

Noise Reduction in US Kidney Images

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ABSTRACT: The Image denoising techniques is necessary to remove noises. The presence of speckle is undesirable since it degrades image quality and it affects the tasks of human interpretation and diagnosis. As a result, speckle filtering is a critical preprocessing step for feature extraction, analysis, and recognition from medical image measurements. For 2-dimensional B-mode kidney ultrasound images, we use an image enhancement algorithm based on filtering and noise reducing procedures from the coarse to fine resolution images that are obtained from the wavelet-transformed data.

KEYWORDS: speckle noise, wavelet transform & thresholding

I. INTRODUCTION

Medical images are often deteriorated by noise due to various sources of interferences and other phenomena that affect the measurement processes in imaging and acquisition system. Speckle noise occurrence is often undesirable, since it affects the tasks of human interpretation and diagnosis. It is used for imaging soft tissues in organs like spleen, uterus, liver, heart, kidney, brain etc. gnosis. On the other hand, its texture carries important information about the tissue being imaged. This paper to developing in the Kidney images.



Fig: 1: ultrasound image corrupted by the speckle noise

The existence of speckle is unattractive since it disgrace image quality and it affects the tasks of individual interpretation and diagnosis. Accordingly speckle filtering is a central pre-processing step for feature extraction, analysis, and recognition from medical imagery measurements. Previously a number of schemes have been proposed for speckle mitigation. A wavelet-based method is introduced in this paper for efficient speckle suppression in sonographic images of the kidney. The proposed wavelet approach avoids both log and exponential transform, considering the fully developed speckle as additive signal-dependent noise with zero mean. The proposed method throughout the wavelet transform has the capacity to combine the information at different frequency bands and accurately measure the local regularity of image features. In image processing, image is corrupted by different type of noises. An appropriate method for speckle reduction is one which enhances the signal to noise ratio while conserving the edges and lines in the image. The main objective of the speckle noise reduction is necessary to remove the noise with different types of the wavelets function.

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II. RELATED WORK

Digital image acquisition and processing techniques play an important role in current day medical diagnosis. Images of living objects are taken using different modalities like X-ray, Ultrasound, Computed Tomography (CT), Medical Resonance Imaging (MRI) etc. Highlights the importance of applying advanced digital image processing techniques for improving the quality by removing noise components present in the acquired image to have a better diagnosis. Also shows a survey on different techniques used in ultrasound image denoising. Has presented the work on use of wiener filtering in wavelet domain with soft thresholding as a comprehensive technique. Also, compares the efficiency of wavelet based thresholding technique in despeckling the medical Ultrasound images with five other classical speckle reduction filters. The performance of these filters is determined using the statistical quantity measures such as Peak-Signal-to-Noise ratio (PSNR) and Root Mean Square Error (RMSE).

III. EXPERIMENTAL RESULTS

The Wavelet Transform (WT) is a mathematical tool useful in the analysis of signals. Its representation involves the decomposition of the signals in wavelet basis functions. Wavelet analysis represents the next logical step: a windowing technique with variable-sized regions. Wavelet analysis allows the use of long time intervals where we want more precise low-frequency information, and shorter regions where we want high-frequency information.

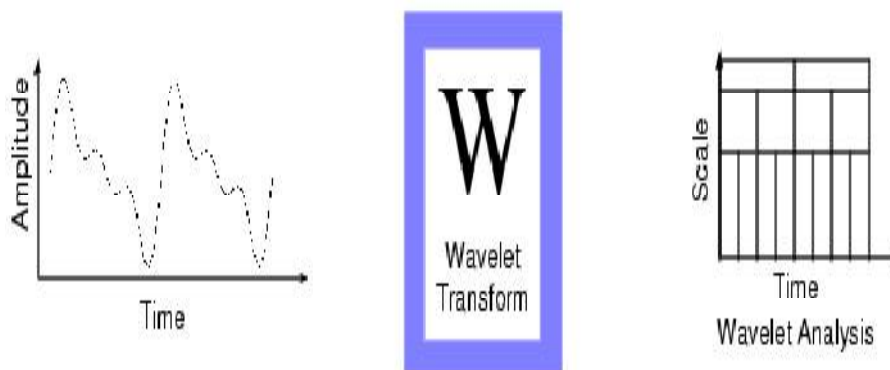


Fig 2: Wavelet Transform on a signal

The decomposition process can be iterated, with successive approximations being decomposed in turn, so that one signal is broken down into many lower resolution components. This is called the wavelet decomposition tree. Lifting schema of DWT has been recognized as a faster approach. The basic principle is to factorize the polyphase matrix of a wavelet filter into a sequence of alternating upper and lower triangular matrices and a diagonal matrix. This leads to the wavelet implementation by means of banded-matrix multiplications. All the wavelet filters use wavelet thresholding operation for denoising. Speckle noise is a high-frequency component of the image and appears in wavelet coefficients. One widespread method exploited for speckle reduction is wavelet thresholding procedure. The basic Procedure for all thresholding method is as follows:

- Calculate the DWT of the image.
- Threshold the wavelet coefficients. (Threshold maybe universal or sub band adaptive)
- Compute the IDWT to get the denoised estimate.
- There are two thresholding functions frequently used ,i.e. a hard threshold, a soft threshold. The hard-thresholding is described as

$$\eta_1(w) = wI(|w| > T) \text{ Where } w \text{ is a wavelet coefficient, } T \text{ is the threshold.}$$

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The Soft-thresholding function is described as

$$\eta_2(w) = (w - \text{sgn}(w)T) I(|w| > T)$$

Where $\text{sgn}(x)$ is the sign function of x . The soft-thresholding rule is chosen over hard-thresholding, as for as speckle removal is concerned a preprocessing step consisting of a logarithmic transform is performed to separate the noise from the original image. Then different wavelet shrinkage approaches are employed. The different methods of wavelet threshold denoising differ only in the selection of the threshold.

IV. CONCLUSION

Image denoising has been achieved using new technique of wavelet transform in combination with wiener filters and results have been obtained that could be measured subjectively by viewing the pictures of restored image attained as above results and checking the speckle noise reduction of final restored image that shows very less distortion parameter. Also, Image quality has been measured objectively using MSE value with different wavelets. At the end we conclude that haar wavelet with wiener filter provide better results than symlets and coiflets wavelet. Haar wavelet is better than coiflets wavelet and coiflets is better than symlets using wavelet thresholding and transform.

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