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Medical Image Segmentation of Cardiac Quiescent by using Gaussian Mixture Model

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Abstract - ***Cardio Vascular Diseases (CVDs) leads to loss of life of more humans. The risk of CVD is higher when compared with all other case. This disease can be analyzed through imaging modalities such as electrocardiogram (ECG), Computed Tomography (CT), etc., But their precision for finding their quiescent is few. The precision can be improved through echocardiography and it is labeled by its geometrical topographies with practical performances. In this work, the quiescent existing in the Mitral Valve (MV) can be sensed by Doppler echocardiography. In this paper the cardiac quiescent is assessed and the segmentation process can be exercised using Gaussian Mixture Model and is performed in MATLAB Software. The precision of this work is more efficient than the previous projected works.***

Key Words: *Doppler echocardiography, Cardio Vascular Disease (CVD), Mitral Valve, Gaussian Mixture Model (GMM).*

1. INTRODUCTION

Echocardiogram is also known as ultrasonic scan for the heart. With the help of echocardiogram the disease which present in the miniature portion of the heart can be assessed. Some of the things which can be evaluated are size and shape of the heart, blood leakage, tissue damage, valve motion, blood clot and wall thickness [1]. The process of echocardiogram takes place through the transducer. The sound waves are passed through the transducer to the heart and due to the reflection process the transducer absorbs the waves and it produces the video of the working heart in display. The transducer which is used for echocardiogram should have high frequency so that we can achieve the accurate video. The benefit of using echocardiogram is non-intrusive and it does not have any hazards in future. The modalities of echocardiography which are used clinically is described below.

- M-Mode Echocardiography is also called as one dimensional echocardiography.
- B- Mode Echocardiography is also called as two dimensional echocardiography or it is also called as real time echocardiography.
- Doppler Echocardiography is also called as combination of both M-mode and B-mode echocardiography.

M-Mode echocardiography will not show the image of the heart but it shows the structure during the period of cardiac cycle. The M-mode recordings permit the measurement of cardiac dimensions and motion patterns. Also it facilitates the analysis of time relationships with other physiological variables such as electrocardiogram and heart sounds.

B-Mode echocardiography is mainly used to diagnose the structure and motion of the heart during the time of the work. In this method ultrasound is transmitted along with the several scan lines is about 90-120 degree. If it is over a wide then it ranges about 90 degree. This two dimensional echocardiography appears like cone shape in the monitor. The M-Mode and B-Mode echocardiography is also called as conventional echocardiography [5].

Doppler echocardiography is mainly used to find the path of blood flow. The Doppler echocardiography shows both the inflow and outflow of blood accurately. With the help of this we can diagnose several cardiovascular disease like valvular regurgitation (aortic regurgitation, tricuspid regurgitation and mitral regurgitation) and valvular stenosis (aortic stenosis, mitral stenosis and tricuspid pulmonic stenosis).

All these above modalities are considered as same in their principle but their difference is how it collects the reflected sound waves and analyzed [1], [10].

In this paper the disease assessed from the heart is Mitral Regurgitation (MR). Mitral Regurgitation is the disease occurs due to the leakage of blood which takes place in the mitral valve region. During the inhale process the mitral valve gets open and there the fresh oxygenated blood flows from left atrium to the left ventricle. During the exhale process the mitral valve gets closed since the blood flows through that mitral valve. This leakage of blood is called as Mitral Regurgitation (MR) disease [11].

2. METHODOLOGY

2.1 Background Modeling

In use the B-Mode echocardiography is used in the most efficient way. Even-though it is efficient it shows only the perpendicular view of the heart. To have the clear view we use doppler echocardiography. It has three types in their usage. They are as follows.

- Continuous wave doppler- It is mainly useful for high velocity flow. (e.g.) Aortic Stenosis disease.
- Pulsed wave doppler- It is mainly useful for low velocity flow. (e.g.) Mitral valve disease.
- Color flow doppler- Color flow is the combination of both M-mode and B-mode echocardiography. In this different colors are used to assign the direction blood flow.

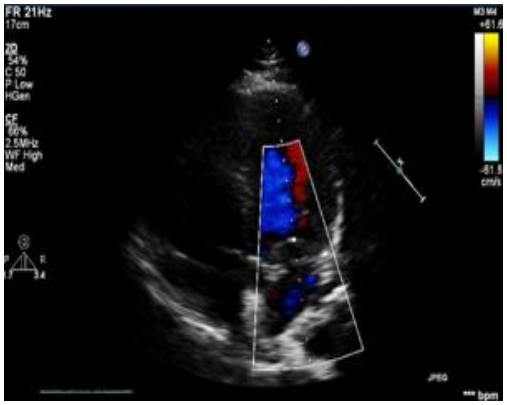


Fig -1: Doppler Image

From the Doppler image the color designation is shown below.

- Red color represented as the blood flow towards the transducer.
- Blue color represented as the blood flow away from the transducer.
- Mosaic pattern represented as severe abnormality in the heart.

The overview of the proposed methodology is described below in fig 2

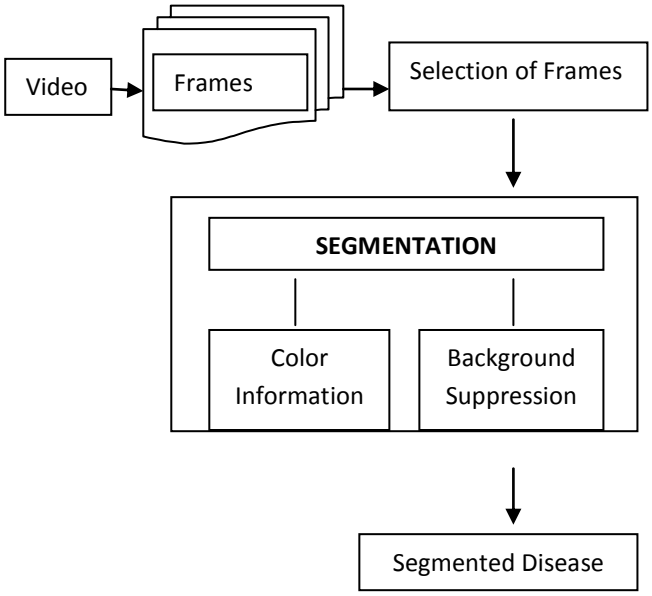
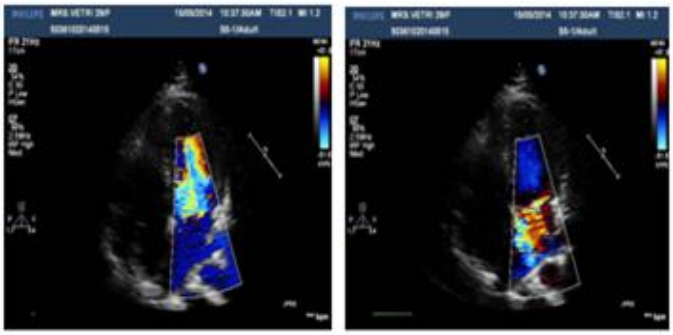


Fig -2: Proposed Block Diagram

From Doppler echocardiography the input video is taken and this input video is converted into frames. Our video will play around two seconds. In normal case the conversion video takes 24 (fps) frames per second (i.e.) it will have thin frames. This conversion process can be done with the help of MATLAB (R2011a) software. From our video we got 22 frames on the whole. Only incase of film or other cases 24 fps will occur. From these 22 frames six sample frames are taken out for further process. The sample frames are selected based on the color representation. The frame which has more cyan color is taken out for segmentation process. The six sample frames are shown in fig 3.



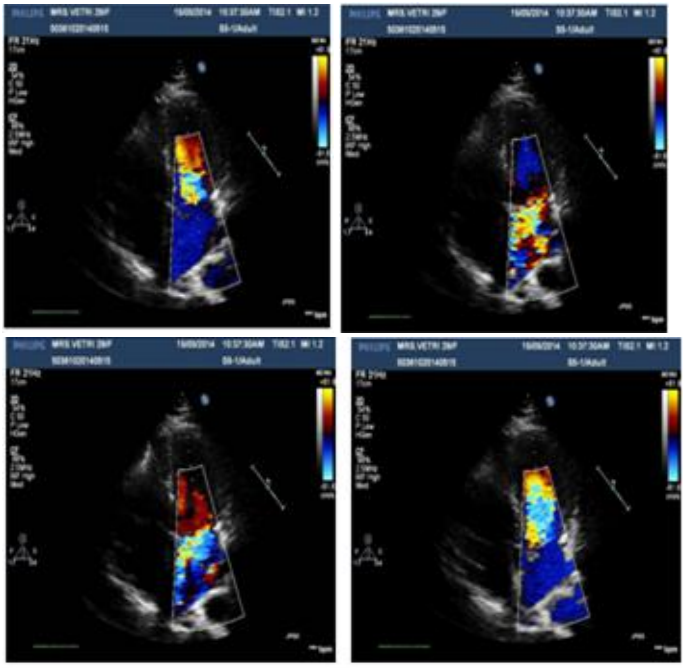


Fig -3: Six Sample Frames

2.2 Image Segmentation

In segmentation process, the main aim is to fragment the particular color information with the background suppression. In this work the particular thing which we segment is Mitral Regurgitation disease. This disease is denoted as cyan color and this color is combination of blue and green color in color code.

The first step in this process is that with the help of edge command the border is made for each color in the frame.

The next step is to identify the particular color information (i.e.) to extract the image regions that have desired range of colors. That term is called HSV (Hue, Saturation and Value). With the help of HSV the color information can be analyzed accurately.

H is denoted as Hue. It describes the pure color. Here the colors are more pure as in the rainbow (i.e.) the color won't have any shades. The pure colors are red, orange, green, yellow, blue and violet. The other shades of colors re represented as saturation, intensity, brightness, etc,.

S is denoted as Saturation. Saturation means it is the dominance of hue in the color or it is said to be a pure color which is diluted by white light. Through this any shades of color can be achieved. Here it is used as a mask to isolate light shaded colors.

V is denoted as Value. Value means it is defined as intensity of that particular color. Here the color considered is cyan color.

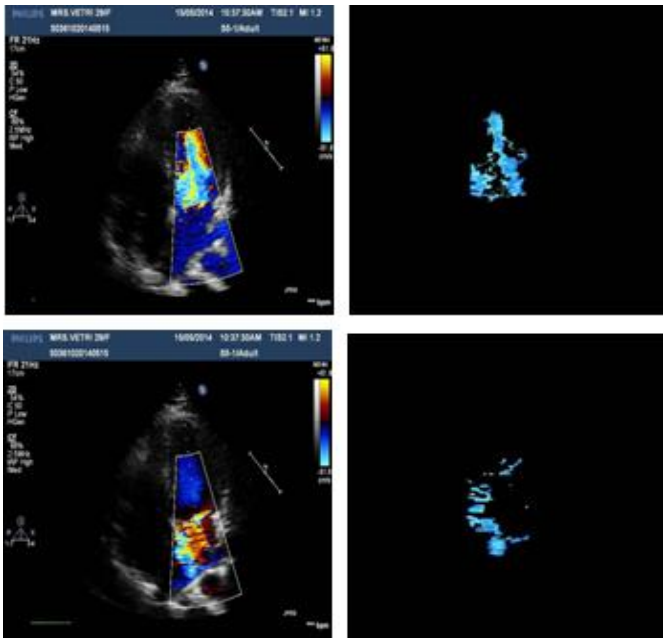
From these HSV the average mean of Hue, Saturation and Value is calculated. The next step is that the calculated average mean value is compared with each pixel value of that total area. If the pixels gets matched that will be extracted out. If it is not matched that will be considered as zero. This process will be proceeded till it get the clarity segmentation.

The final step of this process will be done with the help of edge command. Through this the edges are formed

for that particular color information and the background of the color is suppressed by using imfill command. Thus the disease can be segmented out in the accurate manner.

3. RESULTS

From the six sample frames the particular color information was fragmented out with the help of MATLAB (R2011a) software. Here the particular color considered is cyan color. It is also represented as mitral valve disease or Mitral Reurgitation (MR) disease.



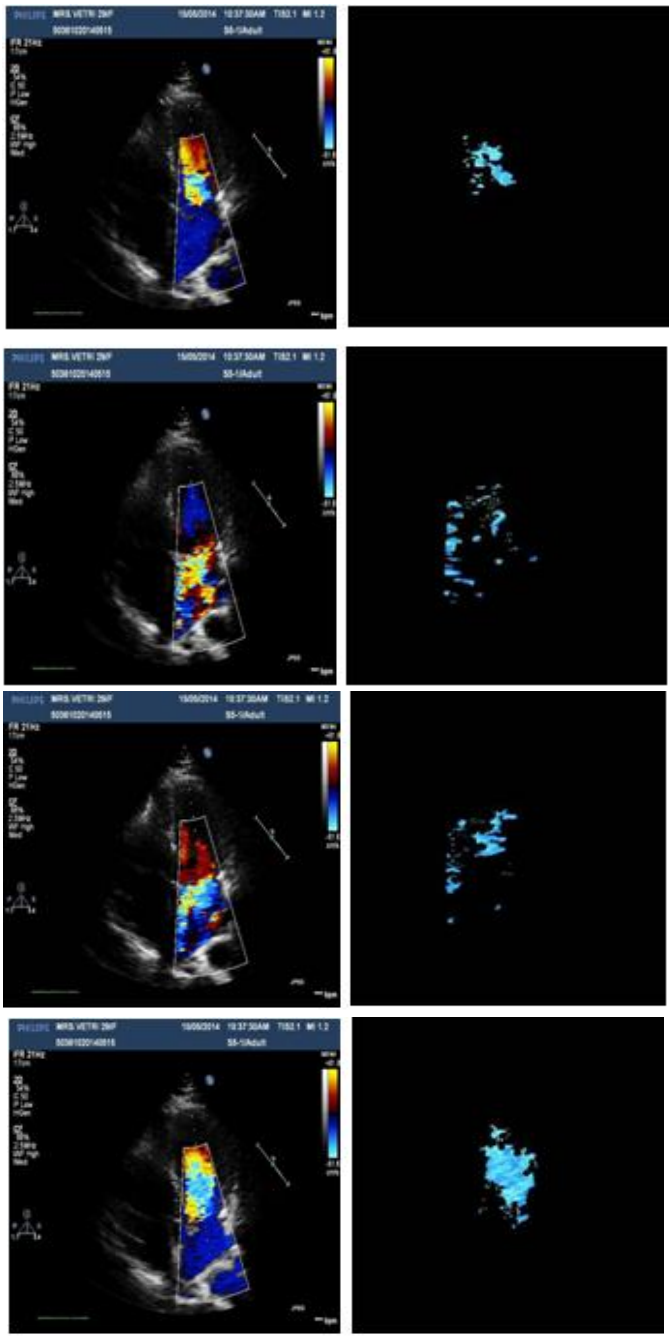


Fig-4: Comparitive analysis of sample frame with segmented frame.

The fig 4 represents the comparative analysis of input or sample frames with the segmented frames. In input frame it contains all colors that represent the blood flow direction. From that only the cyan color or the Mitral Regurgitation disease alone is segmented out in the most accurate manner.

4. CONCLUSION

The projected work intense only in finding the outflow of blood from the Mitral Valve (MV) and is generally called as Mitral Regurgitation (MR). Through the echocardiographic video, the outflow is traced and segmented. The Gaussian Mixture Model is a novel framework used for the segmentation procedure. This segmentation procedure is completed through the MATLAB command. Though few procedures can implement the similar procedure, the precision of this work is higher when compared to other work.

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BIOGRAPHIES

S.Ashvini was born in Tamilnadu on 1992. She is a M.E. student of Applied Electronics department in IFET College of Engineering, Villupuram, India. She completed her Bachelor of degree in Electrical and Elecronics Engineering in Sri Manakula Vinayagar Engineering College, Puducherry, India in the year 2013.

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