ISSN (Online) 2278-1021
ISSN (Print) 2319-5940

IJARCCE

International Journal of Advanced Research in Computer and Communication Engineering
ISO 3297:2007 Certified
Vol. 7, Issue 6, June 2018

A Hybrid Optimization Approach with CLBP Based Splitted Ultrasound Image Despeckling Refinement

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Abstract: Ultrasound image plays a vital role in medical profession as this is the best approach to look inside the body structure without any cuts and without any use of much expensive equipments. Ultrasound imaging is less expensive, safe, accurate and good in forming real time imaging. Image acquisition is based on the principle that when ultrasound waves travel through tissues, they are partly reflected back as echoes to the transducers. The major issue associated with ultrasound imaging is that it may corrupted by speckle noise during image acquisition. Hence it is necessary to de-speckle the medical images like ultrasound images, so that the effective and reliable decision can be taken on the basis of acquired images. There are various methods that have been developed in the past and still the research is going on. Traditionally the LBP i.e Local Binary Pattern was used for de-speckling the ultrasound images. After having the review to the problem with existing techniques the proposed work aims to replace the traditional LBP method with CLBP, which is an enhanced version of LBP technique. CLBP i.e Compound Local Binary Pattern, this method is considered to be efficient and more accurate than the traditional methods. From the results obtained it is concluded that the new methods is accurate and efficient than the traditional methods of ultrasound image de-speckling.

Keywords: Ultrasound images, Speckle noise, Local Binary Pattern, Compound Local Binary Pattern.

I. INTRODUCTION

In computer language an image is considered as a matrix which contains square pixels in columns and rows. An image can be of in two dimensional or three dimensional, such as a photograph, screen display or statue, hologram respectively. Basically to capture these images, two methods have been followed named as optical devices i.e. camera, mirror, lenses, telescope etc and another one is natural object i.e. human eye or water surface. A graph, a map, a pie chart and a painting is also referred as a two dimensional figure in a broader sense. In a broader sense it can be interpret using manually or automatically. By the term manually we mean with drawing i.e. art of painting or carving etc. and on the other hand, automatically implementation occurs with the help of printing and computer graphics technology. Only digital images are used for computation and processing. If there is analog image, it first gets converted into digital form so that it can be used for further computer processes. Digital image is composed of discrete pixels of different brightness and color. Noise is the kind of thing or interrupts which occurs from outside of the network such as hum. Occurrence of noise is higher in the case of analog signals but it can also occur is digital signals sometime. Each and every recording or sound consist of some amount of noise always. But noise is considered as a problem in signals only when it increases from a threshold level. But in case when the existence of noise in signals is not recognizable i.e. it is not hearable in the sound then it does not affect the signal.

Image Noise Reduction: Image is a combination of x and y axis such as it is known as 2-D digital object. The image can get corrupted with the occurrence of noise in the signals while transmission or conversion of the image. The process of detecting and removing such components from images is known as de-noising. This process is done to increase the quality of images by eliminating the noisy signals and pixels from the image. The noise from the image can not be removed totally but it can be reduced to some extent.

Noise: Noise and Distortion both can occur in an image instantly. Distortion is as same as noise but there is a difference between them. Distortion means change in the signals and noise is the unwanted value in the signal or in the image
> It can add unwanted spots or objects to the real image
> It can lead to loss of data from actual image
> It can reduce the quality of the original transferred image

ISSN (Online) 2278-1021
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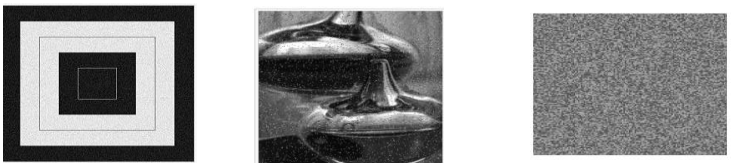
Some basic types of noises
Gaussian Noise
Salt and Pepper Noise
Speckle noise



(a) Gaussian noise (b) Salt & Pepper noise (c)Speckle Noise

Fig. 1. Example of Noises

DIGITAL IMAGE PROCESSING

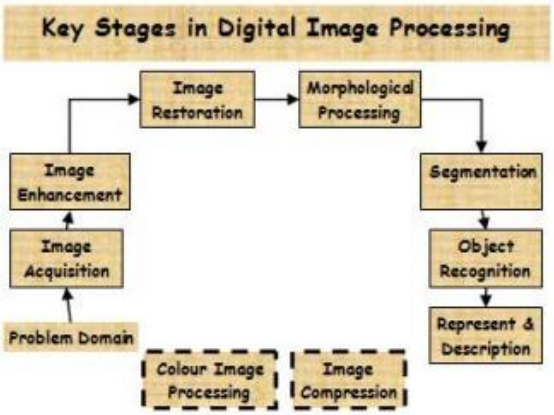


Fig. 2. Stages in Digital Image Processing

LBP

Local Binary Pattern (LBP) is a simple yet very efficient texture operator which labels the pixels of an image by threshes holding the neighborhood of each pixel and considers the result as a binary number. Due to its discriminative power and computational simplicity, LBP texture operator has become a popular approach in various applications. It can be seen as a unifying approach to the traditionally divergent statistical and structural models of texture analysis. Perhaps the most important property of the LBP operator in real world applications is its robustness to monotonic gray-scale changes caused, for example, by illumination variations. Another important property is its computational simplicity, which makes it possible to analyze images in challenging real-time settings. LBP is a gray scale invariant that describes local primitives such as curved edges, points, spot, flat areas etc. LBP methodology has contributed a vital role in texture analysis. It is widely used in different computer vision problems such as face recognition, motion analysis, medical image analysis, finger print recognition, palm print recognition, vessel extraction of conjunctiva images etc. Over the past ten years different variant to LBP such as uniform patterns, dominant local binary pattern, combination of Gabor and LBP, center symmetric local binary pattern etc. has been reported in the literature [24-34]. To generate LBP code for a neighborhood, the weight assigned to each pixel is multiplied with a numerical threshold. The process is repeated for a set of circular samples.

II. PROBLEM FORMULATION

Ultrasound images play an important role in decision making regarding any disease to the patient. Hence it is necessary to de-speckle the medical images like images of ultrasound so that the effective and reliable decision can be taken. There are various that had been developed in past and still the research is going on. Traditionally the LBP i.e. Local Binary Pattern was used for de-speckling the ultrasound images. It divides image into various sections. Along with this the concept of intensity was also applied which act as filter to detect the speckle noise from the image. The disadvantage of this technique was that it uses LBP which is quite old method since new or advanced methods are available in the field. Other lacking point was that it works on the basis intensity in which the information of the image cab get effected if the two portions with the different intensity value is merge as a one in order to create the section or window. Hence it is requirement that a new technique should be developed which de-speckles the image without affecting its informative content.

III. PROPOSED SYSTEM

After having a review to the problem with existing techniques that is defined in previous section of problem formulation, the proposed work aims to replace the traditional LBP method with CLBP which is an enhanced version of

ISSN (Online) 2278-1021
ISSN (Print) 2319-5940

IJARCCE

International Journal of Advanced Research in Computer and Communication Engineering
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LBP technique. CLBP i.e. Compound Local Binary Pattern allots a 2P-bit code to the middle pixel taking into account the dark estimations of a nearby neighborhood containing P neighbors whereas LBP utilizes one piece for every neighbor to express just the indication of the contrast between the middle and the relating neighbor dark values, the CLBP strategy utilizes two bits for every neighbor. Along with this proposed work implements the enhanced FIR digital filters for filtering the image. For this purpose a hybrid technique by combining PSO (Particle Swarm Optimization) and GA (Genetic Algorithm) is used. Hence this combination of CLBP and enhanced FIR filters will leads to the most proficient results as compare to the traditional result.

IV. METHODOLOGY

1. Select an Image from the database to process it
2. Next step is to apply CLBP which will convert the image into various sections.
3. Now apply digital FIR filters and get a filtered image A. Simultaneously obtain a redefined image B.
4. Now compare both redefined images and check if image B is more refined as compare to image A then save the results.

If the image A is more refined as compare to image B then apply hybrid GA-PSO

Block Diagram**:** The block diagram of proposed work is as follows:

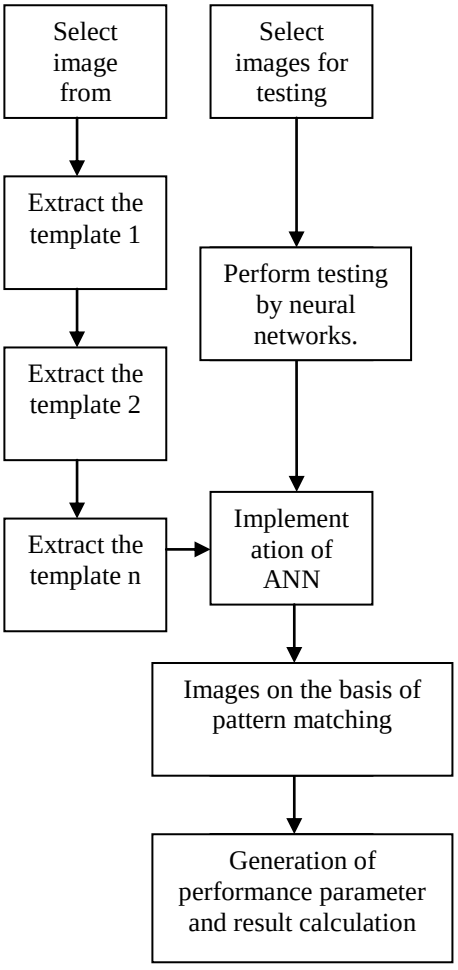

Fig. 2. Block diagram of proposed work

V. RESULTS AND DISCUSSIONS

In this section of Results and discussion are discussed about the results that were obtained by applying proposed method and the traditional method of image de-speckling. Image is first captured using ultrasound machines and the image is being processed and checked for the speckle noise. Thus this helps in identifying the type of noise present in the image. In ultrasound image de-speckling various techniques have been used to remove the noise. Various filters have been applied on the image to re appropriate the pixel intensity with a weighted sum of the pixels in its local

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IJARCCE

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Vol. 7, Issue 6, June 2018

neighborhood. Here Compound Local Binary Pattern techniques have been used for removal of noise. Following are the two ultrasound images with noise. First image refers to the original image selected from database and second image shows the noisy image

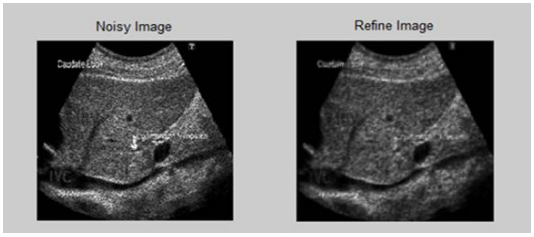

Fig. 4. Noisy image and Refined image using CLBP

Below are the tables shows the difference in different aspects of an image before and after using the CLBP technique

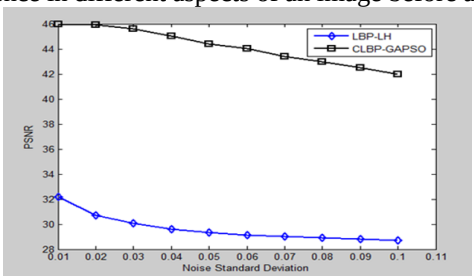

Fig 5. PSNR (peak signal to noise ratio) before and after using CLBP

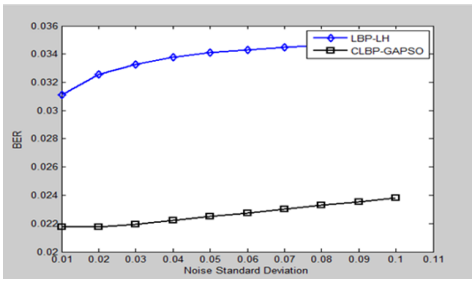

Fig 6. BER (Bit Error Rate) before and after using CLBP

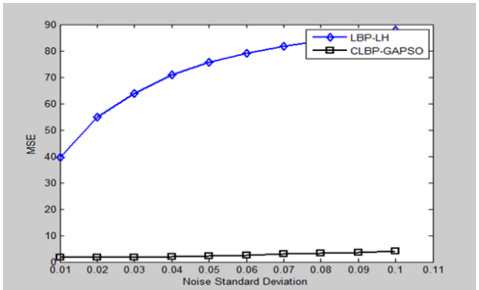

Fig 7. MSE (Mean Square Error) before and after using CLBP

VI. CONCLUSION AND FUTURE SCOPE

in the field of medical science, as the human‘s body visual representation process upgrading as well as increasing day by day, amid all of them, ultrasound images are supposed to the most portable, non-invasive, accurate and non-toxic to the human body. These characteristics of ultrasound image, make it famous amid all the hospitals and thus adequate diagnosis is done by the doctors. Despite of its usefulness, the image quality degrades due to many factors in which speckle noise is the one that we are considering as the responsible factor. The speckle noise destroys the image details such as quality, contrast, preserving edges etc. Thus, the presence of speckle noise lacks the observer to diagnose the problem, effectively. Thus, manifold efforts have been taken into account in order to reject the speckle noise, known as de-speckling methods. For de-speckling the very famous method used earlier was LBP that is Local binary Pattern, but this methods was not of that much help now a days so a new method that is being used now a days is CLBP that is Compound Local Binary Pattern.

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FUTURE SCOPE

The result obtained shows that this method is accurate and efficient than the traditional approaches of the noise reduction .In this thesis CLBP is used for the reduction and removal of noise from images. In future various techniques can be enhanced by using other noise reduction method or by using a hybrid approach to make the process of noise reduction more accurate and reliable.

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