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AN IMPROVED CLASSIFIER FOR IMAGE SEGMENTATION QUALITY THROUGH EFFECTIVE REGION MERGING-A SURVEY

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Abstract

In recent years,complexity in finding a particular technique that will give accrate segmentation results for all type of images is growing.In this survey,we have compared different approaches for improving image segmentation quality which are in practice.We have extended our work with fuzzy classifier for improving image segmentation quality through effective region merging.Our method is to start from an over segmented image,which is obtained by applying a standard morphological watershed transformation on the original image.We have efficiently applied the proposed approach to brightness segmentation on different standard test images, with good visual and objective segmentation quality results.The experimental results show that the proposed algorithm is more noise than the standard fuzzy, with more certainity and less fuzziness.This will lead to its practicable and effective applications in medical image segmentation.There is no single method which can be considered good for all type of images,nor all methods equally good for a particular type of image.The proposed method will suit for the accurate segmentation of sequential images.

Keywords: Image Segmentation,Fuzzy Classifier,Region Merging.

I. INTRODUCTION

Image segmentation is one of the most widespread means to classify the pixels of an image in a decision oriented applications. Image segmentation is a technique that partitions an image into uniform and non-overlapping regions based on some likeness measure.The goal of segmentation is to simplify and/or change the representation of an image into something that is more meaningful and easier to analyze.Image segmentation is typically used to locate objects and boundaries (lines, curves, etc.) in images.Within the current clinical setting, medical image segmentation is a vital component of a large number of applications,such as to:(i) study anatomical structure (ii) identify regions of interest, i.e. locate tumor, lesion and other abnormalities (iii) measure tissue volume to assess growth or decrease in size of tumor (iv) help in treatment planning prior to radiation therapy and in radiation dose calculation.

Our aim is to find a classifier for improving the quality of image segmentation results that suilts well for almost all type of medical images without restrictions.This survey covers different techniques used so for to improve the segmentation quality.

II. RELATED WORKS

Zhenghao Shi and Lifeng He[1] discussed the application of artificial neural networks in medical image processing.This paper tries to answer the major strengths and weakness of applying neural networks for medical image processing.The feed forward neural network is the most used neural network for medical image segmentation. According to the review of this paper 6 of 17 papers employed the feed forward network for medical image segmentation.Compared with the traditional Bayesian classifier based medical image segmentation,feed forward neural network based segmented images appear less noisy and is also less sensitive to the selection of training sets than Bayesian.However,most feed forward neural network based methods have a very slow convergence rate and require a priori learning of parameters.These drawbacks limited the application of feed forward neural networks in medical image segmentation.This paper suggests a solution to these problems which is to combine fuzzy technique with neural networks.

Noor Elaiza Abdul Khalid[2] proposed a method of k-Nearest Neighbor in abnormalities segmentation of MRI brain images.A preliminary data analysis is performed to analyze the characteristics for each brain component of “membrane”, “ventricle”, “light abnormality” and “dark abnormality” by extracting the minimum,maximum and mean grey level pixel values.The k-NN segmentation performance is tested to 150 controlled testing data which is designed by cutting various shapes and sizes of various abnormalities and pasting it onto normal brain tissues.The tissues are divided into three categories of “low”, “medium” and “high” based on the grey level pixel value intensities.The k-NN has higher accuracy and stability for MRI data than other common statistical classifiers,but has a slow running time.The accuracy of the segmentation performance are then statistically measured using ROC(Receiver Operating Characteristic) analysis.

The k-NN segmentation is observed to produce good segmentation outcomes in both medium and low background grey level values for light and dark abnormalities.However,the segmentation performances for light and dark abnormalities within the high background grey level value are found to be unsatisfactory especially for light abnormality.Therefore it tells there is a scope for improvement to enhance the segmentation outcomes in future.

M.C.Jobin Christ[3] adapted some of the existing segmentation algorithms using Bayesian classifier and focused the effect of Bayesian classifier in segmentation algorithms.Bayesian classifier is an efficient method used to improve the medical image segmentation. In order to eliminate the background noises of images,we need preprocessing of images.After preprocessing Bayesian classifier is used for classifying of particles in the image.Bayesian classifier is a powerful probabilistic graphical model that has been applied in computer vision.It finds its application in Glioblastoma Multiforme Brain tumor Segmentation, Brain activation from functional brain images and Topology correction of cortical surfaces.It has to be improved for its application in other medical imaging.

Zhaozheng Yin[4] presented a pixel classification approach that is independent of cell type or imaging modality to segment cells from the background accurately. They train a set of Bayesian classifiers from clustered local training image patches. Each Bayesian classifier is an expert to make decision in its specific domain.The decision from the mixture of experts determines how likely a new pixel is a cell pixel.They demonstrate the effectiveness of this approach on four cell types with diverse morphologies under different microscopy imaging modalities. Each local Bayesian classifier is trained from a specific cluster of image patches, thus it is an expert to perform classification on new pixels whose surrounding image patches are similar to the training image patch cluster. To save computational cost, they use integral histogram technique for histogram computation and Nystrom method for spectral clustering.

Any new pixel to be classified is assigned a posterior probability about how likely it is a cell or background pixel based on the mixture-of-experts model.The binary segmentation results are obtained by MAP classification.They evaluate their approach quantitatively on four different types of microscopy images with 92.5% average accuracy.

Abraham Duarte[5] proposed a new evolutionary region merging method in order to efficiently improve segmentation quality results.Their approach starts with an oversegmented image, which is obtained by applying a standard morphological watershed transformation on the original image.Next,each resulting region is represented by its centroid. The oversegmented image is described by a simplified undirected weighted graph, where each node represents one region and weighted edges measure the dissimilarity between pairs of regions according to their intensities, spatial locations and original sizes. Finally, the resulting graph is iteratively partitioned in a hierarchical fashion into two subgraphs, corresponding to the two most significant components of the actual image, until a termination condition is met. This graph-partitioning task is solved by a variant of the min-cut problem (normalized cut) using a hierarchical social (HS) metaheuristic.

The definition of MRAG and the application of a hierarchical social (HS) metaheuristic to solve efficiently the normalized cut problem is the core of the proposed method.This new model allows the processing of larger spatial resolution images than other typical graph-based segmentation methods.The HS metaheuristic was applied to exploit the power of competition and cooperation among different groups of regions resulting from the initial over segmentation, in order to explore the solution space. An important advantage of the approach is that MRAG structure does not need to be updated when merging regions. The major advantage of using a Ncut as group objective function in HS metaheuristic is that the quality of the segmentation is very high.However, the Ncut value is nsot an adequate group objective function, since it is not defined for several cuts.

Tin Tin Htar[6] proposed a new enhanced region merging algorithm based on dynamic region merging method.Here neighboring regions are progressively merged if there is an evidence for merging according to the minimum edge weights between those regions and their homogeneity. Watershed segmentation is a morphological based method of image segmentation. The gradient magnitude of an image is considered as a topographic surface for the watershed transformation. The result of the watershed transform is degraded by the background noise and produces the oversegmentation.They propose a technique that focus on the solution of oversegmentation problem of images by applying preprocessing on the input image.Tin Tin Htar successfully enhanced the region merging algorithm for image segmentation.Using opening-closing reconstruction and finding minimal minima, the oversegmentation problem is overcome.Region Adjacency Graph is constructed and the edge weight of adjacent region pair is found.Consistency of the adjacent regions with minimum edge weight is calculated by randomly choosing half-size of the pixels of each region pair with respect to Nearest Neighboring Region.According to the experimental results, it can be obviously seen that the implemented system can generate the segmented image with meaningful regions which is very helpful to the image annotation.

Dwarikanath Mahapatra[7] examined random forest (RF) classifiers, their learned knowledge during training and ways to exploit it for improved image segmentation. Apart from learning discriminative features, RFs also quantify their importance in classification.Feature importance is used to design a feature selection strategy critical for high segmentation and classification accuracy, and also to design a smoothness cost in a second-order MRF framework for graph cut segmentation.The cost function combines the contribution of different image features like intensity, texture, and curvature information. Experimental results on medical images show that this strategy leads to better segmentation accuracy than conventional graph cut algorithms that use only intensity information in the smoothness cost.An RF is an ensemble of decision trees, where each tree is typically trained with a different subset of the training set, thereby improving the generalization ability of the classifier. Samples are processed along a path from the root to a leaf in each tree by performing a binary test at each internal node along that path. This knowledge is particularly useful when the number of samples is low when compared with the number of feature elements.But,the trained RF may not generalize well to novel samples.

Mahesh Yambal[8] presented a latest survey of different technologies used in medical image segmentation using Fuzzy C Means (FCM).The conventional fuzzy c-means algorithm is an efficient clustering algorithm that is used in medical image segmentation.Their survey includes Brain Tumor Detection Using Segmentation Based on Hierarchical Self Organizing Map, Robust Image Segmentation in Low Depth Of Field Images,Fuzzy C-Means Technique with Histogram Based Centroid Initialization for Brain Tissue Segmentation in MRI of Head Scans. Modifying and generalizing the FCM algorithm is a prevailing research stream in fuzzy clustering in recent decades. Low Depth of Field(DOF) is a method used to give special importance to a part of image which is essential or which has to be focused. This method can be used in the fields like sports, photography & medical.

Self Organizing Map (SOM) algorithm is another important method proposed for medical image segmentation. For image segmentation, the important part is to produce an image which is noiseless.So to produce such kind of image without noise there is a use of filters.The incorporation of spatial information in to the objective function of standard FCM yielded successful results for robust and effective image segmentation of noisy images & techniques like DOF(depth of field) can be applied to segment colored images.The techniques reviewed in this survey are applicable to analysis of MRI images and in future can be applied to other medical image types like CT and PET for better analysis.It also suggests that in future a hybrid technique based on clustering algorithms and classifiers like Neural Networks and etc can be combined to work on input data set for better results and previously designed algorithm can be modified to work for color image segmentation.

H. Costin[9] reported a new (semi)automated and supervised method for the segmentation of brain structures using a rule-based fuzzy system. In the field of biomedical image analysis fuzzy logic acts as a unified framework for representing and processing both numerical and symbolic information, as well as structural information constituted mainly by spatial relationships. The developed application is for the segmentation of brain structures in CT (computer tomography) images. Promising results show the superiority of this knowledge-based approach over best traditional techniques interms of segmentation errors.

Though the proposed methodology has been implemented and used for model driven in medical imaging,they may be applied to any imagistic object that can be expressed by expert knowledge and morphological images. The application of fuzzy logic for biomedical image segmentation proved superior results in terms of segmentation errors,in comparison with other methods. A main advantage of this method is that knowledge is directly represented in the image space by means of fuzzy sets. Thus, the obtained average accuracy of 5.6% was found very good by the medical neuro-surgeon who helped them during experiments. Another advantage of this method is that the computing time when implementing this non-iterative algorithm is kept at a low value and it is possible to be lowered by further parallelization.

H.P.Narkhede[10] compared the performance of different image segmentation techniques.Based on the comparison of different image segmentation techniques H.P.Narkhede produced the following results.Edge detection technique is the way in which the humans perceives objects and works well for images having good contrast between regions.But it does not work well with images in which the edges are ill-defined and also with too many edges.Though thresholding does not require a prior information of image it does not suit for an image without any obvious peaks or with broad and flat valleys.Region based technique is quite expensive both in computation time and memory.Fuzzy technique provide a way to handle the uncertainty inherent in a variety of problems due to ambiguity rather than randomness but the computation involved would be intensive.Neural Network can fully utilize the parallel nature of neural networks but the training time is long.Hence there is no single method which can be considered good for all type of images,nor all methods equally good for a particular type of image.

III. RESULTS AND DISCUSSIONS

We have successfully surveyed different techniques used for improving the image segmentation quality.In comparison with other techniques neural network classifier and fuzzy classifier proved to be the best for both CT and MRI images.

IV. CONCLUSION

Hereby,we conclude that there is no single method which can be considered good for all type of images,nor all methods equally good for a particular type of image.Our future work is to experiment segmentation of medical images through effective region merging with fuzzy classifier that takes different spatial features into consideration.

V. REFERENCES

[1] Zhenghao Shi and Lifeng He, "Application of Neural Networks in Medical Image Processing" Proceedings of the Second International Symposium on Networking and Network Security (ISNNS '10) pp. 023-02

[2] Noor Elaiza Abdul Khalid,Shafaf Ibrahim and Puteri Nurain Megat Mohd Haniff, "MRI Brain Abnormalities Segmentation using k-Nearest Neighbors" International Journal on Computer Science and Engineering (IJCSE) Vol. 3 No. 2 Feb 2011

[3] M.C.Jobin Christ, K.Sasikumar, and R.M.S.Parwathy, "Application of Bayesian method in Medical Image Segmentation" International Journal of Computing Science and Communication Technologies, VOL. 2, NO. 1, July 2009.

[4] Zhaozheng Yin, Ryoma Bise, Mei Chen and Takeo Kanade, "Cell Segmentation in Microscopy Imagery using a Bag of Local Bayesian Classifiers" IEEE international symposium, April 2010

[5] Abraham Duarte, Angel Sanchez , Felipe Fernandez, Antonio S. Montemayor , "Improving image segmentation quality through effective region merging using a hierarchical social metaheuristic" Pattern Recognition Letters 27 (2006) 1239–1251

[6] Tin Tin Htar, and Soe Lin Aung, "Enhancement of Region Merging Algorithm for Image Segmentation" International Conference on Advances in Engineering and Technology (ICAET'2014)

[7] Dwarikanath Mahapatra, "Analyzing Training Information from Random Forests for Improved Image Segmentation" IEEE TRANSACTIONS ON IMAGE PROCESSING, VOL. 23, NO. 4, APRIL 2014.

[8] Mahesh Yambal, Hitesh Gupta, "Image Segmentation using Fuzzy C Means Clustering: A survey" International Journal of Advanced Research in Computer and Communication Engineering Vol. 2, Issue 7, July 2013.

[9] H. Costin, "A Fuzzy Rules-Based Segmentation Method for Medical Images Analysis" INT J COMPUT COMMUN, ISSN 1841-9836 April, 2013.

[10] H.P.Narkhede, " Review of Image Segmentation Techniques" International Journal of Science and Modern Engineering (IJISME), Vol.1 July 2013.