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Brain Tumor Detection and Classification using SVM

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***Abstract*—**Brain tumor is most dangerous disease among the cancerous diseases. The chances of the death in brain tumor is more as compared to other diseases. To avoid the chances of death in the early detection of brain tumor is necessary. Now a days Brain tumor detection and classification is one of the most active research areas in medical image processing field. Detection of the brain tumor manually by doctors is a very difficult and time consuming process. To avoid the mis-classification and to minimize the time, automatically brain tumor detection and classification is necessary.

Keywords*—*Brain tumor, Gray level cooccurance matrix (GLCM), SVM.

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I. INTRODUCTION

With the increase in the world population, cancer is the growing health problem. As per the survey, In each year , the population of cancerous people is about 12.7 million among them 7.6 million peoples dies because of cancer [1]. Brain tumor is the uncontrolled growth of the brain tissue, which causes abnormalities in the functioning of the brain. Brain tumors are of two type first one is the tumor that is originated at brain tissue itself and another one is started on another part of the body and migrate towards the brain.

Basic block diagram of brain tumor classification is as shown in figure 1. The basic block diagram consists of four modules

1. Image preprocessing
2. Feature extraction
3. Feature optimization
4. Training and testing

In medical imaging, the acquired images are very noisy because of the physical process of imaging. The presence of the noise can misclassify the images and may degrade the performance of the classifier. Image preprocessing is the process which enhances the image by filtering approach.

Feature extraction is the quantitative measurement of the images. I feature extraction, image data are transformed into some statistical numeric value. There are various features which can be extracted from the image such as contrast, homogeneity, correlation, energy, entropy etc. GLCM is a technique which extracts a features form gray as well as binary images. Extracted feature is the most import input for the classifiers.

Classifier analyses the input data features and classify the images accordingly. There are a number of learning classifiers such as support vector machine (SVM), k- nearest neighbor KNN, artificial neural network (ANN), Hidden Markov Model (HMM), Probabilistic Neural Network (PNN). Every classifier has its own advantages as well as disadvantages. KNN has advantages when feature sets are less, but when features set increases the KNN performance also degraded. ANN is fast and robust, but computing cost is more hence consuming high CPU's primary physical memory. SVM show more accuracy than other algorithms [1].

II. RELATED WORK

R. J. Ramteke et al. [5]Present an automatic medical image classification technique. KNN classifier is used to classify the medical image into normal and abnormal image. KNN is the simple method which required low computational cost.

Khushboo Singh et al. [8] Proposed a MRI image classification technique based on SVM classifier. Advanced classification techniques based on Support Vector. Support vector machine is a supervised learning algorithm. In SVM, the classification is performed by quadratic programming.

Shweta Jain et al.[7] extract a feature using GLCM technique and extracted features were classified using the artificial neural network. ANN is a mathematical problem which is inspired by the biological nervous system Priyanka et al.[6] proposed a urvey on the brain tumor detection algorithm and its location in the brain.

Classifiers such as SVM, KNN, ANN etc. has a large number of applications such as handwritten character recognition, face detections, iris detection, text classification etc.

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III. PROPOSED ALGORITHM

The flow chart for proposed brain MRI classification technique is as shown below

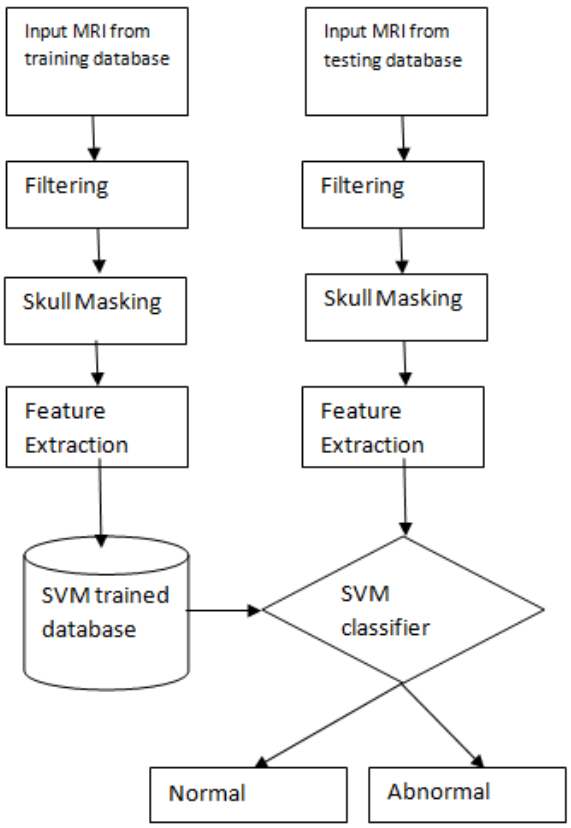


Figure 1. Proposed flow chart

1. Input Image

The MRI images were collected from various Hospitals like TATA cancer hospitals, Jahangir hospital. The images were verified from the doctor. For training purpose we used 150 images and testing were done on 80 images.

2. Filtering

The main aim of filtering is to remove noise from the medical images because medical images are somewhat noisy. In proposed work we used media filter to smoothing and removing noise from the image.

3. Skull Masking

Skull masking is the process of removing on brain tissues from the image. It is very useful because it minimizes the chances of mis-classification. The main operation involved in this process is opening and closing. The opening operation is the combination of erosion followed by dilation.

$$A \circ B = (A \ominus B) \oplus B \quad \text{-----(1)}$$

4. Feature extraction

GLCM is the algorithm used to extract a feature from the gray image. The fourteen features were extracted from the image and it is selected by forward selection and backward elimination process. The fourteen features are enlisted below

1. Contrast
2. Homogeneity
3. Energy
4. Entropy
5. Sum of average
6. Sum of variance
7. Autocorrelation
8. Standard deviation
9. Dissimilarity
10. Difference variance
11. Difference variance
12. IDM
13. Inverse difference moment normalization
14. Correlation

These features are extracted from image and feed input to the classifier.

5. Classification

Support vector machine is the linear learning algorithm. It is a supervised algorithm.The process of classification forward through training and testing.
The linear function is given by

$$f(x) = w^T X + b \quad \text{---------(2)}$$

where , Xi are the training samples which yield two class by inserting hyperplane between classes. As show below figure.

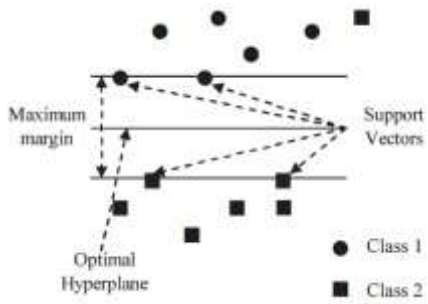
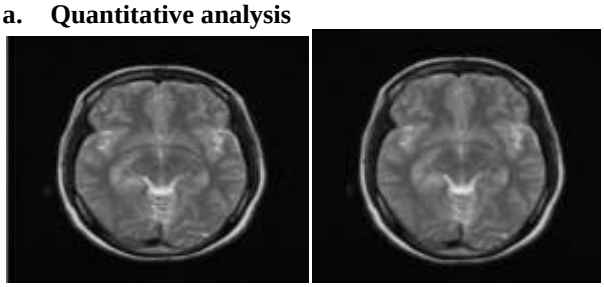


Figure 2. Linear SVM

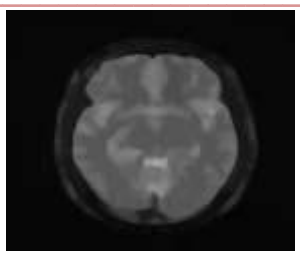
IV. RESULT

The results of various operations are shown below

a. Quantitative analysis



(a) (b)



(c)

Figure 3. Preprocessing output (a) input image (b) median filter output (c) skull stripped output

b. Qualitative analysis

The qualitative analysis of Proposed approach is tabulated below

Sensitivity	Specificity	Accuracy
91.52	67.74	83.33

TABLE I. PERFORMANCE ANALYSIS

V. CONCLUSION

Brain MRI image classification is an important task. In proposing work image preprocessing is done with median filtering and skull stripping method. It shows better performance. The features were extracted using GLCM techniques and SVM is used as a classifier.

SVM approach gives good result having sensitivity of 91.52% , Specificity of 67.74% and Accuracy of 83.33%.

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