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Medical and Natural Image Segmentation Algorithm using M-F based Optimization Model and Modified Fuzzy Clustering: A Novel Approach

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Abstract

In this paper, we propose and present a novel algorithm for medical image segmentation (MIS). By analyzing the current state-of-the-art related algorithms, we introduce the multi-band active contour model based limit function to make the multilayer segmentation available. With the development of image segmentation technology, the development of medical image segmentation technology also got very big, because there is no find common, accepted effect ideal is suitable for medical image segmentation method, almost existing each kind of segmentation method has application in the field of medical image segmentation. Furtherly, with the optimized aims of being robust to the noise and avoiding the bad effluence on the result, we adopt the kernel method and new initialization curve. This model suffers from low noise robustness, and model algorithm is difficult to achieve. Integrated segmentation technology refers to two or more technology is used, combined with their own advantages, so they can on the accuracy or efficiency to achieve better performance than when using a single. A new penalty term is introduced to improve numerical stability and the step length is increased to improve efficiency. As far as the robustness and effectiveness are concerned, our method is better than the existing medical image segmentation algorithms. Experimental analysis verifies the success of our method.

Keywords: *Medical Image Segmentation (MIS), Kernel Function, Modified Fuzzy Clustering, Multi-band Active Contour Model, Optimization Model*

1. Introduction

Medical image segmentation is becoming a hot topic in recent years. With continuous effort, researchers have proposed many image segmentation methods. However, many image segmentation problems remains unresolved, including the isolation method of low accuracy, high complexity, low robustness, and there is no universal method. Medical imaging due to the complexity of organizational structure, various organs of irregular shape and differences between individual factors, such as unclear itself is so general complex composition, texture, difficult to image segmentation. Plus noise is inevitable in the process of image capture, local effect, field offset effect which make with general image segmentation method for medical image processing effect is not ideal, the medical image segmentation become a challenging research direction in the field of image processing. These problems make the research on image processing, image segmentation of an open question. The existing image segmentation methods can be divided into the following classes. With the development of image segmentation technology, the development of medical image segmentation technology also got very big, because there is no find common, accepted effect ideal is suitable for medical image segmentation method, almost existing each kind of segmentation method has application in the field of medical image segmentation. Segmentation and integration technology, fuzzy segmentation, the segmentation technology based on knowledge and segmentation based

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on artificial neural network technology will be the development direction of medical image segmentation technology in the future. In this paper, an improved image segmentation method based on partial differential equations and the application of medical image segmentation is proposed.

Medical image of the active contour and adaptive contour map model [1] and multi-channel high computing efficiency and the advantage of the initial curve do not affect the segmentation result. This model can also provide more image data for the doctor, is applied to the analysis of the patient's condition. This model suffers from low noise robustness, and model algorithm is difficult to achieve. Integrated segmentation technology refers to two or more technology is used, combined with their own advantages, so they can on the accuracy or efficiency to achieve better performance than when using a single. Medical image is more complex, often in different regions have their own different characteristics, combine multiple technologies to form a new segmentation method is easier to obtain better segmentation effect. This will be an important research direction in the field of medical image segmentation. RSF differential model [2] with weighted local entropy takes full advantage of image intensity and local information, which results in more accurate segmentation in medical images. Fuzzy segmentation technique in the neighborhood of the medical image segmentation is the result of medical image itself with a lot of uncertain information. And fuzzy technology to deal with uncertain information has a good effect. This model is robust to noise and less sensitive to the initialization of level-set.

To design a novel level-set based image segmentation method to overcome the defect of the aforementioned methods, we get the ideas from some research papers [3-17]. A multi-band Local Binary Fitting segmentation model [18] for medical images is proposed, which is an improved model based on RSF model and LCV model [18]. The segmentation technology based on knowledge application in the field of medical image segmentation is an important development trend. In the process of segmentation algorithm is improved, in considering the medical knowledge algorithm can get better effect. Useful medical knowledge including medical knowledge, such as the position of the symptoms of the disease, and will happen; the different features of imaging mode; the shape of the tissues and organs, anatomical structure, and general grayscale distribution, etc. Segmentation based on artificial neural network technology is obtained by training multilayer perceptron to the basic idea is linear decision function, and then classifying pixels using decision function to achieve the goal of segmentation. Medical image segmentation is according to certain rules of the area of medical image is divided into a few meaningful and adhere to the principle of consistency in every area. Image segmentation technology made it possible to medical image visualization, with the help of image segmentation technology, medical imaging classification effectively, and can provide essential diagnostic basis was provided for the clinical diagnosis and treatment, improve the real-time and accuracy of the diagnosis and treatment.

Artificial neural network technology was applied to medical image segmentation can be achieved better effect. We name the model to be the M-L model. Compared with WRSF model, LCV model has less impact factor and strength performance is better, but the level set of initialization will influence the results. For this purpose, the active contour model for regional restriction function and adaptive contour map and multi-channel multi-layer image segmentation algorithm and gauss curve function is used to improve the robustness of our model noise. Initializes a new curve is used to avoid the adverse outflow segmentation results and the introduction of the new penalty term liquid phase epitaxy Li to improve numerical stability and increase the step length to improve efficiency. Finally, get the better performance in image segmentation, a new method is also easy to use and spread. In the end, we conduct the experimental analysis with MATLAB. By comparing with the other methods, we draw the conclusion that our method holds the following advantages: (1) we use the novel border control function to control the level-set function’s

speed; (2) we adopt a novel penalty function to introduce the function of regional limit to achieve the goal pf multi-layer segmentation.

2. The Establishment of the Proposed Model

2.1. The Definition of Proposed Model and Prototype

The Ω represents the image, curve C act as the zero level-set curve of the level-set function $\phi:\Omega\to R$, the following formula is the definition. Based on threshold image segmentation method is simple, small amount of calculation, the characteristics of high stability, is the most basic method, is widely used.

$$\begin{cases} inside(C)=w_{k+1}=\{x\in w_k:\phi(x)<0\} \\ outside(C)=\bar{w}_{k+1}=\{x\in w_k:\phi(x)\geq 0\} \end{cases} \tag{1}$$

Gray image pixel gray discontinuity and similarity of these two characteristics at the same time, the gray image segmentation is generally determined according to these two features. Boundary pixel gray value in the image area can produce jumping which has no continuity, and regional internal pixel has similarity. Then on the basis of regional pixel gray discontinuity produced a series of image segmentation method based on edge detection, based on the similarity of pixel gray level in the area of produced a series of image segmentation method based on region. Image segmentation algorithm based on region is first rules for the image into several blocks, and then establish a specific attributes, based on the principle of attribute consistent, from the rule of excluding attributes is consistent, merge attributes between adjacent blocks of the same parts again, repeatedly, finally divided into the target area. Image segmentation algorithm based on edge detection using window operation, the use of the operation of the pixel gray value within the window to detect the discrete grey value of pixels, the border of different regions of the pixels, so as to detect the area, the image region is turned into multiple segments as Figure 1.

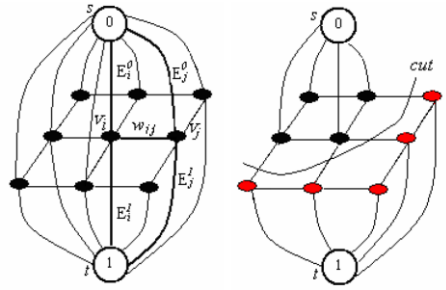

Figure 1. The Multiple Segment Organization and Topology

In the proposed model, From setting threshold means we can put the threshold segmentation methods are divided into two categories: one is artificial selection of threshold, a kind of automatic threshold choice is. Artificial selection combined with subjective visual perception threshold refers to the people through according to the picture observation and the histogram, can choose a accurate segmentation threshold of the image, generally in the middle part of the trough of the histogram threshold value or trough near the border of larger peak, repeatedly until the segmentation area edge smooth, completely separated from the target and background or goals and targets.

$$\bar{w}_{k+1}=w_k-w_{k+1} \tag{2}$$

We can put the number of setting the threshold value from threshold segmentation method is divided into single threshold segmentation and threshold segmentation. As the

image background and target gray value gap is larger, the gray histogram of the image will appear bimodal phenomenon, has obvious two peak valley, we take the valley's intermediate point as segmentation threshold, can obtain a good segmentation effect. This method targeted strong, application is very restrictive, gray were similar to background and target image is not applicable, not a good segmentation. Single threshold segmentation refers to in the process of image segmentation we only set a threshold, the image is divided into directly to the target and the background and threshold segmentation is to use multiple threshold divided into multiple target region and background from the image which can be expressed as the formula 3.

$$M^k(x) = H\left(-\phi^k(x)\right) + H\left(\phi^k(x)\right) \tag{3}$$

Based on threshold image segmentation is a widely used segmentation technology, using the gray scale characteristics of target and background difference segmentation, simple implementation, but also can compress the data, reduce the image storage space, but closely linked to threshold segmentation and image grayscale histogram, the image histogram has certain requirements, make its application with limitations. For complex medical imaging, if only by using threshold segmentation is short of the ideal segmentation results. It can be formulated as:

$$\delta_{1,\varepsilon}(x) = H'_{1,\varepsilon}(x) = \frac{1}{\pi}\frac{\varepsilon}{\varepsilon^2 + x^2} \tag{4}$$

$\delta_{1,\varepsilon}(x)$ represents Edges in the image pixel gray value of discontinuity or mutation of area, is an essential part of the image, is an important attribute of the image characteristics, contains a lot of information, has an important role in image segmentation. Edge detection is mainly about the detection of image gray level change ϕ^k .

$$\phi^{k+1} = \underset{\phi}{argmin}\, E(f_1, f_2, d_1, d_2, \phi; \phi^k) \tag{5}$$

When the minimizer ϕ is the same as initial value φ_0, Due to gray scale image edge discontinuity or mutate, so if a pixel is located in the border of the image and its neighborhood usually result in a change to a gray zone, this change has the gray level change rate and direction of these two features, gray level change rate can be expressed with the size of the gradient vector, gray level change direction can be represented with the direction of the gradient vector. Edge detection based on differential operator of gray level change within each pixel neighborhood was quantified and determine the direction of this change. The classical edge detection method using differential operator to extract the image edge, inspects each pixel in the image in the neighborhood, the variance of the use of the changing rule of the first or the second order directional derivative edge detection. The formula 6 define the model：

$$E = (1-\omega)E^{local} + \omega E^{globad} + \nu L_g(\phi) + \mu P(\phi) \tag{6}$$

Basic principle is to detect the image local gradient maximum, and then use two threshold judgment strong edge and the weak edge respectively, when connected to weak edges and keep the weak edges. Canny operator to noise ability is stronger, is not susceptible to noise interference, the edge detection of noisy conditions can obtain good results, the daylighting is uneven and edge more complex image is not applicable. The edge detection based on differential operator can only detect the image edge of a series of points, and can't get the full continuous edge. Especially for medical image, due to the imaging equipment, noise and bias field, exacerbate this discontinuity. Image segmentation based on edge detection must be on the edge of a complete premise to complete, so we have to use some rules such as boundary tracking these discontinuous edge points into the edge of more integrity.

Boundary tracking is a kind of serial boundary segmentation technology, starting from a boundary point in the gradient map, based on the order of the boundary point search,

connect adjacent edge points and detect the boundary of the target of interest. The key technology of it has three: first is the starting point of how to establish the search, the starting point of the set has a great influence on algorithm segmentation result; Second search strategy is established, based on has been found that the boundary point according to a certain data structure to determine the new boundary point, considering the previous search results to detect the effects of a boundary point under the in keeping with the boundary smoothness, weaken the influence of noise; Finally ending the search is to select suitable conditions, the algorithm to meet the conditions to stop the search. The formula 7 defines the term.

$$\begin{aligned} E^{local} &= \lambda_1 \int_\Omega \int_\Omega K_\rho(x-y)\left|I(y)-f_1(x)\right|^2 H_{1.\varepsilon}(-\phi(x)M^k(x)dydx \\ &+\lambda_2 \int_\Omega \int_\Omega K_\rho(x-y)\left|I(y)-f_2(x)\right|^2 H_{1.\varepsilon}(\phi(x)M^k(x)dydx \end{aligned} \tag{7}$$

The local energy function E^{local} is gained by a weighted integral of region w_k, State space search method also called graph search method, is a kind of heuristic global search method, the problem of edge detection and edge connectivity issues combined into seeking the path of minimum cost problem in graph theory. We commonly there are two ways to obtain the minimum cost path, the first is a greedy method, which is a global search method to find the minimum cost path, large amount of calculation. The second is the dynamic programming method, choose suboptimal solution to find the minimum cost path, fast, we introduce the Guassian kernel into the model as the following:

$$E = \lambda_1 \int_\Omega \int_\Omega K_\rho(x-y)H_{1.\varepsilon}(-\phi(x)M^k(x)dydx \tag{8}$$

Where $\rho > 0$ is a scale parameter, and the function $\psi(u)$ is a symmetric function.

$$\psi(u)=\begin{cases} Ae^{-1/(1-|u|^2)} \; if & |u| \le 1 \\ 0 \qquad\quad if & |u| > 1 \end{cases} \tag{9}$$

In the formula 9, the parameter is a constant of normalization. Edge detection based on deformable model by using the theory of physics, geometry, and the approximate knowledge, combined with image data and a prior understanding of the target area of image segmentation, can directly produce closed curve or surface segmentation, and its noise and pseudo edge has strong induction, is a kind of effective and efficient image segmentation method, is widely used in the field of medicine. This method combines the information of region and boundary, as a deformable model in the external and internal binding can produce natural elastic response under the action of object, the basic principle is to define the image data related to outside and internal energy. The formula 10 defines the term.

$$E^{globad} = \alpha_1 \int_\Omega \left|G_k * I(x) - I(x) - d_1\right|^2 \tag{10}$$

Where deformation model parameters can be divided into deformable model and geometric deformable model. Deformation model parameters in the form of a parameter; Geometric deformable model is a generalization of the parameters of deformation model in three-dimensional space, using multi-dimensional function of level set, said the guidelines for the use of 3D data the user interaction of reduced demand, faster and better performance. Model of image segmentation curve is relatively accurate, but this approach requires predefined initial contour curve, and the shape is more sensitive to the initial curve, can change shape of the initial topology and parameters, if the initial curve close to target contour, better segmentation performance; If the initial curve deviates from the target contour distant, the model is easy to converge to local minimum value, even for a specific profile can't convergence, segmentation performance is limited.:

$$L_g(\phi) = \int_\Omega gM^k(x)\delta_{1.\varepsilon}(\phi)\left|\nabla\phi\right|dx \tag{11}$$

The energy functional $P(x)$ is a penalty energy term, defined as. Geometric deformable model is the theoretical basis of the level set theory. Level set theory is that when we put a moving interface as the zero level set function is embedded into the high dimension, according to the evolution of the closed hypersurface equation can be concluded that the evolution of the level set function equation, and then based on the embedded closed hypersurface must be the principle of the zero level set, we have identified the zero level set can get the moving boundary of the evolution of the results. The level set theory is applied in edge detection, the geometric deformable model defines the level set of a high dimensional vector function, use it to mean more than more than curve and curved surface, the evolution of the curve or surface will have nothing to do with parameters, are free to change the topology, topology of flexibility, and simple calculation, the template can automatically change, merger or division:

$$P(x) = \int_{\Omega} p_2(|\nabla \phi|) M^k(x) dx \tag{12}$$

Using this new punishment to the level set function can effectively protect the weak edge, otherwise be missed. Based on region segmentation method that is looking for is consistency of pixels according to the rules applied to the segmentation of connected together constitute a regional process. This method some pixels in the image or region, according to the regional similarity principle, increase or decrease of the area of the existing pixels, when these areas meet the termination conditions. Region merging method based on image as a whole, division, to the whole image is divided into arbitrary non-overlapping small initial area, then according to certain rules method to divide the area constantly merged, gradually improve the segmentation of the divided into all areas of performance, until the whole image is divided into a minimum of homogeneous area, end of the algorithm. At the same time, it also helps to increase the step length, the evolution of more efficient. The full M-L definition is:

$$E(f_1, f_2, d_1, d_2, \phi; \phi^k) = v\int_{\Omega} gM^k(x)\delta_{1.\varepsilon}(\phi)|\nabla \phi| dx + \mu \int_{\Omega} p_2(|\nabla \phi|) M^k(x) dx$$

2.2. The Process of Minimizing Energy Function

First, the Euler equation is got by using the variational method to solve the partial differential equations. Region growing method is another common area segmentation method, to some extent can be said to be the reverse of regional division consolidation method. Have a certain similarity of the pixel region growing method to gather together constitute the region, according to the regional internal similarities and differences between the segmented image processing for the unit with the area, in the process as much as possible to ensure area of consistency and integrity of adjacent pixels. Basic method to be split in each area to select a pixel as the seed pixels that growth starting point, and then in the pixel neighborhood search with regional consistency or similarity of pixels, if found the new find the point of merging into the seed pixel region, and at this point as a starting point to continue to look for new find, until you can't find a satisfied and this area has the similarity of the pixel, the area is no longer expansion. Then steepest decent is used to convert the equation to a gradient decent equation.

Region growing method is an iterative method and the calculation is simple, because in the segmentation process make full use of the spatial correlation between the pixels, so reducing the outlier, weakened the isolated noise on the result of segmentation. But seed pixels segmentation must be large artificial selection is one of its defects, reduce the efficiency and accuracy of the algorithm, and segmentation is sensitive to noise, not suitable for target area is empty or local segmentation effect of the image. With the development of the digital image technology, image segmentation as an important part of the image processing is taken seriously more and more, people on the efficiency of image segmentation, performance requirements, such as precision is higher and higher, traditional methods have been enough to meet the demand of the development of the

reality, must be a breakthrough. So the researchers shift in thinking, the various new methods of theory and technology is applied to image segmentation technology, produce many new methods of image segmentation, the sustainable development of these methods for image segmentation techniques. Threshold segmentation method based on image entropy is the basic idea is: define certain information entropy for image, assuming a threshold could be divided into target and background images, according to certain rules to make the image entropy is obtained when the maximum or minimum threshold is we are looking for the best segmentation threshold, the threshold segmentation of image will be used this approach under the best segmentation effect. The result is as follow:

Then a time variable t is introduced and the gradient descent method is used to get partial differential equation from the energy function: $E(f_1, f_2, d_1, d_2, \phi; \phi^k)$.

$$\frac{\partial \phi}{\partial t} = \delta_{1.\varepsilon}(\phi) M^k(\phi)(F_1 + F_2) + vgM^k(\phi)\delta_{1.\varepsilon}(\phi) div(\frac{\nabla \phi}{|\nabla \phi|}) \tag{13}$$

Found in field of pattern recognition, neural network is used to solve the problem of pattern classification, and the category of medical image segmentation is a classification problem, we use the medical image segmentation to the human body cells, the cortex, bones and various lesion body marking, and classification so as to achieve the aim of auxiliary diagnosis and treatment, so the neural network theory are introduced in the field of medical image segmentation, has been widely studied and used. Wavelet transform can also be combined with the threshold method for image segmentation, the basic idea is: the gray histogram of image is given, then using binary wavelet transform to break it down to all levels of wavelet coefficients, the segmentation threshold is given by these wavelet coefficients and the segmentation criteria to determine. Image segmentation process of fine degree can be controlled by the scale. The F1 and F2 are presented as the following:

$$F_1 = (1-\omega)(\lambda_1 \int_\Omega K_\rho(y-x)\left|I(x) - f_1(y)\right|^2 dy - \lambda_2 \int_\Omega K_\rho(y-x)\left|I(x) - f_2(y)\right|^2 dy)$$

$$F_2 = \omega(\alpha_1 \left|G_k * I(x) - I(x) - d_1\right|^2 - \alpha_2 \left|G_k * I(x) - I(x) - d_2\right|^2)$$

2.3. The Numerical Algorithm for Model

Here still use the traditional digital solutions: using finite difference method in partial differential equations (19), use the time forward difference scheme for variable and central difference scheme for spatial variables. Mathematical morphology based on set theory to study the basic geometry features, including the geometry and structure. Mathematical morphology is the morphological characteristics of the images of a research method, so in recent years gradually to the field of image processing, its application direction including image segmentation, connected component labeling, image reconstruction and skeleton extraction, etc. Image segmentation method based on mathematical morphology is the basic idea is: to determine the structural elements of the form as a basic tool to detect and extract the image corresponding to a certain shape, which can extract target edge, in-depth analysis of the image and recognition. Use the watershed algorithm for image segmentation process is a process of continuous corrosion image. We are in each regional image grayscale minimum in hole, and then let the water poured out of the hole, spread to high altitudes. At different valley water gathered build DAMS will be cut off. The boundary of these DAMS is the watershed and we are looking for the boundary of image segmentation. Watershed algorithm can better detect weak edge, the image overlap and adhesion area especially sensitive to the edge of the weak, algorithm is simple and good performance. Therefore, the partial differential equations are discretized by forward difference scheme which can be expressed as the following formula:

$$\frac{(\phi_{i,j}^{n+1}-\phi_{i,j}^{n})}{\Delta t}=\delta_{1.\varepsilon}(\phi_{i,j}^{n})M^{k}(\phi_{i,j}^{n})\left((1-\omega)(\lambda_1\int_{\Omega}K_{\rho}(y-x)\left|I(x)-f_1(y)\right|^2dy-\lambda_2\int_{\Omega}K_{\rho}(y-x)\left|I(x)-f_2(y)\right|dy)\right) \quad (14)$$

Where, $I(x)$ is the original image, $M^{k}(x)$ is calculated every time for obtaining the value of ϕ^{k+1} which is the level-set function in evolvement. The evolvement starts from the regions with lowest brightness and the initializing level-set function ϕ_0 is defined as:

$$\phi_0=\begin{cases}+\rho & for \quad M^{k}(x)=0 \text{ or } I(x)<min\{I(x)\left|M^{k}(x)=1\right.\}+\theta\\ -\rho & otherwise\end{cases} \quad (15)$$

Where, ρ is a constant, θ is a positive constant. $\rho = 4$ and -4 is set in model, thus the initializing level-set function ϕ_0 has only two values: -4 and 4. The main steps of the proposed method are shown as the following. The application of fuzzy set theory in the aspect of image segmentation is usually combined with other traditional segmentation method, the combination formed many segmentation method with the characteristic of fuzzy set theory, including fuzzy clustering method and fuzzy threshold segmentation method and fuzzy edge detection method, the fuzzy degree of connection methods. The fuzzy clustering method is a representative application of it. Paste clustering segmentation method to simulate human thinking mode, the binary logic transformed into multi-valued logic, use of the multivalued logic makes it easy to describe the image with complex structure, and is not sensitive to noise, and has the advantages of fuzzy set theory is suitable for all kinds of uncertainty of objects within for processing, thus more accurate image segmentation.

Rough set theory has been widely attention, compared with the rest of the soft computing theory, rough set theory of mathematics basic mature, besides about processing for data collection, does not need to provide any additional prior knowledge, and with other soft computing theory can have very strong complementary to each other, and ease of use is very strong, has been successful in many fields of science and engineering applications, such as data analysis, artificial intelligence, pattern recognition and image processing, etc. Rough set can reflect the collection objects do not distinguish between namely, rough and the rough sex is caused by the granularity of knowledge. And the correlation of image information is usually have stronger and complexity, in the process will reflect the accuracy and completeness, the rough set theory is introduced into image segmentation field, compared with hard calculation methods, sometimes get better effect. Has put forward many methods and each has its pertinence, often for a specific imaging model or for a specific area, so I can't find a unified medical image segmentation method applies to all, can have the ideal segmentation results on these images, and to determine an application is not easy to quickly find a proper method. Therefore, the evaluation method of image segmentation study of meaningful imperative which can be simple for quantitative evaluation of image segmentation result is a must. To evaluate the result of image segmentation can promote the researchers constantly optimized algorithm, improve the quality of segmentation, the development of medical image segmentation algorithm is.

3. Experimental Analysis

Above M-L model is applied and the result is analyzed. Testing images can be divided into two categories: man-made images and real images. Real images are mainly x-ray images and MRI images. A PC with 2.13GHz CPU, 4GB RAM, Windows 7 operating system and MATLAB R2013a is used in the experiments. In most cases, only on the basis of gray difference for object segmentation algorithm is not enough, they can also be reflected in the differences in other statistical parameters of gray-scale image derived. Therefore can be composed of image gray scale, texture and other parameters of the

multi-dimensional clustering analysis in the feature space. Clustering method is when the pixel mapping according to certain rules are divided into several regions after the feature space, if a pixel belongs to a certain area, has the gray level image pixel is belong to the class. In the following figures, we show the related experimental result.

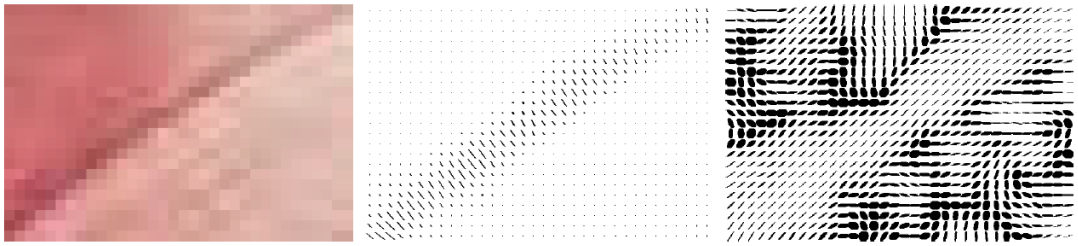

Figure 1. The Sample Result of the Edge based Segmentation

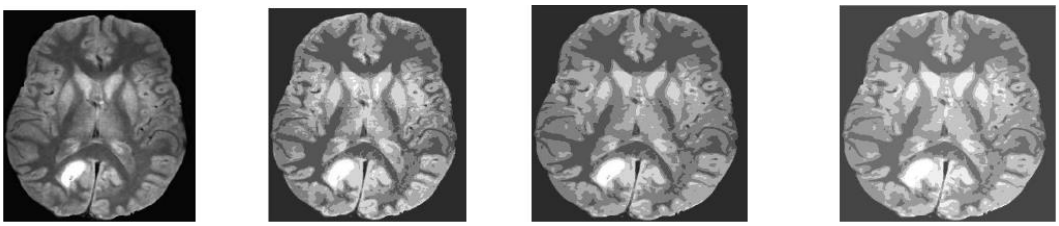

Figure 2. The Multiple M-L Model Base Segmentation

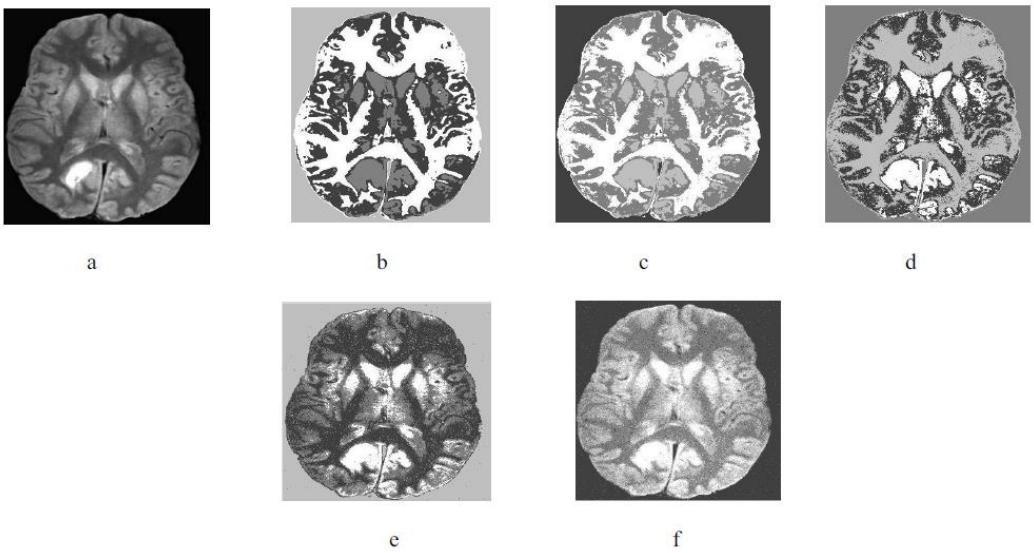

Figure 3. The Experimental Set One

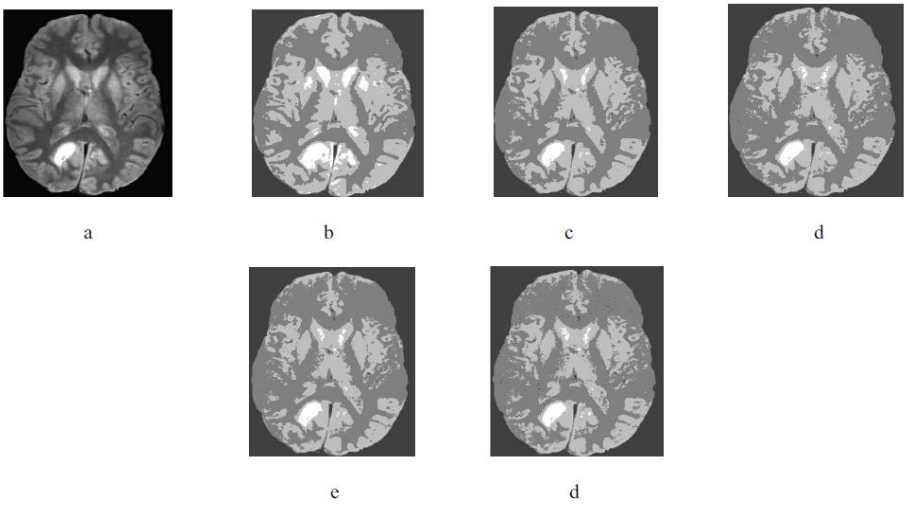

Figure 4.The Experimental Set Two

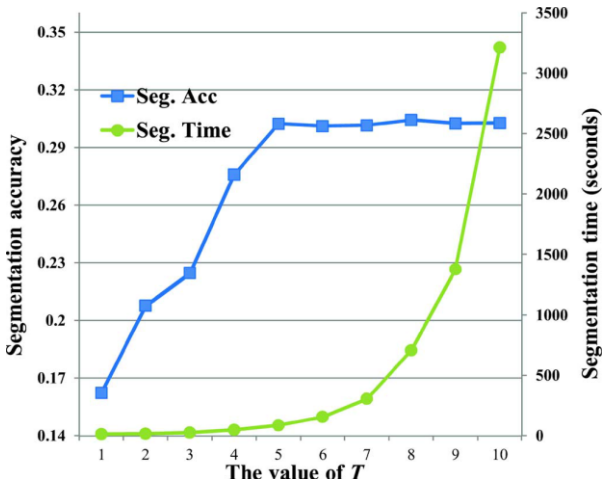

Figure 5. The Numerical Simulation srt One

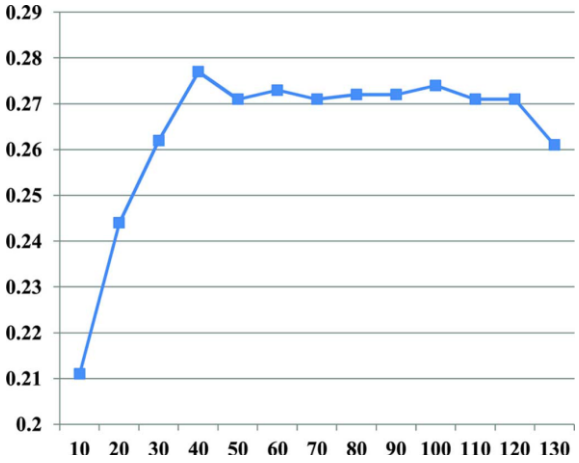

Figure 6. The Numerical Simulation srt Two

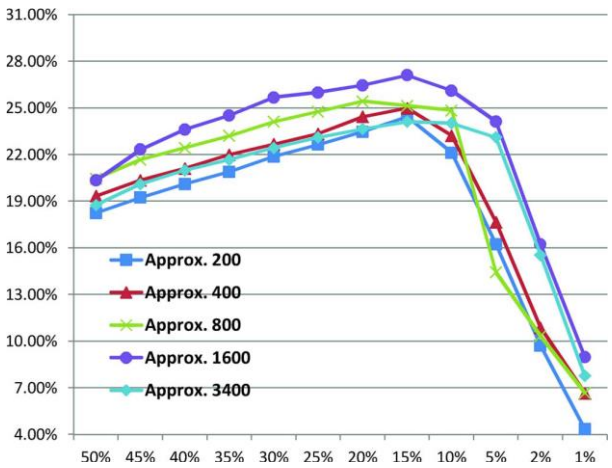

Figure 7. The Numerical Simulation srt Three

5. Conclusion and Summary

In this paper, the M-L model is proposed for medical image segmentation. Fuzzy clustering segmentation is one of the good methods of segmentation of MR images. It is very suitable for processing things inherent uncertainty, and is not sensitive to noise, its use of the multivalued logic to describe complex system, can more accurately for image segmentation and it converts the binary logic of mathematics into continuous valued logic and make it more close to people's way of thinking. However, in practice, fuzzy clustering technology still exist some problems to be further research. These problems embodied in the choice, the parameters of the fuzzy clustering is how to choose parameters in fuzzy clustering, choose different parameter may not only result in different optimal partitioning feature space, but also great influence on the clustering speed, they are from different aspects affecting the speed and accuracy of clustering. Curved surface fitting method the basic idea is the image gray level as high, with a surface to fitting a small window of image data. As a result of the fitting surface is to meet a rational surface smoothness. Thus it can be make more smoothing of image noise. In the future, we will conduct more related research to optimize the current methodology.

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