Implementation of Hybrid KNN – FCM for Brain Tumor Segmentation

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Abstract - **The method of brain tumor segmentation is the separation of different tumor region from Magnetic Resonance images (MRI) but it is a complicated task, due to the brain cells structure and deformation occurrence, where most of the cells are overlapped with each other. In medical research segmentation is a primary problem in spatial image recognition due to 2D dimensional datasets. In this paper presents a new segmentation methods, KNN based block matching algorithm with Fuzzy C-Mean clustering approach, for segmenting brain cells classification to identify tumor at its early stages. A cluster based BTD algorithm is implemented to overcome real time issues in training and learning techniques. Also adaptive Local K-nearest neighbor (KNN) density based estimation is applied to cluster the spatiotemporal datasets. In this approach, BBTD algorithm contributes in determining the tumor cells as earliest compare to existing approaches.**

Key words: Segmentations, Brain tumor, Hybrid KNN, FCM, MRI Image, Fuzzy

I. INTRODUCTION

Brain tumor segmentation in MRI images has been an active research and complicated task in bio medical area. Extraction of unique and recognized features is a most primary need for successful image segmentation. The brain tissues of subcortical region and cerebrospinal fluid region in the MR brain images have complex structure leads features extraction is a challenging task. Intensity level selection across those region is an important characteristics in segmenting tumor from other structural tissues in the brain. From Ref. [1], the authors use intensity and a conventional fuzzy c-means clustering algorithm (FCM) for segmentation of GM, CSF and WM in MR images. However, this intensity selection technique alone has been verified to be deprived method for precise extraction of features. Fractal Dimension (FD) providing a statistical index of complexity is a functional tool to distinguish the textured images and surface roughness [3] over cells. On the other hand, researchers have used feature selection in many applications such as medical imaging, data mining and lexical works [6-7]. The authors in Ref. [8] develop a novel algorithm for normalizing the intensities of an image to best match those of a model distribution. In Ref. [9], the authors carry out KLD over image modalities, including structural, functional and EEG for data fusion and modelling. In this work, we compared efficiency of different multi resolution texture models of brain tissues to segment brain tumors in pediatric T1, T2, and FLAIR MRI respectively.

II. PREVIOUS WORKS

Joachim M. Baehring, done a research on 89 patients for malignant glioma, diffusion weighted imaging technique to make early conclusion making process of a different cases where the diagnosis in the early stages is crucial.

In a study done by Ishtiaq A Chishty , Muhammad Zafar and Rafique, MunawarHussain on Fifty-three patients having dissimilar neurological symptoms referred to Radiology Department Aga Khan University Hospital for MRI inspection were integrated in the study where patients were diagnosed radiologically having intra-axial brain tumor or consequently found to have pathologically confirmed primary intra-axial brain tumors occurrence. MRI scans were evaluated for location, constancy, internal bleeding, necrosis, margins, edema, MRI signals contrast enhancement and any additional features for staging the tumor. Through that accuracy of MR imaging in diagnosing and staging the brain tumors was determined. Sensitivity, specificity, precision, positive predictive value and negative predictive value of MRI in characterizing the lesion was also calculated.

A. Fuzzy C-Means and SVM Clustering

Support vector machines (SVMs) are a set of organized learning methods used for classification, regression and outlier's detection of give classes. It is mostly used in classification and estimation. In this algorithm, each data item is plotted as a point in n-dimensional space (where n is number of features you have) with the value of each feature being the value of a particular synchronization. Then, we perform arrangement by finding the hyper-plane that differentiate the two classes. In SVM, it is easy to have a linear hyper-plane between these two classes using kernel trick which takes low dimensional input space and transform it to a higher dimensional space in kernels.

III. DEVELOPMENT OF NEW APPROACH

Hybrid k-nearest neighbor algorithm:

We propose an iterative adaptive edge preserved median filtering through guided image extractions with adaptive frequency clusters and classification method, which gives promising solutions in a broadly applicable RTTD (run time tumor detection) environment. Mutation cells extraction is done by initially generating a group of clusters through FCM and KNN based iterated background prior propagation classification, then fusing most promising clusters to obtain tumor segmentation.

This proposed method yields efficient and accurate tumor extraction with challenging scenes in both segmentation accuracy and execution efficiency.

In this paper, KNN algorithm along with the edge preservation technique is used for better classification and segmentation of the brain tumor and hence termed as Hybrid KNN.

KNN algorithm is a simple classification algorithm and can achieve accuracy with better results. Also it can also be used for regression problems identification.

KNN algorithm preserves all possible cases and update new functions based on a similarity measure between cells (e.g., distance functions). it has been used in statistical model estimation and pattern recognition in cells as a independent technique used to classify predictive problems in brain cells. KNN algorithm find across all parameters so that it is commonly used for its easy of elucidation and low calculation time.

KNN assumes that the data is in a feature space where the data points are in a metric space that can be scalars or possibly even multidimensional vectors.

Edge preservation algorithm cleans up the image noise in the consistent areas, but preserves all image structures like edges or corners of selected region. Edge preservation is not only applicable to grayscale images, but also applies to multi-channel data, like color images too. Edges with unreliable contrasts that may be present in real images have been simulated. These nonlinear algorithms calculate filtered gray value in dependence of the content of a defined neighbor pixels. Thus, with this Hybrid approach better performance like accuracy, MSE and PSNR values. Medical images from MRI, CT, and positron emission tomography are gradient based and are vulnerable to week edges and other methods are intensity-based and vulnerable to noises and distortion. But the medical images have both of these two characteristics that we need to overcome.

Existing segmentation methods are roughly categorized based on the image features used for segmentation, into two basic approaches, the edge-based and region-based methods. From this paper we proposed a novel technique to resolve deformation issues in edges. Advantages: Improves accuracy for most distorted scanning. Lower learning error rate (max shrink & min shrink) Improves DS (detection and solution) performance and min-max detection rate.

IV. RESULTS

The new approach provides the improving results and better performance than the existing approaches and the comparison results are shown here.

Cases	Accuracy		MSE	PSNR
	SVM	Hybrid KNN		
Case 1	74.3	92.9	0.0917	58.5
Case 2	70.1	91.6	0.0236	64.4
Case 3	71.4	92	0.19	55.4
Case 4	74	92.8	0.058	60.5
Case 5	73.4	92.7	0.00903	68.6
Case 6	75.6	93.1	0.0288	63.5
Case 7	77	93.5	0.0435	61.7
Case 8	74.4	92.9	0.386	52.3
Case 9	73	92.5	0.22	54.7
Case 10	73.8	92.7	0.0493	61.2

Table I

Here the images output of various stages of the processing is displayed comparing the existing and new approach. It is evident that the Hybrid KNN provides better performance and detection of the brain tumor as comparing to previous approaches.

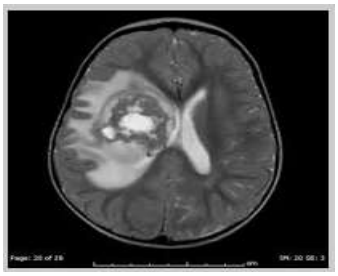

Fig I: Original Image

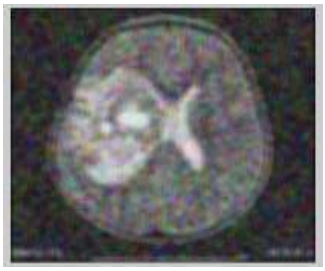

Fig II: Noise added Image

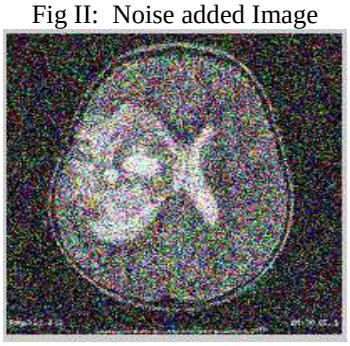

Fig III: Noise Filtered Image

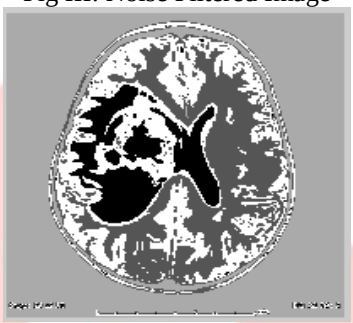

Fig IV: Fuzzy C-Means clustered

Fig V: Segmented Image using KNN

Fig VI: Segmented Image using Hybrid KNN

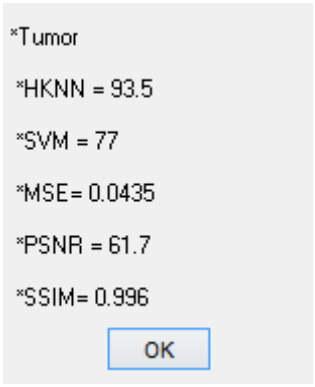

Fig VII: Message dialog box to display the detection and parameter details

V. CONCLUSION

In this paper, with the objective of enhancing brain tumor segmentation accuracy with the use of features extracted from deformation caused by the compression from brain tumor, we proposed a new method of Hybrid KNN for brain tumor segmentation systems. It has been shown that, the algorithm provide more than ninety percent accuracy for detecting the tumor. The algorithm provides a high extent of smoothing in the consistent areas without affecting structures like edges or corners. So the following feature extraction steps can be applied without the effects of noise.

Also, this approach have low impact on the implementation of the parameter. The classification accuracy of new approach is relatively consistent with the execution of the different values of parameter, as compared to the conventional approach. The segmentation accuracy is severely degraded if inappropriate values of parameter are reported to the classifier. Hence, the selection of the proper value for the parameter is not a critical issue for the developed classification approach. Especially in the situation where the training samples are limited and insufficient for the preparation of the training set and the validation set.

In future, other alternative methods for calculating distance and similarity measurement, with lower computational cost, in order to propose a more effective and efficient classification approach.

VI. REFERENCES

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