International Journal of Engineering Research in Electronic and Communication Engineering (IJERECE) Vol 3, Issue 5, May 2016

De-Noising, Enhancement and Developmental Analysis for Fetal Images

[1] Shamya Shetty, [2] Dr. Jose Alex Mathew
[1][2] Department of E &C, Sahyadri College of Engineering and Mangement,
[1]Shamya.mtechec14@sahyadri.edu.in, [2] Jose.ec@sahyadri.edu.in

***Abstract*— Medical Image Processing has broadened in recent years. To monitor the behavior of the fetal ultrasound images are considered. These images provide the view of internal organs of the body. But ultrasound images have the drawback of having speckle noise. The quality of the image gets reduced due to the presence of speckle noise. Hence, it is necessary to reduce the speckle noise and to enhance the quality of the image for further images analysis. The detection of any movement as well as the development of the fetus can be analyzed after the preprocessing steps. The system helps the pregnant women to take care of her health stage by stage.**

***Index Terms*— De-noising, Enhancement, image analysis, ultrasound Image.**

I. INTRODUCTION

Ultrasound images are considered to analyze the behavior of fetus. The tool that provides the view of internal organs of the body is the ultrasound imaging tool. Ultrasound images have certain features like noninvasiveness, low cost imaging, real time imaging, and continued improvements in the quality of image. Because of the no ionization exposure property of the device, the images formed by the ultrasound are well suited for fetal imaging. But these images comprise of speckle noise which are resulted from the constructive and destructive interface. These noises degrade the quality of image. Hence it is necessary to remove this noise for further image analysis. De-noising is the method used for the process. Preprocessing unit includes image de-nosing and enhancement before the further image analysis.

II. METHODOLOGY

The aim is to analyze and detect the development and movement of the fetus after doing the preprocessing steps like image De-noising and enhancement for the ultrasound images. Fig. 1 shows the block diagram of the system. It is three main parts: De-noising stage, enhancement stage and morphological image processing unit.

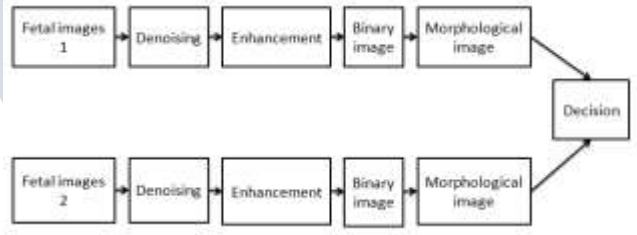


Fig. 1. Block Diagram

A. De-noising Stage

Ultrasound images compose of speckle noise. These noise degrades the quality of the image by back scattered wave appearance and makes it difficult for the observer to discriminate the fine details of the image [1]. De-noising is the method used to remove this noise.

De-noising is a central preprocessing step used to remove noise and to strengthen the quality of image by restoring the small details that may be hidden in the image. De-noising is done by using Discrete Wavelet Transform (DWT) by standard wavelet technique. Wavelet transform has been proved to be the effective method for noise removal .The input signals gets decomposed into multiple scales which represent the time frequency of the original image. At each scale, thresholding [2] and statistical modeling [4-6] can be performed to suppress noise. The processed wavelet coefficients are transformed back to spatial domain to accomplish De-noising.

B. Enhancement Stage

Enhancement is a process for improving the quality of the image for further image analysis. Histogram

Equalization is the technique used to improve the image contrast [7]. This method improves the overall contrast by equalizing the histogram of under and over contrast areas of the image.

Histogram equalization is a popular method for improving the contrast of the image. Due to its simplicity the method is used most commonly for the enhancement process. This method well distributes the pixels intensity over the full intensity range.

C. Development Stage

Development analysis is done by the morphological image processing unit. Dilation and erosion are the operations in morphological image processing. Morphological image processing is a collection of nonlinear operation related to the shape of features in an image. The method relies on relative ordering of pixel values. The method is well suited for processing the binary images. Morphological techniques carefully examine the image with a small shape called as structuring element. A structuring element is simply a mask that allows defining arbitrary neighborhood structures. These are positioned at all the locations of image and are compared with corresponding neighborhood of pixels.

The two morphological operations dilation and erosion are depends on the shape and size of the structuring element. Dilation and erosion are the two operations that have opposite effects. Dilation is a process of maximizing any shape with the reference shape by adding a layer of pixels to both inner and outer boundaries of regions. Whereas erosion is a process of minimizing any shape with the reference shape. The discontinuous area is removed in the process.

D. Movement Detection

The detection of movement is done by considering the ultrasound video sample. Frames of the video sample are taken and the preprocessing method like De-noising and enhancement is done.

The consecutive frames of the video are analyzed using fuzzy logic which includes correlation, mean and standard deviation. Correlation is a simple principle. The aim is to find all the places in the image that matches the sub image. The sub image is considered as the spatial filter and the sum of products is computed to find the matches. The most basic of statistical measure is the mean. It is the measure of average intensity. Standard deviation is the measure of average contrast. It shows how much dispersion exists from the average.

III. MATLAB RESULTS

The results of De-noising, enhancement, and development analysis and movement detection are shown below.

A. De-noising

Image De-noising is done by Discrete Wavelet Transform method. Figure 2 shows the results for De-noising where the high frequency component is removed from the original image.

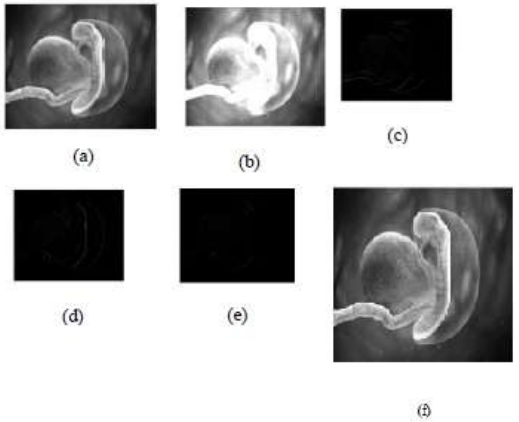


Fig. 2. Result Of De-noising:(A)Gray Image Of Fetus At Week 5 (B) Ll Component Of (A) (C) Lh Component Of (A) (D) Hl Component Of (A) (E) Hh Component Of (A) (F) Reconstructed Image Of (A)

B. Enhancement

Enhancement of the de-noised image is done by the histogram equalization technique. The results of the enhanced image are as shown in figure 3.

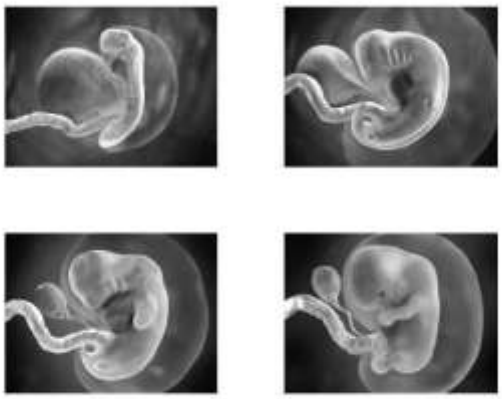
(a)

(b)

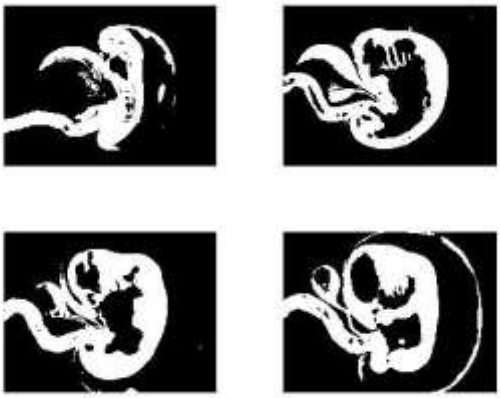
FIG. 3. (A) De-noised Image OF FIG.2 (A) (B) Enhanced Image of (A)

C. Development Stage

The images of fetal of gestational age of week 5 to week 8 are considered. Erosion of these images is done and the development is observed by considering the morphology of the images. Figure 4 shows the result of development analysis.



(A)



(B)

Fig.4. (A) Gray Image Of Fetus From Week-5 To Week-7 (B) Erosion Of (A) Showing Development Process

D. Movement Detection

The figure 5 shows the results of movement detection for the two frames of the video.

(A)

(B)

(C)

(D)

(e)

Fig.5.(a) First Frame of Video (b) De-noised First Frame (c) Enhanced First Frame (d) De-noised Second Frame (e) Enhanced Second Frame

IV. CONCLUSION

Pre-processing of image is done by units like De-noising and enhancement stages. The denoised and enhanced image is passed to the morphological image processing unit for the development analysis. And the detection of movement is observed by the fuzzy logic applied to the video frames after the preprocessing steps.

REFERENCES

[1] Richard N. Czerwinski, Member, IEEE, Douglas L. Jones, Senior Member, IEEE,and William D. O'Brien, Jr., Fellow, "Detection of Lines and Boundaries in Speckle Images—Application to Medical Ultrasound", IEEE Transactions on Medical Imaging, vol. 18, no. 2, february 1999

[2] D.L.Donoho,"De-noising by softthresholding," IEEE Transactions on Information Theory, vol. 41, pp. 613–627, 1995

[3] M.K.Mihc-ak, I.Kozintsev, K.Ramchandran, P.Moulin, "Low complexity image De-noising based on statistical modeling of wavelet coefficients," IEEE Signal Processing Letters, vol.6 (12) pp.300–303, 1999.

[4] S.G.Chang, B.Yu, M.Vetterli, "Spatially adaptive wavelet thresholding with Context modeling for image De-noising," IEEE Transaction on Image Processing, vol.9 (9), pp.1522–1531, 2000.

[5] A.Pizurica, W.Philips, I.Lamachieu, M.Acheroy, "A joint inter and intrascale statistical model for Bayesian wavelet based image De-noising," IEEE Transaction on Image Processing, vol.11 (5), pp.545–557, 2002.

[6] R. Gonzalez, R.E. Woods, Digital Image Processing, Upper Saddle River, NJ, Prentice Hall, 2002