Speckle Noise Reduction in Various Ultrasound Images Using (SMU) Approach

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Abstract - ***In medical imaging devices, image noising has become a major disadvantage for better image acquisition. Some noise present in this may degrade the image quality. Imaging in different field may follows various methods. Some coherent imaging methods such as synthetic aperture radar, sonar and optical maser are used in many applications. Ultrasound is one of the CIM (coherent imaging method) serve their application mostly in medicine for human interpretation and diagnosis. Speckle noise present in this ultrasound imaging may give an undesirable final result. In ultrasound imaging system, speckle makes it tough for human interpretation and analysis. Consequently, for examination of ultrasound images speckle reduction is a primary drawback. In the current era several methods for speckle suppression were proposed and many filters were discussed till now. This paper presents a novel algorithm SMU (Srad Median Unsharp) for noise suppression in kidney and prostate gland ultrasound images. The presented algorithm has been created as MATLAB-based application. A comparative study of the results obtained by the proposed method demonstrates higher performance for speckle reduction.***

Keywords: Image Noising, Coherent Imaging Methods (CIM), Speckle Noise, SMU Algorithm, MATLAB.

I. INTRODUCTION

Ultrasound imaging becomes one of the most useful techniques for diagnosis. It provides areal-time imaging. Moreover, it is non-invasive and doesn't use X ray, low cost and no painful. Nevertheless, one of its main shortcomings is the poor quality of image, which is corrupted by noise during its acquisition. The existence of speckle is unattractive since it destroys image quality and it affects the accuracy of human interpretation and diagnosis. The main objective of image denoising is to remove noise while retaining as much as possible the important signal features. Accordingly, speckle filtering is a crucial pre-processing step, for feature and forbetter image visualization. So speckle filtering is an essential pre-processing step for diagnosis and can give better image of organs. Many techniques are proposed to reduce speckle noise. In this paper, we recommend a algorithm (SradMedian Unsharp) SMU for denoising speckle in b-mode ultrasound images [1] and SMU filter used to reduce speckle noise.

II. THE ROLE OF DIAGNOSTIC ULTRASOUND AND B-MODE

Ultrasound imaging is a very important and inseparable part in modern medicine to early diagnoses of various diseases. In clinical practice are used different types of ultrasound imaging according to examined tissues. A-MODE, B-MODE imaging is considered as basic 2D imaging, M-MODE or Doppler Mode. This paper is focused on B-MODE images, their computer analysis and evaluation to diagnostics. B-images (B-MODE images) are cross-sectional images which represent tissues and organ boundaries within the body displayed as 2D digital image. It is constructed from echoes,small irregularities within tissues are due to reflection of ultrasound. The principle of ultrasound is based on pulse of sound which are sent from the transducer and propagate through a tissue and then reflected as echoes to the transducer which is the basic of ultrasound imaging. In B-MODE each echo is displayed as a point in the 2-D image. The points have various level of echogenicity which describes ultrasound wave's reflection from the examined tissue. Echogenicity of each tissue in B-image is repesented by grayscale intensity.

III. SPECKLE NOISE

Presence of Speckle noise [2] may degrade all coherent imaging systems especially ultrasound imaging system. Principle behind the ultrasound is simple. The initial sound waves given to the particular tissue and sound wave get reflected back to the sensor in the probe. The scattered sound waves with different angles may undergo a constructive or a destructive interference in a random manner. The interference pattern, called speckle [3] that implies the bad quality of image and delays the interpretation of the image content.

IV. SMUALGORITHM

In signal processing, it is often desirable to be able to perform some kind of noise reduction on an image or signal in order to improve the results of later treatment. Our new pre-processing approach SMU [5] is composed of many steps. In fact, it combines three types of filters as it is shown in the diagram below Fig 4.1.

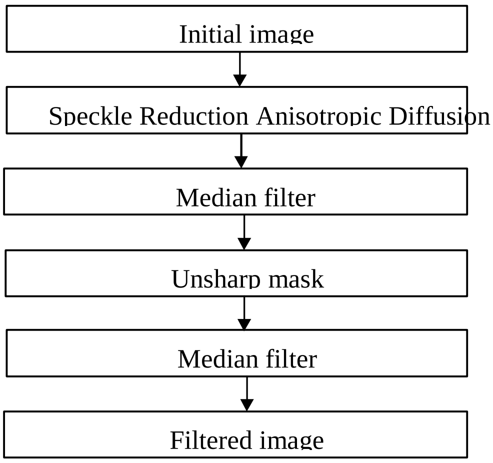

Fig. 4.1 SMU

A. Speckle Reduction Anisotropic Diffusion

Anisotropic diffusion works well for images corrupted by additive noise. Several supplements and methods of edge detection have been described in the literature for images with additive noise. The advantage of the anisotropic diffusion includes the smoothing of intraregional and the preservation of contours. In the case of images with speckle noise as ultrasound images, the speckle reducing anisotropic diffusion [4] is approved.

B. Median filter

The median filter is a nonlinear digital filtering technique, often used to remove noise. It preserves the edge of the image while removing the noise.

C. Unsharp masking

Unsharp masking is a technique that produces an edge imagefrom an input image

V. METHODOLOGY

Read the initial image from the user and resize the following images into [256,256] size afterwards convert the following images grey scale images and adjust the contrast of the images by applying the histogram equalization. The above following procedures are the pre-processing methods of speckle noise reduction [6] and finally apply the SMU filter to obtain the result. The following methodology technique is represented in the Fig 5.1.

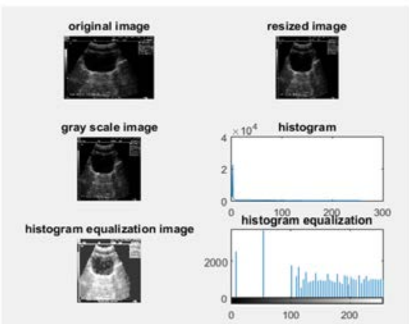

Fig. 5.1 Methodology

VI. RESULT

Resultant image of the prostate gland after applying SMU filter shows the clear image Fig 6.1and it is very easy to diagnosis. Histogram equalization image is the correct combination of the brightness and contrast enhancement.

Fig. 6.1. Filtered Image

VII. CONCLUSION

Speckle noise in ultrasound images has very complex statistical properties which depend on several factors. In this work, we presented a new approach for speckle reduction. We have simulated this method on synthetic images and breast ultrasound images, and carry a comparative study. Experimental results show that our proposed approach presents the best performance compared to the other denoising techniques in the literature. The proposed method reduces significantly the speckle while preserving the resolution and the structure of the original ultrasound images and this is suitable to get a precise extraction of the region of interest.

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