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Design and Implementation of Modified FCM in the Detection of Brain Tumor

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ABSTRACT

Medical applications Plays an Important role in human's life. MRI is the important role in human's life. MRI is the important technique in detecting the brain tumor. This proposed paper involves a new hybrid technique which is used for predication of brain tumor. The combination of MFCM (modified Fuzzy C-Means) and Support Vector Machine (SVM) clustering algorithm have been used here. The respective algorithms are used for Segmentation and Classification purpose. To extract the relevant features from the brain images the grey level run length matrix (GLRLM) has been used. These methods provide efficient results for Classification and detection of brain tumor.

Key Words: *MRI, Hybrid technique, Modified FCM, SVM, GLRLM*

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1. INTRODUCTION

Brain tumor is defined as growth of abnormal cells within the brain. It can be malignant or benign. Brain tumor extraction and its analysis are challenging tasks in medical image processing its structure is complicated and it can be analyzed only by expert radiologist presently many medical imaging technique such as Position Emission Tomography (PET), X-ray, Computed Tomography (CT), Magnetic Resource Imaging (MRI) for tumor detection are being used. But MRI imaging technique is being widely used because of its higher resolution. Classification is a branch of data mining field. Data mining is a simple and robust tool to extract the information from large data set. In this field many Classification techniques are available for medical images such as Artificial Neural Network (ANN), Support Vector Machine (SVM), Decision tree and Bayesian Classification. The MRI images were enhanced using Contrast improvement and Mid-range stretch. Segmentation is a technique to extract suspicious region from images. Segmentation technique was done by modified Fuzzy C-Mean clustering before applying modified Fuzzy C-Mean clustering techniques Skull striping has been done. The method uses GLRLM to extract features. The brain MRI images were classified using SVM techniques which are widely used for data analyzing and Pattern recognizing. The above work provides efficient better result in the detection of the tumor in MRI images.

2. LITERATURE REVIEW

Support Vector Machine and Artificial Neural Network (ANN) were applied in many researches which are given in [3-5]. S.H.S.A. Ubaidillah, R.Sallehuddin and N.A Ali, worked on cancer detection using Artificial Neural Network and support vector machine: A Comparative study. They compared the performance on four different cancer datasets using SVM and ANN classifiers. In this study the ANN classifiers obtained good classification performance on the datasets that have bigger amount of input feature SVM also presented good performance on the datasets with smaller amount of input features but finally SVM classifier provided better result tumor [3]. A Padam and R.Sukanesh their study on SVM based classification of soft tissues in Brain CT image using Wavelet based Dominant Gray level Run length Texture Feature. They have emphasized on the technique of medical CT imaging as one of the widely applied and reliable technique used for the detection and location of Pathological changes efficiently using SVM. They obtained 98% accuracy [4]. Kailash Sinha, G.R.

Sinha they study on Efficient Segmentation Methods for Tumor Detection in MRI Images. Segmentation plays an important role in the processing of medical images. Presents a comparative study of three segmentation methods implemented for tumor detection. The methods include k-means clustering with watershed segmentation algorithm, optimized k-means clustering with genetic algorithm and optimized c- means clustering with genetic algorithm. [5]

3. PROPOSED SYSTEM

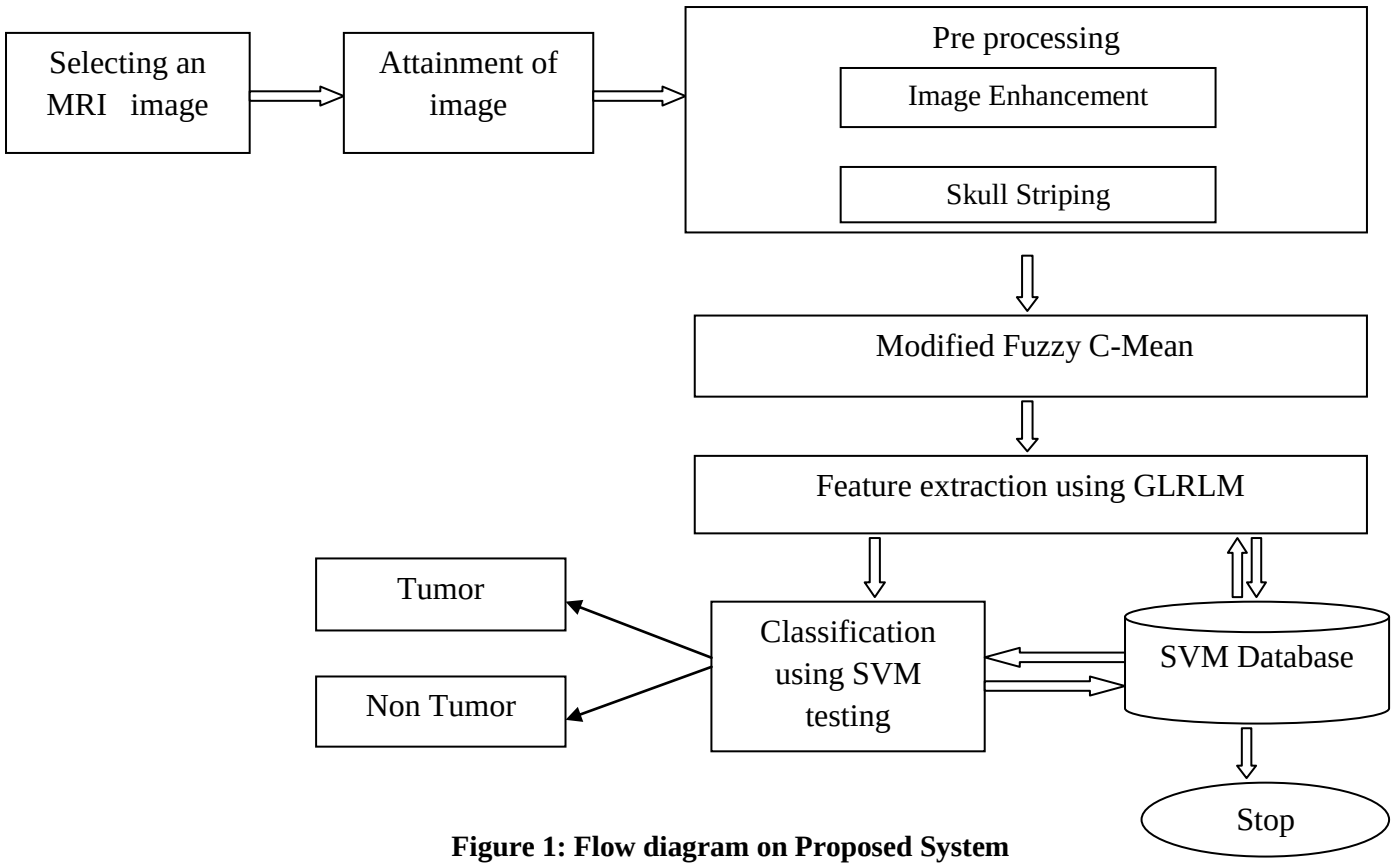

Figure 1: Flow diagram on Proposed System

Image is Processed through:

- Attainment of Images
- Pre Processing
- Modified Fuzzy C-Mean (MFCM)

- Feature Extraction using GLRLM
- SVM classifier

A. Attainment of Images

Brain MRI image were collected from different medical centres.These brain MRI images were converted into two dimensional matrices.

B. Pre Processing

The pre processing Phase is done using image Enhancement and skull striping .The qualities of images are improved using Enhancement technique. The method given below that is used for enhancement of brain MRI images.

- **Contrast Improvement: -** MRI images are RGB images which are converted into gray scale images. These gray scale images are called intensity mages after convention the image will be resized.
- **Mid Range Stretch:-** In this method the middle range MRI image intensity value are stretched so it Improved the quality of brain MRI images. In this techniques gray scale images pixels are mapped between 0 and 1. Skull Striping method of eliminating the Non brain tissues. The steps involved in Skull striping are given below.
- **Double thresholding**: - It is a segmentation technique. The techniques convert the image into binary form that is gray scale image to binary image. This technique generate the mask by setting each pixel in the range of 0.1*255-0.88*255 to 1 means white and remaining pixels to 0 means black. Non brain tissues pixels were discarded in MRI image. Here double thresholding is consider as upper and lower thresholding.
- **Erosion**: - In this stage unwanted pixels are removed from MRI image after thresholding. The skull portions are removed.

C. Modified Fuzzy C-Mean (MFCM)

Segmentation is the technique of separating an image into multiple slices and object region. This Provides good results for tumor segmentation. In this work fuzzy c-mean algorithm was used in MRI Image segmentation. The modified FCM algorithm is based on the concept of data compression. The Data compression includes two steps quantization and aggregation. The quantization of the feature Space is performed masking lower value ‘m’ bits of the feature value. In the process of aggregation Feature vector which are common intensity values are grouped together.

This modified FCM for brain tissue segmentation can be summarized in the following steps.

Step1: Read the brain volume data.

Step2: Pre-compute the degree of symmetry matrix for the entire image.

Step3: Set the number of tissue classes c, select initial cluster centroids, and set the ε to a small

value(1×10^{-5}).

Step4: Update fuzzy membership u_{ik} using equation (6).

Step5: Update cluster centroids V_i using equation (7)

Step6: If $\|u_{ik}^{new} - u_{ik}^{old}\| \leq \mathfrak{E}$, proceed to step 7, else return to step 4.

Step7: Get the final segementation results using the maximum fuzzy membership value of each pixel.

D. Feature extraction using GLRLM

Feature extraction is a technique to find the relevant features from images which are used to understand the images easier. This input data set images are converted into compressed form is called feature extraction. Here feature extraction is isolating the relevant features which lead to understand the brain MRI images well. The Gray Level Co-occurrence Matrix (GLCM) method is a way of extracting statistical texture features.

E. SVM classifier

SVM classifier has a fast learning speed even in large data. SVM is a supervised learning method. It is a good tool for data analysis and classification. SVM based on the conception of decision planes. A decision plane is one that separates between a set of items having different class memberships. The classification and detection of brain tumor was done by using the support vector machine technique. classification is done to identify the tumor class present in the image. The idea of SVM is to maximize the distance between the hyper plane and the closest sample point. That is good separation can be achieved when the hyper plane has longest distance.

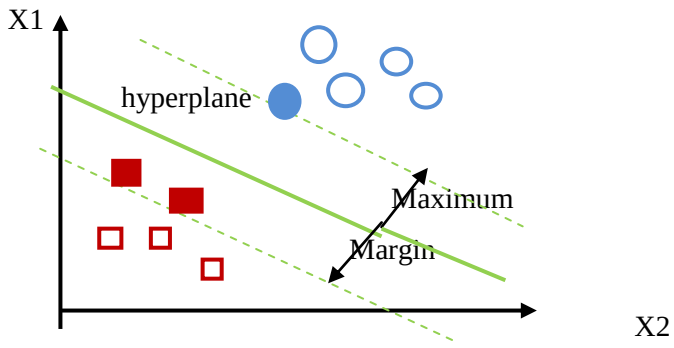

Figure 2: Support Vector Machine

G. Performance measures

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

- True Positive (M): Abnormal brain correctly identified as abnormal.
- True Negative (N): Normal brain correctly identified as normal.
- False Positive (O): Normal brain incorrectly identified as abnormal.
- False Negative (P): Abnormal brain incorrectly identified as normal.

1) Sensitivity= M/ (M+P)*100%

2) Specificity= N/ (N+O)*100%

3) Accuracy= (M+N)/ (M+N+O+P)*100%

Figure 3: Noiseless input image of brain MRI consist of Tumor

Fig: 4 Figs: 5

Figure: 4 and 5 represents segmented image with FCM and MFCM

4. RESULT

The experimental result from MRI brain images using segmentation and classification algorithm. An MRI Images is initially segmented by modified fuzzy c-means algorithm and then segmented image is classified using support vector machine. The proposed method can successfully segment a tumor provided that the parameters are set correctly is shown in table 1 . The proposed techniques is designed for supporting the tumor detection in brain images with tumor and without tumor.

TABLE 1 SEGMENTATION PERFORMANCE OF CLUSTERING AND GLRLM TECHNIQUES

SI No	Clustering Method	Accuracy	Sensitivity	Specificity
1	K –Means	91.67%	83.45%	75.67%
2	Conventional FCM	84.16%	67.43%	81.16%
3	MFCM	88.50%	75.13%	85.20%

5. CONCLUSION

In this proposed system by presenting an effective modified fuzzy C- means segmentation technique of brain tumor. The proposed technique consist of pre- processing segmentation using modified FCM., feature extraction of the region and find classification that the modified FCM technique received a better quantity rate for all the input image that our technique achieved better result for specificity, sensitivity and accuracy which proved the effectiveness of the proposed technique.

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