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Liver Boundary Segmentation Using Fuzzy C Means In Ct

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ABSTRACT:
Liver Segmentation is a major problem of medical side. In liver Segmentation is a much more challenging task among other segmentations. So we have to introduce automatic segmentation of liver in CT images and MRI has become significant in medical side, we focus on managing the domain from MRI to CT volumes on the example of 2D and 3D liver segmentation. Here we have to implement fuzzy clustering method to the purpose of segment a liver disease affecting area. The purpose of this method is to use for the segment the liver boundary values using fuzzy C means and Fuzzy clustering algorithm and further processed using Support Vector Machine (SVM for classification). The Spatial liver boundary constraints are named with different method such as the user can choose on particular region of interest and iterate the contour methods until more accurate result to be obtained.
Keyword: Fuzzy C means, Fuzzy Clustering, MRI, SVM.

I. INTRODUCTION

Organ Segmentation is an important task in clinical practice, as it is often used for preoperative planning and aids in image based diagnostics. The liver is an organ only found in synthetic which detoxifies various metabolities, synthesizes proteins and produce biochemical necessary for digestion. Particularly the segmentation of the liver is essential for volume measurement and computer assisted surgery. In humans can be find it is located in the right upper quadrant of the abdomen, below the diaphragm. Liver has a kind of complexity in image segmentation, which rises from the similarity between the intensity values of liver and other surrounding organs in the abdomen as spleen, kidney and stomach. Magnetic Resonance Imaging(MRI) is a well known modality of liver imaging and Computed Tomography (CT) images have been widely used for diagnosis of liver disease and volume measurement for liver surgery or transplantation. In particular approaches for semantic segmentation of natural images have been adapted to the special properties that medical images of various modalities yield. So we have to improve the segmentation for basic of step regarding other image processing algorithms.

II. RELATED WORK

In [3] Liver Segmentation in CT with MRI data: zero-shot domain adaption by contour extraction and shape priors D.D.Pham, G.Dovletov, and J.Pauli address the problem of domain adaption for segmentation tasks with deep convolution neural network. So it can focus on managing the domain level from MRI to CT volumes in 3D liver segmentation. Where domain adaption between modalities is particularly of practical importance, as different in their clinical routine. Zero-shot domain adaption method due to the fact that abdominal image-to-image translation tasks seem to be more difficult than pseudo CT generation. Although these kind of adversarial approaches do not require paired training data, major advantage of these method to contour and shape based strategy is, that it does not require any target domain datasets at all and it straight forward to implement.

In [7] A comparative study of K-means and Graph cut 3 method of liver segmentation Shraddha Sangewar and Premadaigavane to comparative analysis between K-means and graphcut segmentation technique for extraction of liver organ is done and on the basis of the result obtained different parameters related to liver are computed. It is based on comparison between two different segmentation techniques. In order to obtain enhance view of liver organ, region growing and canny edge detection is used.

In [11] Automatic liver segmentation for volume measurement in CT images Seong-Jae Lim, Yong-YeonJeong, Yo-Sund Ho proposed the morphological filter with region labeling and clustering to detect the search range and to generate the initial liver contour. In this search range, deform liver contour using the labeling based search

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algorithm following pattern features of the liver contour. The experimental measurement of area and volume is compared with those using manual tracing method as a gold standard by the radiological doctors and demonstrates that this algorithm is used to effective for automatic liver segmentation and volume measurement method of the liver. The final results are compared to manually segmented image and manually volume measured results by the radiologist and positive/negative error is almost not existed.

In [13] Liver Segmentation in MRI: A fully automatic method based on stochastic partitions F.Lopez-Mir, V.Naranjo, J.Angulo, M.Alcaniz, L.Luna present a new method for liver segmentation based on the watershed transform and stochastic partitions. It improve accuracy of selected contours, the gradient of the original image is successfully enhance by applying a new variant of stochastic watershold. The obtained results in comparison to other methods demonstrate that the new variant of stochastic watershed is a robust tool for automatic segmentation of the liver in MRI. It presents a new fully automatic method for liver segmentation in MRI for clinical use. Finally, based on the liver gray level properties and the inter slice co-location of organ, a classifier was implemented to obtain the final mask.

In [15] Liver segmentation in MRI images based on whale Optimization algorithm AbdallaMostafa, Aboul Ella Hassanien, Mohamed Houseni, HeshamHefny was proposed tested using a set of 70 MRI images, annotated and approved by radiology specialists. The resulting image is valid to using Structural Similarity Index Measure (SSIM), Similarity Index (SI) and other five measures. The purpose of Whale Optimizer Algorithm (WOA) is a bio-inspired technique which is used to get the optima solution, where the optimal solutions is considered the image clusters. When we cluster the image the clustered image is multiplied by the statistical image. This removes a part of the abdomen includes other organs. It required clusters to representing the liver pixel is picked up manually to get an initial segmented liver. The overall accuracy of the experimental result showed accuracy of 94.75% using SSIM and 96.5 using SI%.

III. METHODS:

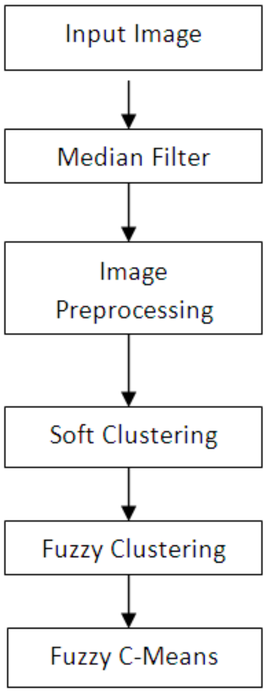

Fig.1.The proposed method is composed of three phases: Median Filter, Fuzzy clustering, Fuzzy C-means

A) CT/MRI:

Computed Tomography(CT) scan. It is the detailed images of internal organs are such as liver, heart etc., are obtained by this type of sophisticated x-ray device. The CT scan reveal anatomic details of internal organs for liver, heart, kidney etc.. that cannot be seen in conventional x-rays. The term " Computed Tomography or CT scans are refers to a computerized x-ray imaging procedure abdominal part in which a narrow beam of x-rays is aimed at a patient and very fast rotated around the body, producing signals transfer that are processed by the machine's computer to generate cross- sectional images or " slices" of the body.

Magnetic Resonance Imaging (MRI) scan used to produces an image of the body using a strong magnet and radio waves. MRI scan can show the muscles of liver, ligaments and tendons, nerve roots and cartilage with precision. An MRI scan uses a large magnetic waves, radio waves comparing to CT, and a computer to created a detailed, cross-sectional image of internal organs and structures. MRI scanner would be used anomalies of the brain and spinal cord, tumors, cysts and other organ anomalities in different parts of the

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body diseases of the liver and other abdominal organ.

B) MEDIAN FILTER:

A median Filter operates over a window in filtering techniques by selecting the median intensity in the window. The median filter is a non-linear digital technique filtering method, often used to remove noise from an image or signal. In noise reduction is a typical preprocessing of step to improve the results of later processing (for example, edge detection on an image).

Neighborhood pixel point in an averaging filter can suppressed in isolated out-of-range noise, but the side effect is that can also blurs sudden changes such as line features, sharp edges and other filter images to find a corresponding filter technology to high spatial frequencies.

Specifically the median filter replaces a pixel by the median method , to instead of the average of all pixels in a neighborhood

Y[m,n]=median{x[i,j],(i.j)£w}

Where w represents a neighborhood defined by the user, centered around location [m.n] in the image.

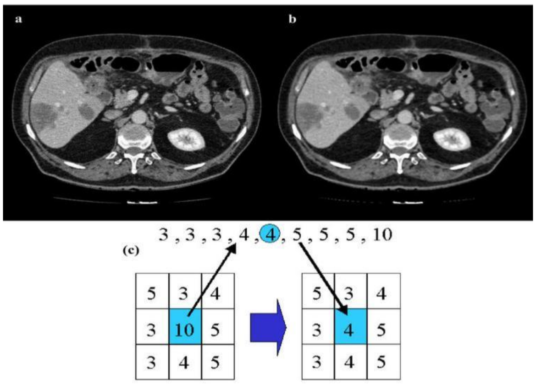

Fig 2. Results of median filtering, original image (a)applied to a CT image (b)median filter.

C) IMAGE PREPROCESSING:

Image Preprocessing is a common name for image operations technique method with in an images at the lowest priority level of abstraction in both input and output are becomes intensity images. The aim of preprocessing is an improve of the image data quality and that suppresses unwanted distortions or enhance some images features important for further processing. Four categories of images preprocessing methods that allocate to the size of the pixel neighborhood that is used for the calculation of a new pixel brightness. (i) The pixel brightness transformation (ii) A geometric method transformation (iii) preprocessing methods that use a local neighborhood pixel of the processed method and (iv) image restoration that requires to knowledge about the entire image. Image preprocessing methods use the considerable redundancy a value in images. Neighboring pixels align corresponding to one object in real images have an essentially comes to the same or similar brightness value.

(D) SOFT CLUSTERING

Soft Clustering is about grouping the data items such than an item can exist in multiple clusters. Fuzzy C-means is a famous soft clustering algorithm. It is based on the fuzzy logic method and it is often with to referred as the FCM algorithm. The way FCM works is that the items are assigned probabilities which are essential expressing the strength of the belonging of the item into the cluster.

(E) FUZZY C-MEANS CLUSTERING

In Fuzzy clustering, every point has a degree of belonging to clusters, an in fuzzy logic, rather than belonging completely to just one cluster. Thus point on the edge of a cluster may be in the cluster to a lesser degree than points in the center of cluster. The FCM algorithm is one of the best and most widely used fuzzy clustering algorithms. The FCM algorithm attempts to partition of a finite collection of elements in clustering point that define X={…..} into a collection of C fuzzy clusters with respect to some given criterion. In FCM algorithm is based on minimization pixel point of the following objective function.

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

Where m, it denotes (the fuzziness Exponent) is any real number is greater than 1, and N is the number of data, C is the number of clusters, Uij is the degree of membership of Xi in the cluster j, Xi is the ith of d-dimensional measured data, Cj is the d-dimensional center of the cluster and || *|| is any norm expressing the similarity between any measured data and the center.Given a finite set of data, the algorithm returns a list of C cluster centers V, such that

V=Vi ,i=1,2,3,….C and a membership matrix U such that U=Uij, i=1,… C, j=1,….n where Uij is a numerical value in [0,1] that tells the degree to which the element Xj belongs to the ith cluster.

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IV. EXPERIMENTS DATA & IMPLEMENTATION

The experimental steps consists preprocessing an Image, and fuzzy algorithm to grouped a cluster in a liver tumor part and it performed in CT scan images.

1. ENHANCED MEDIAN FILTER

Median filtering technique is one kind of smoothing level technique as is linear Gaussian filtering. We are using a smoothing techniques in a median filters, and that are effective at removing noise in smooth patches or smooth regions of a signal, but adversely affect edges. So we have to choose a median filter to identify the tumor in liver CT images. To increasing the contrast level of the CT image, that the intensity values is increase and high frequencies of the original images were removes and adjusted firstly using median filter approach. It if followed by a transforming method of the abdominal CT image to NS domain. It consumes less time consuming and less sensitive to noise and performs well on uniform CT images.

Enhanced median filter algorithm:

```
AllocateoutputPixelValue[imagewidth]
[image height]
allocate window[window width × window height]
edgex := (window width / 2) rounded down
edgey := (window height / 2) rounded down
for x from edgex to image width - edgex do
for y from edgey to image height - edgey do
i = 0
forfx from 0 to window width do
forfy from 0 to window height do
window[i] := inputPixelValue[x + fx - edgex][y + fy
- edgey]
 i := i + 1
sortentries in window[ ] outputPixelValue[x][y] :=
window[window width *window height / 2]
```

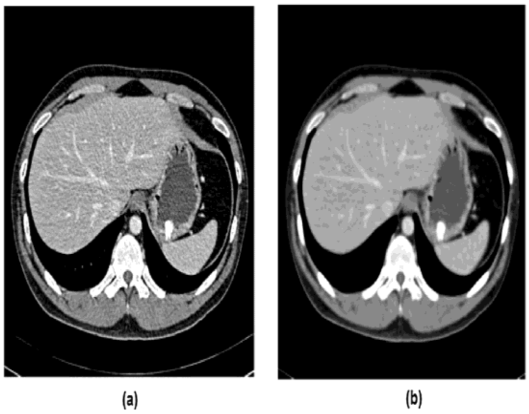

Fig.2. CT liver enhancement using median filter approach. a) The original image b) enhanced CT image.

2. FUZZY CLUSTERING

Fuzzy Clustering is conducted on the enhanced image to classify the pixel into different tissue types. It can be generalized in partition clustering methods(such as K-means) by allowing an individual to be partially classified into more than one cluster. In regular clustering, it can be define each level of individual is a member of only one cluster. But in fuzzy clustering that cluster with membership can spread among all clusters.

A regular clustering method searching for three clusters will force two points into specific clusters. This may cause distortion in the final solution. Fuzzy clustering assign a probability of each cluster in equal membership probability pixel connect two points are outlier.

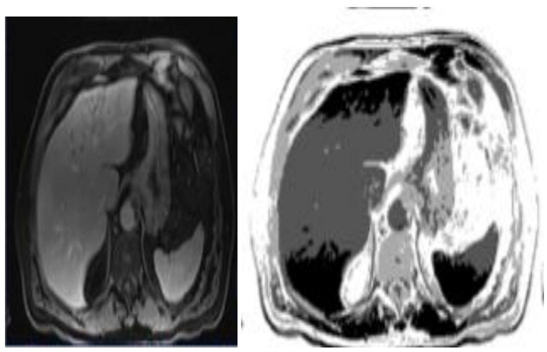

Fig.3, Median filter liver image covert into fuzzy clustering a) median filter b) fuzzy cluster.

3. FUZZY C-MEANS

Fuzzy C-means (FCM) is a data clustering technique which a data set is grouped into N clusters. The functions starts with a random initial guess for the cluster centers. That is the mean location of each cluster. We select a dataset in

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assign every data point a random membership grade for each cluster.

Fuzzy C-means algorithm:

```
x=[2 3 4 5 6 7 8 9 10 11];
c1=3;c2=11;
for j=1:1
k=1;
for i=1:length(x)
u1(k)=1/(((x(i)-c1)/(x(i)-c1))^2+((x(i)-c1)/(x(i)-
c2))^2);
if(isnan(u1(k))) u1(k)=1;end
u2(k)=1/(((x(i)-c2)/(x(i)-c1))^2+((x(i)-c2)/(x(i)-
c2))^2);
if(isnan(u2(k))) u2(k)=1;
end
k=k+1;end
u=[u1;u2;u1+u2]'
c11=sum((u1.^2).*x)/sum(u1.^2)
c22=sum((u2.^2).*x)/sum(u2.^2)
c1=c11;c2=c22;
```

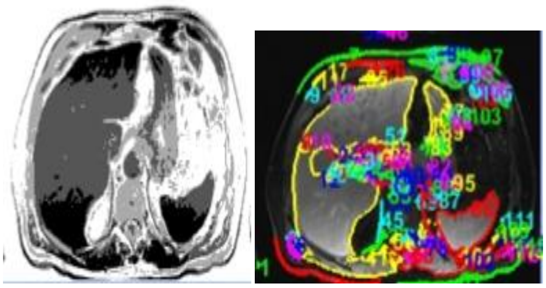

Fig.4, cluster segment find in a liver boundary values. a) cluster image b) boundary calculation

V. RESULT& DISCUSSIONS

The Proposed work consists of extracting the liver organ from CT images using segmentation techniques and this is our first implementation part and here we comparing the results so as to detect which technique gives the accuracy in extracting the proper size and shape of the liver. The proposed work starts with in preprocessing technique which a help to denoise the input image. Here, a noise is removed with the help of median and average filter. So this process is essential for remove a redundant bits and noise during transmission. FCM algorithm is applied by clustering a data and it centralized a center point. Here, the pixel of same intensities form groups by fixing a certain priority.

VI. CONCLUSION AND FUTURE WORK

In this paper, we have to detect the noise image and to cluster the pixel point to using a fuzzy C-means algorithm and finally find out the liver boundary pixel. In future work, we have to segment the liver tumor area and decrease the error time detection.

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