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Detection & Classification of Brain Tumour

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ABSTRACT: The use of digital images has become a subject of widespread interest in different areas such as medical technological application and many others. There are lots of examples where image processing helps to analyze interpret and make decisions. The main use of image processing is to improve the quality of the images for human interpretation, or the perception of the machines independently. In this paper, it is intended to summarize and compare the methods of automatic detection of brain tumor through MRI. Brain Image classification techniques are studied. Brain tumor detection in MR imaging is important in medical diagnosis because it provides information associated to anatomical structures, necessary for treatment planning and patient follow-up. In this project a brain tumor Detection and Classification System is developed. The image processing techniques such as preprocessing and feature extraction have been implemented for the detection of brain tumor in the MRI images. In this paper extraction of texture features in the detected tumor is achieved using Gray Level Co occurrence Matrix (GLCM).SVM and K-Nearest neighbor classifier is used to classify MRI brain image into abnormal and healthy image.

KEYWORDS: GLCM,KNN classifier, Medical Imaging,MRI, SVM Classifier.

I. INTRODUCTION

With the growing population, cancer has become a global public health problem. According to the World Cancer Researcher, cancer is the world's first cause of death. The incidence of brain tumors is rapidly increasing in the young generation because cell phone radiation & other reasons. The development of tumors in the brain can be diagnosed with both CT(computer tomography) and MRI scans, but only MRI has the resolution to detect heterogeneity within tumors that might indicate its origin and treatment. It is possible that the chances of survival can be increased when the tumor is detected and classified correctly at its starting stage. Detection of these tumors from brain is very difficult at the regions where a tumors is overlapped with dense brain tissues. Visual detection of these abnormal group of cells may result in misdiagnosis of volume and location of unwanted tissues due to human errors caused by visual fatigue. Automatic classification method required because it reduces load on human observer, accuracy is not affected due to large number of images. In this paper the designed system is developed for Detection and Classification of Brain tumors from a given MRI image. The proposed method consists of two stages namely feature extraction and classification. In the first stage, calculate features related to MRI image using Gray Level Co-occurrence Matrix(GLCM)based methods, this is one of the tools for extracting features and second stage, the classifier is classified images using K-NN & SVM classifier.

II. LITURATURE SURVEY

- R. Mishra et. al. proposed the system for MRI based Brain Tumor Detection using Wavelet Packet Feature and Artificial Neural Networks [1]. This paper proposed tumor identification system using wavelet packet aspect and Artificial Neural Networks in MR images. Features were extracted from wavelet packet and classify features using Artificial Neural Network as normal and abnormal images in this system. The improvement of using wavelet packet is that it gives wealthy investigation by decomposing estimation as well as detail component every time as compared to wavelet transformation method.
- E. A. El-Dahshan and T. Hosney et. al. [2]. proposed a hybrid system for tumor detection in MR images and categorize them using artificial neural networks (ANN) and k-nearest neighbor (KNN). During this method features were extracted using discrete wavelet transform (DWT) and then for selection of best extracted features, principle component analysis (PCA) method was used. These selected features were given as input to classifiers as KNN and

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ANN. K-Nearest Neighbor and Artificial Neural Network involve two phases, training and testing. These two classifiers KNN and ANN categorize MR images as normal and abnormal images. The negative aspects of these systems are, every time new information is arrived needs new training and KNN precision can rapidly degrade when number of features grows.

- H. Selvaraj et.al et. al. [3]. proposed a system for classification of Magnetic Resonance Images by means of wavelet features which were given as input to SVM and ANN.In proposed method neural network Self Organizing Maps (SOM) were used as classifiers for tumor recognition and it simply captures non linear computation and reached precision rate of 94 percent as evaluated to SVM which captures linear and non linear computation and precision rate attained was 98 percent.S. Chaplot and L.M. Patnaik proposed brain tumor identification using wavelets transformation method and SVM. Generally two phases were considered. Initially, in processing phase noise was detached from the signal and through wavelet method features were extracted and then features were given as input to SVM for classification as normal and abnormal brain.

III. METHODOLOGY

BLOCK DIAGRAM:

The basic block diagram or methodology of developed system is consisting of following steps:

- **Database Representation**: feature extraction and representing the database in terms of extracted features.
- **Classifier Train:** Train the classifier with databases and ground truth of database.
- **Feature Extraction of Query:** Extract the features of query.
- **Classification:**Use the trained network of classification query.

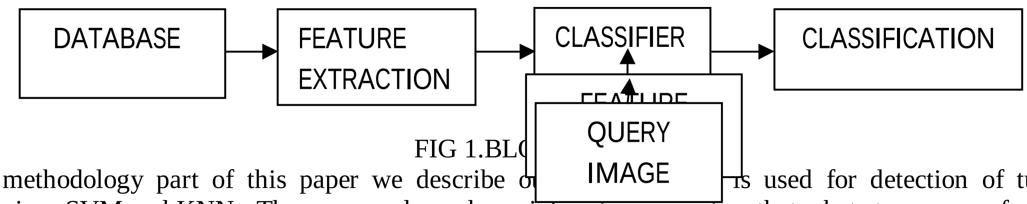

FIG 1.BL

In the methodology part of this paper we describe o is used for detection of tumor in human brain using SVM and KNN. The proposed work mainly gives a review that what steps are performed throughout the entire process to detect presence or absence of tumor from MRI of brain and not to locate or detect it. The frame work is mainly consists of two phases. In the first phase textural features are extracted from MRI and in the second phase MRI is classified as normal or abnormal The measurements obtained from the study of textural feature are given as input to the SVM and KNN classifier for training in order to classify it.

CLASSIFICATION:

Approaches used for classification is divided into two categories. First category is supervised learning technique such as a Artificial Neural Network (ANN) & Support Vector Machine (SVM) ,K-Nearest Neighbor (KNN) Algorithm which are used for classification. Another category is unsupervised learning for data clustering such as K-means Clustering, Self Organizing Map (SOM). Many of the detailed decisions required for supervised classification but not required for unsupervised classification.

SHORTCOMINGS OF SOME ALGORITHM:

Artificial Neural Network (ANN) appears to be promising alternative; however they failed to model sequence data such as online images, due to their complexity. Also, ANN cannot differentiate the different abnormal brain images based on the calculated feature set.[1]

The main shortcoming of the Self Organization Map (SOM) is that the number of neural units in the competitive layer needs to be approximately equal to the number of regions required in the segmented image. It is not however, possible to determine a priory the correct number of regions M in the segmented image. This is the major limitation of the conventional SOM for image segmentation. The HSOM directly address the aforesaid shortcomings of the SOM.

Because of these shortcomings, in this paper we use K-nearest neighbor & Support Vector Algorithm.

KNN is a method for classifying objects based on closest training examples in the feature set. It is a type of instance based learning, where the function is only approximated locally and all computation is continued until classification.

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An object is classified by a majority vote of its neighbors, the object assigned to the class most common amongst its k - nearest neighbors. The neighbors are taken from a set of objects for which the correct classification is known. In order to identify neighbor, the objects are represented by position vectors in a multidimensional feature space. The k-Nearest neighbor algorithm is sensitive to the local structure of the data.

SVM is a nonlinear classification algorithm based on kernel methods. In contrast to linear classification methods, the kernel methods map the original parameters into a higher (possibly infinite) dimensional feature space through a nonlinear kernel function. Computational efficiency of SVM is high.[3]

TEXTURE FEATURE:

Texture is a commonly used feature in the analysis and interpretation of the images. Texture is characterized by a set of local statistical properties of difference of pixel intensities. We base our texture feature extraction on the spatial gray level co-occurrence-matrix (SGLCM). The GLCM method considers the spatial relationship between pixels which has different gray levels. The method calculates a GLCM by calculating how different a pixel with a certain intensity i, occurs in relation with another pixel j, at a particular distance d, and orientation θ. Each element (i, j) in the GLCM is the sum of the number of times that the pixel which has value i, occurred in the specified relationship to a pixel with value j, in the raw image. Once the GLCM is calculated several second-order texture features.where Pd, θ (i, j) is the GLCM between i and j .Some features are as follows:

2.3.1 Maximum Probability:

f1= max P(i,j)

2.3.2 Contrast: A measure of difference moment and is defined as:

$$f2 = \sum_{i,j=1}^{N} |i-j|^2 P(i,j)$$

2.3.3 Inverse Different Moment (Homogenity):

A measure of local homogeneity that can be defined as

$$f3 = \frac{\sum_{i,j=1}^{N} P(i,j)}{1+(i-j)^2}$$

2.3.4 Entropy:

A measure of predectability in the image based on the probability of co-occurrence values and can be defined as

$$f4 = \sum_{i,j=1}^{N} P(i,j)\left[-\log\left(P(i,j)\right)\right]$$

2.3.5 Energy:

A measure of homogeneity that can be defined as

$$f5 = \sum_{i,j=1}^{N} (P(i,j))^2$$

2.3.6 Correlation Coefficient:

A measure of dependency of brightness and can be defined

$$f6 = \frac{\sum_{i,j=1}^{N} ijP(i,j) - \mu_x\mu_y}{\sigma_x\sigma_y}$$

Where, N is the number of distinct gray levels in the quantized image, equal to 256 for images in the present study. µx, μ_y, σ_x, σ_y are the mean and standard deviation values of GLCM in the x and y directions, respectively.

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IV.RESULT

MRI is an imaging technique that has played an important role in neuro science research for analysing brain images. Classification is an important part in order to distinguish between normal patients and those who have some abnormalities or tumor.The GLCM matrix can be used to determine the performance of the proposed method.This matrix describes all possible outcomes of a prediction results in table structure. The possible result of a two class prediction be represented as True positive (TP), True negative (TN), False Positive (FP) and False Negative (FN). The good and abnormal images are correctly classified as True Positive and True Negative respectively. A False Positive is when the outcome is incorrectly classified as positive (yes) when it is a negative (no). False Positive is the False alarm in the classification process. A false negative is when the outcome is incorrectly predicted as negative when it should have been positive. From the GLCM matrix, the precision and recall values can be measured using the following formulea.

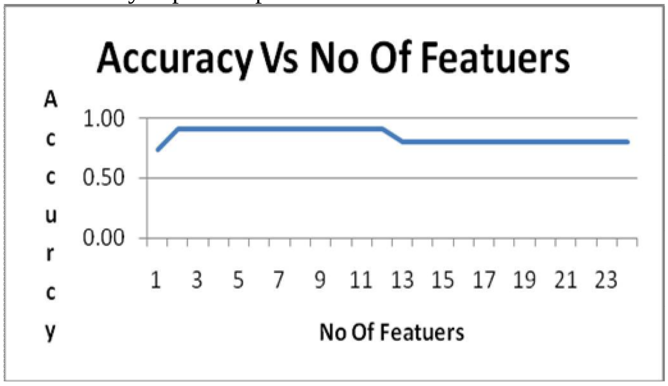
Precision: It is defined as the fraction of the classified image, which is relevant to the predictions. It is represented as

Precision =TP/ TP + FP

Recall: It is defined as the fraction of the classified image for all the relevant predictions. It is given as

Recall = TP/TP + FN

From using above results we can calculate Accuracy but it depends upon how much features we take to train classifier. The following graph shows how accuracy depends upon no. of features.



V. CONCLUSION

By using this proposed method classification & detection of brain tumor can be achieved fast. And also very small tumors from MRI images can be identified precisely and more rapidly. This classification is performed on proton Magnetic Resonance Spectroscopy images. But the classification accuracy results are different for different datasets which is one of the drawbacks of this approach. Experiments are conducted on various real-world datasets and the results concluded that the proposed algorithm yield good results when compared with the other classifiers. For precision & recall, SVM shows better result than KNN. In simple terms, high precision means that an algorithm returned substantially more relevant results than irrelevant, while high recall means that an algorithm returned most of the relevant results. Hence for our approach SVM shows better results. The proposed algorithm has been found to be performing well compared to the existing classifiers. The accuracy of 97% was found in classification of brain tumors. The developed brain tumor classification system is expected to provide valuable diagnosis techniques for the physicians.

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