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A Review on Overview of Image Processing Techniques

Hirdesh Chack[1], Vijay Kumar Kalakar[2], Syed Tariq Ali[2]

[1,2]Lecturer, Department of Electronics and Telecommunication,
[1]Government Polytechnic College, Jatara, Madhya Pradesh, India
[2]Government Women's Polytechnic College, Bhopal, Madhya Pradesh, India

ABSTRACT

Image processing is actually among the fast-growing innovations across various areas of a business with applications. Image processing frequently forms key scientific areas within the areas of electronics and computer science. Image processing is a tool for refining raw photographs obtained in our everyday lives from rockets, ships, space samples or military identification flights. Thanks to technologically powerful personal computers, broad databases of current devices and the Graphic Technology and the accessible resources for such software and apps, this area is strong and common. The provided input is an image and its output an enhanced high-quality image according to the techniques used in the image processing procedure. Image processing is typically called digital image processing, although it is often possible to optically process and analogy photograph. An overview of image processing methods is given in this article. This article focuses mainly on identifying specific methods utilized in various image processing phases.

KEYWORDS: *Image Processing, Image Processing Techniques, Segmentation, Enhancement*

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I. INTRODUCTION

Image Processing is a method for enhancement of raw photographs from spacecraft, space probes and aircraft or pictures obtained from cameras or sensors similar systems provide regular existence. Over the last five decades, many technologies have been established in the area of image processing. Many techniques for enhancing pictures of spacecraft's, spatial samples and military inspection flights have been developed. The simple availability of powerful personal computers, large-size memory devices and graphics applications are making image processing systems more common.

Image Processing are given two methods as follow:

- Analog Image Processing
- Digital Image Processing

Computer algorithms are used in digital image processing for the rendering of images. Unlike analog image processing, digital image processing provides a range of advantages. The input data was used for a broad variety of algorithms. In digital image processing, at any stage during signal processing we can prevent such processing issues, such as noise and signal distortion. Throughout the 2000s, fast computers became a common method of image processing for signal processing and digital image processing. Of this purpose, the processing of signal images has been both flexible and cheapest [1].

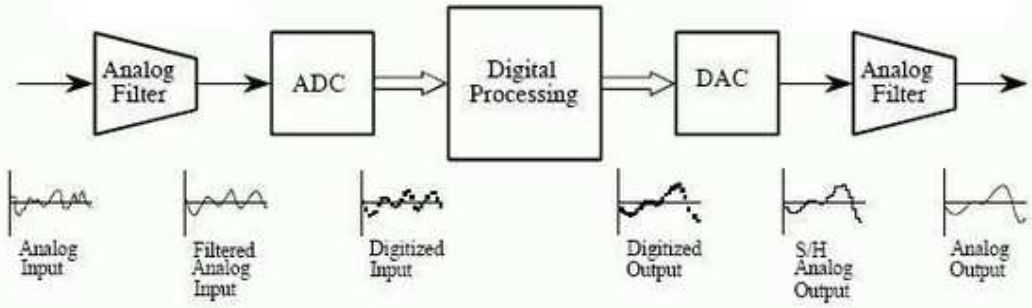

Figure 1 Digital signal processing of Image

For hard copies such as printouts and photos, image processing utilizing analog techniques can be required. Image analysts use these graphic tools across a number of basics of perception. The analysis of photographs is not only confined to the region to be learned, but also to expert knowledges. Association is another essential method of image analysis. Analysts use a mix of professional and collateral information in the analysis of images.

Image processing has a strong connection to computer vision and graphics. The image processing priorities can be classified into five groups:

- Hallucination (Monitoring events not visible).
- Restoring and sharpening images (for improved image creation).
- Image repossession (image of interest search).
- Pattern analysis (measures a representation of a variety of objects)
- Recognition of image (difference of artifacts in an image)

II. TRANSFORMATIONS IN IMAGE PROCESSING

1. Image-to-Image transformation
   - Enhancement
   - Restoration
   - Geometry
2. Image to information transformation
   - Image statistics (histograms) histogram helps in analyzing and processing the image
   - Image compression
   - Image analysis includes image segmentation, extracting the features in image, pattern recognition scheme)
   - Computer-aided design.
3. Information-to image transformation
   - Decompression from the image which is already compressed.
   - Reconstruction of small parts of images to forms new original image.
   - Animations Computer graphics, and virtual reality.

III. IMAGE PROCESSING TECHNIQUES

Digital image processing has developed various techniques in recent years. The accompanying diagram illustrates different phases in the processing of images and the manner in which they are done. The reference image or the video frame is used for all these measures.

Classification of Image Processing techniques are given below:-

1. Image representation
2. Image preprocessing
3. Image enhancement
4. Image analysis
5. Image compression
6. Image Segmentation
7. Image Restoration

3.1. Image representation

Representation involves the conversion of raw data to a type appropriate for more operation by computers. Two types of representation techniques are:

- Representation of boundaries
- Representation of the region

If the emphasis is on internal shape characteristics such as corner, squared, border representation is sufficient.

Regional representation when the emphasis is on internal characteristics e is acceptable. e.g.. Skeleton, structure, shape.

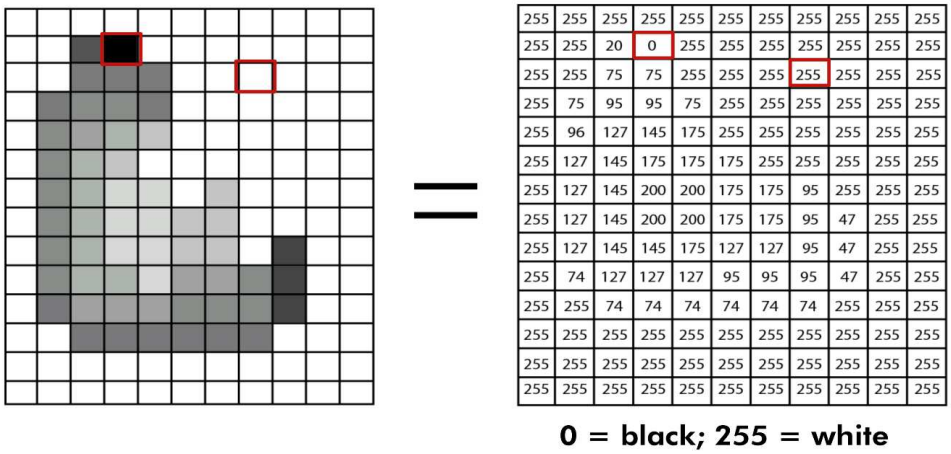

Figure 2 2D Image Digital Representation

3.2. Image preprocessing

Preprocessing indicates that the same tissue type may have a different scale of signal intensities for different images. Preprocessing functions involve those operations that are normally required prior to the main data analysis and extraction of

information and are generally grouped as radiometric or geometric corrections. Radiometric corrections include correcting the data for sensor irregularities and unwanted sensor or atmospheric noise, removal of non-brain vowels and converting the data so they accurately represent the reflected or emitted radiation to find out a transformation between two images precisely.

The preprocessed images will have some noise which should be removed for the further processing of the image. Image noise is most apparent in image regions with low signal level such as shadow regions or under exposed images. There are so many types of noise like salt and pepper noise, film grains .All these noise are removed by using algorithms. Among the several filters, median filter is used.

Image noise is more noticeable in low-signal environments, such as shadow zones or visible images. Too many kinds of noise occur, such as salt and pepper static, and movie grains. The formulas are used to suppress all such sounds. The median filter is used among the various filters.

3.3. Image enhancement

Image enhancement is the process by which the effects of the image can be rendered better, changed from the initial images so that the effects become more appropriate for processing or further study of the image. It helps to remove noise, sharpen the image or brighten the image, making it easy to identify key features. The process of improving the quality of the images from the original image by removing noise, improves the image by sharpening the original image and increasing the image contrast.

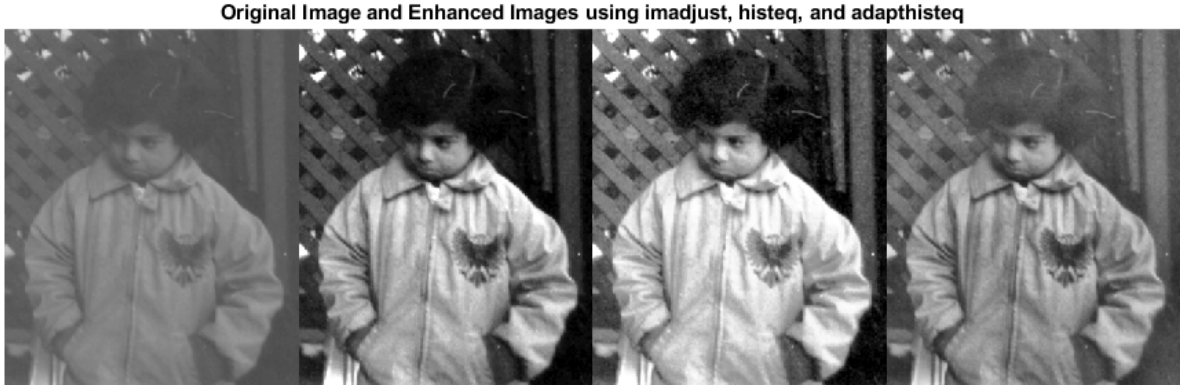

Figure 3 Enhanced Example Image

3.4. Image analysis

Image analysis approaches derive information from an image using automated or semi-automatic techniques such as scene interpretation, image classification, image comprehension, object recognition, computer / machine vision. Image analysis differs from other types of image processing techniques, such as improvement or reconstruction, in that the end product of the process of image analysis is a numerical production rather than a video.

3.5. Image compression

Image compression minimizes the size of an image file bytes without reducing the consistency of the image order in order to produce a finer image. The file size reduction allows more files to be stored in a given volume of disk or memory space. This also eliminates the time it takes to transfer images over a network or import from a web page.

Two types of compression

1. Lossless
2. Lossy

Lossless Compression: In image compression, there is no loss in information regarding image, during compression of a text file or program can be compressed without any errors and the application includes images stored in medical repository, text file compression, and technical drawings.

- No loss of information
- Extracting original data from compressed image.
- Lower compression ratio

Lossy Compression*:* Compression techniques that involves the loss of information included in used at low bit rates, and used in application streaming media and internet telephony.

- Loss of information.
- Perceptual loss of information reduced (controlled)
- Higher compression ratio

Figure 4 Lossless vs Lossy compression

3.6. Image Segmentation

It is the process of breaking down an image into its constituent parts. Output is usually a raw pixel data. Image segmentation is typically used to locate objects and boundaries (lines, curves, etc.) in images. More precisely, image segmentation is the process of assigning a label to every pixel in an image such that pixels with the same label share certain characteristics.

Figure 5 Image Segmentation

Different methods of image segmentation:

- Region Based
- Edge Based
- Threshold
- Feature Based Clustering

Region Based

Region is a group of connected pixels having similar properties. Region based segmentation is a process of partitioning an image into region. Regions are used to interpret images. A region may correspond to particular object or different parts of an object. Region-based techniques are generally better in noisy images (where borders are difficult to detect). Fair accuracy levels are offered in region based methods.

Edge Based

Image segmentation algorithms generally are based on discontinuous intensity values and similar intensity values. In case of discontinuous intensity values, the approach is to partition the image based on abrupt changes in intensity, such as edges in an image. Segmentation based on Edge Detection refers to the boundaries where there is an abrupt change in the intensity or brightness value of the image. Edge detection is the problem of primary value in image analysis. The obtained boundary marks the edges of the desired object. Hence by the detection of its edges, the object can be segmented from the image. The output that is received by applying edge detection algorithm is a binary image. Edge based methods are interactive in nature. There are three fundamental steps in edge detection:-

- Filtering & Enhancement: In order to facilitate the detection of edges, it is essential to repress as much noise as possible and determine changes in intensity in the neighborhood of a point, without destroying the true edges.
- Detection of edge points: determine which edge pixels should be discarded as noise and which should be retained (usually, thresholding provides the criterion used for detection).
- Edge localization: Not all of the points in an image are edges for a particular application. Edge localization determine the exact location of an edge. Edge thinning and linking are usually required in this step

Threshold

Image segmentation by thresholding is a simple and powerful technique for segmenting images having light objects on shady background. Thresholding operation converts a multi-level image into a binary image by choosing an appropriate threshold T and divide image pixels into several regions and separate objects from background. The separation of the objects from the background is generally done by selecting a value T. Depending on the thresholding value there are two techniques. Local thresholding and global thresholding. When T is constant, the approach is called global thresholding otherwise it is called local thresholding. If the background illumination is uneven then the global thresholding method become failed. But these uneven illuminations are compensated in local thresholding method by using multiple thresholds.

Feature Based Clustering

Clustering is the process of grouping together of objects based on some similar properties so that each cluster contains similar objects which are dissimilar to the objects of other clusters. Clustering is a process which can be performed by different algorithms using different methods for computing or finding the cluster. The quality of the good clustering methods produces high intra-cluster and low inter-cluster similarities. A general approach to image clustering involves addressing the following issues:

1. How to represent the image.
2. How to organize the data.
3. How to classify an image to a certain cluster.

The Clustering methods are classified into K mean clustering, Fuzzy C- Means [FCM] Algorithm etc. Kmeans is one of the fast, robust, simplest unsupervised learning algorithms that solve the well-known clustering problem. The method is to classify the given data set through a certain number of k clusters that are fixed a priori. K-means clustering algorithms gives optimal result when data set are dissimilar. Fuzzy Clustering is a method which allow the objects to belong to more than one cluster with different membership. This is the one of the effective method for pattern recognition. Most commonly used fuzzy clustering algorithms is the Fuzzy C-Mean. By using FCM we can retain information of the data set. In FCM, the data point is assigned membership to each cluster center as a result of which data point may belong to more than one cluster center.

3.7. Image Restoration

Restoring the clear image from the degraded or corrupted image is provided by the technique called image restoration. Corrupted/Blur images are due to noisy, blur images or camera miscues. Blurring occurs due to formation of bandwidth reduction of an ideal image caused by imperfect image formation process. Thus the images will be restored into original quality by reducing the physical degradation.

Degradation model

Distortion is due the imperfection in the imaging system that occurs mainly involved in stored images. This problem leads to severe due to random noise involved in the imaging system. Degradation operation works on input image f(x, y) to lessen a degraded image g(x, y).

Categories in image restoration technique Image restoration technique is classified into two types depending upon the degradation of the image. If information about degradation is known previously, then deterministic method of image restoration can be used. If it is not known then the stochastic method of image restoration has been introduced.

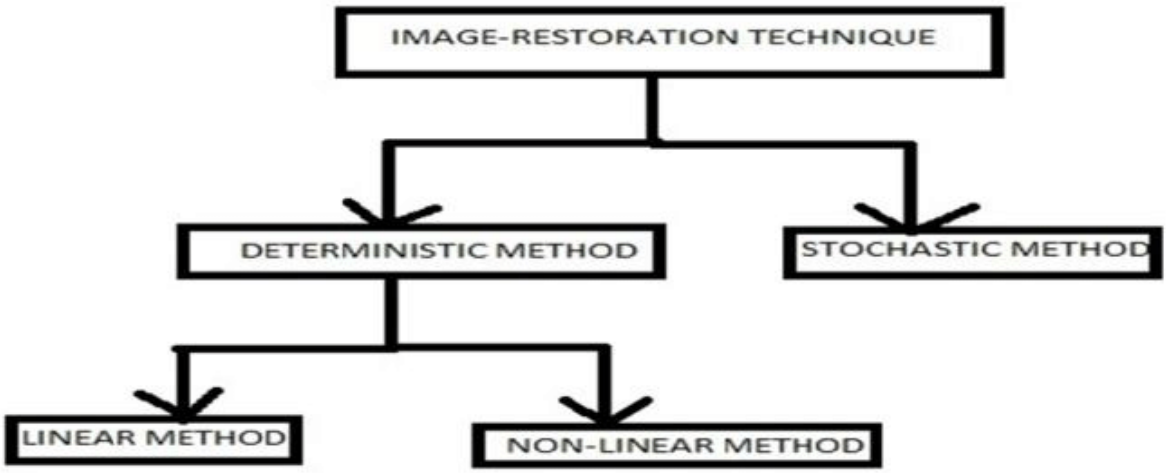

Figure 6 Image Restoration technique

IV. CONCLUSIONS

This paper addresses other methods for image processing, such as segmentation, compression, edge detection, etc. Choosing the type of image processing relies on the purpose for which it is to be used. Each procedure has its own benefit and downside, but transforms the input image into the form that is appropriate for further processing. This paper will allow individuals to grasp the fundamental principles of image processing.

In this article, we have presented a detailed analysis of the image processing and its applications. We tried to show the fundamentals of image analysis and segmentation techniques. They addressed the fundamentals of image processing, such as image interpretation and understanding, image manipulation, compression methods and their applications. The segmentation approach can be classified into different categories depending on the constraint chosen for segmentation, such as pixel size, homogeneity, discontinuity, cluster data, topology, etc. Any solution has pros and cons. The result obtained using a single segmentation approach cannot be the same as the other approach.

Despite several decades of work, there is no widely adopted image segmentation algorithm because image segmentation is influenced by several variables such as image size, color, strength, noise level, etc. There is therefore no standard algorithm applicable to all types of images and the complexity of the problem. Because of both of the aforementioned reasons, image segmentation remains a significant unresolved concern in the field of image processing. Techniques that are unique of particular purposes also yield greater efficiency and choosing the right solution to the problem of segmentation can be a challenging task. A single solution to the section with all images can be virtually impossible.

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