BRAIN TUMOR HYBRID SFC TECHNIQUE FOR SEGMENTATION USING K-MEANS CLUSTERING FROM MRI USING DWT & PCA FOR FEATURE EXTRACTION AND NN FOR CLASSIFICATION

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Abstract : An abnormal growth of cells in the brain is called a brain tumor. A brain tumor consists of a collection of abnormally functioning brain cells that have begun to grow and reproduce inappropriately. The uncontrolled growth of group of cells compresses and damages normal brain structures, which causes a variety of neurological symptoms. According to the reports of National Cancer Institute, Primary brain tumors are the leading cause of tumor cancer deaths in children, now surpassing acute lymphoblast leukemia and are the third leading cause of cancer death in young adults ages 20 to 39. There are more than 120 different types of brain tumors, making effective treatment very complicated. As per classification system defined by World Health Organization (WHO), brain tumor is named for the cell type of origin. Brain tumors can either originate from within the brain or from cancer cells that have metastasized from other organs or tissues. Various techniques are developed in the past to detect brain tumor. This research work proposed a Brain tumor Hybrid SFC Technique for segmentation using K-means Clustering from MRI using DWT & PCA for Feature Extraction and SVM for Classification.

***IndexTerms* - brain tumor, magnetic resonance imaging segmentation, pca, glcm..**

I. INTRODUCTION

Image processing is a procedure of changing a picture into advanced organization to get an upgraded picture by playing out a few tasks with a specific end goal to see some helpful data. It is the investigation and control of a digitized picture particularly for the change of its quality. The principle motivation behind picture preparing system is to recognize the picture under thought for less demanding representation and for picture honing and reclamation, picture recovery and example estimation. Picture Processing shapes the center of the exploration territory inside designing, business and furthermore in software engineering disciplines [1].

Innovation in medical field and advancements in technology for treating patients towards a healthy living and cure for their ailment is possible through successful researches by the efficient researchers. Invent of every new medicine and treatment involves a great number of people who gather together for a healthy study. In the past, in the absence of advanced technology, treatments were often given to patients based on guesses by the doctors which turned out to be a failure in most of the cases. Good research has removed such guess works from medical field in recent days. Research in medical sciene evolves many methods of good treatment, care and cure for the patients.

Each year, more than 19,000 people in the United States, 10,000 people in Canada and 9000 people in India are diagnosed with brain tumor. The overall incidence of all brain tumors is 100,000 people per year. Although as many as 70% of children diagnosed with brain tumors survive, but they are often left with long-term side effects. Recently most of the research works are based on early detection of brain tumor and its reliability. This thesis is based on MRI brain tumor detection by segmentation using various soft computing techniques.

II. BACKGROUND

El-Dahshan et al. [2] suggested a hybrid technique,in which feed forward pulse-coupled neural network is applied for the segmentation of the brain images. For feature extraction they consider approximation component of DWT. For feature reductuion they used PCA and for the classification they used back propagation neural network and achieved 99% accuracy.
Chaplot et al. [3] have introduced a scheme for feature extraction and classification. To validate the introduced system they are taken a standard dataset of 52 brain MRI images. For feature extraction, they consider coefficient of level-2 approximation subband of 2D DWT. Daubechies-4 (DAUB4) filter is used as decomposition filter. After getting the features they employed

self organizing map (SOM) and support vector machine (SVM) as classifier and they achieved higher classification rate for SVM with radial basis function (RBF) classifier i.e. 98% compared to the self-organizing map i.e. 94%.

Chatterjee et al. [4] have proposed a scheme for feature extraction and classification. For the feature extraction they have used slantlet transform (ST) and for the classification they used back-propagation neural network (BPNN) and archived ideal result. In [5] they introduced a scheme, they used ST for feature extraction and fuzzy c-means for classification and from the experimental result they observed that the proposed scheme outperformed.

Selvaraj et al. [5] suggested a system for brain MR image classification. For classification they have used many classifier i.e. SVM classifier, Neural classifier, statistical classifier. Among all these classifier LS-SVM outperformed with 98% of success rate.

El-Dahshan et al. [6] suggested a technique. The suggested technique comprises three stages i.e. feature extraction, feature reduction and classification. For feature extraction the approximation subband of DWT is considered. Principal component analysis (PCA) is used for feature reduction and for the classification feed forward back-propagation neural network (FP-ANN) and k-nearest neighbor (k-NN) used as classifier and they achieved 97% and 98% accuracy, respectively.

Zhang et al. [7] have proposed a scheme for classification. They have taken 160 images (20 normal,140 abnormal) to validate the scheme. For feature extraction level-3 approximation component using Haar wavelet is used. After feature extraction, PCA is used for feature reduction and for the classification forward neural network is used and they achieved 98.75% classification accuracy.

Saritha et al. [8] suggested a scheme, in which they have used entropy of wavelet approximation component at level-8 computed along with SWP for feature extraction. For the classification they used Probabilistic neural network (PNN) and their results indicate that they achieve high success rate.

Yang et al. [9] suggested a wavelet-energy based approach for brain MR image classification. For feature extraction they have used 2D DWT. For brain image classification SVM classifier was employed and BBO method was utilized to optimize the weights of the SVM. They noticed that their scheme was superior then KSVM, PSO-KSVM and BPNN.

Nayak et al. [10] have proposed hybrid technique for brain MR image classification. For feature extraction through brain MR images they utilizes the approximation coefficient of level-3 of discrete wavelet transform (DWT). To reduce the large set of extracted features from brain MR images they have employed kernel principal component analysis (KPCA). After getting the reduced set of features they have employed least square support vector machine (LS-SVM) as a classifier with different kernel function and they have reported that proposed scheme outperform with high accuracy.

Rao et al. [11] introduce a mechanized technique to distinguish and portion the cerebrum tumor districts. Medicinal picture preparing is an exceedingly difficult field. Medicinal imaging strategies are utilized to picture the internal bits of the human body for restorative conclusion. MR pictures are broadly utilized as a part of the analysis of mind tumor. The proposed strategy comprises of three principle steps: introductory division, demonstrating of vitality work and advance the vitality work. To influence our division more solid we to utilize the data exhibit in the T1 and FLAIR MRI pictures. We utilize Conditional arbitrary field(CRF) based structure to consolidated the data introduce in T1 and FLAIR in probabilistic area. Fundamental favourable.

Shree et al. [42] concentrated on commotion evacuation system, extraction of dark level co-event framework (GLCM) highlights, DWT-based mind tumor area developing division to lessen the many-sided quality and enhance the execution. This was trailed by morphological separating which expels the commotion that can be framed after division. The probabilistic neural system classifier was used to prepare and test the execution precision in the identification of tumor area in mind MRI pictures. The exploratory comes about accomplished almost 100% precision in recognizing ordinary and anomalous tissues from cerebrum MR pictures illustrating the viability of the proposed method.

III. PROPOSED TECHNIQUE

1. Select Test Image used for processing. Test image is the input image that is selected for further processing.
2. Perform preprocessing, Grayscale conversion and Binarization. Data preprocessing is a technique that involves transforming raw data into an understandable format. Real-world data is often incomplete, inconsistent, and/or lacking in certain behaviors or trends, and is likely to contain many errors. Data preprocessing is a proven method of resolving such issues. Data preprocessing prepares raw data for further processing. Image is converted from RGB image to grayscale image for further processing.
3. Computation and Segmentation of Super-Pixels to detect pixel highly effected by the tumor.
4. Apply K-means Clustering to segment the tumor. K-*means clustering* partitions a dataset into a small number of clusters by minimizing the distance between each data point and the center of the cluster it belongs to.
5. Show the segmented Tumor image. *Segmentation* partitions an *image* into distinct regions containing each pixel with similar attributes.
6. Apply DWT to generate frequency transform of the Image. DWT is any wavelet transform for which the wavelets are discretely sampled.
7. Pass DWT feature vector the PCA to get finite Coefficient of image. *Principal component analysis* (*PCA*) is a statistical procedure that uses an orthogonal transformation to convert a set of observations of possibly correlated variables into a set of values of linearly uncorrelated variables called principal components.
8. Perform Training using NN of the dataset. Neural Network (NN) are supervised learning models with associated learning algorithms that analyze data used for classification and regression analysis.
9. Evaluate the result and classify Tumor Type.
10. Show different parameter like computation time, Mean , Standard deviation, Entropy, RMS and Accuracy

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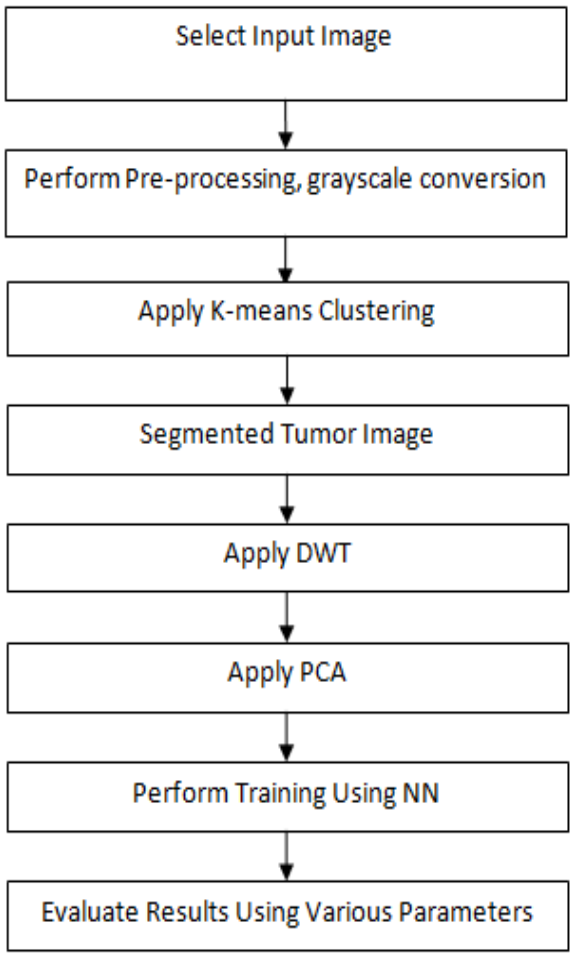

Figure 1: Flowchart of Proposed Technique

II. RESULTS AND DISCUSSION

This section presents experimental results of the proposed technique. Performance of proposed technique is evaluated on the basis of accuracy and time. Proposed technique is implemented using MATLAB tool.

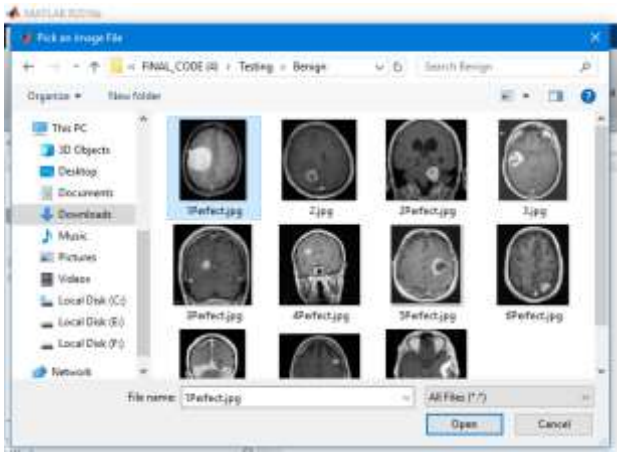

Figure 2: Choosing the image

This is the first window, Here we select an image of brain to segment brain tumor.

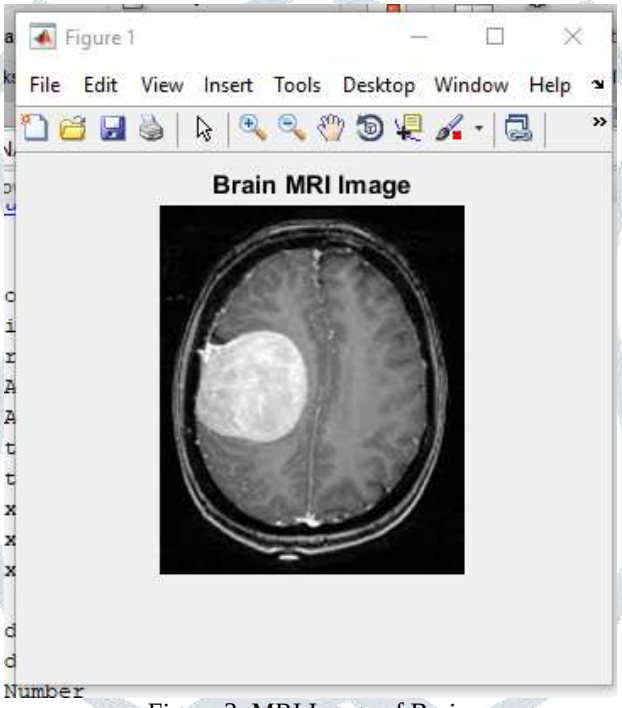

Figure 3: MRI Image of Brain

Above figure shows magnetic resonance image (MRI) of brain. MRI is a noninvasive method for imaging internal tissues and organs.

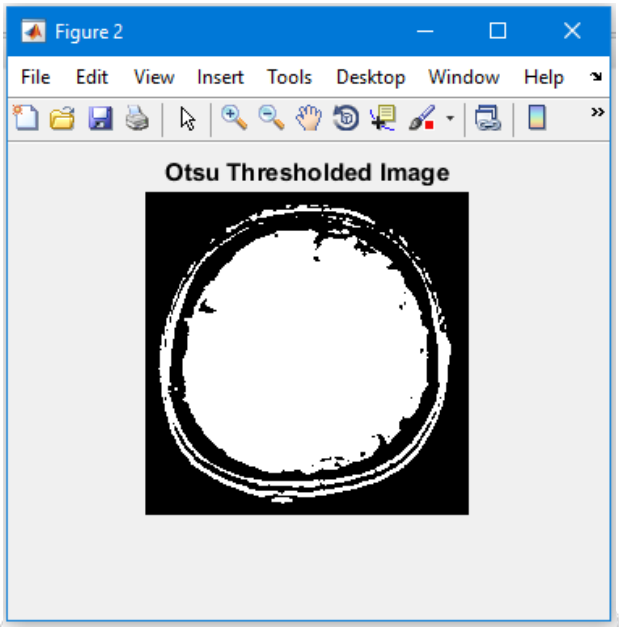

Figure 4: Showing Segmented Image Using Otsu Method

Above figure shows segmentation of brain MRI (magnetic resonance image) of the brain image using Otsu method. Otsu's method is a means of automatically finding an optimal threshold based on the observed distribution of pixel values.

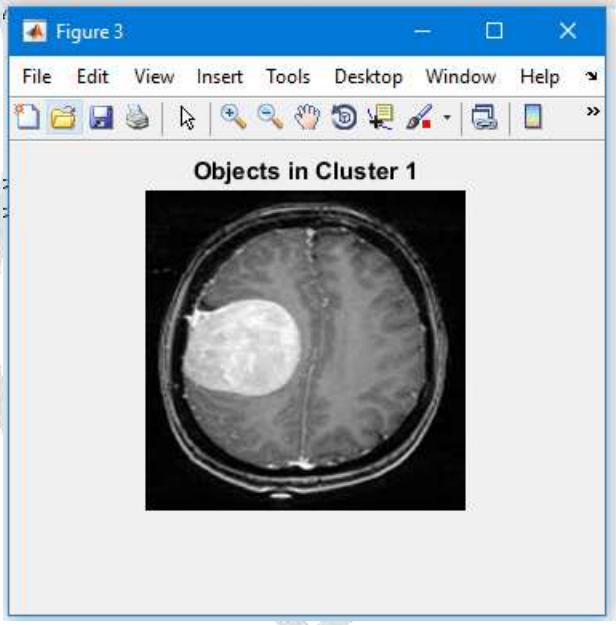

Figure 5: Showing Objects in Cluster

Above figure shows objects in the form of cluster. Cluster is used to show similar type of objects together. A *cluster* is therefore a collection of objects which are "similar" between them and are "dissimilar" to the objects belonging to other clusters.

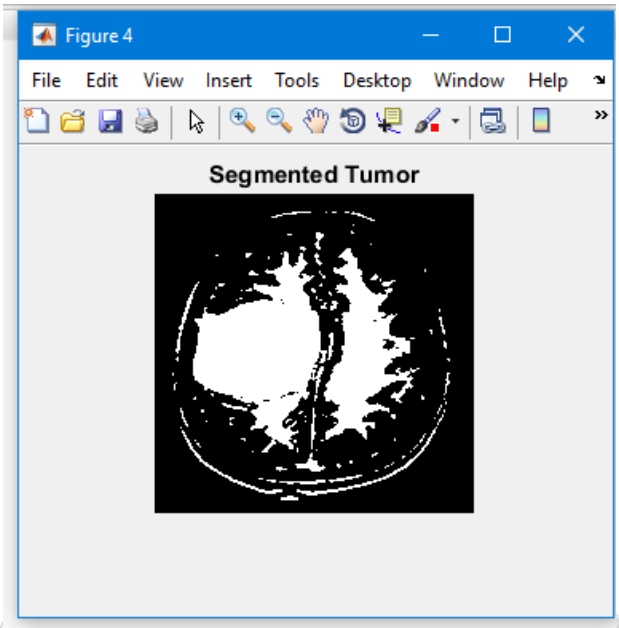

Figure 6: Showing Segmented Tumor
Above figure shows segmented image of brain tumor.

could not earn higher profits and interest rates from the economy and foreign companies could not earn considerably higher returns in terms of exchange rate. The investor could only earn a normal profit from KSE.

FiguresandTables

Table 1: Feature Set

Parameter	Value
Smoothness	0.9205
Skewness	0.4690
Contrast	0.2088
Correlation	0.1990
Energy	0.7621
Homogeneity	0.9352

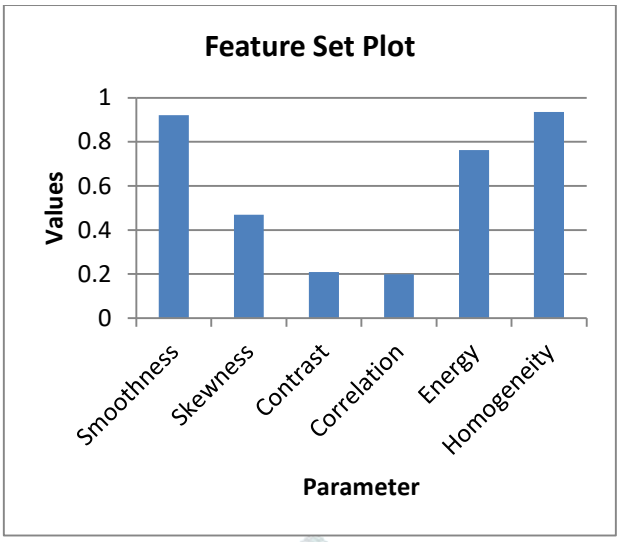

Figure 7: Feature Set Plot

V. CONCLUSION AND FUTURE SCOPE

This research work proposed a Brain tumor Hybrid SFC Technique for segmentation using K-means Clustering from MRI using DWT & PCA for Feature Extraction and SVM for Classification. In human body the very important part is brain. So, brain image segmentation is to be done accurately and perfectly. Various techniques are developed in the past to detect brain tumor. This work study different Brain MRI techniques and Tumor types. Proposed technique is implemented using MATLAB. Various parameters like computation time, Mean, Standard deviation, Entropy, RMS and Accuracy are used to evaluate the results. Experimental results show that proposed technique has more accuracy than the existing technique and takes less time as compared to the existing technique. It is demonstrated that proposed technique outperforms the existing technique. In future, we may use neural network or any other machine learning application instead of using support vector machine. Also, in future feature set vector are optimized for further optimization so that time of classification will reduce.

REFERENCES

[1] Cohen, L 1991, 'On active contour models and balloons', Computer Vision, Graphics and Image Processing, vol. 53, pp. 211 - 218.

[2] E.-S. A. El-Dahshan, H. M. Mohsen, K. Revett, and A.-B. M. Salem, "Computer-aided diagnosis of human brain tumor through mri: A survey and a new algorithm," Expert systems with Applications, vol. 41, no. 11, pp. 5526–5545, 2014.

[3] S. Chaplot, L. Patnaik, and N. Jagannathan, "Classification of magnetic resonance brain images using wavelets as input to support vector machine and neural network," Biomedical Signal Processing and Control, vol. 1, no. 1, pp. 86–92, 2006.

[4] M. Maitra and A. Chatterjee, "A slantlet transform based intelligent system for magnetic resonance brain image classification," Biomedical Signal Processing and Control, vol. 1, no. 4, pp. 299–306, 2006.

[5] H. Selvaraj, S. T. Selvi, D. Selvathi, and L. Gewali, "Brain mri slices classification using least squares support vector machine," International Journal of Intelligent Computing in Medical Sciences & Image Processing, vol. 1, no. 1, pp. 21–33, 2007.

[6] E.-S. A. El-Dahshan, T. Hosny, and A.-B. M. Salem, "Hybrid intelligent techniques for mri brain images classification," Digital Signal Processing, vol. 20, no. 2, pp. 433–441, 2010.

[7] Y. Zhang, S. Wang, and L. Wu, "A novel method for magnetic resonance brain image classification based on adaptive chaotic pso," Progress In Electromagnetics Research, vol. 109, pp. 325–343, 2010.

[8] M. Saritha, K. P. Joseph, and A. T. Mathew, "Classification of mri brain images using combined wavelet entropy based spider web plots and probabilistic neural network," Pattern Recognition Letters, vol. 34, no. 16, pp. 2151–2156, 2013.

[9] G. Yang, Y. Zhang, J. Yang, G. Ji, Z. Dong, S. Wang, C. Feng, and Q. Wang, "Automated classification of brain images using wavelet-energy and biogeography-based optimization," Multimedia Tools and Applications, pp. 1–17, 2015.

[10] D. R. Nayak, R. Dash, and B. Majhi, "Least squares svm approach for abnormal brain detection in mri using multiresolution analysis," in Computing, Communication and Security (ICCCS), 2015 International Conference on. IEEE, 2015, pp. 1–6.

[11] C.Hemasundara Rao, P.V. Naganjaneyulu, K.Satya Prasad, "Brain tumor detection and segmentation using conditional random field", IEEE, International Advance Computing Conference, 2017, pp. 807-810.

[12] N. Varuna Shree, T. N. R. Kumar, "Identification and classification of brain tumor MRI images with feature extraction using DWT and probabilistic neural network", Springer, 2018.