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DEMPSTER SHAFER EVIDENCE THEORY BASED IMAGE FUSION AND EXTRACTION OF ARTERY DISEASE

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ABSTRACT: ***Image processing consists of the several operations such as image fusion, image segmentation, image compression, image filtering, image classification etc. In this study we have chosen the two image processing techniques such as image fusion, image segmentation for detecting the artery disease. In present study image fusion is done based on the Dempster-Shafer evidence theory (DS Theory) and image segmentation is done by Fuzzy K-Means Clustering (FKM). Image fusion process consists of combining information from different sources in order to improve the decision process. Dempster has given a rule to combine evidences coming from different independent sources. Image segmentation is the technique of dividing all elements in a group has a common property. In medical image, the common property is usually the elements that belong to the same tissue type or organ. Applying FKM clustering technique, Segmentation allows the visualization of the structure of interest by removing unnecessay information. Segmentaion also enables structure analysis such as calculating the thickness of the artery disease which is the important part of image guided surgery.***

Keywords: FKM, Image Segmentation, Image Fusion, DS Evidence Theory.

I INTRODUCTION

Image processing is a method to convert an image into digital form and perform some operations on it, in order to get an enhanced image or to extract some useful information from it. In this paper, Image processing techniques are applied on the medical image. Ultrasound imaging uses high-frequency sound waves to view soft tissues such as muscles and internal organs. Because ultrasound images are captured in real-time, they can show movement of the body's internal organs as well as blood flowing through blood vessels. The different types of ultrasound modes are A-Mode (Amplitude Modulation), B-Mode, (Brightness Modulation), M-Mode (Motion Mode). In this paper B-Mode Modulation is used for extracting the artery disease because unlike A-Mode and M-Mode, B-Mode consists of brightness with the absence of vertical spikes and its displays an image of large and small dots, which represent strong and weak echoes, respectively. If the images are corupted by randam variation in intensity, illumination or poor constant can't be used directly for further purpose, to rectify the problem the filter method is used. Medical image contain

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much pathology information. In order to denoise the speckle noises from the image, filtering technique is used in proposed method.

1.1 MOTIVATION

In the present study, Medical image have been carefully examined to understand the characteristic and boundary extraction. Different methods for boundary extraction of carotid artery have been proposed in recent years and different research groups have reported contradictory results. The Research of this paper is to develop novel technique to find the artery disease with Fuzzy K-Means clustering. The techniques are tested with B-mode Ultrasound (US) images of the carotid artery.

1.2 SCOPE AND OBJECTIVE

The scope to this research is calclulating the thickness of the disease which is the important part of image guided surgery.

The rest of the paper is organized as follows. Section 2 presents the related works. Problem description are discussed in section 3. In section 4, we describes the proposed method. The implementation results are in section 5. Finally conclusion are presented in section 6.

II RELATED WORKS

In [1], the algorithm is adaptive to the image content in the sense that influence from the neighbouring pixels is suppressed in non homogeneous regions in the image. A cluster merging scheme that merges two clusters based on their closeness and their degree of overlap is presented. Through this merging scheme, an `optimal' number of clusters can be determined automatically as iteration proceeds. In [5], the homogram considers both the occurrence of the gray levels and the neighboring homogeneity value among pixels. Therefore, it employs both the local and global information. Fuzzy entropy is utilized as a tool to perform homogram analysis for finding all major homogeneous regions at the first stage. Then region merging process is carried out based on color similarity among these regions to avoid over segmentation. The proposed homogram-based approach (HOB) is compared with the histogram-based approach (HIB). In [10], Fuzzy clustering techniques, especially fuzzy c-means (FCM) clustering algorithm, have been widely used in automated image segmentation. However, as the conventional FCM algorithm does not incorporate any information about spatial context, it is sensitive to noise. To overcome this drawback of FCM algorithm, a novel penalized fuzzy c-means (PFCM) algorithm for image segmentation is presented in this paper. The algorithm is formulated by incorporating the spatial neighbourhood information into the original FCM algorithm with a penalty term. The penalty term acts as a regularize in this algorithm, which is inspired by the neighbourhood expectation maximization (NEM) algorithm and is modified in order to satisfy the criterion of the FCM algorithm. Experimental results on synthetic, simulated and real images indicate that the proposed algorithm is effective and more robust to noise and other artifacts than the standard FCM algorithm.

II-PROBLEM DESCRIPTION

Carotid artery is one of the parts that is hard to identify by inexperience doctor or radiologist because the shape is almost

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same like the muscle layer. A common, non-invasive test used to check for carotid artery disease is a Doppler ultrasound. This variation of the conventional ultrasound assesses blood flow and pressure and possible narrowing of the blood vessel by bouncing high-frequency sound waves (ultrasound) off red blood cells.

Clustering is a process for classifying objects or patterns in such a way that samples of the many clustering strategies have been used, such as the hard clustering scheme and the fuzzy clustering scheme, each of which has its own special characteristics. The conventional hard clustering method restricts each point of the data set to exclusively just one cluster. As a consequence, with this approach the segmentation results are often very crisp, i.e., each pixel of the image belongs to exactly just one class. However, in many real situations, for images, issues such as limited spatial resolution, poor contrast, overlapping intensities, noise and intensity in homogeneities variation make this hard (crisp) segmentation a difficult task. Due to this fuzzy theory was proposed, fuzzy clustering as a soft segmentation method has been widely studied and successfully applied in image segmentation. Among the fuzzy clustering methods, fuzzy K-means (FKM) algorithm is the most popular method used in image segmentation, because it has robust characteristics for ambiguity and can retain much more information than hard segmentation methods. Although the conventional FKM algorithm works well on most noise-free images, it has a serious limitation, i.e., it does not incorporate any information about spatial context, which cause it to be sensitive to noise and imaging artifacts.

In existing Fuzzy C-Means clustering and similar algorithms are used that have problems with high dimensional data sets and a large number of prototypes. Therefore FKM is used in proposed. The fusion is done on image using Dempster-Shafer rule of combination to find the artery disease. [9] proposed a method in which the minimization is per-formed in a sequential manner by the fusion move algorithm that uses the QPBO min-cut algorithm. Multi-shape GCs are proven to be more beneficial than single-shape GCs. Hence, the segmentation methods are validated by calculating statistical measures. The false positive (FP) is reduced and sensitivity and specificity improved by multiple MTANN.

IV PROPOSED MEHTOD

4.1 DEMPSTER'S MODEL

Dempster introduced a special form of upper and lower probabilities model. For the static part of the model, he considers a space X endowed with a probability measure PX and a mapping M from space X to space 2Y. Let M(x) denote the image of x under M for x∈X. He defines upper and lower probabilities measures P* and P* on Y such that

∀A”Y:
$P*(A) = PX(M*(A))$
and
$P*(A) = PX(M*(A))$
Where,
$M*(A) = \{x: x∈X, M(x)”A, M(x)\neq Ø\}$
and
$M*(A) = \{x: x∈X, M(x)∩A\neq Ø\}.$

Dempster's rule of combination, a rule to combine the beliefs induced by two distinct pieces of information.

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4.2 FUZZY K-MEANS ALGORITHM

Fuzzy K-means (FKM) is a method of clustering which allows one piece of data to belong to two or more clusters. This method is frequently used in pattern recognition. It is based on minimization of the following objective function:

$$J_m = \sum_{i=1}^{N}\sum_{j=1}^{C} u_{ij}^m \left\| x_i - c_j \right\|^2 \quad , \quad 1 \le m < \infty$$

where m is any real number greater than 1, u_{ij} is the degree of membership of x_i in the cluster j, x_i is the ith of d-dimensional measured data, c_j is the d-dimension center of the cluster, and ||*|| is any norm expressing the similarity between any measured data and the center.

Fuzzy partitioning is carried out through an iterative optimization of the objective function shown above, with the update of membership u_{ij} and the cluster centers c_j by:

$$u_{ij} = \frac{1}{\sum_{k=1}^{C}\left(\frac{\left\| x_i - c_j \right\|}{\left\| x_i - c_k \right\|}\right)^{\frac{2}{m-1}}}$$

$$c_j = \frac{\sum_{i=1}^{N} u_{ij}^m \cdot x_i}{\sum_{i=1}^{N} u_{ij}^m}$$

This iteration will stop when ε is a termination criterion between 0 and 1, whereas k are the iteration steps. This procedure converges to a local minimum or a saddle point of J_m. The algorithm is composed of the following steps:

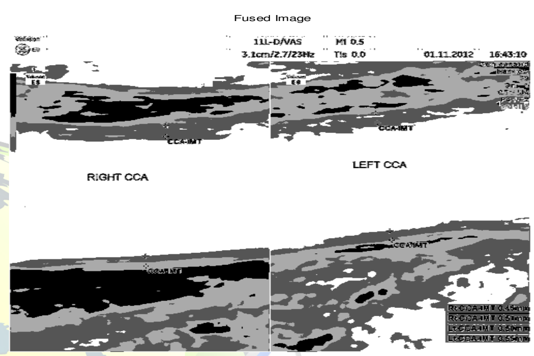
$$\max_{ij}\left\{\left| u_{ij}^{(k+1)} - u_{ij}^{(k)} \right|\right\} < \varepsilon$$

1. Initialize U=[u_{ij}] matrix, $U^{(0)}$
2. At k-step: calculate the centers vectors $C^{(k)}$=[c_j] with $U^{(k)}$
3. Update $U^{(k)}$, $U^{(k+1)}$

$$u_{ij} = \frac{1}{\sum_{k=1}^{C}\left(\frac{\left\| x_i - c_j \right\|}{\left\| x_i - c_k \right\|}\right)^{\frac{2}{m-1}}}$$

4. If || $U^{(k+1)}$ - $U^{(k)}$||< ε then STOP; otherwise return to step 2.

V IMPLEMENTATON RESULT



The Experiment is carried out with the help of MATLAB 7.6. Ultrasound B-Mode image of 976 x 735 pixels is selected in this paper for detecting the artery disease. The image contains 200 KB raw pixels. To presented in this paper an approach of image segmentation, image fusion.

The steps for detecting artery disease using image fusion and image segmentation techniques are described below:

Step 1: Give Ultrasound B-Mode image as input.

Step 2: Convert color image into gray scale image.

Step 3: Apply Dempster-Shafer theory for fusion of original image and gray scale image.

Step 4: Apply Fuzzy K-Means algorithm for image segmentation and appropriate image from segmented image in which artery disease is present.

Step 5: Remove noise and other particles from final image using filtering technique.

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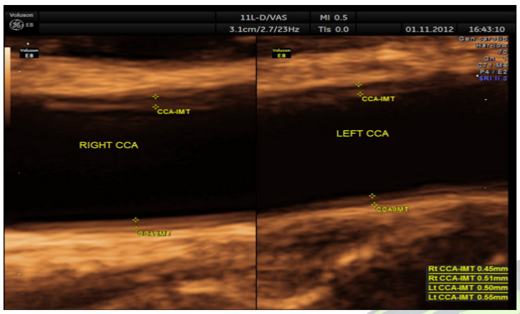
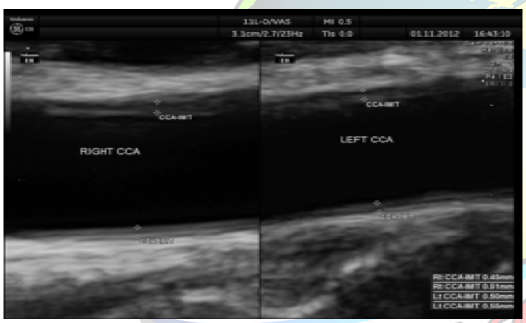
Step 6: Final output with artery disease is found.

5.1 Original Image



5.2 Gray Scale Image



5.5 Filtered Image

IMAGES IMA	FUZZY DISTANCE	ECUCLIDEA DISTANCE	IMT
Image 1	0.158	6.895	1.719 mm
Image 2	0.198	6.444	1.217 mm
Image 3	0.128	6.882	0.423 mm
Image 4	0.176	6.662	1.217 mm
Image 5	0.135	6.575	1.164 mm

Table 5.1.1 IMT Calculation

Five different types of ultrasound B-Mode images are used for analysis and the result is for different images is shown in above table.

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VI-CONCLUSION

Dempster-Shafer's evidence theory and Fuzzy K-Means algorithm is presented in this paper. In existing method, the FCM algorithm is used for segmentation, where the computation time is slow and clustering distance is more. To overcome the drawback fuzzy k-means algorithm is used as proposed. The experimental result shows that the FKM algorithm is outperforms well as it can be seen from table 5.1.1.

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