

## Chapter 74

# A Primitive Survey on Ultrasonic Imaging– Oriented Segmentation Techniques for Detection of Fetal Cardiac Chambers

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### **ABSTRACT**

*Recognition of presence of fetal cardiac chambers through ultrasonic Doppler imaging poses a huge challenge for the clinical community. The four-chamber view and outflow tracts are found to be a potential identity marker for presence of all heart chambers as well as current states of fetal heart. Given the cine loop ultrasonic imaging sequences, computer-aided diagnostic tools have been developed to detect and measures the chambers through automated mode. Segmentation and region of interest identification process contribute significantly towards the presence of heart chamber and presence of abnormality. This study provides a primitive survey towards the ultrasonic imaging-oriented segmentation techniques for detection/recognition of all four fetal cardiac chambers. The challenges for the biomedical community were also reported.*

## INTRODUCTION

Ultrasound happens to be important imaging modality which is used widely used for diagnostic as well as treatment purpose. It is non invasive, which do not require ionizing radiation as compared to the other imaging modalities and hence not harmful. It is well known for its use to scan the development of the fetus during pregnancy.

Ultrasonic system is one of the diagnostic tool that is widely used in medical field which works above the frequencies of human hearing i.e., above 20 kHz. Ultrasound gel is directly placed the on the skin and a transducer (probe) is used. Probe is used to transmit sound waves or high frequency in to body to which gel is smeared. The transducer collects the sounds that bounce back and feeds into a computer to create an image. The images of ultrasound show the movements and structures of the internal organs as they are captured in real time. Blood flowing through blood vessels can also be observed WHO 1998. There are different modes of ultrasound imaging.

Circulatory system and tissue motion can be evaluated by an advanced sonographic technique called Doppler based Ultrasound imaging. It provides information related to abnormalities like blood clots, cardiac or valve insufficiency and blocked vessels. This technique provides information related to velocity of blood flows and flow patterns across valves and inside cardiac chambers. The direction of blood flow towards or away from the probes can be assessed.

Ultrasound imaging is a non-invasive technique to detect any abnormalities and provides an aid to give treatment. Detection of organs plays very important role. Computer aided diagnosis (CAD), involves the use of image processing technique which has the capability to identify the organs and detect any abnormalities. Earlier CAD was involved important subjects in medicines related to breast cancer, cardiovascular diseases and lung cancer. Kunio Dio et al, 2008 have discussed the importance and usefulness of CAD in assisting the diagnosis of various conditions and the different factors in the development of CAD.

Segmentation is the process of dividing an image into regions with similar properties, it can be with respect to its gray level, color, texture, brightness, and contrast. In case of medical image segmentation the aim is to study anatomical structure and identify Region of Interest i.e. locate tumor, lesion and other abnormalities, measure tissue volume to measure growth of tumor. The role of segmentation is crucial in most tasks requiring image analysis. The success or failure of the task is often a direct consequence of the success or failure of segmentation. However, a reliable and accurate segmentation of an image is, in general, very difficult to achieve by purely automatic means. Ultrasound images will have low resolution and less contrast which leads to speckle noise. Due to this segmenting ultrasound images is a difficult task. Some of the common segmentation techniques are edge detection based, region growing based, threshold based as well as neural network based methods. Speckle noise of ultrasound images can be removed by preprocessing techniques like mean curvature evolution, anisotropic diffusion and some mode based segmentation techniques. Having the prior knowledge about the shape of object, location and intensity level can also help to segment ultrasound images Sheng Yan et al, 2010.

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