Preliminary Level Automated Classification of Brain Tumor using PCA and PNN

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Abstract- Probabilistic neural networks(PNN) are finding many uses in the medical diagnosis application. The goal of this paper is to use Probabilistic Neural Network(PNN) with one important mathematical technique 'Principal Component Analysis' (PCA) for preliminary level brain tumor classification. As a result, the tested Magnetic Resonance Image(MRI) of brain is classified either ',' benign' or malignant. Automated classification of brain tumors is performed in two stages. Feature extraction using Principal Component Analysis (PCA) and classification using Probabilistic Neural Network(PNN).

Keywords – Principal Component Analysis, Probabilistic Neural Network, Magnetic Resonance Image

I. INTRODUCTION

PNN provides a powerful tool to help doctors to analyze, model and make sense of complex clinical data across a broad range of medical applications. Most applications of PNN in medical field are classification problems; that is, the task is on the basis of the measured features to assign the patient to one of a small set of classes of particular disease..

Conventional methods of monitoring and diagnosing the diseases rely on detecting the presence of particular features by a human observer. Due to large number of patients in intensive care units and the need for continuous observation of such conditions, several techniques for automated diagnostic systems have been developed in recent years to attempt to solve this problem. Such techniques work by transforming the mostly qualitative diagnostic criteria into a more objective quantitative feature classification problem.

PNN are finding many uses in the medical diagnostic application. According to Qeethara Kadhim Al-Shayea [1].PNN provide a powerful tool to help doctors to analyze, model and make sense of complex clinical data across a broad range of medical applications. Most of the applications provide the solution to the classification problem. According to N. Kwak, and C. H. Choi [2] Feature selection plays an important role in classifying systems such as PNN.The higher performance with lower computational effort is expected with this process. One of the most popular methods for dealing with this problem is the PCA method. This method transforms the existing attributes into new ones considered to be crucial. E. D. Ubeyli and I. Guler [3] used feature extraction methods in automated diagnosis of arterial diseases. Since classification is more accurate when the pattern is simplified through representation by important features, feature extraction and selection play an important role in classifying systems.

T.Logeswari , and M. Karnan [5] used image segmentation based on the soft computing for improved implementation of the brain tumor detection. The MRI brain image is acquired from patient's database and then Image acquisition, preprocessing, image segmentation is performed for brain tumor detection. Georgiadis. Et all [6] also did the work for improving brain tumor characterization on MRI by probabilistic neural network and non-linear transformation of textural features. According to Chettri, S. R. and Cromp, R.F., the PNN architecture can be used for high speed classification of remotely sensed imagery and can be applied to remotely sensed data

II. RESEARCH METHOD

The automated classification of brain MRI images by using some prior knowledge like pixel intensity and some anatomical features are proposed [7]. Currently there are no methods widely accepted, therefore automatic and reliable methods for tumor detection are of great need and interest. The application of PNN in the classification of data for MRI images problems are not fully utilized yet. These include the clustering and classification techniques especially for MRI images problems with huge scale of data and consuming time and energy if done manually.

Thus, fully understanding the recognition, classification or clustering techniques is essential to the developments of Neural Network systems particularly in medicine problems

Decision making will be performed in two stages:

1. Feature extraction using the PCA and
2. Classification using PNN.

The performance of the PNN classifier will be evaluated in terms of training performance and classification accuracies. PNN gives fast and accurate classification and will be a promising tool for classification of the tumors.

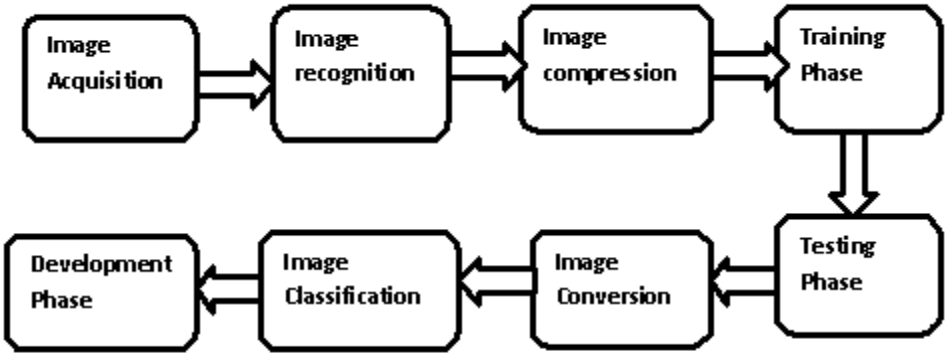


Figure 1. Block Diagram of the proposed work

Image Acquisition: - Maximum MRI Images of brain are collected form possible resources like Radiologists, Internet, Medical Atlases, Hospitals etc.

Image recognition and Image compression: - Database of MRI images of brain is prepared. All images are converted into one standard size. If colour image is there, it is converted into gray image for simplicity. Similarly images are converted into two dimensional or single dimensional according to the requirement.

Training Phase: - Mathematical technique 'PCA' is used to extract feature vectors of all images in the database. Back Propagation algorithm is used to train the neural network.

Testing Phase: - Feature vector of the test image will be computed in this phase. Eclidean Distance is also calculated to decide in which class of ' brain tumor' the i/p image is to be fitted.

Image Conversion: - MR images will be converted into matrices form using MATLAB as a tool.

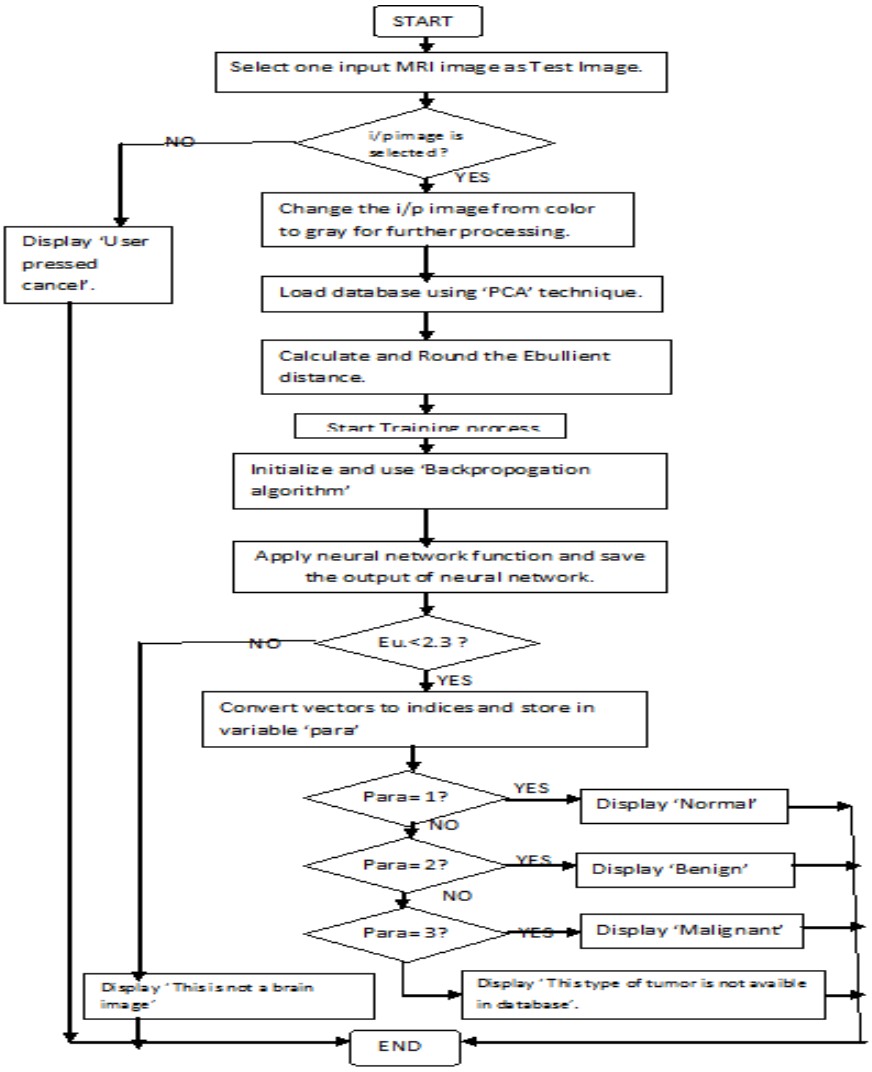
Image Classification: - Feed Forward PNN will be used to classify MRI images. Already avaible function for PNN is used as it is in MATLAB.

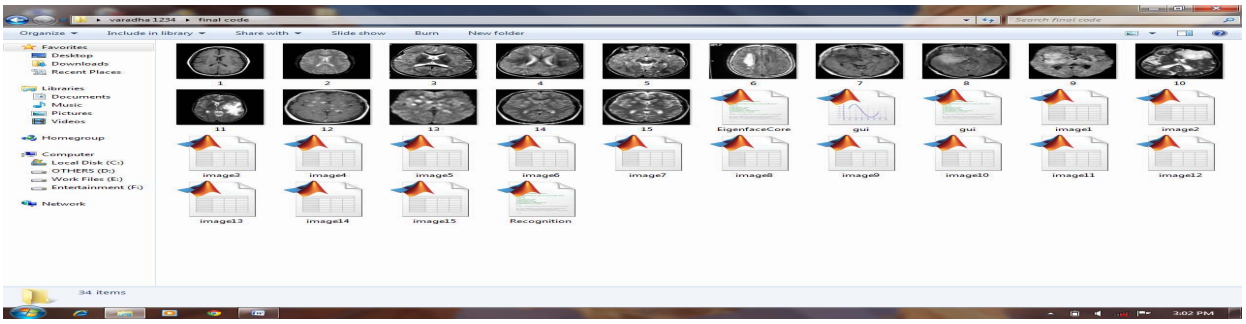
Development Phase: - Performance analysis based on the result will be carried out in the development phase.

III.IMPLIMENTATION

IN ORDER TO IMPLEMENT THE PROPOSED SYSTEM, MATLAB IS USED AS A TOOL. MRI IMAGES OF BRAIN ARE STORED IN THE DATABASE.

Proposed system can be represented in the form of flowchart as follows





III. EXPERIMENTATION AND RESULT

Figure 2.

Above Figure 2. illustrates, some collected MRI images used as database and some important MATLAB files created for specific purpose.

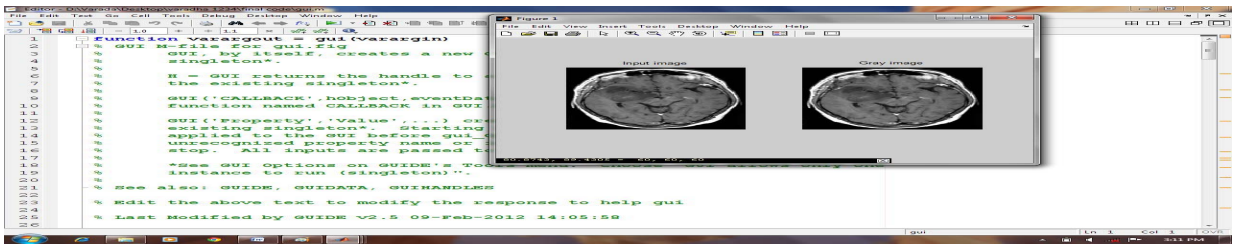


Figure 3.

Above Figure 3. illustrates that input image is immediately convertaed into gray image for further processing.

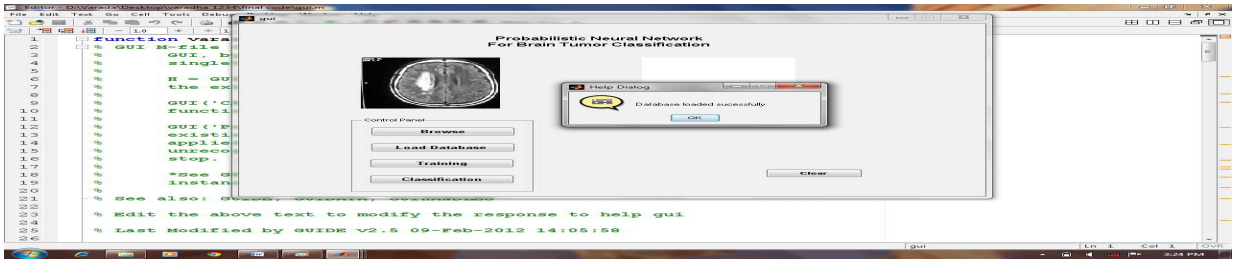


Figure 4.

Above Figure 4. illustrates, database is loaded successfully using 'PCA'

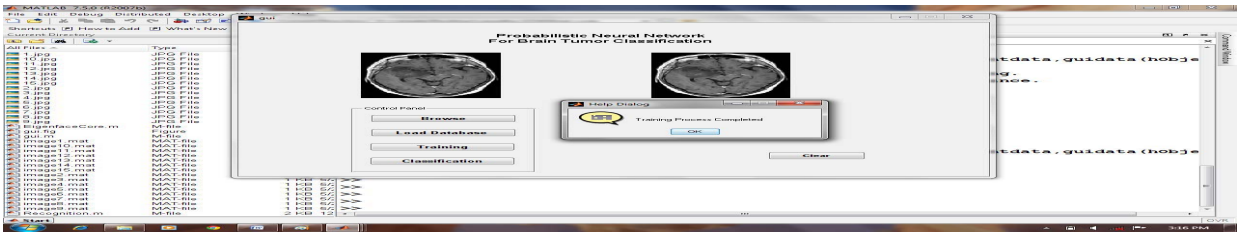


Figure 5.

Above Figure 5. illustrates, training of PNN using Back Propagation Algorithm.

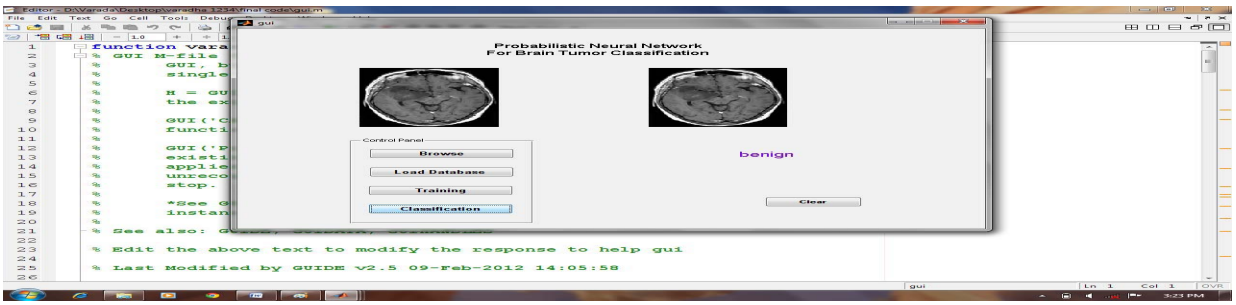


Figure 6.

Above Figure 6. illustrates, the tested input image is classified under the category 'benign' type of brain tumor.

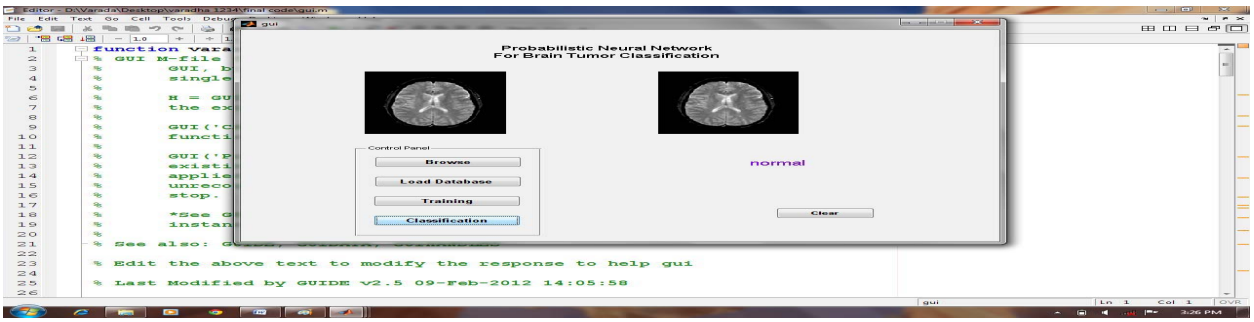


Figure 7.

Above Figure 7. illustrates, the tested input image is 'normal' .

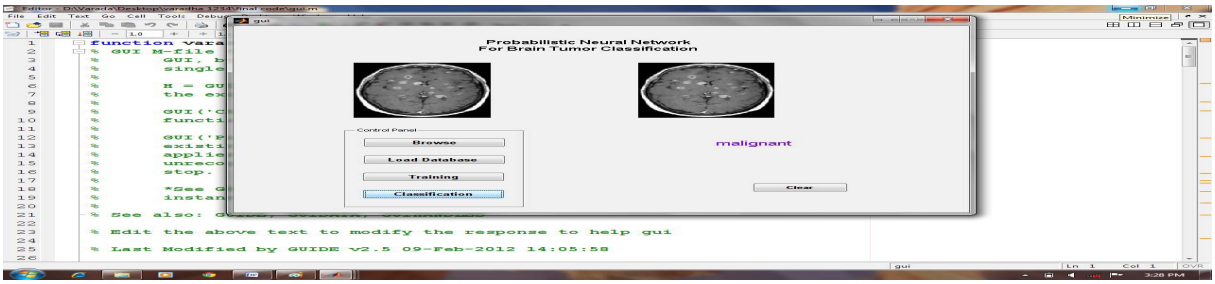


Figure 8.

Above Figure 8. illustrates, the tested input image is classified under the category 'malignant' type of brain tumor

IV.CONCLUSION

By using the PROPOSED method for classification , preliminary level detection of brain tumor can be achieved fast. By performing feature extraction using PCA and classification using 'PNN', MRI images can be classified as 'benign' or 'malignant' fast. Currently there are no methods widely accepted, therefore automatic and reliable methods for tumor detection are of great need and interest. For future development, more types of brain tumor images illustrating different types can be considered to give more accurate results.

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