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CBIR for MRI Brain Tumor Images

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***Abstract*—With world being digitized the CBIR has attracted many researchers. CBIR can make a major difference in the field of medicine. Several efforts is been made to minimize the human intervention in the system. The paper presents a CBIR system for the retrieval of the brain tumor images on the correct classification of the tumor by SVM classifier using the features extracted from the tumor images. The method is implemented using 200 MRI brain tumor images containing benign and malignant images**

***Keywords*— CBIR; Features; SVM classifier; MRI images**

I. INTRODUCTION

The ultimate goal in any field is to identify and solve the problem in less amount of time. The same applies for the medical diagnosis as well. Unlike any other field, medical field deals with the life of the patients. Brain tumor has become a serious cause for increase in the death rate around world. If the tumor is identified at early stages the life of the patients can be saved. Identifying and the decision of the stages of the brain tumor takes lot of time and is a tedious job. A retrieval system can give a helping hand in the decision process by retrieving the early cases seen in the respective field. The MRI scans are used for capturing image of the abnormalities as it gives better differentiation among the tissues and is less harmful than CT. .

II. LITERATURE SURVEY

Gayatri Chavan[1] used a method of retrieval which involved the feature extraction by GLCM . The features were subjected for selection by using sfs algorithm. A hybrid classifier namely SVM-KNN was used. The job of the classifier was to classify the MRI images into cancerous, non cancerous and normal images Euclidian measure was used to retrieve the images from the appropriate classified class.

Amit K. Rohith[2]integrated an application for the CBIR where along with the retrieval process the tumor detection was done. The approach involved extraction of 2d wavelet features, classification for the normal and tumor cases by SVM and tumor detection by ISNN, invariant moments.

DR.A.KANNAN [3] applied a HKNNSVM method for retrieval. Here the author has used the GLCM features and has performed reduction of feature size by using SFS. The classifier is used for the determination whether the brain image is normal, benign or malignant. Euclidian measure was used for closeness measure.

ABDERRAHIM KHATABI [4] has applied the art for feature extraction. He has used the traditional transformation technique for the feature extraction. The segmentation is performed using the KNN method. The feature so extracted is fed to an SVM classifier to determine whether the tumor is present or not. The co-efficient difference serves as closeness measure. Here the presence of the tumor is identified by the KNN technique.

Akila[5]used an approach were the moment consistent features were extracted. Ann was used for classification. The trigonometric distance measure was used for the measure of similarity. The most similar images of the classified class are retrieved for the given query.

III. METHODOLOGY

The method involves 2 stages training and testing stage.. In the training stage the brain tumor images are segmented for the identification of the tumor region. The next step is the feature extraction. The features extracted are GABOR, EHD and LBP. The classification for benign and malignant class is performed using the SVM classifier.

In the testing stage a random image is given as a query. The segmentation for the query is done the features are extracted. The feature vectors are used for determination of the class of the query. Closeness measure is performed by

Euclidian metric. The image feature vector which is closest to the query image feature vector is retrieved.
The proposed methodology consisting of training stage and testing stage is as shown in the below fig1

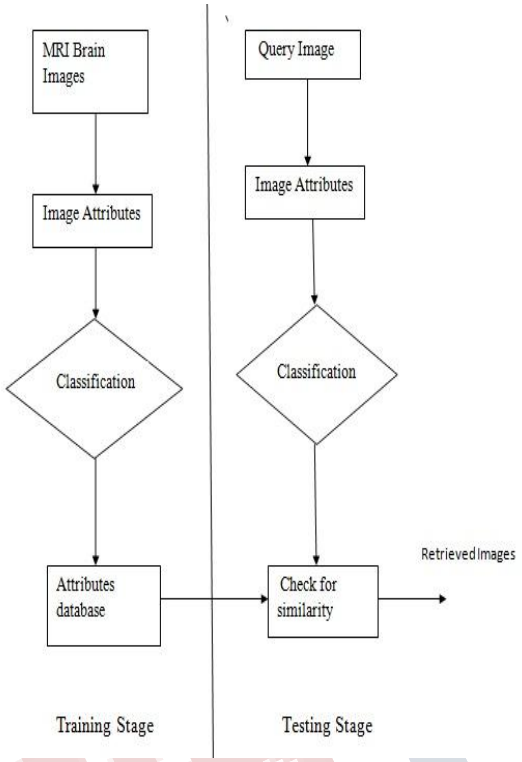

Fig. 1: Methodology

Segmentation

the segmentation technique used here is the fuzzy type 2 logic. The brain image contains 4 regions the white matter, grey matter, cerebrospinal fluid and the tumor region. These 4 regions correspond to 4 membership functions. These membership values are determined by using the fuzzy type 2 logic [6]

Feature extraction

The features extracted here are

- Gabor features
- Edge histogram descriptors
- local binary bit paten

The Gabor features are found by using the 2d Gabor filters given by [7]

$$H(x,y) = \frac{1}{2\pi\sigma_x\sigma_y} e^{\left[-\frac{1}{2}\left(\frac{x^2}{\sigma^2_x}+\frac{y^2}{\sigma^2_y}\right)+\frac{2\pi jFx}{1}\right]}$$

The similar function of the filter can be obtained by dilating and rotating of the function

$$h_{kl}(x,y) = b^{-2k}h(x',y'), b \geq 1$$

$$x' = b^{-k}(x\cos\theta + y\sin\theta)$$

$$y' = b^{-k}(-x\sin\theta + y\cos\theta)$$

The scale factor a is selected to be greater than 1. The scale m and orientation n are specified and

$\theta = \frac{n\pi}{N}$, n=1,2,….n and m=1,2,…m

The so obtained results are convolved with the image to obtain the filter output. The feature vector is constructed by considering mean as well standard deviation.

$$H_{kl}(x,y) = A(x,y) * h_{kl}(x,y)$$

$$\mu_{kl} = \frac{1}{U\,xV}\sum_x\sum_y |H_{kl}(x,y)|$$

$$\sigma_{kl} = \sqrt{\frac{1}{U\,x\,V}\sum_x\sum_y (|H_{kl}(x,y)| - \mu_{kl})^2}$$

The EHD is found for 5 different directions namely $0^0, 90^0, 45^0, 135^0$ and non directional. The features are obtained using he following filters[7]

1	-1
1	-1

a) ver_edge_filter()

1	1
-1	-1

b) hor_edge_filter()

$\sqrt{2}$	0
0	$-\sqrt{2}$

c) dia45_edge_filter()

0	$\sqrt{2}$
$-\sqrt{2}$	0

d) dia135_edge_filter()

2	-2
-2	2

e) nond_edge_filter()

Fig. 2: edge filters for 5 directions

The LBP for each pixel value is calculated by considering 8 neighbors for each pixel using[8].

$$(BP)_{UV} = \sum_{u=0}^{U-1} T(P_u - P_c)2^u$$

$$T(y) = \begin{cases} 1, & y \geq 0 \\ 0, & y < 0 \end{cases}$$

The concatenation of all the above features are considered for final vector

Classification

Here the svm classifier is used for classifying images into benign and malignant using their feature vectors. The rbf is used as the kernel to obtain the decision using

$$k(a,b) = e^{\frac{\|a-b\|^2}{2\sigma^2}}$$

Similarity measure

eucledian distance is used for checking the closeness of the query feature vector with the database feature vectors.

$$d = \sqrt{\sum_{i=1}^{n} (q_i - p_i)^2}$$

SIMULATION AND RESULTS

the method is implemented using matlab 2013a run on a windows 7 os with i5 processor.

The 3 parameters for measuring the performance are as follows

$$Precision = \frac{Number\ of\ relevant\ images\ retrieved}{Number\ of\ images\ retrieved}$$

$$Recall = \frac{Number\ of\ relevant\ images\ retrieved}{Number\ of\ relevant\ images\ in\ the\ database}$$

$$Accuracy = \frac{TP+TN}{TP+TN+FP+FN} \times 100$$

Accuracy is found using the confusion matrix which is the result of the classification stage as shown in table 1.

TABLE I. CONFUSION MATRIX

Tumor Type	Benign	Malignant
Benign	TP	FN
Malignant	FP	TN

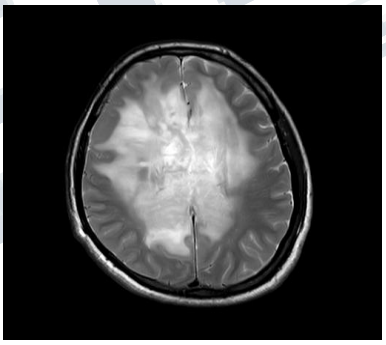

Fig. 2: input image

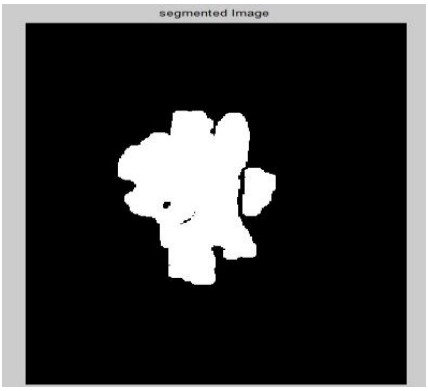

Fig. 3: segmented region

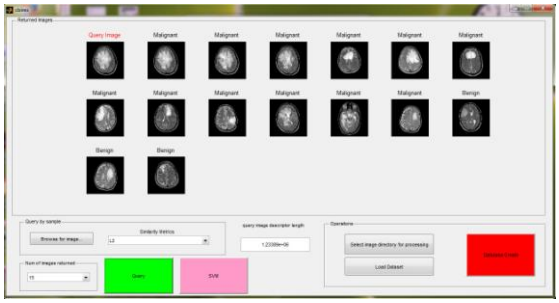

Fig. 4 : retrieved images

IV CONCLUSION

Here an approach for retrieval of brain tumor images is been proposed and implemented.

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