A Review: Ultrasonic Imaging Based Fetal Cardiac Chambers Segmentation and Detection of Abnormality

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Abstract **Heart problems are the most common type of major birth defect and a leading cause of infant death, according to the Centers for Disease Control and Prevention. These defects are a result of underdeveloped chambers of the heart. The early detection can certainly have benefits. In this paper median filter are used to removal of noise and DWT is used to segmentation. By taking LV/RV ratio gestation period of baby can be determined in terms of week also any defect in the fetal heart can be identified.**

Key words: **ultrasound, filter, discrete wavelet transformation.**

I. INTRODUCTION

Fetal cardiac defects are the most common abnormality found at birth and are the primary reason for the death of the new-born. These defects can be detected by many methods using ECG signals of fetus and mother. But The FECG will be contaminated by many of the unwanted signals such as power line interference, muscle contractions, respiration, skin resistance interference, and instrumental noise and uterine contractions. By using various filters can remove that noise but not fully. For that purpose ultrasound imaging is used to detect the cardiac defects also fetal growth.

II. LITERATURE SURVEY

Prabha *et al* [1] have presented the paper on ultrasonic imaging based fetal Cardiac chambers segmentation using discrete wavelet transforms. Doppler Ultrasonic imaging has been used to study the structural and functional aspects of fetal cardiac chambers. The ratio of left ventricle width to right ventricle width estimation closely matches with the theoretical bound for different gestation week.

Veenadevi *et al* [2] have presented a paper on extraction of fetal electrocardiogram from maternal electrocardiogram and classification of normal and abnormal signals. The method uses Kalman filter (KF), Least Mean Square (LMS) algorithm based on adaptive noise cancellation to extract fetal ECG. This method provides extract high quality, high signal to noise ratio fetal electrocardiogram from the mixture of maternal ECG, fetal ECG and various noises which gives clear picture of fetal heart beat signal.

Baumgartner *et al* [3] have presented a paper on SonoNet real-time detection and localisation of fetal standard scan planes in freehand ultrasound. In this paper, they propose a novel method based on convolution neural networks, which can automatically detect 13 fetal standard views in freehand 2-D ultrasound data as well as provide a localization of the fetal structures via a bounding box.

Jacob *et al* [4] have presented a paper on fetal cardiac structure detection from ultrasound sequences. They proposed a novel method for the detection of fetal cardiac structure from ultrasound sequences. This method is effective to detect the structure of fetal heart.

Marzbanrad *et al* [5] have presented a paper on automated estimation of fetal cardiac timing events from Doppler ultrasound signal using hybrid models. In this paper, a new non invasive method is proposed for automated estimation of fetal cardiac intervals from Doppler Ultrasound signal. This method is based on an oval combination of empirical mode decomposition and hybrid support vector machines—hidden Markov model.

Maraci *et al* [6] have presented a paper on a frame work for analysis of linear ultrasound videos to detect fetal presentation and heart beat. In this study the problem of automatically locating anatomical features in fetal ultrasound video specifically motivated by a real world global health application of low-cost ultrasound for identification of breech presentation and fetal viability. Ultrasound will give the effectively identify structures of interest and interpret the images with high confidence.

Krishna [7] have presented a paper on fetal ECG extraction using time-frequency analysis techniques. In this paper extraction of fetal ECG is done by using the combination of the commonly used Independent Component Analysis (ICA) technique and the Time Frequency Representation (TFR).

Zhang *et al* [8] have presented a paper on automatic image quality assessment and measurement of fetal head in two-dimensional ultrasound image. They used obstetric ultrasound due to its non invasive nature, low–cost, and real-time

acquisition. The main goals of the fetal US scan are to estimate the gestational age and weight, confirm growth patterns, and show the presence of possible abnormalities. They conduct two experiments were carried out to validate fetal head segmentation and the US image quality assessment method. They fetal biometric measurements are directly derived from the segmented region.

Manikandan, Prabakar [9] have presented a fetal cardiac defect is one of the most high risk fetal congenital anomalies and is also one of the primary reasons for the death of the newborn. The fetal heart structure detection from is important for diagnosis of the fetuses which is difficult due to the small size of the initial level of the fetuses. A novel method is proposed for the detection of fetal heart structure from ultrasound images. An initial pre-processing is done for removal of noise and enhances the noiseless images. Level set method is applied to the sequence of fetal ultrasound images to segment the region of interest.

Sriraam *et al* [10] have proposed the paper on automated screening of fetal heart chambers from 2-D ultrasound cine-loop sequences. Fetal cardiac ultrasonic imaging technique has become increasingly popular in the recent years for the detection of fetal congenital abnormalities at an early stage. Due to the low signal-to-noise ratio of the ultrasound imaging, the automatic detection methods should incorporate suitable pre processing filtering techniques to enhance the segmentation techniques efficiently. This paper suggests the application of median and morphological filtering operation for removing speckle noise. The four heart chambers are segmented independently based on the shape priors.

III. RELATED WORK

A congenital heart defect (CHD) is a heart problem which is present at birth. It is caused by abnormal formation of the heart during fetal development. This problem can overcome if it is detected in earlier stage, hence the abnormal birth of the child with cardiac problems can be reduced. The main objective is to identify and Segmentation of the fetal ultrasonic heart image using image processing and determine any abnormality of the fetus.

Ultrasound imaging is considered as the effective tool for assessing the human fetus growth from mother's womb. This ultrasound image will be converted into frames. Here RGB to gray conversion will used. The converted gray image having speckle noise to remove that noise filters is used. It may a median filter or any other filter. After removal of noise, segmentation is done because to locate objects and boundaries (lines, curves, etc.) in images. Followed by wavelet and Haar transformation is done. Wavelet transform is used to decompose a signal into a set of basis functions. The Haar transform performs the simplest compression process. At end we get image of four chamber of heart of fetus in that LV and RV will selected. Later LV/RV ratio is calculated. This ratio will compare with standard values. If any hole in the fetus heart can easily identified.

IV. CONCLUSION

Ultrasound imaging is considered as the effective tool for assessing the human fetus growth from mother's womb. The cardiac problems are more in newly born child. The early detection can certainly have benefits. It makes use of the preliminary concept framework and employs wavelets based segmentation procedure for chamber segmentation. The segmented chambers were finally measured for LV/RV ratio to recognize the status of the fetal cardiac chambers.

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