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Detection and Reduction of Speckles in Ultrasound Images in Medical Applications

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ABSTRACT: Ultrasound (US) is nothing but a high frequency sound waves used to characterize different tissues. US have some properties such as compression, reflection, impedance etc. used to identify and characterize different tissues. Due to the random fluctuations of back scattering waves, a noise is generated which is nothing but speckle in ultrasound image. Speckle alters the image by lowering its contrast resolution, due to which it is difficult to detect small/low contrast structures in clinical examination. Speckle is also called as spot in ultrasound images. Speckle reduction gives a better denoised image which helps to diagnose disease very easily from denoised image. The main advantage of reducing the speckle is to provide the radiologist with better view of the Ultrasound image through reducing the noise without destroying important features. This paper proposes filtering techniques for the removal of speckle noise from the digital images.

KEYWORDS: US, SNR, NCD, PSO, PCA.

I.INTRODUCTION

There are number of techniques for detection of speckles in ultrasound images. Some of them are spot detection, unsupervised Clustering techniques, by detecting lines and boundaries of US images, morphological tree representation etc. These techniques are used for detecting spots or speckles in ultrasound images. Boundary detection technique in ultrasound images based on image enhancement technique. A spot detection in ultrasound images can be done by using morphological tree representation. After extracting the spots they are tracked by using a point set registration algorithm. For reduction of speckles in ultrasound images techniques used are image enhancement, median filter, ideal low pass filter, second order Butterworth filter, wavelet filter, Particle Swarm Optimization (PSO) etc. Some time reduction is done by after tracking the speckles. Nonlinear Coherent Diffusion (NCD) model is used to reduce ultrasound speckle while preserving the appearance of structured regions and organ surfaces. This technique has the advantages of robust parameter selection, speed of computation and preservation of texture and organ surfaces.

As Ultrasound image is a way of diagnosing disease in medical applications, ultrasound image participates strongly in the assistance of medical diagnosis and treatment. Ultrasound imaging is gaining more and more importance in medical practice nowadays. So it is very important to gain the best results of Ultrasound image without any distortion.In our work, we introduced a method which reduces speckle noise in ultrasound images retaining the original content of these images. Principal Component Analysis (PCA) image fusion technique is used to remove speckles in image. This method enhances the Signal to Noise ratio and perceives the original features of the images. The following model is considered to express speckle noise:

$$f(x, y) = f_0(x, y) . \eta_m(x, y) + \eta_a(x, y)$$

where ,
f(x , y) is noisy image,
$f_0(x, y)$ noise free image
,$\eta_a(x, y)$ and $\eta_m(x, y)$ are additive and multiplicative noise.
Since, additive noise is lower than multiplicative noise ignoring the additive noise, the image with the speckle noise is expressed as:

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$$f(x, y) = f_0(x, y) \cdot \eta_m(x, y)$$

II. LITERATURE REVIEW

Paper "Detection of lines and boundaries in speckle images-Application to medical ultrasound," proposed a boundary detection technique in ultrasound images based on image enhancement technique. This article uses Sticks algorithm to enhance images for boundary detection. This method is applied in medical ultrasound imaging because of their ability to enhance the linear image features which correspond to issue boundaries. Also a spot detection in ultrasound images by using morphological tree representation. After extracting the spots they are tracked by using a point set registration algorithm. After tracking spots they are reduced by using different filters like median filter, low pass filter, and wavelet filter on that image. Nonlinear coherent diffusion (NCD) model reduces ultrasound speckle while preserving the appearance of structured regions and organ surfaces. This technique has the advantages of robust parameter selection, speed of computation and preservation of texture and organ surfaces. The new technique has a large potential in real-time ultrasound imaging enhancement and in assisting automated segmentation/calculation techniques.

III.SCOPE

The proposed method covers the information regarding the detection of speckle, its causes, and possible methods to reduce them. Denoising plays a very important role in the field of the biomedical image processing. Denoising has to be performed to recover the useful information. Speckle degrades the quality of ultrasound images. Ultrasound images are often degraded by speckle which also contains diagnostic information. Therefore removing the speckle in these images must be carried out without disturbing the edges and boundaries in the image. So it is better to remove these speckles in images.

Speckle reduction technique has to be followed, to enhance the quality of ultrasound image. After reducing the speckle, I will get a clear and enhanced image as compared to input image. The main advantage of reducing the speckle is to provide the radiologist with better view of the Ultrasound image through reducing the noise without destroying important features. So detection and reduction of speckles plays an important role in medical applications.

IV. METHDOLOGY

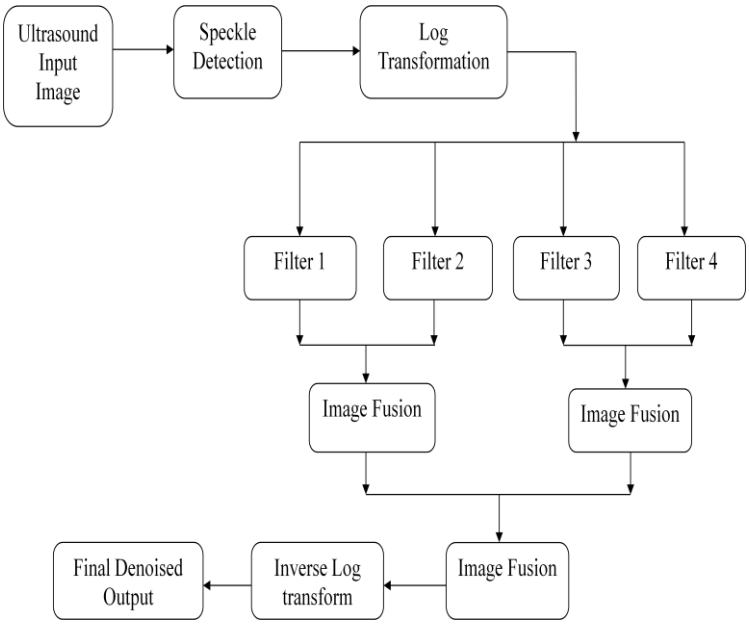

Fig.1 Schematics block diagram of work.

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The above figure shows the proposed system. the steps to be followed is given as,the first step is load the us image and convert it to the gray scale. the next step is enhancing the contrast level of image because the input image has low contrast. in pre-processing perform the histogram method and decide the threshold level to detect the speckle. the next step is log transformation. log transformation is carried out to convert multiplicative noise to additive noise. speckle noise being multiplicative in nature, contains some information's itself, so it is feasible to convert it to an additive one by using logarithmic transformation. after this step we have the additive noise image like gaussian noise so we can easily apply the different filter for de-noising the image. image fusion method is applied on the outputs of filters. pca technique is used for image fusion. which has the advantage like it reduces complexity in images grouping with the use of pca. due to reduction of noise maximum variations are removed and so the small variations in the background are ignored automatically. apply the pca algorithm on outputs of filter1 and filter2 as well as on filter3 and filter4, which gives two image fused outputs. again apply the pca algorithm on these two outputs which gives the denoised image. after that perform the log inverse transform and will get the final denoised output with reduced form of speckles as compared to original image.

V.CONCLUSION

The main aim of proposed work is detection and reduction of speckle noise from ultrasound image. It enhances the quality of ultrasound image. It recovers the useful information in ultra sound image overlapped due to speckles. It will provide the radiologist with better view of the Ultrasound image without destroying important features. Also recovers the useful information in US overlapped due to speckles. Also recovers the useful information in US overlapped due to speckles.

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