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A Novel Approach for the Detection of Different Brain Tumor Techniques

B. Sainaz[1], Dr. G. Sreenivasulu[2]

[1]M.Tech Student, Department of ECE, Sri Venkateswara University College of Engineering, Tirupati, Andhra Pradesh, India

[2]Professor, Department of ECE, Sri Venkateswara University College of Engineering, Tirupati, Andhra Pradesh, India

ABSTRACT

Now a days brain tumor detection plays very imporatnt and crucial role in the field of digital image processing . in recent years different techniques introduced in order to detect this brain tumor .the techniques used in the recent years are like k-means,fuzzy c-means,watershed segmentation etc.but these techniques detect the area of the tumor but cannot prdict the exact area of the tumor.to overcome these drawbacks ,here we proposed a paper based on these techniques and also calssification done based on SVM classifier i.e; support vector machine classifier which is used to classify the features of the tumor and aslo we can detect the exact area of the tumor which saves the time .experimental results proves that this method gives better performance than the other state of art methods.

Keywords : Brain Tumor Techniques, SVM classifier, glioblastoma, astrocytomas, CSF, CGVIS

I. INTRODUCTION

In recent times, the introduction of information technology and e-health care system in the medical field helps clinical experts to provide better health care to the patient. This study addresses the problems of segmentation of abnormal brain tissues and normal tissues such as gray matter (GM), white matter (WM), and cerebrospinal fluid (CSF) from magnetic resonance (MR) images using feature extraction technique and support vector machine (SVM) classifier.

The tumor is basically an uncontrolled growth of cancerous cells in any part of the body, whereas a brain tumor is an uncontrolled growth of cancerous cells in the brain. A brain tumor can be benign or malignant. The benign brain tumor has a uniformity in structure and does not contain active (cancer) cells, whereas malignant brain tumors have a nonuniformity (heterogeneous) in structure and contain active cells. The gliomas and meningiomas are the examples of low-grade tumors, classified as benign tumors and glioblastoma and astrocytomas are a class of high-grade tumors, classified as malignant tumors.

Clustering is an important tool for a variety of applications. Clustering is division of data into groups of similar objects. Each group consists of objects that are similar between themselves and dissimilar to objects of other groups. From the machine learning perspective, Clustering can be viewed as unsupervised learning concepts. Unsupervised machine learning means that clustering does not depend different types of clusters depending on the predefined classes and training examples while classifying the data objects. Clustering algorithms are mainly divided into two techniques: Hierarchical algorithms and partition algorithms. A hierarchical clustering algorithm divides the given data set into smaller subsets in fashion. A partition clustering algorithm partitions the data set into desired number of sets in a single step. Numerous methods have been proposed to solve clustering problem. The most popular clustering method is K-Means clustering algorithm. This algorithm is more prominent to cluster massive data rapidly and efficiently. So it can be used in image processing techniques especially in segmentation.

Recently, particular attention has been dedicated to Support Vector Machines as a classification method. SVMs have often been found to provide better classification results that other widely used pattern recognition methods, such as the maximum likelihood and neural network classifier. Thus, SVMs are very attractive for the classification of remotely sensed data. The SVM approach seeks to find the optimal separating hyperplane between classes by focusing on the training cases that are placed at the edge of the class descriptors. These training cases are called support vectors. Training cases other than support vectors are discarded. This way, not only is an optimal hyperplane fitted, but also less training samples are effectively used; thus high classification accuracy is achieved with small training sets (Mercier and Lennon 2003). This feature is very advantageous, especially for remote sensing datasets and more specifically for Object-based Image Analysis, where object samples tend to be less in number than in pixelbased approaches. A complete formulation of Support Vector Machines can be found at a number of publications. Here, the basic principles will be presented and then their implementation and application to Object Based Image Analysis will be evaluated.the svm classifier is used to detect the features.

II. RELATED WORK

There are many image processing techniques so far used inliterature by different researchers to accomplish differentproblem solutions. Regarding human brain lot of work havebeen done and still going on. So far we have gone throughliteratures speaking of intensity based thresholding toseparate cerebrospinal fluid from skull, histogram equalization along with thresholding to detect brain tumourwhere clear detection is not visible and some normal cellswere also considered to be abnormal, gray level adaptivemorphological operators have been designed, segmentation of computer Graphics, Vision and Information Security (CGVIS)coronary artery using morphological operators andwatershed and many more works in medical field.

k-means clustering method

k-means clustering is a method of vector quantization, originally from signal processing, that is popular for cluster analysis in data mining.k-means clustering aims to partition n observations into k clusters in which each observation belongs to the cluster with the nearest mean, serving as a prototype of the cluster. This results in a partitioning of the data space into Voronoi cells.

Additionally, they both use cluster centers to model the data; however, k-means clustering tends to find clusters of comparable spatial extent, while the expectation-maximization mechanism allows clusters to have different shapes .The main drawbacks of this method are Difficult to predict K-Value.With global cluster, it didn't work well.Different initial partitions can result in different final clusters.It does not work well with clusters (in the original data) of Different size and Different density.In the following slide comparing the original image with the k-means methodUsing k-means method only image divides into clusters and the image did not segmented clearly.

Watershed segmentation

In the study of image processing, a watershed is a transformation defined on a grayscale image. The name refers metaphorically to a geological watershed, or drainage divide, which separates adjacent drainage basins. The watershed transformation treats the image it operates upon like a topographic map, with the brightness of each point representing its height, and finds the lines that run along the tops of ridges.There are different technical definitions of a watershed.

In graphs, watershed lines may be defined on the nodes, on the edges, or hybrid lines on both nodes and edges. Watersheds may also be defined in the continuous domain. There are also many different algorithms to compute watersheds. Watershed algorithm is used in image processing primarily for segmentation purposes.The main disadvantage of the Watershed Transform is that for most natural images it produces excessive over segmentation.In the following slide comparing the original image with the watershed segmentation image.

Fuzzy c-means clustering method

Fuzzy clustering (also referred to as soft clustering) is a form of clustering in which each data point can belong to more than one cluster.Clustering or cluster analysis involves assigning data points to clusters such that items in the same cluster are as similar as possible, while items belonging to different clusters are as dissimilar as possible. Clusters are identified via similarity measures. These similarity measures include distance, connectivity, and intensity. Different similarity measures may be chosen based on the data or the application.the main drawbacks of fuzzy c means are

Neural Network

The networks normally used for pattern recognition are called feed forward because they have no feedback. They simply associate inputs with outputs. Neural networks are now used successfully in speech, language, and image recognition.Neural Network Architecture. Humans and other animals process information withneural networks. These are formed from trillions of neurons (nerve cells) exchanging brief electrical pulses called action potentials. This neural network is formed in three layers, called the input layer, hidden layer, and output layer.

III. METHODOLOGY

The SVM classifier is a binary classifier that maximizes the margin. The separator hyperplane is parallel to the margin planes and is midway between the planes. Each margin plane passes through point(s) of the learning set that belong to a particular class and is closest to the margin plane of the other class. The distance between the margin planes is called the margin. Note that multiple pairs of margin planes are possible with different margins. The SVM algorithm finds the maximum margin separating hyperplane. The points from each class that determine the margin planes are called the support vectors (SVs).

We can set up an optimization problem by directly maximizing the margin (geometric margin). We want the classifier to be correct on all examples . Note that yt is directly related to the true class. Subject to these constraints, we would like to maximize the margin i.e. maximize γ/kθk. Thus, we can alternatively minimize . Which gives us the following optimization problem, minimize . Which effectively becomes, minimize . This is a convex (actually quadratic) optimization problem. Such problems have efficient algorithms to solve them. And an important property is that the local optimum is also the global optimum. So, we are guaranteed to find the optimal solution. We won't be going into the details. But further analysis requires knowledge of Lagrange Multipliers and KKT conditions.

Support vector machines (SVMs) are a set of related supervised learning methods that analyze data and recognize patterns, used for classification (machine learning)|classification and regression analysis. The original SVM algorithm was invented by Vladimir Vapnik and the current standard incarnation (soft margin) was proposed by Corinna Cortes and Vladimir Vapnik . The standard SVM is a non-probabilistic binary classifier|binary linear classifier, i.e. it predicts, for each given input, which of two possible classes the input is a member of. Since an SVM is a classifier, then given a set of training examples, each marked as belonging to one of two categories, an SVM training algorithmbuilds a model that predicts whether a new example falls into one category or the other.

Intuitively, an SVM model is a representation of the examples as points in space, mapped so that the examples of the separate categories are divided by a clear gap that is as wide as possible. New examples are then mapped into that same space and predicted to belong to a category based on which side of the gap they fall on.

A version of SVM for regression analysis|regression was proposed in 1996 by Vladimir Vapnik, Harris Drucker, Chris Burges, Linda Kaufman and Alex Smola. This method is called support vector regression (SVR). The model produced by support vector classification (as described above) depends only on a subset of the training data, because the cost function for building the model does not care about training points that lie beyond the margin. Analogously, the model produced by SVR depends only on a subset of the training data, because the cost function for building the model ignores any training data close to the model prediction (within a threshold . There is also a least squares version of support vector machine (SVM) called least squares support vector machine (LS-SVM) proposed in Suykens and Vandewalle .

The parameters of the maximum-margin hyperplane are derived by solving the optimization. There exist several specialized algorithms for quickly solving the QP problem that arises from SVMs, mostly reliant on heuristics for breaking the problem down into smaller, more-manageable chunks. A common method for solving the QP problem is Platt's Sequential Minimal Optimization (SMO) algorithm, which breaks the problem down into 2-dimensional sub-problems that may be solved analytically, eliminating the need for a numerical optimization algorithm.

Another approach is to use an interior point method that uses Newton-like iterations to find a solution of the Karush-Kuhn-Tucker conditions of the primal and dual problems. Instead of solving a sequence of broken down problems, this approach directly solves the problem as a whole. To avoid solving a linear system involving the large kernel matrix, a low rank approximation to the matrix is often used to use the kernel trick.

IV. RESULTS

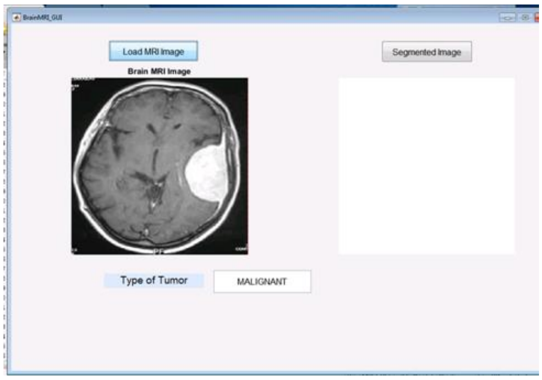

Figure 1 : Original Image

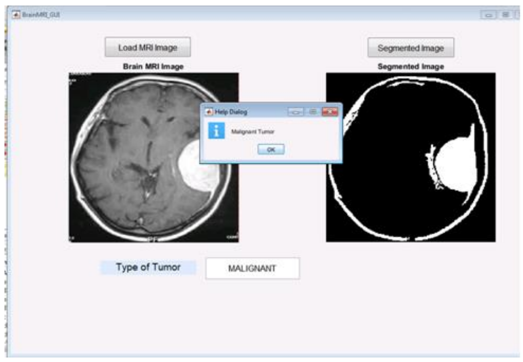

Figure 2 : Segmented Image and type of tumor

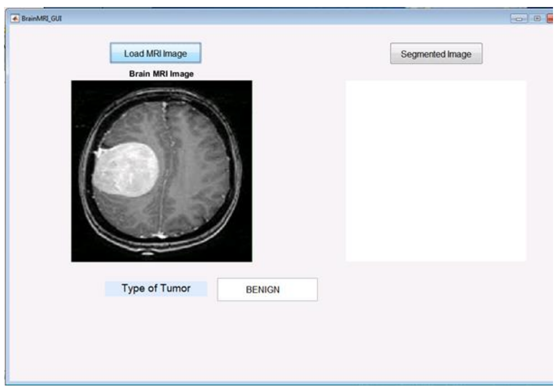

Figure 3 : Original Image

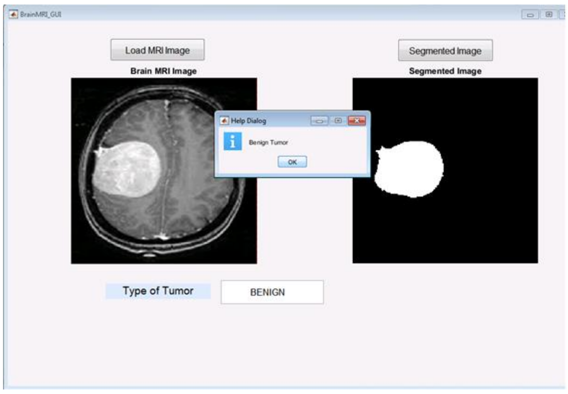

Figure 4 : Segmented Tumor and type of tumor

Tabel 1. PSNR and MSE for Existing Methods

Methods	**Existing methods**	
	MSE	PSNR
k-means	6	30
watershed	4	33
Fuzzy	3	19
Neural network	2	41

Table 2. PSNR and MSE for Proposed Method

Methods	**Proposed method**	
	MSE	PSNR
Benign	0.0025	72.8834
allignant	0.0019	73.7080

V. CONCLUSION

This paper presents the various recent approaches used in the brain tumor detection and the current work is based on svm classifier from which the tumor can be classified and the type of the tumor detected,this method proves to be better when compared to the other recent techniques .

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