analog Image Processing

I. INTRODUCTION

A two-dimensional signal is known as an Image and also it is defined as a mathematical function $f(x,y)$ where x represents a horizontal co-ordinate and y represent a vertical co-ordinate which is depicted in Figure 1.

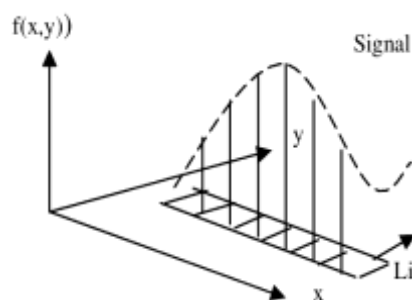


Figure 1: Two-dimensional function

Signal processing is a subset of the field of mathematics and electrical engineering. It deals with analysis and processing of analog and digital signals, with storing, screening, and other operations on signals. These signals include transmission signals, sound or voice signals, image signals, and other signals. In Image processing the type of signals for which the input is an image and the output is also an image. As it names suggests, it deals with the processing on images. Image processing principally contains the following three steps: 1) Bring in the image via image acquisition tools 2) Image Examining and manipulating 3) Output in which outcome can be reformed image or report that is based on image analysis.

II. TYPES OF IMAGE

There are four types of image. They are Binary image, Black and White Image, 8 bit Image and 16 bit image.

- Binary Image: It is also called as Monochrome image. It contains only two values 0 and 1. 0 represent black and 1 represent white.

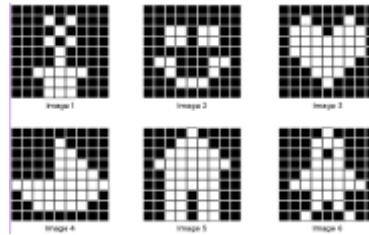


Figure 2: Binary Image

- Black and White Image: In this image only two colors are possible namely Black and White.



Figure 3: Black & White Image

- 8-bitImage:It is also called as Grayscale image. It contains 256 different colors. It is the most famous image compare to others. In this image 0 means Black and 255 means white.



Figure 4: 8 bit Image

- 16-bitImage:It is also called as High color image. It contains 65,536 different colors. It is also the most famous image.



Figure 5: 16 bit Image

III TYPES of IMAGE PROCESSING

Analog Image Processing

Analog image processing is done on analog signals. Its processing depends on two dimensional analog signals. In this type, the images are manipulated by electrical means by varying the electrical signal. It is a contiguous signal and not broken into small components. Analog Image Processing is slower and expensive process.

Digital image processing

Figure 6 depicts basics of digital image processing. Digital image processing deals with developing a digital system that achieves operations on digital image. Digital image processing is done by following some steps including Pre-processing, enhancement and display, information extraction. Digital image processing is fast and inexpensive process.

INPUT	OUTPUT	
	IMAGE	OTHER INFORMATION
IMAGE	Image Processing	Image Analysis Pattern Recognition
OTHER INFORMATION	Image Synthesis Computer Graphics	Other Types Of Information Processing

Figure 6: Basics of Digital Image Processing

Medical Image Processing

Image Processing is broadly used for the clinical purposes. Here, for getting the appropriate results uses the observed technology. For medical imaging, it needs radiation with tissues. The major parts of medical image processing consist of Ultrasound, Projection X-ray, Magnetic Resonance Imaging, X-ray Computed Tomography, Nuclear Medicine and Fundus Images.

Satellite Image Processing

Mainly the satellite images processing for the outer part of the world / surface of the unreached area / world are taking the specialized camera. The use of Web Mirror has enabled to receive the image from the satellite.

IV. PURPOSE OF IMAGE PROCESSING

The purpose of image processing is as follows,

Visualization - Witness the objects that are not visible.

Image sharpening and restoration - To create a better image.

Image retrieval - Try to find for the image of interest.

Measurement of Pattern – Measures various objects in an image.

Image Recognition – Differentiate the objects in an image.

V. BUILDING COMPONENTS OF IMAGE PROCESSING

The basic building components of Image Processing is shown in Figure 6.

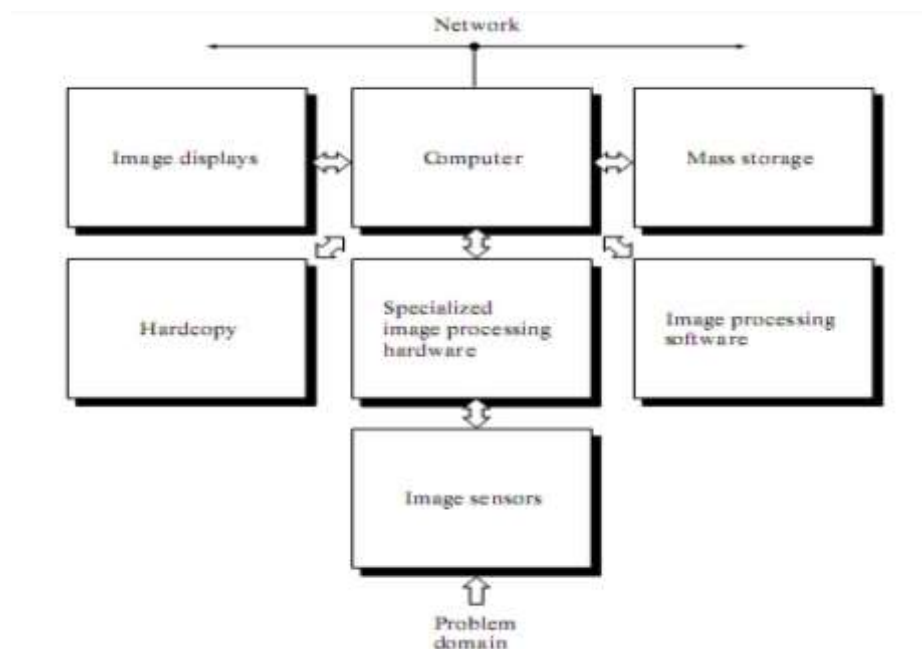


Figure 7: Components of Image Processing

Computer:In an image processing system a general-purpose computer that can range from a PC to a super computer is used. In dedicated applications, sometimes specially designed computers are used to achieve a required level of performance.

Software:Image processing software contains specialized modules that execute specific tasks. A well-designed software has the ability to use minimum number of specialized modules along with the user code. Specialized modules play a major role in sophisticated packages.

Mass storage:Capability is must in image processing applications. Digital storage for image processing applications falls into three principle categories: (1) short-term storage (2) on-line storage for relatively fast recall, (3) archival storage, characterized by infrequent access. Storage space is measured in terms of bytes, Kilo bytes (KB), Mega Bytes (MB), Giga Byte (GB) and Tera Byte (TB).

Image display:It displays the images.

Hardcopy Devices:Used for recording images includelaser printers, film cameras, heat sensitive devices, inkjet units and digital units such as optical and CD-ROM disks.

VI. FUNDAMENTAL STEPS OF IMAGE PROCESSING

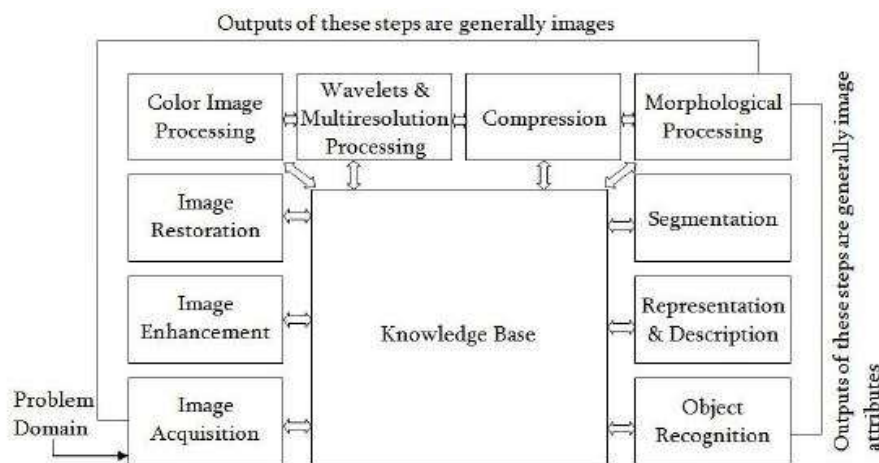


Figure 1

Figure 8: Steps involved in image processing

- Image acquisition: This is the first step and it is used to obtain an image.
- Image restoration: The Appearance of the image can be improved by image restoration.
- Image processing: To improve the image in several ways that increases the chances for success of the other processes.
- Image segmentation: To partition an input image into its integral parts or objects.
- Image representation: To convert the input data into a form appropriate for computer processing.
- Image description: To extract features that result in some quantitative information of interest or features that is basic for distinguishing one class of objects from another.
- Image recognition: To assign a label to an object created on the information delivered by its descriptors.
- Image interpretation: To assign denotation to an ensemble of recognized objects.
- Knowledge Database: Awareness about a problem domain is coded into an image processing system in the form of a knowledge database.
- Image Enhancement: It is divided into two types. 1. Spatial domain methods and Frequency domain method.
- Image Analysis: Extract some information from an image using automatic or semiautomatic method.
- Image Compression: to save space and transmission time image can be compressed.

VII. APPLICATIONS OF IMAGE PROCESSING

Visual information is the most vital type of information observed, processed and interpreted by the human brain. One third of the cortical area of the human brain is dedicated to visual information processing. Digital image processing, as a computer - based technology, brings out automatic processing, manipulation and interpretation of such visual information.

- Medical/Biological image processing
- Computerized photography
- Space image processing
- Remote sensing: aerial and satellite image interpretations
- Automatic character recognition
- Finger print
- Industrial applications

VIII. ADVANTAGES OF IMAGE PROCESSING

The main advantages of image processing are

- Increased accuracy, higher speed and advanced colour shade processing technology are some of the advantages image processing system.
- Image sizes can be enlarged or declined.
- Images can be smoothened.
- It allows robots to have vision.
- Digital images can be processed by digital computers.
- Features such as edges can be extracted from images
- Images can be given more sharpness and better visual appearance.
- Minor errors can be rectified.
- Images can be compressed and decompressed for faster image transfer over the network.
- Images can be automatically sorted depending on the contents they have.
- It allows industries to remove defective products from the production line.
- It allows weather forecasting.
- It is used to analyses cells and their composition.
- It is used to analyses medical images.

IX. CONCLUSION

Here basic concepts of image processing like types of image, image processing classification, components, purpose, fundamental steps, applications and advantages of image processing is reviewed and presented. This work will afford a useful material for fresher's and researchers.

REFERENCES

1. C. Solomon, T. Breckon, Fundamentals of Digital Image Processing. A Practical Approach with Examples in Matlab, Wiley-Blackwell
2. Image Processing and Analysis with Graphs - Olivier Lezoray
3. Digital Image Processing, 3rd Edition by Rafael C. Gonzalez, Richard E. Woods
4. Digital Image Processing Using MATLAB, 2nd Edition by Rafael C. González, Richard
5. Burge and Burger, Principles of digital image processing
6. Sonka, et al. Image processing, analysis and machine vision
7. Nixon, Feature extraction & image processing for computer vision
8. Parker, Algorithms for image processing and computer graphics