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A Review on Subpart of Image Processing Technique:Image Filtering

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Abstract

In this paper, there is a discussion about what the image really is, why there is a need to process the image and explains the steps for image processing. And we are going to do deep review of one of the step used in the image processing and i.e. is image filtering. Developed to address two major issues. Improve image data to reduce unwanted distortion. Improve image data to reduce unwanted distortion. In addition, two techniques for image filtering are described. One is fuzzy logic filtering and the other is guided filtering.

Keywords*-Image processing, Imgae Filtering, Fuzzy Filters, Guided Image Filtering*

I. INTRODUCTION

An Image is a function let it be named as F(x,y) such that x denotes co-ordinates of x axis and y denotes co-ordinates of y axis. If the x and y co-ordinates are finite and the amplitude of image F is finite, the image can be called as "Digital Image". In such images, each pixel of every point of x and y have a different value at different locations [1].

A. Image Categories:

i. Binary Image: As name signifies, this type of image has two elements of pixels. And those pixels are 0 and 1. Pixel 0 stands for black color and pixel 1 stands for white color. Binary image can also be named as Monochrome image.

ii. Black and white image: Black & white image: When we get the image of black and white color, then it is considered as Black & White image.

i. 2, 3, 4, 5, and 6-bit color formats: Each of these colors has more than one gray level, so unlike binary images, it has a gray color. Images of these color formats are not in used now. As this format was used in old television displays or monitor displays.

iii. 8-bit color format: It is the advanced version of the above image format, it contains 256 shades of various colors and image formed by this format is named as "Gray Scaled" image. From 256 shades, 0 presents the black color, white color is represented by 255 and gray is determined by 127.

iv. 16-bit color format: The current images we are using are considered under this format, called as "Colored image ". There are 65,536 colors in this format. This format is also called as High Color Format and the color distribution scheme of this format is different than the color scheme of 8- bit format. Colored image format is categorized in well known format i.e. RGB.

II. IMAGE PROCESSING

Processing image refers to perform a numerous operations on the input image in order to get useful information from that image. Output we get after processing input image is the type of the signal that will be enhanced image or we get properties linked with the input image. The objective of this process is to take as input as a digital image showing almost all features of the initial image [2].

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A. Image Processing includes following steps:

i. Image acquisition: This is the initial step for starting image operations. Image acquisition involves capturing an image. This includes preprocessing such as scaling and color conversion.
ii. Image Filtering: After capturing the image, filters are applied to it to the input image so as to remove noise and to improve contrast so as to get more attractive and relevant image in output.
iii. Image restoration: Improve image quality using mathematical or stochastic models.
iv. Colored image processing: Today, processing digital image includes pseudo color as well as full color processing models to systematically and perfectly color the images..
v. Multi-resolution processing: The process of representing images to varying degrees.
vi. Image compression: It includes the techniques that perform operations to shrink the image by reducing its size while maintaining the quality of the image.
vii. Geomorphologic processing: It uses various tools to take out image components that are helpful for representing and describing shapes.

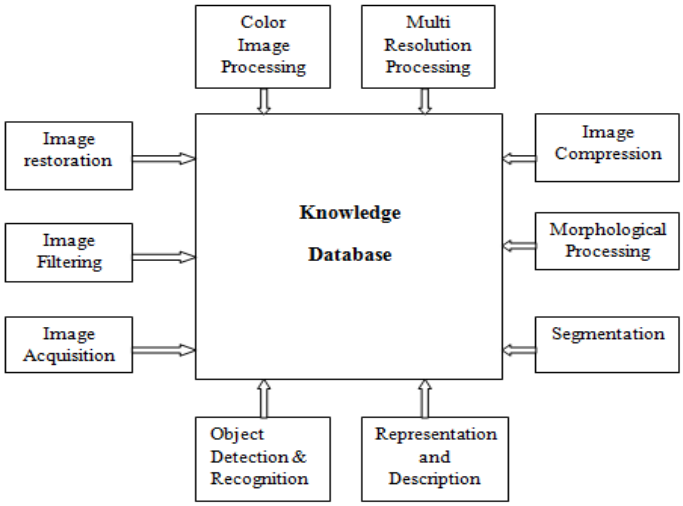

Figure 1. Steps in Image Processing

viii. Segmentation: Includes segmenting an image into multiple segments. This is the most difficult step in image processing.
ix. Expression and description: Follow the output of the segmentation stage. This includes the representation of the image with a boundary representation (external shapes) or a regional representation (internal properties). The description also extracts important features from each segment.
x. Object detection and recognition: In this process, objects are assigned by the labels as per their descriptions.

III. IMAGE FILTERING

When acquiring images with a camera or other imaging system, it is often not directly available on the target vision system. Images can be corrupted by random fluctuations in intensity or lighting. In such cases, you need to perform certain operations on that particular image, such as smoothing, sharpening, de-noising, and edge detection, to get a high-quality image. Filters are defined by the kernel. The kernel is a small array and is applied to every single pixel in processing image and its neighbors.

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Without Filter With Filter

Figure 2. Comparison of image with and without use of filter

A. Filtering Techniques

There are basically two types of filtering techniques [3].

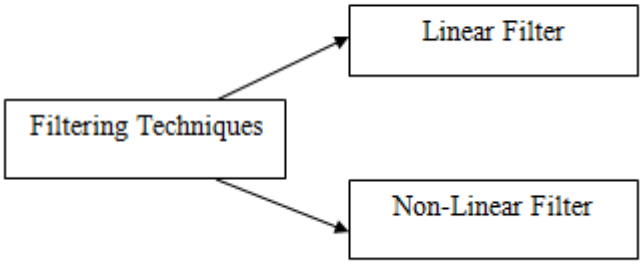

Figure 3. Filtering Techniques

i. Linear filters: This filter is applied to get rid of specific categories of noise also filters in it used to blur sharp edges and this filter helps in destroying the extra lines as well as other noisy details of the image. A Gaussian and an averaging filter are used for this purpose.

i. Nonlinear Filters: These filters are developed to overcome the shortcomings of linear filters like rank conditional, weighted & relaxed median and rank selection.

IV. LITERATURE REVIEW

In the literature review we will study various types of methods under Filtering Techniques.

A. Fuzzy Filters for Image Filtering

Fuzzy image processing is a collection of several different approaches to understand, to represent, to process images, to find the segments of the image as well as their features in form of Fuzzy Sets. Whatever fuzzy method is chosen, each has different representation and processing scheme depends on the problem type. The general scheme behind applying the filter is to observe all the pixels and find the average pixels among the nearest pixels when processing for better structure of image for instance edges.

The main idea to introduce filters is to make a distinction among local variations caused because of noise and image structure. Enhanced technique is developed for filtering which shows the two main features named as narrow-tail and medium-narrow-tail noise. In the initial step, filter is used to find

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fuzzy derivatives which will be of less prone to local variations because of structure of image and in the last step, fuzzy smoothing is performed via adapting the association function according to noise level [4]. An experimental result of this method also demonstrates the achievability of innovative filters and stopping criteria.

i. Fuzzy Differential Estimation: This type of filtering technique could be like chicken and egg problem. To perform filtering operation, one has to represent edges in an accurate manner, but to find such an edges, we need filtering method. In Fuzzy Differential Estimation, user starts by looking for an edge. And the results attempts to provide stout estimates with the help of fuzzy rules.

ii. Fuzzy smoothing: In order to find the exact correction needed for the processed pixel value, one have to apply combinations of fuzzy rules, and the idea behind the rule is that if the given edges are not in a proper direction, the (sharp) derivative in that particular direction will be used to find the correlation term. The initial part (edge assumption) will get by using fuzzy derivatives and with the final (filtering) part we are able to differentiate between positive and negative numbers [5].

Before Fuzzy Filter After Fuzzy Filter

Figure 4. Comparison of image with and without use of fuzzy filter

B. Guided Image Filtering

The imguidedfilter function uses the contents of other image known as the guidance image which is used to perform edge smoothing while preserving the quality of the image. The second image which we are considering for guidance can be itself as of the same initial image, or a separate version of first and initial image, or a fully dissimilar image. This filtering technique, is considered as nearest filtering operation, but gives an explanation by the statistics corresponding in the second image when finding the value for the resultant pixel. This includes the second image known as guidance image I, the initial input image p, and the output image q. Variables I and p both are programmed by the user supervisor or by the application and can be same as the initial also. The resultant output at pixel i is articulated as a weighted average [6].

$$q_i = \sum_j W_{ij}(I) p_j$$

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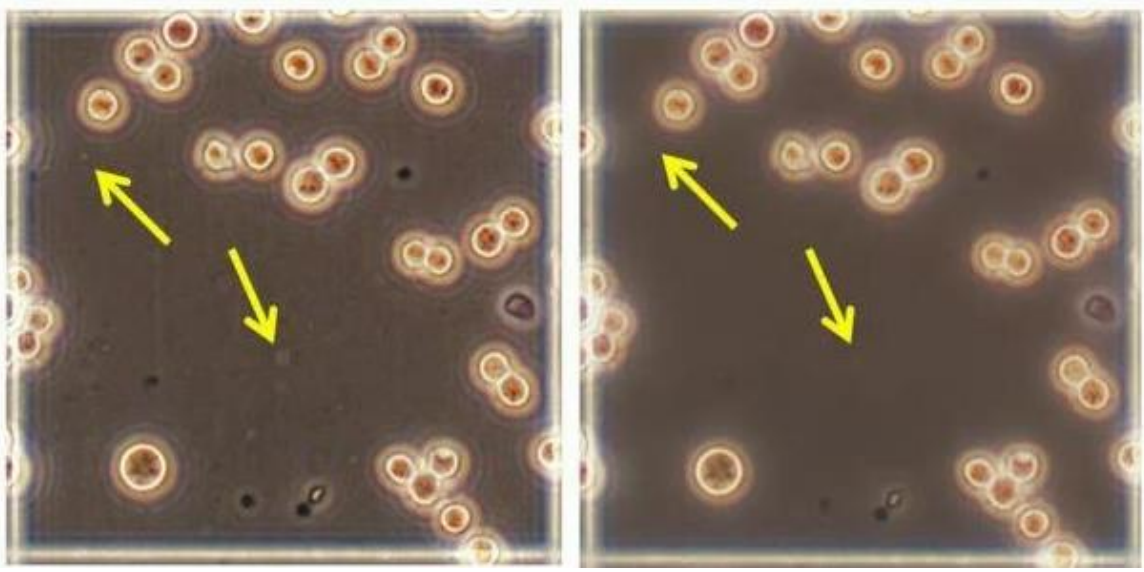
Wherever i and j are called as pixel indices. The Wij is a function for filter kernel used for the second image considered as guidance image I and is independent of p. This kernel filter is linear with respect to p. This filter is more versatile than smoothing and can be applied to the transfer of structures, thus enabling new applications of filter-based feathering. An advanced version of Guided Image Filtering is called as Joint Image Filtering. Guidance image is used by joint filtering technique in advance as well as transfers structural details from the guidance image to the target image in order to reduce disturbance in name and increase image resolution. An already accessible method of Guided image filtering depends either on a variety of plain filter structures or actually planned purposeful functions, by applying this method we get results which are difficult to understand and improve. Here, the author proposed a learning-based approach in order to build joint filters based on convolution neural networks. The most important dissimilarity between the existing and propose d technique is that the existing method can consider only guidance images while the proposed technique is able to transfer salient structures that matches guidance image and the target image [7].



Without Guided Filter With Guided Filter

Figure 5. Comparison of image with and without use of Guided filter

Another method is proposed by an author in whom a new joint filter is created with the help of a spatially variant linear representation model (SVLRM), where there's a linear relationship between the target and guidance image. In order to compute the linear representation coefficients, the author builds up an efficient algorithm depends on deep convolution neural network (CNN). Here, author projects a deep CNN with the help of which we can calculate approximately the spatially variant linear representation coefficients which defines the structural information of both the guidance and initial images. The algorithm projected by the author is giving very much accurate results when applying to a variety of applications. Broad investigational results show that the projected algorithm performs completely against state-of-the-art methods and gives better results than that have been initially designed for each task [8].

V. CONCLUSION

This paper starts with a brief introduction of image and continued with the current situation of image, when cryptography is performed on image for security, there may be various changes in the original image, when it will deliver at the destination spot. So, there is a need to process the image before it is received by the recover. Above, various steps of image processing are described. The

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most important step to process the image is 'Image Filtering', and discussed most important and widely used two techniques of Image Filtration i.e. Fuzzy Logic Filtering and Guided Filtering. There are various other techniques to filter the image to get the enhanced feature of initial image.

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