# AN EFFICIENT DE-SPECKLING AND QUALITY ENHANCEMENT TECHNIQUE FOR ULTRASOUND IMAGE

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***Abstract: Magnetic Resonance Imaging(MRI) could be a powerful process speckle noise in an inherent property of medical ultrasound imaging, and it generally tends to reduce the image resolution and contrast, thereby reducing the diagnostic value of this imaging modality. As a result, speckle noise reduction is a necessary prerequisite, The present study shows conceptually and through an experiment that this assumption is simplistic and unnatural. Moreover, it may result in inadequate performance of the speckle reduction strategies but, the incorporated noise during image acquisition degrades the human interpretation, or computer-aided analysis of images. Time averaging of image sequence aimed at improving the signal/noise(SNR) would end in further acquisition time and scale back the temporal resolution. Therefore, de-speckling should be performed to improve the image quality for a lot of correct identification. This project implements different approaches of moving ridge based mostly image de-noising ways.***

***Keywords: Noise, De-noising, Discrete Wavelet Transform, Thresholding, Speckle, Filter***

## I. INTRODUCTION

Ultrasound(US) imaging application in medicine and alternative fields in huge. It several blessing over alternative medical imaging modalities; the service of ultrasound in identification is well established as a result of its noninvasive nature, portable, accurate, low cost imaging modality, capability of forming real time imaging and continuing improvement in image quality. It is estimated that one out of each four medical diagnostic image studies within the world involves ultrasonic techniques. Medical images are sometimes corrupted by noise in its acquisition and transmission. The main objective of image de-noising technique is improvement to get rid of such noises while holding the maximum amount as attainable the important signal options, which is significantly necessary necessary if the noise features a multiplicative nature(Speckle). In the past few decades considerable efforts within the field of ultrasound imaging have been directed at development of signal processing techniques meant to combat the most of this imaging modality-speckle noise. Speckle, a form of domestically correlate multiplicative noise that corrupts medical ultrasounds creating visual observation troublesome degrades the target discover ability and recognition in B-scan pictures and reduces the distinction, resolutions which have an effect on the human ability to determine traditional and pathological tissue. It also degrades the speed and accuracy of ultrasound image process task such as segmentation and registration. Due to the speckle presence, ultrasound experts with comfortable expertise could not usually draw helpful conclusions from the picture.

## II. LITERATURE REVIEW

In the field of biomedical imaging, the ultrasound (US) B-Scan images are used for tissue characterization. These images are obtained with a straightforward linear or sector scan US probe, which show a granular look known as speckle. Speckle is modeled as a signal dependent noise, which tends to scale back the image resolution and distinction, thereby reducing the diagnostic value of the imaging modality. The speckle pattern depends on the structure of the image tissue and various imaging parameters. Ultrasound B-scan images represent the back-scattering of an ultrasound beam from structure within the body. There are two main varieties of scattering : diffuse scattering that results in speckle within the image, and coherent scattering that creates clear light and dark options.

Ajay kumarboyat and Brijendrakumarjoshi[2015]A review of different noise model that are necessary in the study of image denoisingtechnique.These noise model can be selected by analysis of their origin. A review of different type noise model is exist like Gaussian Noise model, white noise, salt and pepper noise , speckle noise, photon noise, poison-Gaussian Noise, Gamma Noise etc. Noise model also designed by probability density function using mean, variance amdgary levels in digital images.

Rajni and Anutam [2014]A survey of digital image denoising approaches. Wavelet transform is the best suited for performance because of its properties like multiresolution and multiscale nature.

Jitesh Gupta, Karan Choudhary[2012] Image De-noising by various Filters for different Noise UisngMatlab. De-noised the digital Image by using various filters.

The performance of wiener filter after de-noising for all speckle, poisson and Gaussinanoiseis better than mean filter and median filter.

TanyMondal and Dr. MausumiMaitra [2014] Wavelet 2-D graphical tool except with all the details involved in multilevel image decomposition in command line in order to more easily display it. The compressed image is constructed from only about half as many non zero wavelet coefficient as the original, there is almost no detectable deterioration in the image quality. This process is used to remove Unscaled white noise.Image is also compressedby using Bior 3.5 wavelet with 3 level of decomposition.

G.AmarTej and Prashanth.K.Shah[2015] Enhancement of MRI Image used different type filter, MSE is rapidly reduced

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in wiener filter than the mean or median filter that make the PSNR got increased in Wiener filter. A wavelet transform decomposes signal into set of basic function called wavelets. One level of DWT is used to decompose an input image into different sub band. At each level of decomposition, the high pass filter produces details information, and the low pass filter associated with scaling function produces coarse approximation. The filtering operation determines the image resolution meaning the quality of details information. In wavelet domain low frequency sub band having the low resolution than the image which is used as input for resolution enhancement. PankajHedaoo and Swati S Godbole [2011] Explained wavelet thersholding for Gaussian noise and compared with soft and hard thresholding and their purposed threesholding was best 5 % from soft thersholding.
Nadir Mustafa,Jiang Ping, Saeed Ahmed khan and MohanedGiess [2015] Medical Images is De-noised by using wavelet transform with fixed form Thresholding . The process was not able to remove speckle Noise. The parameter was also measure as MSE and PSNR. Gopinathan S and Poornima S [2015] Ultrasound image speckle noise removed by using different type filter. They proved the winer filter is give the better result for ultrasound images. For future wavelet technique to find the image edge and apply different type of filter for non-edge area in the image to remove the speckle noise.

## III. PROBLEM FINDING

The basic goal behind this paper is that the estimation of uncorrupted ultrasound image from the distorted or speckled image, and isadditionally remarked as image "de-speckling". There are numerous ways to assist restore a picture from noisy distortions. Selection the acceptable technique plays a serious role in obtaining the specified image. The de-speckling ways tend to be drawback specific as an example, a way that's used to de-noise satellite pictures might not be appropriate for de-noising medical pictures. During this paper, a study is made on the various de-speckling technique and which is implemented in MATLABR2009b versions. Each method is compared and classified in terms of its efficiency. In order to quantify the performance of various de-speckling technique, a high quality image is taken and speckle noise is added to it. This would then be given as input to the de-speckling technique, which produces an image close to the original high quality image. The performance of each technique is compared by computing Signal to Noise Ration(SNR) besides the visual interpretation. In case of image de-speckling methods the characteristics of the degrading system and the noise are assumed to be known beforehand. The image S(x,y) is blurred by a linear operation and noise n(x,y) is added to form the degraded image w(x,y). this convolved with the resstoraton procedure g(x,y) to produce the restore image z(x,y).

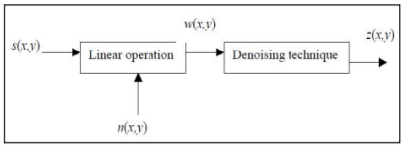

*Figure 1: Denoising concept*

The "Linear operation" shows in fig.1is that the addition or multiplication of noise n(x,y) to the signal s(x,y). Oncethe corrupted image w(x,y) is obtained, it's subjected to de-speckling technique t induce the de-noised image z(x,y). The purpose of focus during this paper is comparison and contrasting may "de-specking techniques". Noise removal or noise reduction are often done on a picture by filtering, by wavelet analysis, every technique has its benefits and drawbacks. De-speckling by wavelet and multiracial analysis are number of the recent approaches wavelet techniques.
Therefore, noise reduction is very vital, s various varieties of noise generated limits the effectiveness of medical image designation. The amount of the noise has the tendency of being either comparatively high or low. Thus , it could degrade the image quality and cause some loss of image data details.

## IV. SPECKLE EFFECT

Speckle noise is of multiplicative type which can be seen as a granular structure. Speckle is primarily due to the interference of the returning wave at the transducer aperture. It affects all coherent imaging system including medical ultrasound. Speckle is obtained by continuous incident and reflected signals generated in the body.

- It diminishes the scope for target detection in B-mode images.
- Leads to false human interpretations because of reduced resolutions and contrast. Slows down the speed and accuracy of performing certain pre-processing tasks on acquired ultrasound images

## V. PERFORMANCE MEASURE

The parameter which are used in estimation of performance are signal to ratio(SNR), Peak signal to noise ratio(PSNR), Mean Square Error(MSE).

*Estimation of PSNR*
PSNR gives the ratio between possible power of a signal and the power of corrupting noise present in the image
PSNR = 20log10(255/RMSE)
Higher the PSNR gives lower the noise in the image i.e higher image quality.

*Estimation of MSE*
Mean Square error (MSE) is given by
MSE=∑Ni=j=1[(i,)-F(i, j)]2/N2
Where, f is the original image F is the image de-noised with some filter and N is the size of image

## VI. PURPOSED TECHNIQUE

In the purposed technique we will de-speckling the image by suing the wiener filter with soft and hard thresholding . The level of decomposition is three and wavelet will be used Bior3.7. to perform the complete technique we will follow all steps mentioned below one by one. The process will be implement by using MATLAB. The purposed model are described below which will be used to de-noised and de-speckling the an ultrasound image.

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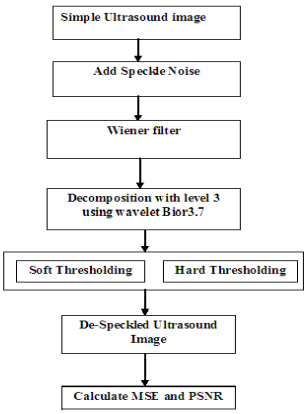


Fig 2 :Purposed Techniques to De-speckling an ultrasound image

We implement the purposed model by using following steps to de-speckle the ultrasound image

Step-1: Browse the ultrasound image.
Step-2: Change RGB to grayscale
Step-3: Add speckle noise with a variance
Step-4 : Filter the image by using efficient Wiener filter filter
Steps-5 : Select the level of decomposition (we choose level 3)
Steps-6 : select the efficient Bior3.7 wavelet
Steps-7 : Decompose the image by using Bior3.7 with level three.
Steps-8:Now we will compressed and de-noised the Decompose image by using Bior3.7,level3 with soft and Hard thresholding.
Steps-9: Now calculate the PSNR and MSE For de-speckle ultrasound image

## VII. RESULT

We analyzed the result with a range of noise variance from 0.02 to 0.08. The measurement observation are mention in following table . The fig 3 is showing the output snapshot after running the MATLAB code.

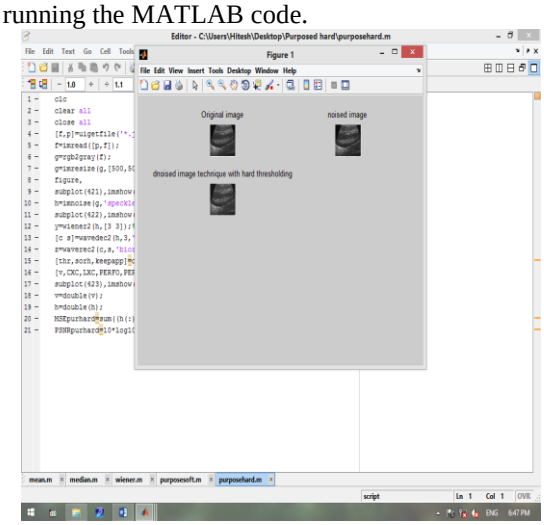


Fig 3: De-speckled image snapshot

Table 1. Result of De-speckled with noise 0.02

| Parameter | MSE | PSNR |
|---|---|---|
| Mean | 1.2815e+003 | 17.0537 |
| Median | 199.2537 | 27.3661 |
| Wiener | 77.7004 | 29.2266 |
| Purposed with Soft Threshold | 50.8249 | 31.0700 |
| Purposed with Hard Threshold | 28.5232 | 33.5788 |

Table 2. Result of De-speckled with noise 0.04

| Parameter | MSE | PSNR |
|---|---|---|
| Mean | 2.0133e+003 | 15.0917 |
| Median | 235.7026 | 24.4072 |
| Wiener | 131.7698 | 26.9326 |
| Purposed with Soft Threshold | 94.1331 | 28.3934 |
| Purposed with Hard Threshold | 51.1850 | 31.0394 |

Table 3. Result of De-speckled with noise 0.06

| Parameter | MSE | PSNR |
|---|---|---|
| Mean | 2.4591e+003 | 14.2231 |
| Median | 350.4771 | 22.6842 |
| Wiener | 181.4029 | 25.5444 |
| Purposed with Soft Threshold | 142.9454 | 26.5791 |
| Purposed with Hard Threshold | 54.3240 | 30.7809 |

Table 4. Result of De-speckled with noise 0.08

| Parameter | MSE | PSNR |
|---|---|---|
| Mean | 2.7915e+003 | 13.6725 |
| Median | 464.7223 | 21.4589 |

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| | | |
|---|---|---|
| Wiener | 227.9390 | 24.5526 |
| Purposed with Soft Threshold | 162.6879 | 26.0173 |
| Purposed with Hard Threshold | 83.3571 | 28.9214 |

After analyzing the results of all technique to de-speckled ultrasound image which speckled with variance of 0.02 to 0.08, Purposed technique with hard thresholding is showing highest PSNR value .so this thesis work observed and prove with their measurement parameter to de-speckling any ultrasound image purposed technique with hard thresholding with Bior 3.7 and three level of decomposition is best to de-speckled any ultrasound image.

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