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DETECTION OF TUMOR REGION USING FAST FUZZY CLUSTERING ALGORITHM

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Abstract

Magnetic Resonance Imaging (MRI) is a medical imaging technique for measuring the anatomy and functions of the body in detail to providing information of the brain and the brain stem. To understand the complex segmentation among the brain regions we propose a fuzzy clustering algorithm. The algorithm starts with globally denoising the brain images using Kernel algorithm. Next, region will be segmented using the FFC (Fast Fuzzy Clustering) algorithms and detecting the tumor region and type of disease will be detected.. The results suggest that the proposed algorithms provide improved performance and segmentation accuracy compared to the existing algorithms.

Keywords: Magnetic Resonance imaging, Denoising, Segmentation, fuzzy clustering.

1. INTRODUCTION

Image segmentation is an important and challenging problem and a necessary first step in image analysis as well as in high-level image interpretation and understanding such as robot vision, object recognition, and medical imaging [2][5]. The goal of image segmentation is to partition an image into a set of disjoint regions with uniform and homogeneous attributes such as intensity, color, tone or texture, etc. The image segmentation approaches can be divided into four categories: thresholding, clustering, edge detection and region extraction. A clustering based method for image segmentation will be considered.

Clustering is a process for classifying objects or patterns in such a way that samples of the same group are more similar to one another than samples belonging to different groups. Many clustering strategies have been used, such as the hard clustering scheme and the fuzzy clustering scheme, each of which has its own special characteristics. The conventional hard clustering method restricts each point of the data set to exclusively just one cluster. As a consequence, with this approach the segmentation results are often very crisp, i.e., each pixel of the image belongs to exactly just one class. However, in many real situations, for images, issues such as limited spatial resolution, poor contrast, overlapping intensities, and noise and intensity in homogeneities variation make this hard segmentation a difficult task. Fuzzy clustering is a class of algorithms for cluster analysis in which the allocation of data points to clusters is not "hard" all-or-nothing but "fuzzy" in the same sense as fuzzy logic. In fuzzy clustering, every point has a degree of belonging to clusters, as in fuzzy logic, rather than belonging completely too just one cluster. Thus, points on the edge of a cluster may be in the cluster to a lesser degree than points in the center of cluster. An overview and comparison of different fuzzy clustering algorithms is available.

The algorithm minimizes intra-cluster variance as well, but has the same problems as *k*-means; the minimum is a local minimum, and the results depend on the initial choice of weights. Using a mixture of Gaussians along with the expectation-maximization algorithm is a more statistically formalized method which includes some of these ideas: partial membership in classes. Another algorithm closely related to Fuzzy C-Means is means. Among the fuzzy clustering methods, Fuzzy C-means algorithm is the most and can retain much more information than hard segmentation methods .To compensate for this drawback of FCM, the obvious way is to smooth the image before segmentation. However, the conventional smoothing filters can result in loss of important image details, especially image boundaries or edges. More importantly, there is no way to rigorously control the trade-off between the smoothing and clustering. In their work, the condition of each pixel is determined by the membership.

Healthy brain tissue can generally be classified into three broad tissue types on the basis of an MR image. These are Grey Matter, White Matter and Cerebrospinal Fluid. This classification can be performed manually on a good quality T1 image, by simply selecting suitable image intensity ranges which encompass most of the voxel intensities of a particular tissue type. However, this manual selection of thresholds is highly subjective. Some groups have used clustering algorithms to partition MR images into different tissue types, either using images acquired from a single MR sequence, or by combining information from two or more registered images acquired using different scanning sequences or echo times (e.g. proton-density and T2-weighted). This approach is a version of the `mixture model' clustering algorithm, which has been extended to include spatial maps of prior belonging probabilities, and also a correction for image intensity non-uniformity that arises for many reasons in MR imaging. Because the tissue classification is based on voxel intensities, partitions derived without the correction can be confounded by these smooth intensity variations. The model assumes that the MR image or images consists of a number of distinct tissue types clusters from which every voxel has been drawn the new algorithm is effective and efficient, and is relatively independent of this type of noise.

2. SCANNING TECHNIQUES

The problems within the human brain without invasive surgery we use scanning techniques. CT(Computed Tomography) scan builds up a picture of the brain based on the differential absorption of X-rays but it reveal the gross features of the brain but do not resolve its structure well. ERP (Event related potentials) provides the electrodes on the scalp measure voltage fluctuations resulting from electrical activity in the brain. But in ERP patients undergone brain surgery or to localize ERP sources is to place electrodes in the brain. PET (Positron Emission Tomography) measures blood flow by injecting people with radioactive water and measure changes in radiation.

MRI produces images at higher resolution than PET. It involves rapid scanning of the brain to see which area of brain becomes activated. It is highly sensitive so small changes also detected and multiple scans can be done on the same subject. Expectation Maximization (EM) is one of the most common algorithms used for density estimation of data points in an unsupervised setting. The EM algorithm is used to estimate the parameters of this model; the resulting pixel-cluster memberships provide a segmentation of the image. According to[8] the EM algorithm has demonstrated greater sensitivity to initialization than the K-Means or FCM algorithms. The Markov Random Field (MRF) [02] models are used for the restoration and segmentation of digital images. They can make up for deficiencies in observed information by adding a-priori knowledge to the image interpretation process in the form of models of spatial interaction between neighboring pixels By using concentration level we can identify the analysis of tumor region. Generally, DWT is used in wavelet based medical image analysis as it preserves frequency information in stable form and allows good localization both in time and spatial frequency domain. However, one of the major drawbacks of DWT is that the transformation does not provide shift invariance. This causes a major change in the wavelet coefficients of the image even for minor shifts in the input image.

3. CLUSTERING

In this section, we elaborate our cluster notion based on characteristic interaction patterns. We want to find clusters of objects, which are represented by sharing a common cluster-specific interaction pattern among the dimensions. Hidden Markov models it measure only the similarity nerve cells only. Sequence Clustering

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Refinement algorithm it acts as a K-means but it does not cluster different regions. Independent component Analysis cluster it measures only the independent nerve cells. Nearest hyper plane distance neighbor clustering algorithm that can be applied to high dimensional data, it cannot be applied to low dimensional data and it does not provide efficient clustering.

An Automatic Unsupervised Classification observed that the grey matter distance can best separate the Alzheimer's disease patients from the cognitively normal control but it takes more time to diagnose the diseases. Fuzzy clustering algorithms classify the tissues based on single channel but after clustering noise and misclassification error may present. Hierarchical clustering analyzes micro array data and makes it easier to interpret the results of a cluster analysis but it diagnoses only Alzheimer's disease only. Recently, compression-based similarity measures have been proposed.

We propose Fast Fuzzy Clustering algorithm (**FFC**) segmenting and detecting the tumor region. In existing approaches based on the recognized power of the 'kernel method' in recent machine learning community present a kernel-based fuzzy clustering algorithm that exploits the spatial contextual information in image data. Unlike the aforementioned algorithms based on FCM for image segmentation which still adopt the squared-norm distance metric in the objective function, the proposed algorithm use a new kernel-induced metric and is shown to be more robust to noise and outlier than classical algorithms. A new approach for segmenting MR image corrupted by noise was presented. The algorithm is based on the well-known 'kernel method', and is realized by modifying the objective function in the conventional fuzzy c-means algorithm using a kernel-induced distance metric and a spatial penalty term that takes into account the influence of the neighboring pixels on the Centre pixel.

While clustering first it takes pixel values from any regions after that it perform image segmentation then preprocessing. In pre-processing, we use kernel metric is used to remove the noise in that image. After that, we use RDWT algorithm it clusters the normal pixels clustered in one group and abnormal pixels in another group. From that, tumor region is detected.

4. PROPOSED SYSTEM

In this section, we introduce the algorithm in FFC which minimizes the clustering objective function. Similar to kernel algorithm to overcome the shift variance problem of DWT. RDWT can be considered as an approximation to discrete wavelet transform that removes the down-sampling operation from traditional critically sampled DWT, produces an over complete representation.

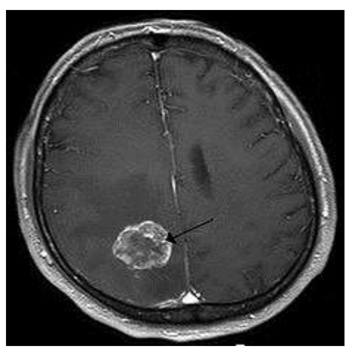

Figure 1.Detecting Tumor Region

Segmentation of biomedical images is the basis for 3Dvisualization and operation simulation. Precision in segmentation is critical to diagnosis and treatment. Conventionally, segmentation methods are divided into region based segmentation and edge or gradient based segmentation. Region based segmentation, is usually based on the concept of finding similar features such as brightness and texture patterns. Edge based segmentation methods are based on finding the high gradient value in the image and then connect them to form a curve representing a boundary of the object. In this section, we propose FFC based medical image segmentation algorithm which is a region-based method but inherently provides the features of edge-based segmentation method too. Since the detail bands of FFC decomposed image provide gradient information, we can use this information for region segmentation. The proposed region based segmentation algorithm is described as follows: Let I be the medical image/volume data to be segmented. This image is decomposed into n levels using RDWT. The proposed approach uses the wavelet energy computed from the approximation band and all the detailed bands using block size of x × x, w, fi, the energy

features for RDWT sub bands (where i = {a, h, v, d} and a- approximation , v - vertical, d - diagonal, h - horizontal),are computed using Equation.
These energy features, fa, fv, fd, and fh, reflect the
texture property of an image, and the wavelet energy features computed from detailed sub bands provide the gradient information which facilitates the robust segmentation.

5. RESULTS AND DISCUSSION

A major advantage of FFC is possibility to identify the detected region. To facilitate, focus on a subset of the models which best differentiates among the clusters. For each pair of clusters, the best discriminating models are selected by leave-one-out validation using objects of the corresponding clusters. The clustering result together with the information about which models best discriminate among clusters is a good basis for user interaction.

Our results show the best segmentation results and detecting the tumor regions

6. CONCLUSION

We define a cluster as a set of objects sharing a specific region among the dimensions. In addition, we propose Fast Fuzzy Clustering algorithm, an efficient algorithm for region-based clustering. Our experimental evaluation demonstrates that the cluster-based cluster notion is a valuable complement to existing methods for clustering tumor regions. FFC achieves good results on synthetic data and on real world data from various domains, but especially excellent results on MRI data. Our algorithm is scalable and robust against noise and improves the segmentation accuracy.

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