International Journal of Research in Advent Technology, Vol.4, No.5, May 2016
E-ISSN: 2321-9637
Available online at www.ijrat.org

A Review on Image Enhancement Technique for Biomedical Images

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Abstract- Medical images are generally contained of signal dependent noises that are speckle noise and broken edges. There are number of the noises signals appearing from machine and environments, these noises are not generally contribute to the tissue differentiation. But, the noise created due to above mentioned reason causes a grainy appearance on the image, so image enhancement is required. This paper shows a technique based on image de-noising and edge enhancement of noisy multidimensional imaging data sets. The proposed algorithm is based on MATLAB and image enhancement will be presented both for standard test images and CT scan image.

Index Terms- Denoising, Edge detection, speckle noise, Scale multiplication, random noise.

1. INTRODUCTION

The technique and process related with medical imaging is used to create images of the human body, parts, and function for clinical purposes or medical science or in medical field. It plays an important role in modern diagnosis, and it is useful in helping radiologist or surgeons to detect pathologic or abnormal regions. It is also used to improve the useful information in an image for diagnosis purposes because medical image qualities are often damage by noise and other data acquisition devices, illumination conditions, etc. The aim of medical image enhancement is mainly to increase low contrast and reduce the high level noises. Medical image enhancement algorithms have been studied mainly on gray scale transform and frequency domain transform. Histogram equalization is the most popular spatial approach for enhancing the contrast of image [1-2]. The worse quality of output image may produce by using histogram equalization than that of the original image, since the histogram of the output image becomes approximately uniform. Due to uninteresting area, large peaks in the histogram can be caused. Therefore, histogram equalization may lead to an increased visibility of unwanted image noises [3]. From this it is clear that it does not adapt to local contrast requirement and minor contrast differences can be entirely missed especially when the number of pixels falling in a particular gray level range is relatively small.

The wavelet transform on which image enhancement algorithm is based is typical method in the frequency domain approaches. Wavelet transform is nothing but the improved version of Fourier transform. While Fourier transform is a powerful tool for analyzing the parts of a stationary signal, it fails for analyzing the non-stationary signal whereas wavelet transform allows the parts of a non-stationary signal to be analyzed. Wavelet transforms have shown promising results for localization in both time and frequency, and due to this it have been used for image processing applications including noise removal [4-5].

In recent years, the digital cameras are very popular so it can be easy to get the digital photos directly. Now it is simple to adjust different photos easily by using the different commercial image-editing software's. Unfortunately, lots of this work requires professional knowledge under many parameter setting because it is not friendly and suitable for most end users of digital cameras. Some software provides the automatic enhancement function for simplifying the process, but in practice they don't work as good in many cases, especially for the photos with high contrast or high dynamic range. It is necessary to smooth the noisy signals, in number of signal and image processing applications, while at the same time preserving the edge information. Linear filtering, averaging filtering and median filtering are the most commonly used smoothing techniques. The linear filter smoothes the noisy signals and also the sharp edges. An odd number of elements is present in the median of a group, is defined as the middle element when the elements of the group are sorted. The median computed at this operation is called the running or the moving median.

2. LITERATURE REVIEW AND RELATED WORK

Image enhancement process is made up of a collection of techniques that help to improve the visual appearance of an image or to translate the image to a form better suited for analysis by a human or machine. The main objective of image enhancement is to modify attributes of an image to make it more suitable for a given task and a specific observer. In this process, modification of one or more attributes of the image is takes place. Several of choices for improving the visual quality of images are provided by Digital Image enhancement techniques. The more appropriate choice of such techniques is greatly influenced by the imaging modality, task at hand and viewing conditions. A familiar example of enhancement is when increase in the contrast of an image and filters it to remove the noise then it looks better. It is important to remember that enhancement is a very subjective area of image processing. Enhancement technique application provides the improvement in quality of these degraded images. The work done by various researchers for Image Enhancement are discussed in this literature survey.

Z. Al-Ameen, G Sulong and Md. Gapar Md. Johar [1] improving the contrast of computed tomography medical images is an essential issue since most of these images suffer from the low contrast phenomenon. This study confirms that managing the contrast of degraded CT scan images before starting the restoration process is highly desired. When comparing seven famous techniques likewise to choose the best method among the different popular contrast enhancement methods.

M. F. Al-Samaraie [2] this paper introduces a new image enhancement approach suitable for digital cameras. High contrast images those are common in the scene with dark shadow and bright light sources. It is very difficult to show the details in both dark and light areas parallel on most display devices. For solving this type of problem, there are many methods of image enhancement proposed to improve the quality of the images. However, numbers of them often get poor results if the images are high contrast and have wide dynamic range. This method for changing the high-contrast digital camera images, which changes the global brightness and contrast of images while preserving details. It is depending on a two-scale decomposition of the image into three layers as base layer, a detail layer and encoding large-scale variations.

R. Grag, B. Mittal and S. Grag [3] in this Paper, prior knowledge on the Histogram Equalization shows a frame work for image enhancement. Several image enhancement schemes has been implemented and compared. For the enhancement purpose more images can be taken from the different application fields so that it becomes clearer that for which application which particular technique is better for both Gray Scale Images and colour Images. Specially, for colour images there are not many performances measurement parameter considered. So, for the evaluation of enhancement techniques new parameters can be considered. For better comparison purpose new colour models can also be chosen. Minimization of various enhancement techniques can be done to decrease computational complexity as much as possible.

R. Vidhyalavanya and M. Madheswaran [4] this paper shows the work of combining Parametric multi wavelet and Sureshrink to remove noise from the signal. In this paper, a parametric multi wavelet with sureshrink threshold is shown to address the issue of image recovery from its noisy counterpart. It is totally based on the generalized Guassian distribution modeling of subband coefficients.

Madhu [12] suggested that the Adaptive histogram equalization produced a best result, but the image is still not free from washed out appearance. The background information as well as the plane is still fogged and poor in contrast and the sharpness is poor. Alpha rooting rendered the entire image in a dark tone. And also the outline of the clouds which was visible in case of histogram equalization is lost. The conventional transform domain image enhancement technique of alpha rooting has long been used for enhancing high contrast edge information and sharp features in images. However the alpha rooting technique is constrained by problems like overall graying, tonal changes and noisy artifacts. This paper explores a new method by which alpha rooting can be used for enhancing even low contrast images

Agaian [13] suggested that no transform-based enhancement technique is global histogram equalization and which attempts to alter the spatial histogram of an image to nearly match a uniform distribution. Histogram equalization suffers from the problem of being poorly suited for retaining local detail due to its global treatment of the image. The equalization will over enhance the image is also common, resulting in an undesired loss of quality, visual data and intensity scale.

Tang [14] suggested global histogram equalization, which is used to adjust the intensity histogram to approximate uniform distribution. The global image properties may not be appropriately applied in a local context is nothing but the global histogram equalization. In fact, all regions of the image equally treated by global histogram modification and thus, often yield poor local performance in terms of detail preservation. Hence, several local image enhancement algorithms have been introduced to improve enhancement.

3. ANALYSIS OF PROBLEM

Medical imaging is one of the best techniques to monitor the person's health problem which is used extensively these days. A number of diseases can be detected using medical imaging methods. One of the major problems that physician faces while diagnosis is low quality of the medical images. So, it is essential to improve the features of the medical images. There are several numbers of methods of image enhancement to make a better insight from medical images. For each of the noise suppression technique noise model is required

4. PROPOSED WORK

Many image enhancement techniques have been proposed earlier, there are some drawbacks of these techniques such as Histogram equalization produced over enhanced image, and especially at the edges the Adaptive histogram produces blurred and washed out images. Whereas to overcome all these drawbacks alpha rooting produces over-graying enhanced images. Proposed method combining spatial enhancement techniques such as power law transforms with alpha rooting and log transforms in order to get the quality of the image. Each domain in these techniques consists of basic nature, simplicity and ease of experimentation and at the same time being efficient also.

The proposed algorithm mainly consist of six stages are as given below.

- Image input (Biomedical image)
- Noise Removal + Pre-processing
- Edge Detection
- Contrast Enhancement method
- Histogram of Histogram Equalized Image
- Enhanced Image

❖ **Project flow**

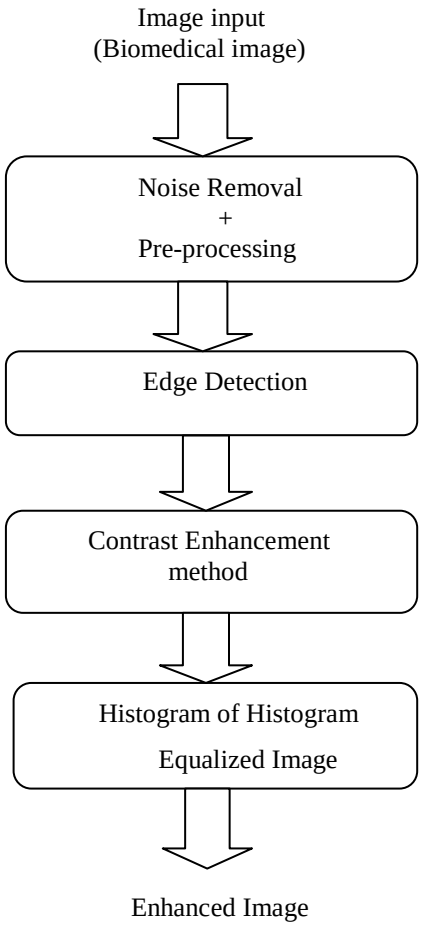

Fig.1 Block Diagram of Proposed Algorithm.

***4.1. Input image (biomedical images)*:-**

In this propose work, considering some biomedical images like CT-Scan image, Retinal image, Heart image, Blood vessel as input image.

***4.2. Noise removal + pre-processing*:-**

In pre-processing of image, first resize the complete 3D image into a new matrix of standard user defined scale to make the verification system independent of the size of the image. After that the image of different grey shades with values from 0-255 is converted to double precision that have values between 0-1. Intensity level '1' indicates to the white colour as it is the combination of all the colours in the frequency spectrum. Intensity level '0' indicates to black colour as it absorbs all the colours in the frequency spectrum then adjusting the grey level of a flame image. As the image has a wide distributed scale of the grey levels, to redistribute an initial adjustment is required using a histogram to equalize the grey levels to be spread entirely over the given image normalized in the range [0, 1]. Then it is necessary to Smoothening the image to eliminate

noise. The image considered with variation in the gray scale indicated as noise is filtered using the standard convolution methods by application of a suitable mask. To minimize the localization edges a Gaussian mask is selected to preserve the edges for further detection.

4.3. Edge detection:-

The goal of edge detection process in a digital image is to calculate the frontiers of all represented objects based on automatic processing of the colour or gray level information in each present pixel. An edge shows boundary between an object and the background and also indicates the boundary between overlapping objects. From this it is clear that if the edges in an image can be identified accurately, as edge identified accurately then all of the objects can be located and basic properties such as area, perimeter, and shape can be measured. Edge detections are an essential tool when computer vision involves the identification and classification of objects in an image. Edge detection is nothing but the process of identifying and locating sharp discontinuities in an image. Edge detection technique is usually applied on gray–scale image. The discontinuities are nothing but abrupt changes in pixel intensity which characterize boundaries of objects in a scene. Edge detection in Classical methods involve convolving the image with an operator (a 2-D filter) and which is constructed to be sensitive to large gradients in the image while returning values of zero in uniform regions.

4.4. Contrast Enhancement method:-

The experts can make decisions depended on the image information which is made during Image enhancement which plays a fundamental role in many image processing applications. In the image processing, we usually use some objective quality criteria to ascertain the goodness of the results.

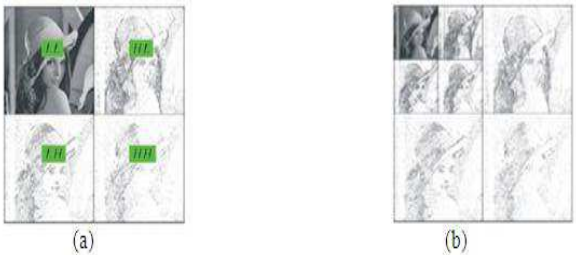

Fig 2: (a) One level wavelet transforms in both directions of a 2D signal; (b) Two levels of wavelet transform in both directions

4.5. Histogram of histogram equalized image:-

In this step the histogram of histogram equalized image is input to the image enhancement to get the final enhanced image.

4.6. Enhanced image:-

Image enhancement operation is used to improve the qualities of an image. Image's contrast and brightness characteristics can be improved using qualities of an image, also reduce its noise content or sharpen its details. The term such as image-processing are often used as synonyms, another different terms such as image-restoration and image-manipulation, and catch-all phrases such as photo-editing are now widely used in the an ever-growing modern circle of consumer digital-imaging. Depending on field or area, all these and other common terms are frequently used is quite different things in different contexts.

5. CONCLUSION

This paper proposes an image denoising method using adaptive multiscale product thresholding. Unlike many other traditional schemes that straight apply threshold to the wavelet coefficients, this method multiplies the neighbouring wavelet sub-bands and then apply threshold to multiscale products for improved edge differentiation. Canny edge detector's performance is enhanced by scale multiplication. Taking the benefit of similarity in filter's response at adjacent scale, it multiplies the responses to enhance edge structure. From the parameters obtained, for enhanced medical image it will be seen that proposed algorithm works well for all types of noisy images and the results obtained will be best for the image corrupted due to poisson noise.

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