INTEGRATING SPATIAL FUZZY CLUSTERING WITH LEVEL SET METHODS FOR LIVER SEGMENTATION FROM COMPUTED TOMOGRAPHY SCANS

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Abstract

This article presents a fully automatic segmentation method of liver CT scans using fuzzy c-mean clustering and level set. First, the difference of unique image is improved to make boundaries clearer; second, a spatial fuzzy c-mean clustering combining with anatomical previous information is engaged to extract liver area automatically Thirdly, a distance regularized level set is used for modification; finally, morphological operations are used as post-processing. The experiment result shows that the method can achieve high accuracy (0.9986) and specificity (0.9989). Comparing with standard level set method, our method is more successful in dealing with over-segmentation difficulty.

Keywords

Liver Segmentation; Fuzzy c-Mean Clustering; Level Set

1. INTRODUCTION

Liver segmentation from CT images is the key research work for the establishment of three dimension representation of liver, which has great importance on the analysis of liver disease. A selection of liver CT image segmentation methods have been projected. These methods include region growing [1-3], level set [4-6], clustering [7, 8], statistic shape representation [9], neural network [7] and support vector machine (SVM) [10-12], etc. The following briefs these progresses.

Ruskó et al. [1] presented an adaptive region growing method. First, the kernel region was determined based on the strength of gray level; second, the liver and heart were divorced based on the anatomical characteristic; thirdly, an enhanced region growing was used to slice the image; finally, a post-processing was engaged to deal with the under-segmentation.Li et al. [4] presented a distance regularized level set method. The main advantage is that it allows the use of more

general and efficient ini- tialization of the level set function. Therefore, relatively large time steps can be used in the finite difference scheme to reduce the number of iterations.

In [9], the author presented an approach for automatic liver segmentation which was based on statistic shape model (SSM) inte- grated with an optimal-surface-detection strategy. First the generalized Hough transform was used to build the average shape model of liver; then the subspace of SSM wasinitialize; finally, deform the shape model to adapt to liver contour through an optimal-surface detection ap- proach based on graph theory. In [10, 11] wavelet transform was used to achieve texture feature extraction; then SVM was employed to make the classification; fi- nally, region growing [10] ormorphological operations [11] was utilized as the post-processing. The programming language used with MATLAB is usually referred to as MATLAB script or M-script. After becoming familiar with the basic syntax of the M-script, a number of useful utilities are available to you that allow you to make extended uses of MATLAB. You can, for example, write programs that involve simulation. You can also create graphics, web pages, and GUI applications. When you develop programs using MATLAB, you can output the results to a number of media, including graphics files, HTML pages, PDF files, and Word documents. You can also connect up MATLAB with other applications, such as Excel or LabView to make extended uses of it. Since it is programmed in part using Java, you can modify it in the background using Java. However, region growing may lead to over-segment when the gray level intensity of liver and around tissues is similar; when us- ing morphological operation as post-processing alone, the parameters should be adjusted carefully, and the ro- bustness may be a problem. Li et al. [5] presented a new FUZZY level set algorithm.

In this paper, we present a fully automatic segment- tion method using fuzzy c-mean clustering combining with level set.

2.LITERATURE SURVEY

The progress of tumor growth and/or shrinkage in tumor treatment can be tracked by tumor segmentation from magnetic resonance (MR) images. In this paper we separates non-enhancing brain tumors from healthy tissues in MR images by automatic segmentation method.An initial segmentation is computed using an unsupervised fuzzy clustering algorithm.[10][11] Then, integrated domain knowledge and image processing techniques contribute to the final tumor segmentation.Our results show that we detected all six non-enhancing brain tumors, located tumor tissue in 35 of the 36 ground truth (radiologist labeled) slices containing tumor and successfully separated tumor regions from physically connected CSF regions in nine of nine slices. This section presents only what is obvious to most people acquainted with Windows applications, but it is useful for one reason, to remind you that most of the standard operations of MATLAB can be performed using the main menu options. As a note, you can also create M-files by selecting File > New > Blank M-file from the top menu. You then immediately see the Editor window. We have deliberately generated a polygon which is symmetrical along the vertical axis for two reasons. First, since lateral ventricles in a healthy brain will be near symmetrical across the longitudinal tissure separating the left and right hemispheres, a good approximation of healthy ventricles should be symmetrical across the same axis.

3. METHODOLOGY

The current methodology is based on voxel-wise features extracted from a single modality, such as FLAIR. In the future, we plan to explore multimodality features that have shown to minimize ambiguities in identifying abnormalities in many imaging applications, and especially in medical research [11][12]. Within the proposed mathematical framework, the application of the method in clinical studies with multiple sequences is easy with the only difference being the further increase in dimensionality. We also plan to investigate wavelet-based or other multiscale features that reduce spatial and spectral redundancy and, therefore, allow a more compact representation of the data, thus providing a means to efficient dimensionality reduction. The collection of all panels in MATLAB is referred to as the desktop. Notice the Current Folder (Directory) panel is on the left. This panel provides a list of the files in the directory you have designated as the current directory. At the top of the desktop, you see a Current Folder field and a browse button.You can always restore these by selecting options from the Desktop menu It has been observed (in the context of cortical surface parcellation) that the optimal warp smoothness ismostly constant across subjects and that good segmentation results can be obtained for a range of smoothness levels.

4. THE GRADIENT FLOW OF THE ENERGY FUNCTION

The FCM algorithm assigns pixels to each class by using fuzzy memberships. Let (1,2,,j xj denotes an image with n pixels to be partitioned into c clusters, wherejx represents features data.An iterative optimization that minimizes the cost function is defined and it's given by

$$J = \sum_{i=1}^{c} \sum_{j=1}^{n} u_{ij}^{m} d_{ij}^{2}$$

$$d_{ij} = \left\| c_i - x_j \right\|$$

The probabilityof similar gray level intensity be-long to the similar cluster is large.The spatial function is defined as and it given by

$$h_{ij} = \sum_{k \in NB(x_j)} u_{ik}$$

Level set is a continuous deformable model method with implicit representation. Its major idea is to implant the de-formable representation in a d+1 dimensional space, to slice iteratively an entity in a d dimensional space, using partial differential equations. The most important benefit of level sets is that it allows changes of surface topology unreservedly.

$$\begin{cases} \frac{\partial \phi}{\partial t} + F\left|\nabla \phi\right| = 0 \\ \phi(0, x, y) = \phi_0(x, y) \end{cases}$$

The purpose of level set function and the signed distance property1, are of the zero level set, in order to ensure correct calculation for curve evolution.

$$\frac{\partial \phi}{\partial t} = -\mu \frac{\partial R_p}{\partial \phi} - \frac{\partial \varepsilon_{ext}}{\partial \phi} = \mu div\left(d_p\left(|\nabla \phi|\right)\nabla \phi\right) - \frac{\partial \varepsilon_{ext}}{\partial \phi}$$

The distance regularization term, the DRLSE can be implemented easily and more resourceful numerical scheme in both full domain and narrow band implementations than standard level set formulations.

The work in this paper is based on spatial fuzzy c-mean clustering and a distance regularized level set. The problem of both methods above is that they are semi-automatic methods. The spatial fuzzy clustering needs user to choose which class is the liver, so the level set refine- ment can continue on that class. The distance regularized level set needs user to select seed points. Moreover, the number of cluster group is fixed. In some cases, liver tissue may be clustered into different groups. For these reasons, human participate is needed. To make the method fully automatic and achieve better segment result

5. EXPERIMENT RESULT

Experiments have shown effectiveness proposed in completely automatic method in formation documents and categorization that is based in the applied clustering algorithm for full texts . Software implementation of the method designed for digital libraries as an element of their search engines. Such an element capable of be as independent search mechanism and serve as a means to improve the quality of other search engines , for example, search by keyword.

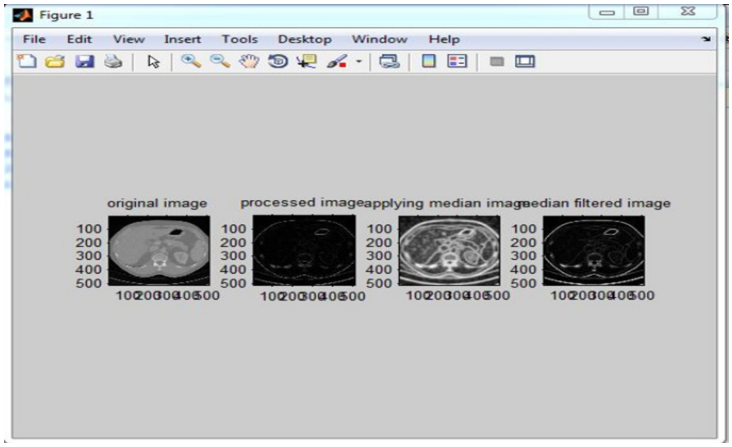

Fig.1 Input Original Image and after filtering

It also proposed method can be used in the preparation tools for analyzing the dynamics of scientific technical expertise in electronic document collections. The first attempt to create an information system based on the Collection of documents as a group. The program interface contained flowcharts groups , allowing for the conversion images to other formats (JPEG / PNG) for reducing the size of a partial loss color information , and the resulting scheme can not be used to navigate the same means that the local system.Search for images intended for searching for images similar to the fragment . The input is investigated image , and the output should appear

images from the database , the most similar to original. The implementation stage involves careful planning, investigation of the existing system and it's constraints on implementation, designing of methods to achieve changeover and evaluation of changeover methods.

Although, as previously stated, not all can be calculated singles, but only some of them, according to a heuristic Similarity and replaced by simpler means. Algorithm showed almost 100% completeness The duplication content in the document are detected based on the template of syntax. It includes the page details, text font, text captions, text inside the table. When the search of the particular document is finished, the algorithm will not compare the same data again and again to test for inclusion. it improves

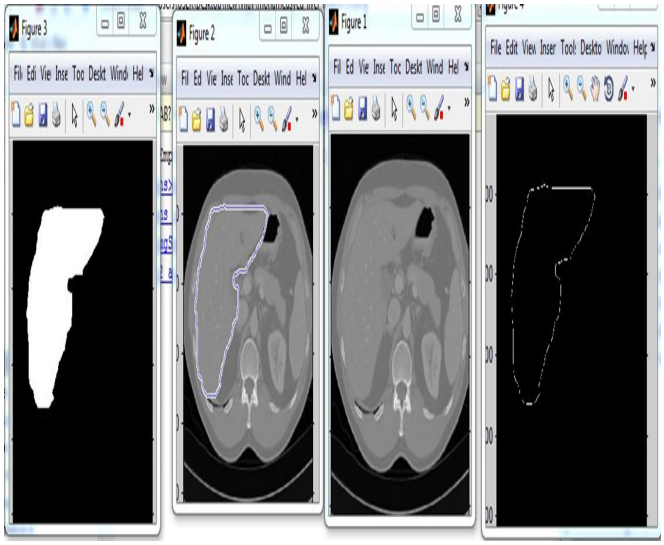

Fig.2 Our results after all process

In this method, the experimental results are evaluated through evaluation metrics namely, specificity and accuracy. The obtained results depict that the proposed duplicate content detection approach produces better results than the exiting classifier in terms of sensitivity, specificity and accuracy.

6. CONCLUSION

In our work, a fully automatic fuzzy clustering segmentation method combining with level set has been presented. It employed spatial fuzzy c-mean clustering with anatomical previous knowledge to take out liver area from CT scan automatically. The distance regularized level set was used for refinement. The experiment result shows high accuracy (average 0.9986) and specificity (average 0.9989)in all testing data. Compared with other method, our method is fully automatic and can achieve better segmentation result even if the image is not clear. The future work will focus on the under segment problem when there are vessels or other in homogeneous tissues on the edge of liver.

The current methodology is based on voxel-wise features extracted from a single modality, such as FLAIR. In the future, we plan to explore multimodality features that have shown to minimize

ambiguities in identifying abnormalities in many imaging applications, and especially in medical research [38]. Within the proposed mathematical framework, the application of the method in clinical studies with multiple sequences is easy with the only difference being the further increase in dimensionality. We also plan to investigate wavelet-based or other multiscale features that reduce spatial and spectral redundancy and, therefore, allow a more compact representation of the data, thus providing a means to efficient dimensionality reduction. It has been observed (in the context of cortical surface parcellation) that the optimal warp smoothness ismostly constant across subjects and that good segmentation results can be obtained for a range of smoothness levels.

the efficiency of an algoirthm through fuzzy based methods. Duplicates were constructed from the query by changing the line breaks and/or appending roughly equal amounts of unrelated text to the beginning and end of the document

7. REFERENCES

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