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Hybrid Technique to Detect Brain Tumour Using SVM Classifier

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ABSTRACT: This paper consists of a new hybrid technique combining Support Vector Machine (SVM) along with two combined clustering techniques namely K-means and Fuzzy C-means for the prediction of brain tumour and to classify the type. Segmentation of the image is done through two clustering techniques namely k-means and FCM in which separate analysis is done and also it is also enhanced by combining both k-means and fuzzy C-means. The feature extraction is done by using Grey Level Run Length Matrix(GLRLM) finally SVM is used to classify the image and also grade the location of the tumour is done with sensitivity, specificity, accuracy parameters .GUI program is constructed to test proposed algorithm.

KEYWORDS: MRI image, k-means, Fuzzy C-means (FCM), Support Vector Machine (SVM), Grey Level Run Length Matrix (GLRLM).

I.INTRODUCTION

Brain tumour can be said as abnormal growth of neurons in brain. The growth of neurons can vary from person to person .there are different types of tumours according to growth it may be Benign or Malignant. If tumour is at its origin then it is benign and if part of tumour spreads and grows on another place then it is malignant. These abnormal tumours effects CSF (cerebral spinal fluid) which causes strokes so detection of brain tumour is very important aspect. MRI scan is safer than any other scan as it does not involve any radiations and it gives high resolution of image.
In this paper, MRI images are enhanced by using contrast improvement and mid-range stretch technique. After image acquisition and enhancement of skull stripping is done. Skull striping involves double thresholding .segmentation is easier after skull striping. Segmentation is used to detect suspicious regions in MRI images .The proposed system first segments the MRI image using k-means [1] and clustering is next done through FCM [2], finally a combined K-means and FCM is used for the segmentation purpose. The combined cluster technique gives more fast and accurate results.
The feature extraction is done by using Grey Level Run Length Matrix (GLRLM) to extract features [3]' SVM classifiers are used to data analyse and for pattern recognize. It creates a hyper plane in between data sets to indicate which classes it belongs to'[4].The main aim of this work is to produce a hybrid technique which classify the MRI images and grade the image based on location successfully and effectively using combined technique k-means and fuzzy c-means with SVM .

II.SYSTEM MODEL

The proposed system consists of seven steps starting from acquisition of brain MRI images. the block diagram of proposed system is given in figure 1 which contains main steps .The hybrid technique first involves enhancement and skull striping, after the complete noise removal is done it is send for segmentation .The segmentation is done by clustering techniques namely K-means , fuzzy c-means and combined K-means and fuzzy c-means ,SVM classifier is used with GLRLM features for the feature extraction and train the SVM classifiers using MRI images and stores the database and testing is done .with these steps it is easier to cluster the segmentation of images and classify the tumour and to grade the tumour according to its location. The image is processed by following steps;

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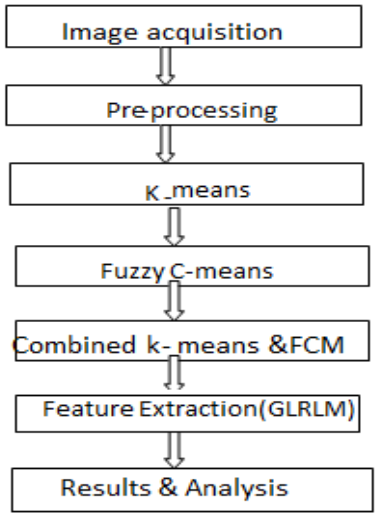

Figure. 1 Block diagram

A. Image acquisition: The brain MRI images are collected from medical centres. The image is converted into 2D matrices using matlab(R2013a).

B. Pre-processing; The pre-processing involves translation of image .It filters the noise and also other artifacts in the image and also sharpens the edges .Pre-processing involves enhancement of MRI images and skull striping

C. K-MEANS; First image is converted into binary form. the algorithm first consists of assigning K values.then centre are chosen randomly. Distance between each pixel to cluster is calculated. Comparison is done with all cluster using distance formula. With shortest distance the pixel moves to it .then centroid is re -estimated. The process stops when centre converges.[1].figure2 shows k-means clustering.

Algorithm

1. Assign number of cluster value s K.
2. Choose randomly K cluster centres.
3. Centroid is calculated.
4. Distance calculation is done.
5. Comparison is done to the nearest clusters and centre moves to it.
6. Otherwise it is moved to next cluster.
7. Re-estimation.
8. Repeat until centre converges.

D. Fuzzy C-means; Fuzzy c-means is method of clustering in which one piece of data belongs to two or more clusters. Fuzzy logic is a way processing the data by giving the partial member ship value to each pixel in the image. The member ship values are 0 to 1.the membership functions defines fuzziness of an image and also to define the information contained in the images.[2]it is shown in figure3.

Algorithm:

Fuzzy C-means

Input: Image in form of matrix

Output: Tumor region

Step 1: Initialize $U=[u_{ij}]$ matrix

Step 2: At k-step: calculate the centres vectors C

Step 3: Update $U^{(k)}$, and $u^{(k+1)}$

$$C_j = \frac{\sum_{i-1}^{N} u_{ij}^{m} * x_i}{\sum_{i-1}^{N} u_{ij}^{m}} \qquad (1.1)$$

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$$u_{ij} = \frac{1}{\sum_{k-1}^{c} \left[\frac{xi - cj}{xi - ck}^{\frac{2}{m-1}} \right]} \longrightarrow (1.2)$$

Step 4: If || U (k+1) – U (k) ||< then STOP; otherwise return to step 2.

E. **Combined K-means and Fuzzy c-means**

In this method it combines both clustering technique namely K-means and Fuzzy c-means.in this image is divided into 5 clusters according to maximum image size and with the actual tumour region is detected automatically with whitish region and rest of the image is made darker by making dark as 0 value.in combined analysis histogram accusation, edge detection ,erosion is done. Way this combined technique performance analysis becomes easier.[7].it is shown in figure4.

F. **Feature extraction using GLRLM**

Feature extraction is extracting the actual tumour at the FCM output. These are used to understand the images easier and to classify it. Here proposed system uses grey level run length matrices (GLRLM) technique. It is used after clustering techniques implemented. Here with GLRLM several feature can be extracted. In this system standard deviation, entropy is calculated.[3]

G. **Support Vector Machine**

The proposed system uses SVM for the detection and classification of tumour that is primary or secondary. After classification is done location of tumour is detected. The linear SVM classifier is used to grade the tumour according to its location .after actual tumour is detected, the area of tumour is calculated the area is calculated by using banalization method. Which consists of image having values either white or black (1 or0).here the maximum size of image is 256*256jpeg image. According to area comparative analysis is done. If area A>1500mm then its grade1;if area>2000mm then it is grade2;rest is taken as grade 3.With this analyzation of the tumour location becomes much more easier.[4].

H. **Performance measures**

Classification, the sensitivity, specificity and accuracy were calculated using below formulas:

- True Positive (TP): Abnormal brain correctly identified as abnormal.
- True Negative (TN): Normal brain correctly identified as normal.
- False Positive (FP): Normal brain incorrectly identified as abnormal.
- False Negative (FN): Abnormal brain incorrectly identified as normal. 1) Sensitivity = TP/ (TP+FN) *100%

2) Specificity = TN/ (TN+FP) * 100%

3) Accuracy = (TP+ TN)/ (TP+ TN+FP+FN)*100%

All these three parameters are used to check the classifiers performance .[11].

III. RESULT AND DISCUSSION

In this paper a hybrid technique combining both K-means and Fuzzy c-means is used with SVM for the segmentation and classification of brain MRI images. the classification of brain tumour are primary and secondary along with that grade is made according to location of tumour the brain images are segmented by double thresholding ,morphological operations and k-means and fuzzy c-means are used for clustering, GLRLM is used for extraction. After SVM is trained accuracy is validated. The result analyse provides better classifier performance by considering parameters such as sensitivity, specificity, accuracy.

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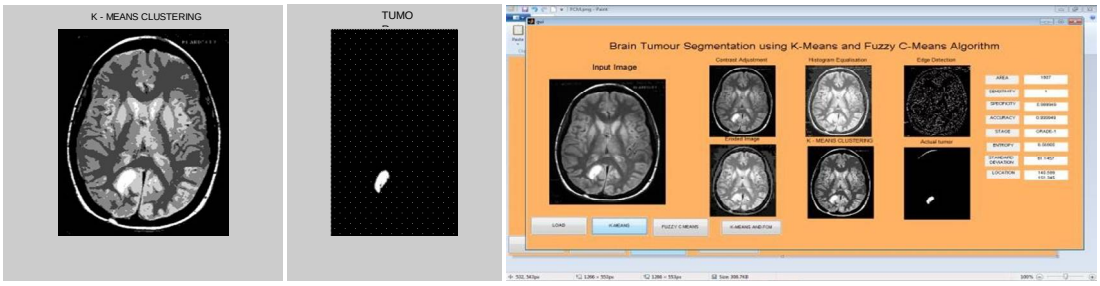

Figure. 2 k-means clustering and tumour detection

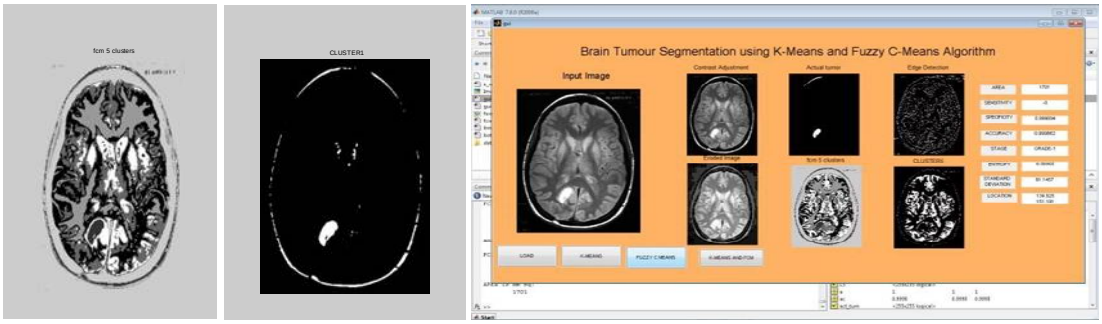

Figure. 3 FCM clustering

Figure. 4 combined K-means and FCM

VI.CONCLUSION

The proposed system is better way to detect and classify the brain tumor in MRI images. the hybrid technique consisting of SVM and two clustering techniques i.e K-means and fuzzy c-means provides more accurate results compare to other algorithms. With this proposed system it is easier to classify the tumour and also to grade the location of the tumour so that the visualization becomes easier with GUI interface. The system has more accuracy rate and less error rate.

In future work,3D analysis of the image can be done with that visualization becomes more easier .3d slicers with matlab can be developed.

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