REVIEW PAPER ON BRAIN IMAGE SEGMENTATION USING CHAN-VESE ALGORITHM AND ACTIVE CONTOURS

*Payal Gupta
Guru Kashi University

**Er. Satinderjeet Singh
Guru Kashi University

Abstract:
Segmentation is the process of partitioning a digital image into multiple segments (sets of pixels). Such common segmentation tasks including segmenting written text or segmenting tumors from healthy brain tissue in an MRI image, etc. Chan-Vese model for active contours is a powerful and flexible method which is able to segment many types of images, including some that would be quite difficult to segment in means of "classical" segmentation – i.e., using thresholding or gradient based methods The model is based on an energy minimization problem, which can be reformulated in the level set formulation, leading to an easier way to solve the problem.
Keywords: Chan-Vese ,level set, active counter, segmentation etc.

I. INTRODUCTION

Image segmentation is arguably the most ubiquitous and is difficult in technical problem such as medical image processing. The problem of partitioning an image into meaningful pieces or, alternatively, delineating regions of anatomical interest has proven to be as difficult as a host of other computational problems that attempt to mimic the capabilities of human intelligence or perception. The ongoing difficultly of image segmentation is not from a lack of attention; thousands of papers and theses on image segmentation describe a wide variety of approaches ranging from statistics, differential geometry, and partial differential equations to game theory, discrete geometry, and computational mechanics. As a result, engineers designing clinical systems that require an image segmentation capability are left with wide range of possible approaches virtually all of which claim to be effective to some degree. To help with this, several researchers have proposed mechanisms for evaluating or validating the effectiveness of various segmentation algorithms [2]. However, quantifying the validity of segmentation has proven to be almost as difficult as the segmentation itself. The challenge stems from the fact that quantifying differences in shapes is also an important, open problem in computer vision and image processing. In the midst of these difficult challenges and proposed solutions one might ask, "How well are we doing?" This paper is a case study that looks at the effectiveness of a relatively simple, well-known segmentation paradigm, hierarchical watersheds with user interaction. In our experience, this method is moderately effective on a wide range of segmentation problems. We systematically study its effectiveness on two different types of data using several commonly cited validation metrics. This study is designed to address the question of whether or not one should use user-assisted watershed segmentation in lieu of hand contouring. The results, however, also provide some insight into the watershed algorithm itself as well as the methodology of validating segmentation algorithms against an expert defined ground truth. Image segmentation is useful in many applications [7]. It can identify the regions of interest in a scene or annotate the data. We categorize the existing segmentation algorithm into region-based segmentation, data clustering, and edge-base segmentation. Region-based segmentation includes the seeded and unseeded region growing algorithms, the JSEG, and the fast scanning algorithm. All of them expand each region pixel by pixel based on their pixel value or quantized value so that each cluster has high positional relation. For data clustering, the concept of them is based on the whole image and considers the distance between each data. The characteristic of data clustering is that each pixel of a cluster does not certainly connective. The basis method of data clustering can be divided into hierarchical and partitioned clustering [4]. Furthermore, we show the extension of data clustering called mean shift algorithm, although this algorithm much belonging to density estimation. The last classification of segmentation is edge-based segmentation. This type of the segmentations generally applies edge detection or the concept of edge. The typical one is the watershed algorithm, but it always has the over-segmentation problem, so that the use of markers was proposed to improve the watershed algorithm by smoothing and selecting markers. Finally, we show some applications applying segmentation technique in the preprocessing. Medical image segmentation is an essential step for most subsequent image analysis tasks. The segmentation of an atomic structure in the brain plays crucial role in Nero imaging analysis. Successful numerical algorithms can help researchers, physicians and neurosurgeons to investigate and diagnose the structure and function of the brain in both health and disease [10]. This has motivated the need for segmentation techniques that are robust in application involving abroad range of anatomic structure, disease and image type .The process of partitioning a digital image into multiple regions or sets of pixels is called image segmentation. Actually, partitions are different objects in image which have the same texture or color. The result of image segmentation is a set of regions that collectively cover the entire image, or a set of contours extracted from the image. All of the pixels in a region are similar with respect to some characteristic or computed property, such as color, intensity, or texture. Adjacent regions are significantly different with respect to the same characteristics.

II. MRI BRAIN IMAGE

The rapid development of imaging technologies now routinely allows living organs and organisms to be explored none invasively. Medical images are obtained for various applications which include image guided surgery, surgical simulation, neon science studies and therapy evaluation. When working with medical images, i.e. Magnetic Resonance Images (MRI), X-Ray, Ultrasound and Computed Tomography (CT) images etc., it is often to delineate the areas and volumes of interest. Medical experts face the task of finding or characterizing abnormalities within such images [1]. The rapid development of different kinds of highly equipped medical instruments and more use of such images have made it difficult for the medical experts to interpreted infer correct diagnosis. Complicated image features, eye fatigue are the factors that may cause an expert to miss an abnormality in an image. Hence, there is a great need for robust methods that process with the interpretation of huge amounts of data with greater accuracy. To alleviate these difficulties in clinical diagnosis, segmentation of medical images provides the potentiality for increasing the diagnostic accuracy. Magnetic Resonance Imaging (MRI) is a well-established non-invasive diagnostic medical imaging technique based on the nuclear magnetic resonance phenomenon [4]. Although qualitative image analysis is often sufficient for diagnosis of diseases, quantitative analysis is necessary for many applications, for which segmentation is a primary step. Segmentation of MR Images is a challenging problem due to its complexity as well as to the absence of models of the anatomy that fully capture the possible deformations in each structure. Conventional MRI relies one difference in a weighted average of spectral and temporal information from tissue to tissue to make diagnosis. The intensity of the MR image of human tissue is homogeneous and the structure of each tissue is connected, but is difficult to separate the adjacent tissue due to the small intensity changes and smoothed boundaries between tissues. Further, the lack of clearly defined edges includes intra and inters observer variability, which deteriorates the significance of the analysis. Brain tissue is a complex structure. The diagnosis of many brain disorders involves accurate tissue segmentation of brain MR images. Manual delineation of the two brain tissues, white matter (WM) and gray matter (GM) in brain Mirage by an human expert is too difficult. Thus, segmentation of brain MR images is an important step for the same, and has attracted the attention of many researchers for the last decade. Fig. 1 shows the example MRI brain image.

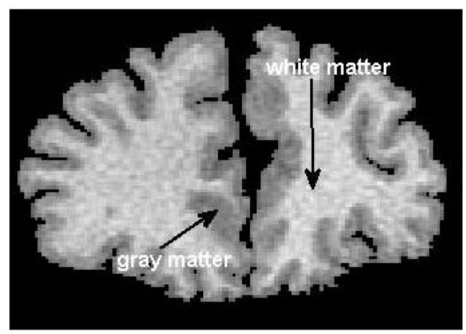


Figure1: MRI brain image

III. LITERATURE SURVEY

Vikram Appia Anthony Yezzi, This enables us to construct a purely region-based energy minimization model without having to devise arbitrary weights in the combination of our energy function to balance edge-based terms with the region-based terms. We show that this novel approach of combining edge information as the geodesic constraint in optimizing a purely region based energy yields a new class of active contours which exhibit both local and global behaviors that are naturally responsive to intuitive types of user interaction.

Prof. P. Tamije Selvy1, Dr.V.Palanisamy[2] and M. Sri Radhai3, Medical Imaging is the technique and a process used to create images of the human body for clinical or medical science. Magnetic Resonance (MR) Brain image segmentation plays an important role in neurosurgical planning and clinical diagnosis. MR image is segmented using Fuzzy C means (FCM) method; the objective function of FCM is modified by a regularizing function called Total Variation (TV) FCM. The proposed robust image regularization Anisotropic Diffusion Total Variation (ADTV) regularization method focuses on smoothing the images and reducing the steps by reinterpreting the traditional TV regularization.

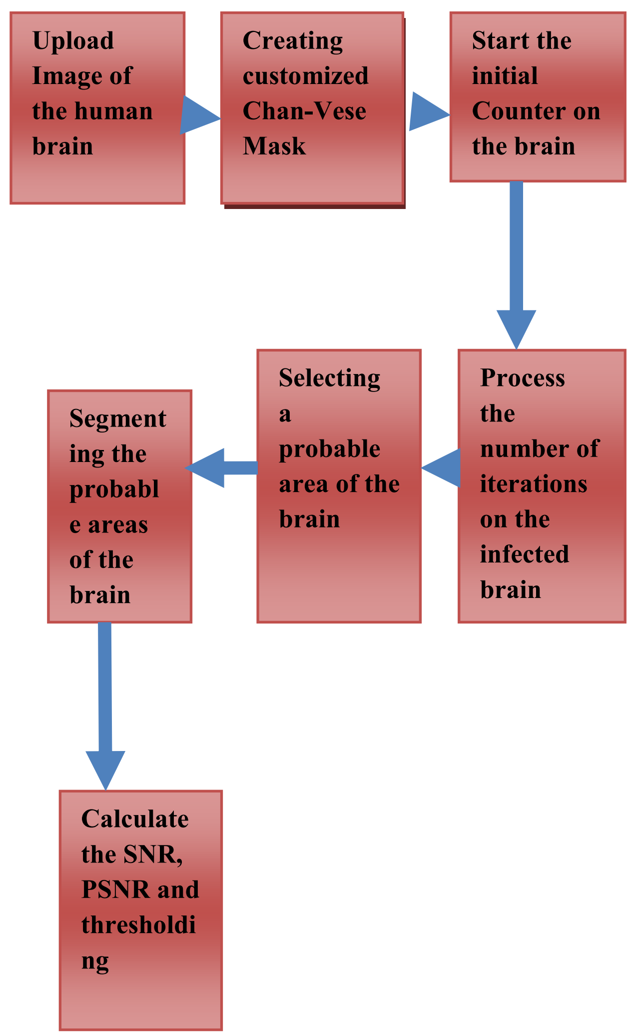
Shawn Lankton, In this paper, they propose a natural framework that allows any region-based segmentation energy to be re-formulated in local way. We consider local rather than global image statistics and evolve a contour based on local information. Localized contours are capable of segmenting objects with heterogeneous feature profiles that would be difficult to capture correctly using a standard global method. The presented technique is versatile enough to bemused with any global region-based active contour energy and instilling it the benefits of localization.

IV. PROBLEM STATEMENT

Image segmentation has long been an important focus of research, yielding many automated methods to perform segmentation of different organs in the human body. Brain image segmentation is an important but inherently difficult problem in medical image processing. In general, it cannot be solved using straightforward, conventional image processing techniques. Among medical images, segmentation of brain images is a challenging problem that has received an enormous amount of attention recently, and this is because proper diagnosis of brain disorders greatly depends upon accurate segmentation of the complex structure of the brain.Medical experts face the task of finding or characterizing abnormalities within such images. The rapid development of different kinds of highly equipped medical instruments and more use of such images have made it difficult for the medical experts to interpret and infer correct diagnosis. Complicated image features, eye fatigue are the factors that may cause an expert to miss an abnormality in an image. Hence, there is a great need for robust methods that process with the interpretation of huge amounts of data with greater accuracy. To alleviate these difficulties in clinical diagnosis, segmentation of medical images provides the potentiality for increasing the diagnostic accuracy.

V. METHODOLOGY

It is based upon GUI (graphical user interface) in MATLAB. It is an effort to further grasp the fundamentals of MATLAB and validate it as a powerful application tool. There are basically different files. Each of them consists of m-file and figure file. These are the programmable files containing the information about the algorithm that we have to implement. In this work we will firstly upload the image in the format in the given window. In the GUI we will take the button and when click on the button the operations are performed on uploaded image and the different values like SNR, PSNR and thresholding. The following steps are performed during the segmentation of the brain images:



VI. CONCLUSION & FUTURE WORK

In this the Brain Image Segmentation is done Using Chan-Vese algorithm and Active Contours and Level Set Functions . In this different research papers are studied . I have faced different problems in different papers. So I have to design the methodology to remove all these problems. In the future work chan-vase algorithm is implemented according to the methodology of the papers and gets the better results.

REFERENCES

[1]. Detection and Quantification of Brain Tumor from MRI of Brain and it's Symmetric Analysis by Sudipta Roy, Samir K. Bandyopadhyay

[2]. Automatic brain extraction methods for T1 magnetic resonance images using region labeling and morphological operations by K. Somasundaram n, T.Kalaiselvi

[3]. An Efficient Brain Tumor Detection Algorithm Using Watershed & Thresholding Based Segmentation I.J. Image, Graphics and Signal Processing, 2012, 10, 34-39 Published Online September 2012 in MECS (http://www.mecs-press.org/)

[4]. Effect of Morphological Filters on Medical Image Segmentation using Improved Watershed Segmentation by 1Usha Mittal,2Sanyam Anand.

[5]. Gonzalez, R. C. (2010). Digital Image Processing. New Delhi: PEARSON Publishers Ltd.

[6]. Effect of Image Gradients as Initial Step for Watershed Approach by Gurpreet Kaur, ,Sumit Kaushik

[7]. Ng, H. P. (2008). Medical Image Segmentation Using Watershed Segmentation with Texture-Based Region Merging. 30th Annual International IEEE EMBS Conference (pp. 4039-4042). Vancouver, Canada: IEEE.

[8]. Rafael C. Gonzalez and Richard E. Woods Digital Image Processing, 2001, pp.220 – 243.

[9]. L. Shawn "Localizing Region Based Active Contours" , IEEE Transaction on Image Processing , Vol.17 no 11, 2008.

[10]. A. Vikram, Y. Anthony, "Active Geodesics: Region-based Active Contour Segmentation with a Global Edge-based Constraint", ICCV IEEE Internation Conference, 2011.

[11]. K. Ramanpreet, "Segmentation In Medical Resonance images to extract the cancerous nodule for early diagnosis on cancer", International Journal of Computers & Technology, Volume 3 No. 2,2012

[12]. S. Geman, D. Geman, Stochastic relaxation, gibbs distributions and the bayesian restoration of images, IEEE Trans. on Image Processing 6 (6) (1984) 721–741.

[13]. J. P. Serra, Image Analysis and Mathematical Morphology, Academic Press Inc., 1982.

[14]. S. Beucher, F. Meyer, The morphological approach to segmentation: the watershed transformation, E.R .Dougherty, 1993, pp. 433–481.

[15]. F. Meyer, Topographic distance and watershed lines, SP 38 (1) (1994) 113–125.

[16]. L. Vincent, P. Soille, Watersheds in digital spaces: An efficient algorithm based on immersion simulations, PAMI 13 (6) (1991) 583–598.

[17]. F. Meyer, S. Beucher, Morphological segmentation, JVCIR 1 (1) (1990) 21–46.

[18]. R. Lotufo,W. Silva, Minimal set of markers for the watershed transform, in: Proc. ISMM2002.

[19]. S. Beucher, Watershed, hierarchical segmentation and waterfall algorithm, Kluwer Academic Publishers, 1994,pp. 69–76.

[20]. J. B. T. M. Roerdink, A. Meijster, The watershed transform: Definitions, algorithms and parallelization strategies, Fundamenta Informaticae 41 (1-2) (2000) 187–228.URL
citeseer.nj.nec.com/roerdink00watershed.html

