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A Novel Approach in the Identification of Diseased Tissues in Brain, Kidney, Lungs and Heart using Median Filter

Agnes Shiny Rachel.N
M.E (VLSI) Assistant Professor, Rathinam Institute of Technology, Pollachi Main Road, Coimbatore-641021.India

A. Ramya[1],M. Kiruthika[2]
1. B.E(ECE) Student, Rathinam Institute of Technology, Coimbatore.
2. B.E(ECE) Student, Rathinam Institute of Technology, Coimbatore.

***Abstract*— Cardiac failure has become a major threat to human life in recent days. Although the rate of mortality due to improper cardiac functioning is increasing rapidly still there is no fast diagnosis method to detect the failures in heart. Hence we have proposed a novel method to identify the diseased tissue using Median Filter and further processing using Bayesian estimation. In this proposed system the contour of the organ is keenly observed in terms of Area and Volume. With these parameters the blood flow can be identified with respect to the increase or decrease in the area and volume. The blood flow would clearly indicate if there is a failure in the examined object. This method has proved to be highly efficient in terms of computation time by 1.26s.**

***Keywords*— Area; Volume; Contour; Computation Time;**

I. INTRODUCTION

In early times a coupled level set segmentation of the myocardium of the left ventricle of the heart using a priori information was developed [1]. It made use of a novel and robust stopping term using gradient and region based information. Later in the year 2007, an automatic approach to segment cardiac magnetic resonance images was presented. The obtained overlapping percentage, mean and maximum distance between the two contours increased the performance [2]. Another new framework for the segmentation of ventricles based on image registration has been developed. The experimental results proved to correct the unrealistic deformations and improve the segmentation accuracy [3]. Later another method which went onsight into both the ventricles using automatic segmentation on dynamic short axis steady state free precession MR images[4]. In the year 2009, a discrete kernel density matching energy for segmenting the

Left ventricle cavity in cardiac magnetic resonance sequences was developed. Quantitative evaluations over 2280 images from 20 subjects demonstrated that the results correlated well with independent manual segmentations [5]. Tomasz Pieciak in the year 2012 proposed a short axis MRI left ventricle segmentation method which was based on an active contour method and gradient vector flow field forces [6]. Also another image compression method using Wavelet and SPIHT encoding scheme has been evolved [7].

In all the above discussed methods although the perfect diagnosis of the disorders has been seriously worked upon yet there was no improvement in computation time. In this proposed method using Median filter followed by Bayesian estimation the information of both the left and right ventricle has been separately studied in order to get a precise data and also the computation time which was otherwise greatly consumed by manual verification has been brought down to a great extent.

II. PROPOSED METHOD

The block diagram of the proposed Median Filtering and Bayesian Estimation has been shown in Fig. 1.

- General Bayesian Formulation

$$p\left(\frac{h}{d}\right) = \frac{p\left(\frac{d}{h}\right)p(h)}{p(d)} \quad (1)$$

d=data
h=hypothesis

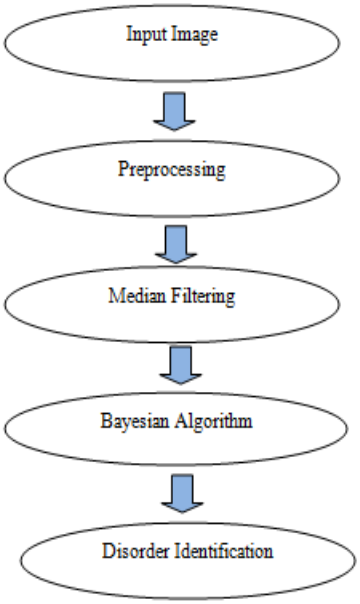


Fig 1. Block Diagram

A. *Preprocessing*

The steps in Preprocessing have been shown in Fig2.

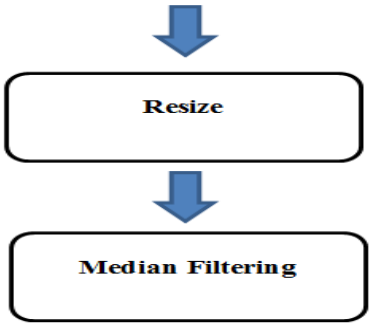


Fig 2. Pre Processing

- The image is initially resized to 256*256.
- Then using a Median Filter the noise in the image is removed

B. *Median Filtering*

It is a non linear digital filtering technique. It goes through the signal on each pixel and replaces it with the median of the neighboring pixels. The neighbors are called as windows. For a one dimensional image there are less number of windows whereas for two dimensional and three dimensional there are n number of windows. Median filters can tend to erase lines narrower than ½ the width of the neighborhood. They can also round off corners.

III. BAYESIAN ESTIMATION

The Bayesian algorithm helps to obtain the area and volume of the organ of interest. The block diagram of this is shown in

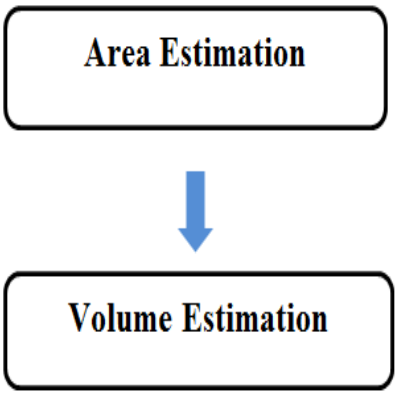


Fig. 3 Bayesian Method

There are two different hypotheses

- Maximum Likelihood Hypothesis
- Maximum a Posteriori Hypothesis.

Of which we make use of the Maximum Likelihood hypothesis.

To determine the Maximum Likelihood hypothesis, we evaluate P (d|h) for the data d, which is the positive lab test and choose the hypothesis (diagnosis) that maximises it.

Area is obtained from the formula

$$\epsilon\left[\frac{A(X)}{Z}\right] = \sum_{X\in\{0,1\}^Q} A(X)\, p\left(\frac{X}{Z}\right)$$

(2)

$$A(X) = \sum_q \delta(X_q, 1)$$

(3)

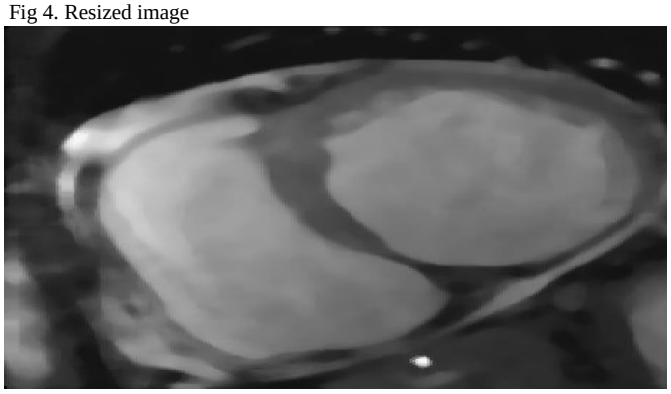
Then the thickness is measured and combined with area to get the volume.

IV. RESULTS AND DISCUSSIONS

A. *Resizing*

The image that is read is resized to a particular dimension as shown in Fig 4.

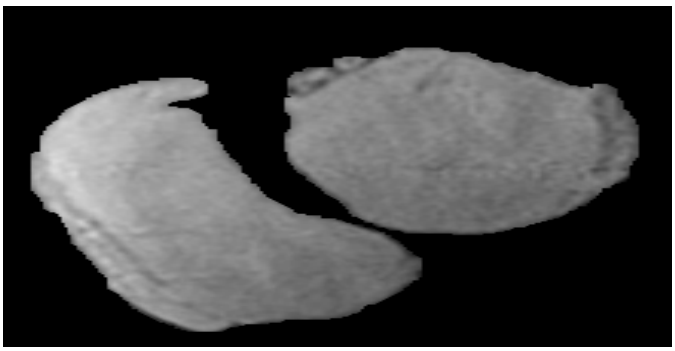
Fig 4. Resized image



B. *Median filter*

The Image is Filtered using Median Filter to make it noise free. The noise free image is shown in Fig 5

Fig 5. Filtered Output



C. *Bayesian Estimation*

The filtered image is then subjected to the algorithm procedure wherein it is separated into the Right part as in Fig 6. And the left part as in Fig 7.

Fig 6 Separation of the Right Ventricle

Fig 7. Separation of the Left Ventricle

The image is then combined and the thickness is denoted in yellow as shown in Fig 8.

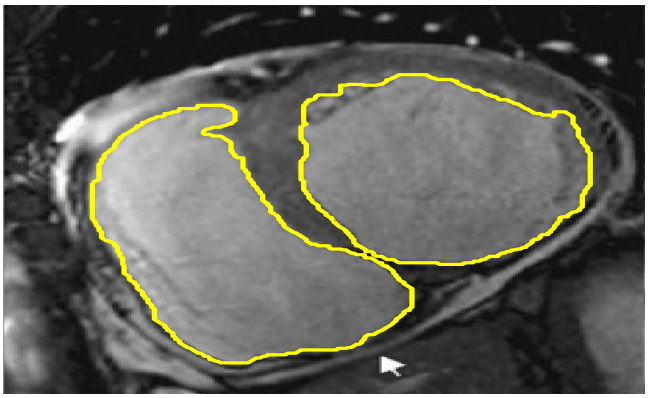


Fig 8. Thickness with Bayesian estimation

The output image for Brain, Kidney and Lungs is shown as follows in Fig 9, Fig 10, and Fig 11.

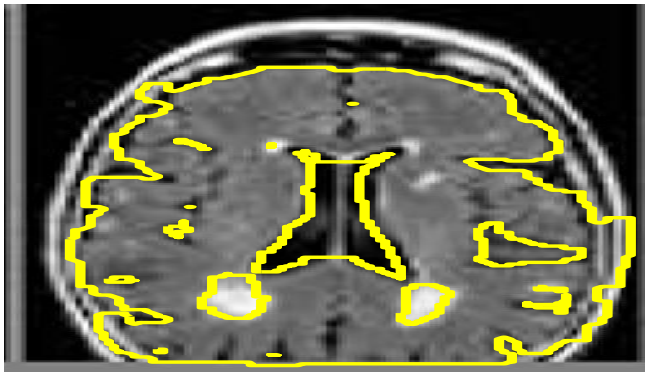


Fig 9. Brain

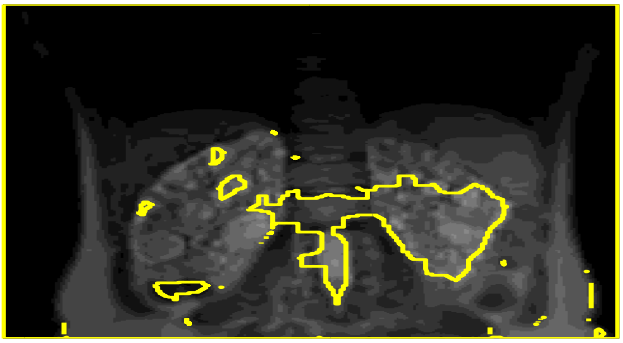


Fig 10. Lungs

Fig 11. Kidney

The Area and the Volume is then Estimated along with the Computation time in Matlab 2010 version which is shown in **Table 1.**

TABLE I. HEART

S.No	*Parameter*	*Value*
1.	Area of LV	11134
2.	Area of RV	12016
3.	Volume of LV	11630
4.	Volume of RV	12638
5.	Computation Time	1.26s

The area of the left ventricle is found to be less than that of the Right also the volume. This can be compared with the areas and volume of a failed Heart so as to identify any sort of abnormalities in the Organ that is examined.

TABLE II. LUNGS

S.No	*Parameter*	*Value*
1.	Area of Left part	114
2.	Area of Right Part	60547
3.	Volume of Left part	162
4.	Volume of Right part	61431
5.	Computation Time	8.4397

TABLE III. KIDNEY

S.No	*Parameter*	*Value*
1.	Area of Left part	8552
2.	Area of Right Part	12101
3.	Volume of Left part	975
4.	Volume of Right part	12709
5.	Computation Time	7.6596

V. CONCLUSION

The proposed method serves to be highly efficient in computation time thereby overcoming the delay. The Bayesian algorithm helped in the clear distinguishing of the left and Right part of the examined organ. Later the blood flow is also known from the area and the volume hence giving appropriate information about the disorders in the organ.

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